City of Gardner, Kansas

Wastewater Master Plan Update

March 31, 2017

HDR Engineering, Inc.
3741 NE Troon Dr
Lee's Summit, MO 64064
(816) 347-1100

Table of Contents

Table of Tables

Table of Figures

1 Executive Summary

1.1 Master Plan Update Purpose and Findings

In 2009, the City commissioned the completion of a Wastewater Master Plan. The 2009 Wastewater Master Plan served to provide the City of Gardner (City) with a comprehensive plan for the development of its wastewater infrastructure to existing and anticipated growth. In recent years, the City has modified its growth management strategy to adjust for changes in its long-term growth pattern. Since 2009, a nation-wide recession caused the number of new investments to slow, construction of the Logistics Park Kansas City Intermodal was completed, and new opportunities for growth outside of the City's existing city limits have been identified. These new opportunities for growth, identified in the "City of Gardner Comprehensive Plan" completed in 2014 and the "Growth Management Strategy" completed in 2015, vary from the long-term growth plan in the 2009 Wastewater Master Plan. Therefore, this report will serve as an update to the 2009 Wastewater Master Plan based upon the City's current anticipated short-term, mid-term, and long-term growth.

A major purpose of this master plan update is to establish the plan for conveyance and treatment of all wastewater that will be generated within the city, not only within its current city boundary but for anticipated growth areas as well. Cooperation and proactive participation in master planning and the development of capital improvement plans are critical to the ability of the city to serve its community and their wastewater needs.

The wastewater master plan update identifies projected wastewater peak flows and evaluates the capacity of the existing collection and conveyance system to convey these projected peak flows without backups of wastewater into residences and businesses and without sanitary sewer overflows. The modeling of the major inceptors owned by the City has provided the information to identify the bottlenecks within the systems. Improvements to the system, such as paralleling or replacing existing overcapacity segments, are recommended based upon the results of the modeling endeavor.

The wastewater master plan update also evaluated the City's existing wastewater treatment plant and its ability to treat the anticipated flows and meet discharge limits. This evaluation provides the City with a plan to increase the capacity of the existing Kill Creek Wastewater Treatment Plant (WWTP) and recommends improvements to meet potential future discharge limits for total nitrogen and total phosphorous. A copy of the permit is located in Appendix D.

Lastly, the wastewater master plan update evaluated alternatives for providing the infrastructure necessary to serve the anticipated growth areas.

This wastewater master plan update provides the City with recommendations for capital improvements that are necessary to serve the community's wastewater needs. This Executive Summary also includes a schedule indicating the recommended capital improvements.

Five scenarios were evaluated during the preparation of the capital improvements plan. These include:

1) Existing development

2) Ultimate development within the existing city limits

3) Ultimate development within the existing city limits including the proposed Short-term growth areas

4) Ultimate development within the existing city limits including the proposed Mid-term growth areas

5) Ultimate development within the existing city limits including the proposed Long-term growth areas

The limits for each scenario are depicted in Figures 3.2 through 3.6. The required system improvements were determined for each scenario and are discussed in Section 5. The capital improvements plan includes the projects that are necessary to be completed to serve the wastewater needs for an anticipated 10-year period. The collection system capital improvements are scheduled to first address those conveyance bottlenecks identified by the model under existing conditions. The improvements scheduled next are those identified in discussions with City staff in accordance with anticipated growth. Finally, a portion of the projects are listed to be completed at the City's discretion. These projects have been identified to either increase the reliability of the collection system by eliminating lift stations or rehabilitate aged infrastructure and eliminate infiltration and inflow within the collection system.

The capital improvement projects relating to the wastewater treatment plant are scheduled first for those required to meet the future anticipated discharge limits that the City will likely receive with the next renewal cycle of the discharge permit at the wastewater treatment plant and then based on improvements required to meet future capacity requirements. Currently, it is anticipated that these projects will not be in the 10-Year CIP.

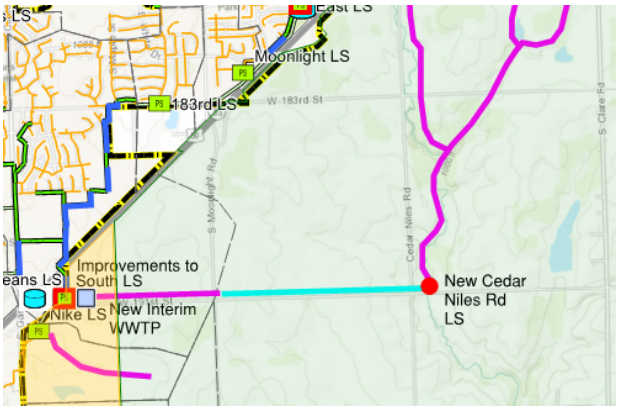
While we have defined when development will be likely to occur outside of the city limits, i.e. short-term, mid-term, long-term, it is another matter to determine when the ultimate buildout within city limits will occur. Therefore, picking the timing of projects is dependent on when growth occurs. In developing the CIP, the projects that were identified were those in which anticipated growth occurs. However, it is recommended that the City revisit the CIP annually and compare the anticipated growth patterns and to monitor the way in which the development clusters. Adjustments to the CIP may be necessary.

Section 5 discusses alternatives for serving the future anticipated development south of I-35. The area to the south could be served either by installing a large lift station that will convey flows to the collection system that discharges to the existing Kill Creek WWTP or by constructing a new wastewater treatment plant. The natural drainage of the future service area south of I-35 is south. Therefore, until sufficient growth occurs in the service area to necessitate permanent

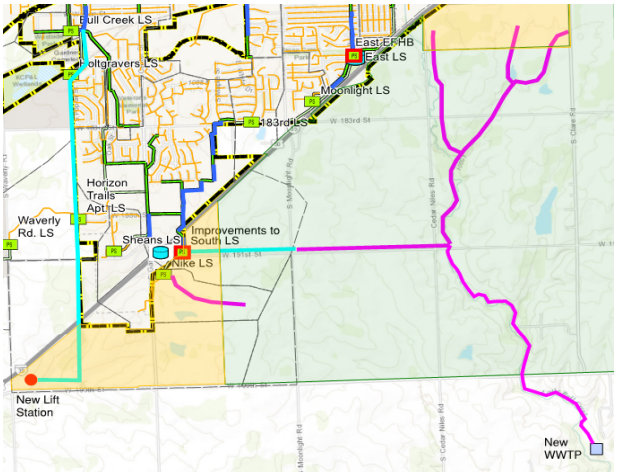
infrastructure, a number of alternatives were evaluated to serve these smaller pockets of development. This included conveying flow to the existing Wal-Mart Lift Station, constructing storage tanks on the site, or installing a small package plant for treating flows.

As the cost of constructing a wastewater treatment plant sized for ultimate development of the proposed future growth is prohibitive, the evaluation was expanded to analyze the costs impacts of constructing a smaller wastewater treatment plant that could be expanded in the future. The wastewater treatment plant would be sized to serve existing flows from the East Lift Station, which includes the Wal-Mart and Moonlight Lift Stations, and the South Lift Station, which includes Nike, Sheans, 183rd, and Waverly Road Lift Stations. Rerouting the flow from these service areas would offset costs for the upgrade of the collection system and the Kill Creek Wastewater Treatment Plant. The plant was evaluated as a 750,000 gpd, which is sized for current flow and provides additional capacity for small growth in the south.

Any proposed new plant that will discharge to a receiving stream will be required to go through the anti-degradation and permitting process. With the TMDL's on the Kansas River, we can expect that the plant will likely get a nutrient limit of a 10 mg/l Total Nitrogen and 1 mg/l Total Phosphorous. The proposed plant could be located in one of two alternative locations: Alternative 1 located at the South Lift Station or Alternative 2 located south of 199th Street in the natural drainage basin for the service area. Alternative 2 allows the City to serve a much larger service area but will have larger costs associated with collection system infrastructure.



Alternative 1 Location



Alternative 2 Location

A cost analysis was conducted comparing the costs associated with sending the flow to the Kill Creek Wastewater Treatment Plant versus constructing the smaller WWTP at either of the two proposed locations. Costs that would be required no matter the alternative are not included in the analysis. This cost is presented in Table 1-1 below:

Table 1-1 Cost Comparison of Smaller South WWTP

	All Flow to Kill Creek WWTP Alternative	South Wastewater Treatment Plant Alternative 1	South Wastewater Treatment Plant Alternative 2
South WWTP		$11,250,000	$11,250,000
Kill Creek Wastewater Treatment Plant - Capacity	$16,820,000	$8,437,500	$8,437,500
Improvements to the East Lift Station	$435,000		
East Lift Station Parallel Forcemain	$1,724,000		
South Lift Station Improvements	$250,000	$250,000	$250,000
South Lift Station Forcemain Improvements to New WWTP		$450,000	$850,000
New Lift Station		$860,000	
New Interceptor to South WWTP [1]			$1,150,000
South Storage Improvements	$2,100,000	$2,100,000	$2,100,000
City Wide Parallel Improvements (Ultimate within City Limits)	$11,192,500	$6,800,300	$6,800,300
	$32,521,500	**$30,147,800**	**$30,837,800**

[1] Costs shown are the additional linear footage from Cedar Niles RD LS to Alternative 2 WWTP location

As can be seen, there is an overall cost savings associated with constructing a smaller WWTP to serve the areas to the south. This alternative will be fully dependent upon the rate at which the development south of I-35 will occur. The development is currently included in the long-term growth plan. The City should continue to monitor this area. The proposed smaller WWTP was not included in the 10-year CIP.

1.2 Recommendation

The recommended 10-Year Capital Improvements Plan is itemized in Table 1-2 and Table 1-3 below. Table 1-2 contains a description of each project as well as the proposed timing of the project or if there is a specific driver for the project, such as future development of a certain area. Table 1-3 contains the 10-Year CIP by year. These projects are indicated on the attached Figure 1-1.

Table 1-2 Capital Improvements Projects

Improvement Number	Project Identification	Description	Proposed Timing/Driver
1	East Lift Station Improvements	This project consists of upgrading the East Lift Station to a capacity of 1.8 million gallons per day, or 1,250 gpm.	<u>Areas to Monitor:</u> *Development south of I-35.* If the development of the south occurs before the ultimate development of areas within the existing city limits, a new WWTP in the south would eliminate this project from the CIP.

2	East Lift Station Parallel Forcemain Improvements, Phase 1	This project consists of upgrades of the force main from the lift station to the gravity interceptor due to the increase in lift station capacity to pump to the North Lift Station.	Areas to Monitor: *Development south of I-35.* If the development of the south occurs before the ultimate development of areas within the existing city limits, a new WWTP in the south would eliminate this project from the CIP.
3	East Flow Monitoring and Parallel Relief Lines • Manhole 30NW105 to 30SW01A	This project consists of the construction of sanitary sewer relief lines. The existing lines do not have capacity to convey the predicted peak sanitary sewer flows. Flow monitoring is recommended prior to the design of the proposed improvements.	5-Year CIP
4	Genesis Proposed Interceptor Improvements	This project consists of the installation of a new gravity interceptor to the North Lift Station to allow the decommissioning of Genesis Lift Station.	City's discretionary use of funds.
5	Genesis Lift Station Demolition	This project consists of the decommissioning and demolition of the Genesis Lift Station.	City's discretionary use of funds.
6	Kill Creek New Gravity Interceptor	This project consists of a new gravity interceptor to serve proposed new growth areas.	Areas to Monitor: *Growth area around S Waverly Rd and W 159th St.*
7	New Bull Creek Parallel Relief Lines • Manhole 26NE56 to 25NW14	This project consists of the construction of sanitary sewer relief lines. The existing lines do not have capacity to convey the predicted peak sanitary sewer flows. Flow monitoring is recommended prior to the design of the proposed improvements.	10-Year CIP

8	North Parallel Relief Lines • Manhole 24NW01 to 25NE23	This project consists of the construction of sanitary sewer relief lines. The existing lines do not have capacity to convey the predicted peak sanitary sewer flows. Flow monitoring is recommended prior to the design of the proposed improvements.	5-Year CIP
9	South Lift Station Improvements, Phase 1	This project consists of upgrading the South Lift Station by adding a second 2,500 gpm pump.	5-Year CIP
10	South Storage Improvements	This project consists of the construction of an excess flow holding basin at the South Lift Station.	5-Year CIP
11	South New Lift Station and Forcemain	This project consists of a new lift station and forcemain to serve proposed new growth areas.	Areas to Monitor: Growth area south of I-35 and north of W 199th St.
12	South Parallel Relief Lines • Manhole South to 35NE11	This project consists of the construction of sanitary sewer relief lines. The existing lines do not have capacity to convey the predicted peak sanitary sewer flows. Flow monitoring is recommended prior to the design of the proposed improvements.	10-Year CIP
13	WWTP Parallel Relief Lines • Manhole 15NW02 to 15SE10	This project consists of the construction of sanitary sewer relief lines. The existing lines do not have capacity to convey the predicted peak sanitary sewer flows. Flow monitoring is recommended prior to the design of the proposed improvements. The extent of the improvements will be affected by future development.	5-Year CIP Areas to Monitor: *Area west of the city limits at Four Corners Road and south of I-35 and north of W 199th St.*
14	WWTP Four Corners LS and Forcemain	This project consists of a new lift station and forcemain to serve proposed new growth areas.	Areas to Monitor: *Area west of the city limits at Four Corners Road*

15	WWTP New Gravity Interceptor	This project consists of a new gravity interceptor to serve proposed new growth areas.	Areas to Monitor: *Area west of existing city limits and north of the Logistics Park.*
16	WWTP New Gravity Interceptor	This project consists of a new gravity interceptor to serve proposed new growth areas.	Areas to Monitor: *Area east of Four Corners Rd and north of W 175th St.*
17	Nike New Lift Station and Forcemain	This project consists of a new lift station and forcemain to serve proposed new growth areas.	Areas to Monitor: *Area between S Gardner Rd and S Moonlight Rd and W 191st St and W 199th St.*
18	Nike New Gravity Interceptor	This project consists of a new gravity interceptor to serve proposed new growth areas.	Areas to Monitor: *Area west of existing city limits and north of the Logistics Park.*
19	Temporary 167th Proposed Interceptor Improvements	This project consists of the installation of a new gravity interceptor to allow the decommissioning of the Temporary 167th Lift Station.	City's discretionary use of funds.
20	Temporary 167th Lift Station Demolition	This project consists of the decommissioning and demolition of the Temporary 167th Lift Station.	City's discretionary use of funds.
21	Willowbrooke Proposed Interceptors Improvements	This project consists of the installation of a new gravity interceptor to allow the decommissioning of the Willowbrooke Lift Station.	City's discretionary use of funds.
22	Willowbrooke Lift Station Demolition	This project consists of the decommissioning and demolition of the Willowbrooke Lift Station.	City's discretionary use of funds.
23	Sunset Proposed Interceptors Improvements	This project consists of the installation of a new gravity interceptor to allow the decommissioning of the Sunset Lift Station.	City's discretionary use of funds.
24	Sunset Lift Station Demolition	This project consists of the decommissioning and demolition of the Sunset Lift Station.	City's discretionary use of funds.

25	WWTP Expansion	This project consists of increasing the treatment capacity of the WWTP from 2.5 mgd to 5.0 mgd.	Projected for approximately 2032 Areas to Monitor: *Overall growth of the City. The development of the future growth area south of I-35 prior to the areas within the existing city limits could result in a new WWTP to the South which could delay this project by approximately 10 years.*
26	Advanced Nutrient Removal at WWTP	This project consists of the installation of an anaerobic selector basin to achieve the nutrient removal required by future operating permits. This project also includes the replacement of the plant's SCADA system and the installation of a backup chemical phosphorous removal system.	Not anticipated for the next permit cycle Areas to Monitor: *The future nutrient limits could be more stringent than anticipated resulting in the need for these proposed improvements.*

Table 1-3 10-Year Capital Improvements Plan

Watershed	Project Description	Opinion of Total Project Costs (2016 $)	Improvements Schedule											
			City Discretion	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
East														
	Lift Station Improvements - Phase 1 upgrade	$435,000					$435,000							
	Parallel Forcemain - Phase 1 upgrade	$1,724,000				$1,724,000								
	Flow Monitoring	$50,000					$50,000							
	Parallel Relief Lines (MH30NW105 to MH30SW01A) [1]	$350,000						$350,000						
Genesis														
	Proposed Interceptor (for LS Removal)	$741,000	$741,000											
	Demolish LS	$30,000	$30,000											
Kill Creek														
	New Gravity Interceptor [3]	$1,071,000												$1,071,000
New Bull Creek														
	Flow Monitoring	$50,000										$50,000		
	Parallel Relief Lines (MH26NE56 to MH25NW14) [1]	$975,000											$975,000	
North														
	Flow Monitoring	$100,000			$100,000									
	Parallel Relief Lines (MH24NW01 to MH25NE23) [1]	$3,600,000				$1,980,000	$1,620,000							
South														
	Lift Station Improvements (add pump)	$250,000		$250,000										
	Storage [2]	$2,100,000			$2,100,000									
	New Lift Station and Forcemain [3]	$2,560,000									$2,560,000			
	Flow Monitoring	$100,000						$50,000	$50,000					
	Parallel Relief Lines (South to MH35NE11) [1]	$2,800,000							$1,680,000	$1,120,000				
WWTP														
	Flow Monitoring	$80,000		$80,000										
	Parallel Relief Lines (MH15NW02 to MH15SE10) [1]	$2,703,000			$1,487,000	$1,216,000								
	Four Corners Pump Station and Forcemain*	$1,104,000		$1,104,000										
	New Gravity Interceptor [3]	$686,000					$686,000							
	New Gravity Interceptor [3]	$1,095,000						$1,095,000						
Nike														
	Lift Station and Forcemain Improvements	$365,000							$365,000					
	New Gravity Interceptor [3]	$809,000								$809,000				
Temporary 167th														
	Proposed Interceptor (for LS Removal)	$79,000	$79,000											
	Demolish LS	$30,000	$30,000											
Willowbrooke														
	Proposed Interceptor (for LS Removal)	$195,000	$195,000											
	Demolish LS	$30,000	$30,000											
Sunset														
	Proposed Interceptor (for LS Removal)	$179,000	$179,000											
	Demolish LS	$30,000	$30,000											

[1] **Recommend flow monitoring to determine project extent, may be able to reduce cost of upgrades**
[2] **From City's current CIP budget**
[3] **Developer driven**

LEGEND

- Gardner City Limits
- WWTP
- EFHBs
- Lift Station
- Force Main
- Modeled Gravity Main
- Collection Lines
- Sewershed Boundary
- Parallel/Replacement Lines
- New Gravity Interceptor
- New Forcemain
- New Lift Station
- Demolish Lift Station

Kill Creek LS
Kill Creek WWTP
North EFHB
North LS
Genesis LS
167th LS
Sunset LS
Willow Brooke LS
Lincoln Lane LS
Walmart LS
Bull Creek LS
Bull Creek LS 5
East EFHB
East LS
Holtgravers LS
Moonlight LS
183rd LS
New Four Corners LS
Horizon Trails Apt. LS
Waverly Rd. LS
Sheans LS
South LS
Nike LS
New Lift Station

W 143rd St
W 151st St
W 152nd St
W 159th St
W 167th St
W 175th St
W 183rd St
W 191st St
W 199th St
Gardner Lake
Gardner Golf Course
Prairie Highlands Golf Course
New Century Aircenter
New Century Business Park
Naval Air Park
Logistics Park Kansas City
Four Corners Rd
Kill Creek Rd
Gardner Rd
Moonlight Rd
S Waverly Rd
Cedar Niles Rd
Homestead Ln
Oak Valley Dr
Roeland Park Dr
Madison St
Burlington Northern Santa Fe

0 Feet 3,200

CITY OF GARDNER, KANSAS
FIGURE 1-1: RECOMMENDED IMPROVEMENTS
10-YEAR CIP

2 Introduction

2.1 Purpose

The purpose of this document is to develop a comprehensive wastewater plan update for the City of Gardner, Kansas (City) based upon the short-term (0-5 years), mid-term (0-10 years), and long-term (10+ years) potential identified in the Comprehensive Plan and the Growth Management Strategy.

The Wastewater Master Plan Update provides the City with a document that addresses the City's wastewater needs and challenges based upon current development as well as future anticipated growth. Specifically, the following tasks are addressed:

A. Modify the 2009 Wastewater Master Plan to account for any collection system improvements that have occurred.

B. Estimate wastewater flows for current development and for four future growth conditions (ultimate development within city limits, short-term growth, mid-term growth, and long-term growth outside of city limits).

C. Prepare a hydraulic model of the major interceptors within the City's wastewater collection and conveyance system. Utilize the hydraulic model to conduct a system analysis of the existing system and identify bottlenecks. Identify solutions to correct areas where there are capacity issues.

D. Identify sewer service recommendations related to growth for the four future growth conditions. Utilize model to establish existing and future capital improvements related to projected growth. Where possible, explore solutions that will allow for the elimination of existing lift stations.

E. Determine current average and peak wastewater flows and pollutant characteristics/concentrations at the Kill Creek Wastewater Treatment Plant. Determine future average and peak wastewater flows and pollutant characteristics/concentrations at the Kill Creek Wastewater Treatment Plant, including future Total Nitrogen and Total Phosphorous discharge limits.

F. Evaluate the Kill Creek Wastewater Treatment Plant to determine the average and peak treatment capacity.

G. Identify phased treatment facility improvements to meet future capacity demands and to meet anticipated future discharge limits. Prepare recommendations based upon the results of the treatment plant evaluation.

H. Based on results of previous and current wastewater system evaluations, prepare recommendations related to reduction, rehabilitation, and/or conveyance of infiltration and inflow in the City's wastewater system.

I. Evaluate the City's current sewer maintenance program and FOG program and make recommendations for improvements.

J. Develop prioritized capital improvements plan.

2.2 Planning Process

The wastewater planning process is primarily driven by the City's land use plan. The City of Gardner has a comprehensive land use plan to guide future development decisions related to the location of residential, commercial, and industrial land uses within the existing city limits. This information is important in establishing future wastewater usage as the City develops to its ultimate build-out. The anticipated future development was provided within the City of Gardner's "Growth Management Strategy" from November, 23, 2015.

2.3 Abbreviations and Acronyms

The following list of abbreviations and acronyms is provided as a reference for common abbreviations used in this report:

cfs	Cubic Feet per Second
CIP	Capital Improvements Plan
City	City of Gardner
EFHB	Excess Flow Holding Basin
EPA	United States Environmental Protection Agency
gpd	Gallons Per Day
gpm	Gallons Per Minute
I/I	Inflow and Infiltration
KDHE	Kansas Department of Health and Environment
mgd or MGD	Million Gallons per Day
PDWF	Peak Dry Weather Flow
PBF	Peak Base Flow
SSES	Sanitary Sewer Evaluation Study
SSO	Sanitary Sewer Overflow

3 Evaluation Criteria

3.1 Land Planning

The City of Gardner lies within Johnson County Kansas on the southwestern edge of the Kansas City Metro area. The nearest cities are the City of Olathe and the City of Edgerton, with many unincorporated areas lying between the boundaries. Figure 3-1 indicates the proximity of the City to its neighbors.

This Wastewater Master Plan projects the wastewater needs of the City at its current development and for four future growth conditions, for a total of five scenarios. The first scenario projects the wastewater at current development. The second scenario is largely based upon ultimate development within the City's existing city limits. The third growth scenario considers ultimate development within the City's existing city limits plus the development of the short-term growth plan from the "Growth Management Strategy". The fourth scenario includes ultimate development within the existing city limits and the mid-term growth plan. The fifth, and final, scenario includes ultimate development within the existing city limits and the long-term growth plan.

3.2 Land Use

Current and anticipated future land uses for the City are indicated in the City's "Growth Management Strategy", completed November 23, 2015 and adopted by City Council. City staff worked with HDR to define the assumptions that would govern these planned growth areas and made slight modifications to the growth maps based upon their knowledge of planned development.

3.2.1 Existing Development

Figure 3-1 depicts property that is currently developed or in the process of being developed. The figure indicates the study boundary and the city limits as they currently stand. The majority of the existing development occurs in the center of town, along US 56 Highway. The development is mostly low density residential, with some medium density residential and commercial development along the 56 Highway corridor.

3.2.2 Ultimate Development

Figure 3-2 shows the projected land use at full buildout. The study boundary for this scenario closely follows the existing city limits.

3.2.3 Ultimate Development plus Short-term Growth

Figure 3-3 depicts the ultimate development with the additional development outside existing city limits of the short-term growth. These areas are along the US 56 Highway corridor near the Gardner Airport on the west side of town. The area will be a mix of commercial growth north and east of the airport and residential growth.

3.2.4 Ultimate Development plus Mid-term Growth

Figure 3-4 depicts the ultimate development with the additional development outside existing city limits of the mid-term growth. The mid-term growth areas are located at the 175th Street and I-35

interchange and the 191st Street and I-35 interchange. The area will be a mix of commercial and residential growth.

3.2.5 Ultimate Development plus Long-term Growth

Figure 3-5 depicts the ultimate development with the additional development outside existing city limits of the long-term growth. The long-term growth areas are to the north of the existing city limits, surrounding the Gardner Lake area, and to the southeast of I-35. The area will be a mix of commercial and residential growth.

3.3 Population Projections and Economic

Population projections were taken from the August 11, 2016 letter from Community Solutions Group. The population projections took into account planned growth areas as well as the relationship of population to other measures. Their estimates included three possible trends of net migration: baseline, high, and low. For the purposes of this evaluation, the high trend values were used. The population projections are summarized in Table 3-1 below.

Table 3-1 Population Projections

	2010	2015	2025	2040
Population	19,195	20,868	29,000	51,270

General demographic information for the City of Gardner was obtained from the Comprehensive Plan and is tabulated as follows for 2013:

- The median age is 31.1
- The median household income is $61,974
- The average number of people per household is 2.9

3.4 Forecasts of Flow

The land use projections provide the basis for projecting wastewater flows, aiding in the evaluation of the City's existing interceptor system, lift stations, and wastewater treatment plant.

3.4.1 Collection and Conveyance System Forecasts of Flow (Peak Flow)

Section DC2, Design Criteria for Sanitary Sewers and Appurtenances, of the City of Gardner's Technical Specifications for Public Improvement Projects, May 2007, includes the methodology for converting residentially and commercially/industrially developed acreage into wastewater flows. A copy of this methodology is located in Appendix A.

The City's flow projection methodology requires sewer system design be completed on a watershed basis, or total tributary area, with sewers sized for ultimate development. It recognizes the need to size these systems for the impact of extraneous flows that come from infiltration and inflow. As systems become older and/or flows from private systems increase, the peak flow in the sewer system can exceed the system capacities required by the City's technical specifications.

Under the City's methodology, sewers are to have sufficient capacity to handle the maximum hourly flow anticipated with a storm event with a 50-year return interval. The flows are projected based upon the total tributary area and a flow per acre, in cubic feet per second. The larger the tributary area, the lower the flow per acre, because wastewater collects more rapidly in smaller tributary areas than in larger ones due to the miles of pipe the wastewater has to flow before it

reaches the main interceptors. Flow also varies between residential and commercial/industrial development. Residential development contributes more wastewater flow than commercial/industrial development. Additionally, a sewer system design should be of sufficient capacity to convey peak flow contributions from other watersheds that will either flow by gravity or be pumped into the design watershed.

A comparison was made the Johnson County Wastewater (JCW) design criteria, which is based upon a 10-year storm. The JCW design criteria utilizes a design flow curve that calculates a flow per acre based upon tributary size. The JCW design criteria is very similar to the City of Gardner's design criteria, with the exception of the design storm frequency. Appendix B contains a copy of the design curve. Table 3-2 below contains a comparison of the two design methods.

Table 3-2 Future Wastewater Characteristics

Area (acres)	Gardner Design Criteria for Residential (cfs/acre)	JCW Design Criteria for Residential (cfs/acre)
200	0.021	0.022
1000	0.014	0.015
2000	0.013	0.014

The JCW design criteria is a more conservative approach to sizing of the sanitary sewers. The design criteria is adjusted based upon the density. The City of Gardner's methodology was used to size all interceptors in future growth areas.

Appendix C contains the projected flow by drainage basin under each flow scenario.

3.4.2 Wastewater Treatment Plant Forecasts of Flow

Future influent wastewater loadings that will be used in subsequent calculations to size equipment are projected in Table 3-3.

Table 3-3 Future Wastewater Characteristics

BOD, mg/L	200
Ammonia, mg/L	35

Future flow projections are based on anticipated residential building permits. Historical residential building permits are shown in Table 3-4. As can be seen from below, the City experienced rapid growth in the 1990's and early 2000's. However, the effect of the 2007-2009 recession can be seen in the decrease in the number of building permits issued each year. The population projections by Community Solutions Group see the growth in the City increase to the point where it was at its most robust. A comparison of the housing starts is one method of verifying actual increase but it is important to note that it does not take into account commercial growth.

Table 3-4 Historical Residential Building Permits

Year	Residential Building Permits
2000	186
2001	167
2002	271
2003	353
2004	443
2005	399
2006	228
2007	192
2008	89
2009	87
2010	70
2011	40
2012	49
2013	78
2014	85

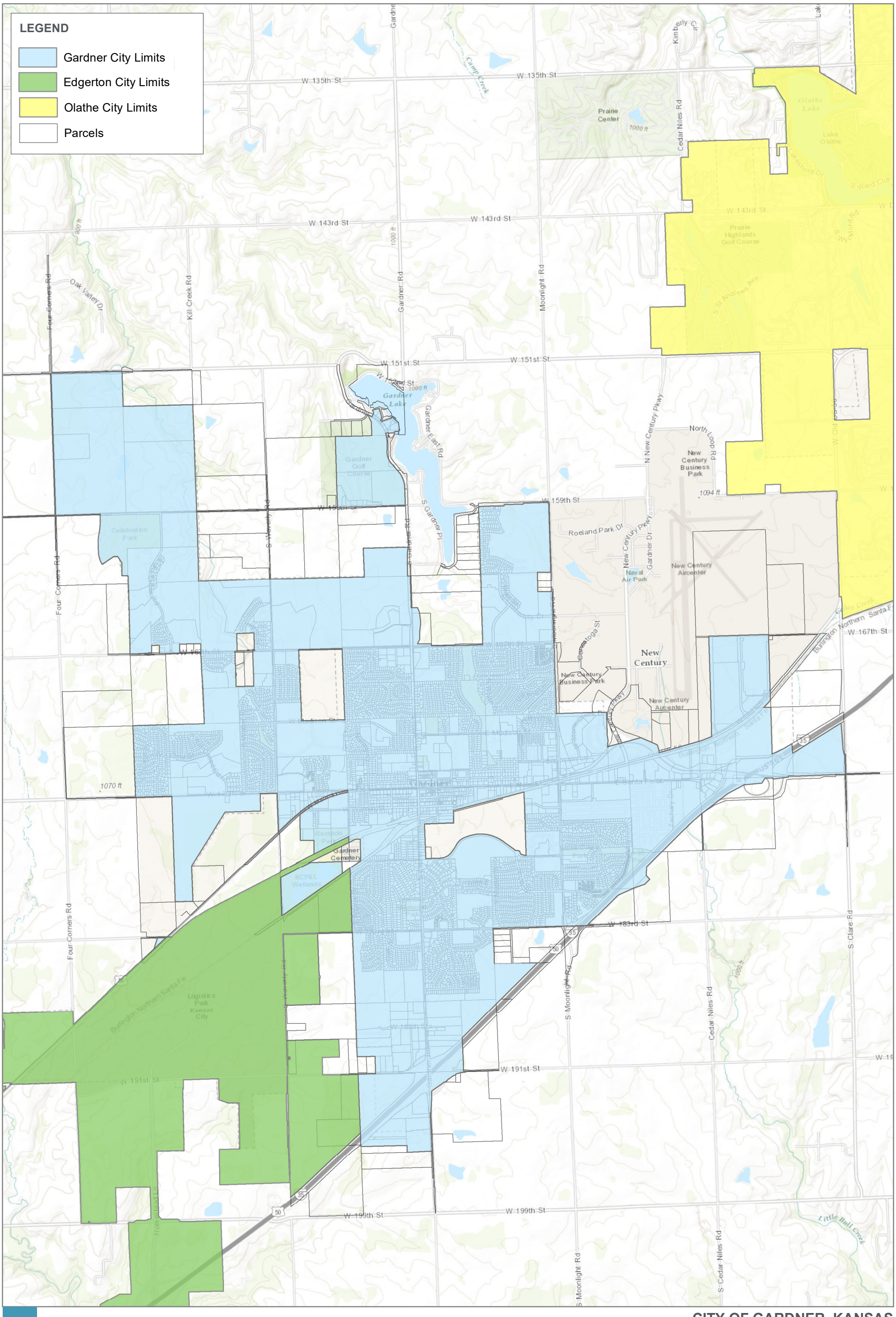
The future flow projection is presented in Table 3-5 and is based on anticipated building permits. This report assumes building permits between 2015 and 2024 will be reduced to 150 applications annually, followed by 200 permit applications from 2025 through 2040.

Table 3-5 Future WWTP Flow Projections

Year	Annual Building Permits	Previous Flow to WWTP, GPD	New Flow to WWTP[1,2], GPD/Year	Total Average Flow to WWTF, GPD
2015	150	1,590,000	43,500	1,633,500
2016	150	1,633,500	43,500	1,677,000
2020	150	1,677,000	43,500	1,851,000
2025	200	1,851,000	58,000	2,083,000
2030	200	2,083,000	58,000	2,373,000
2035	200	2,373,000	58,000	2,663,000
2040	200	2,663,000	58,000	2,935,000

Note 1: Assuming 100 gallons of flow generated per person per day.
Note 2: Average people per housing unit is 2.90, per 2013 census data.

While working with City staff, projected growth areas were defined. If we were to take the projected short-term acreage of 642 additional acres, and assume that there were three lots per acre and a total of 2.9 person per lot, it would result in a population increase of 5,585. This is an approximate annual increase of 1, 110 which is greater than the annual increase of 290 that is assumed above.



CITY OF GARDNER, KANSAS

FIGURE 3-1: CITY SERVICE AREAS

LEGEND

City Limits

- Gardner
- Edgerton
- Olathe

Zoning

- Agricultural
- Commercial
- Industrial
- Low Density Residential
- Medium Density Residential
- Planned Unit Development
- Recreational

0 Feet 3,200

CITY OF GARDNER, KANSAS

FIGURE 3-2: EXISTING DEVELOPMENT

LEGEND

City Limits

- Gardner
- Edgerton
- Olathe

Zoning

- Agricultural
- Commercial
- Industrial
- Low Density Residential
- Medium Density Residential
- Planned Unit Development
- Recreational

0 Feet 3,200

CITY OF GARDNER, KANSAS

FIGURE 3-3: ULTIMATE DEVELOPMENT IN CITY LIMITS

LEGEND

City Limits

- Gardner
- Edgerton
- Olathe

Zoning

- Agricultural
- Commercial
- Industrial
- Low Density Residential
- Medium Density Residential
- Planned Unit Development
- Recreational
- Gardner Short-term Growth

0 Feet 3,200

CITY OF GARDNER, KANSAS

FIGURE 3-4: ULTIMATE DEVELOPMENT PLUS SHORT-TERM GROWTH

LEGEND

City Limits
- Gardner
- Edgerton
- Olathe

Zoning
- Agricultural
- Commercial
- Industrial
- Low Density Residential
- Medium Density Residential
- Planned Unit Development
- Recreational
- Gardner Short-term Growth
- Gardner Mid-term Growth

0 Feet 3,200

CITY OF GARDNER, KANSAS

FIGURE 3-5: ULTIMATE DEVELOPMENT PLUS MID-TERM GROWTH

LEGEND

City Limits
- Gardner
- Edgerton
- Olathe

Zoning
- Agricultural
- Commercial
- Industrial
- Low Density Residential
- Medium Density Residential
- Planned Unit Development
- Recreational
- Gardner Short-term Growth
- Gardner Mid-term Growth
- Gardner Long-Term Growth

0 Feet 3,200

CITY OF GARDNER, KANSAS

FIGURE 3-6: ULTIMATE DEVELOPMENT PLUS LONG-TERM GROWTH

4 Existing Collection, Conveyance, and Treatment Facilities

The City is served by a combination of wastewater collection, conveyance, and treatment systems. The City owns and operates the collection system that collects wastewater from the majority of property owners. This wastewater is conveyed by a network of collection lines, trunk sewers, lift stations, force mains, and interceptors to the Kill Creek Wastewater Treatment Plant. Figure 4-1 indicates the extent of the City's collection and conveyance facilities.

4.1 Existing Collection and Conveyance System

The Study Area consists of 18 existing major drainage basins or watersheds and five future drainage basins or watersheds. Drainage basins define areas within the City where wastewater may be collected and conveyed downhill by gravity. As shown in Figure 4-1, most of the watersheds include lift stations that convey the wastewater to the City's main interceptors. These include the following watersheds: 183rd, Bull Creek, East, Genesis, Holtgravers, Kill Creek, Lincoln Lane, Moonlight, Bull Creek 5, Nike, North, Sheans, South, Sunset, Temporary 167th, Wal-Mart, Willow-Brooke, and WWTP.

Gravity Collection and Conveyance System

The City's sewer collection system consists of approximately 3,500 manholes and over 501,600 linear feet of sewer pipes, both gravity and forcemain. The sewer pipe sizes range from 8-inches in diameter to 36-inches. This Master Plan Update focuses on evaluating only the major interceptors, 8-inches in diameter and greater. Table 4-1 represents an inventory of the major interceptors by watershed within the City.

Table 4-1 Modeled Interceptor Length by Watershed

Pipe Length (Feet)												
Pipe Size (Inches)	8	10	12	15	18	20	21	24	27	30	36	**Totals**
Bull Creek			1,384									**8,134**
East	1,541	5,014	405		78		1.095					**3,454**
Genesis		1,133	1,964	358								**12,451**
Kill Creek		1,389	1,111		4,302		5,127	521				**14,240**
New Bull Creek	254	4,715	4,433		1,702		1,097	2,040				**21,928**
North	8,134	4,821		744	1,250	2,440		285			4,255	**17,330**
South	930	3,594	6,746	3,056	1,272		1,103	628				**2,059**
Wal-Mart			553	692	814							**1,384**
WWTP	1,579	1,506	2,218	11,010	957		4,185		3,411	3,411		**28,260**
Totals	**12,437**	**22,172**	**18,814**	**15,860**	**10,375**	**2,440**	**12,608**	**3,473**	**3,411**	**3,395**	**4,255**	**109,240**

Lift Station and Force Main Conveyance System

Although all of the major watersheds are served by gravity sewer systems, conveyance by gravity to the interceptor system for several watersheds is not possible. 19 lift stations are owned and operated by the City.

Figure 4-1 depicts the location of all of the City's existing lift stations. Table 4-2 summarizes all of the City's active lift stations and their firm capacities.

Table 4-2 Active Lift Station Summary

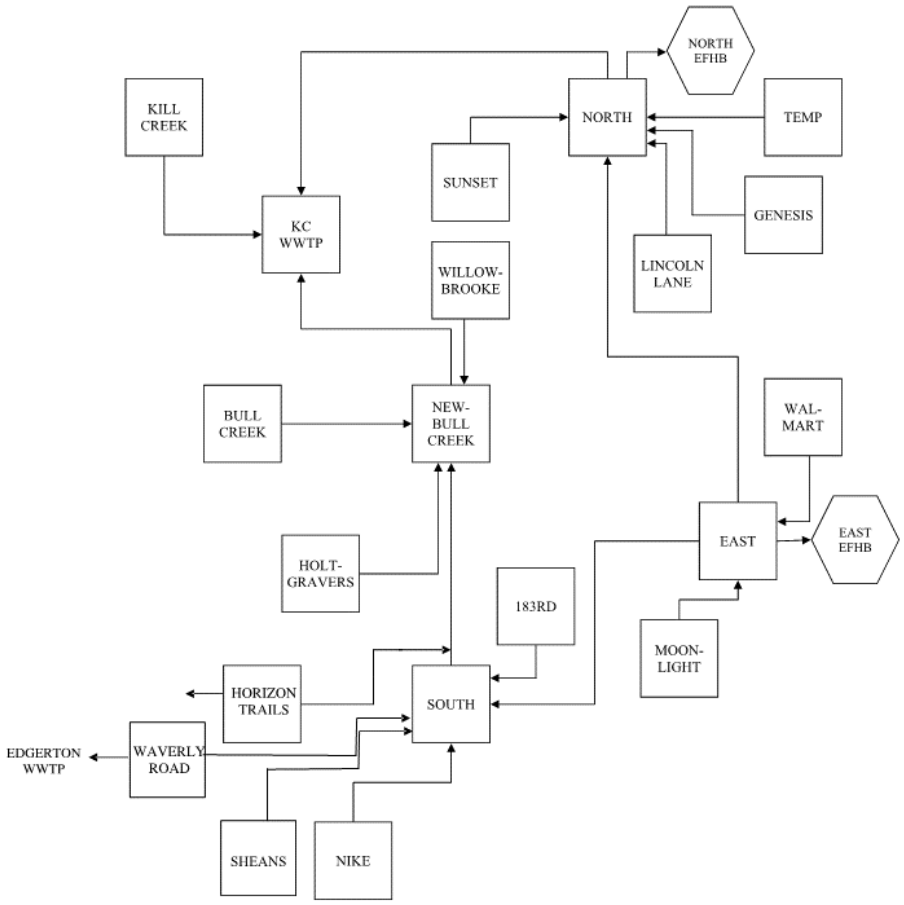
Active Lift Stations		
Lift Station Name	**No. of Pumps**	**Station Firm Capacity (GPM)**
183rd Lift Station	2	500
Bull Creek Lift Station 5	2	220
East Lift Station	2	350
Genesis Lift Station	2	625
Holtgravers Lift Station	2	300
Horizon Trails Apt. Lift Station	2	300
Kill Creek Lift Station	2	5,600
Lincoln Lane Lift Station	2	340
Moonlight Lift Station	2	300
New Bull Creek Lift Station	3	3,300
Nike Lift Station	2	120
North Lift Station	3	3,100
Sheans Lift Station	2	250
South Lift Station	3	1,000[1]
Sunset Lift Station	2	250
Temporary 167th Lift Station	2	250
Wal-Mart Lift Station	2	2,000[2]
Waverly Road Lift Station	2	300
Willowbrooke Lift Station	2	80

[1]Firm capacity includes two 750 gpm pumps running simultaneously. The station contains an additional 2,500 gpm pump

[2]Current firm capacity of the station is in excess of ultimate flow, and far in excess of current flow. A lower flow rate was used in evaluation of existing condition to portray actual need at the East and North Lift Stations where Wal-Mart flows are repumped. Storage provided at these locations will accommodate differences in peak flows and actual lift station pumping rates.

Figure 4-2 is a flow schematic indicating the routing of existing flows. Following is a brief description of each lift station's routing of existing flows, by watershed.

Figure 4-2 Active Lift Stations Schematic



- East - The East Lift Station currently pumps 80% of the flow collected at the lift station to the North Lift Station's interceptor system and 20% of its collected flow to the South Lift Station's interceptor system. The lift station site currently contains a 250,000 gallon excess flow holding basin (EFHB).
- Genesis - The Genesis Lift Station pumps the wastewater flows generated in the watershed into the North Lift Station's interceptor system.
- Temporary 167th - The Temporary 167th Lift Station pumps the wastewater flows generated in the watershed into the North Lift Station's interceptor system.
- Kill Creek - The Kill Creek Lift Station currently pumps to the Kill Creek Wastewater Treatment Plant.
- New Bull Creek - The New Bull Creek Lift Station pumps to the interceptor system leading to the Kill Creek WWTP.

- South - All flows generated in the watershed and collected at the South Lift Station and conveyed to the New Bull Creek Lift Station.
- Moonlight - The Moonlight Lift Station pumps to the East Lift Station's interceptor system.
- Wal-Mart - The Wal-Mart Lift Station pumps to the East Lift Station's interceptor system.
- North - All wastewater flows generated in the watershed are pumped by the North Lift Station to the WWTP's interceptor system. The North Lift Station site contains a 1,000,000 gallon EFHB to store peak flows during a storm event.
- 183rd - The 183rd Lift Station pumps to the South Lift Station interceptor system.
- Sunset - The Sunset Lift Station conveys the watershed's wastewater flows to the North Lift Station's interceptor system.
- Lincoln Lane - The Lincoln Lane Lift Station conveys the watershed's wastewater flows to the North Lift Station's interceptor system
- Nike - The Nike Lift Station pumps directly to the South Lift Station.
- Bull Creek 5 - The Bull Creek Lift Station 5 pumps the watershed's wastewater flows directly upstream of the New Bull Creek Lift Station.
- Horizon Trails – The Horizon Trails Lift Station pumps directly to the South Lift Station forcemain.
- Holtgravers - Holtgravers Lift Station pumps to the New Bull Creek Lift Station's interceptor system.
- Waverly Road – The Waverly Road Lift Station pumps to the Edgerton Wastewater Treatment Plant. The City's current capacity at the WWTP is 200,000 gpd. They currently pump approximately 150,000 gpd. Flows in excess of 150,000 gpd go to the South Lift Station. A copy of the agreement is located in Appendix E.
- Willowbrooke - Willowbrooke Lift Station currently pumps to the New Bull Creek Lift Station's interceptor system.
- Sheans - Sheans Lift Station pumps the watershed's flow to the South Lift Station's interceptor system.

An evaluation was completed of the operation of the existing lift stations. Lift station run data was obtained from the City from January 2015 through April 2016. A comparison of the average daily flows and the peak daily flow is contained in Table 4-3.

Table 4-3 Lift Station Average to Peak Flow Comparison Summary

Lift Station Name	Lift Station Average Daily Flows (gpm)	Lift Station Peak Daily Flows (gpm)	Average Flow to Peak Flow Factor
183rd Lift Station	109	536	4.9
Bull Creek Lift Station 5	7	17	2.4
East Lift Station	191	403	2.1**
Genesis Lift Station	46	131	2.8
Holtgravers Lift Station	12	42	3.5
Horizon Trails Lift Station	11	15	1.4
Kill Creek Lift Station	*	*	*
Lincoln Lane Lift Station	9	13	1.4
Moonlight Lift Station	19	56	2.9
New Bull Creek Lift Station	*	*	*
Nike Lift Station	2	13	6.5
North Lift Station	505	*	*
Sheans Lift Station	10	37	3.7
South Lift Station	335	1,250	3.7
Sunset Lift Station	51	142	2.8
Temporary 167th Lift Station	11	19	1.7
Wal-Mart Lift Station	19	116	6.1
Waverly Road Lift Station***	25	379	15.2
Willowbrooke Lift Station	14	109	7.8

* No data available.

**Peak flow is equalized by using an excess flow holding basin.

***150,000 gpd to Edgerton WWTP

A comparison of the actual recorded peak flows to the peak flows projected utilizing the City's design criteria has been completed. The results are indicated in Table 4-4. The analysis shows that most watersheds are producing a smaller peak flow than projected using the City's design criteria. Only two of the lift stations with available data experience peak flows greater than the projected peak flow: 183rd Lift Station and Nike Lift Station. Five of the lift stations experience tributary peak flows at a ratio of five times or greater than the actual peak flows documented at the lift stations. These lift stations are: Genesis, Holtgravers, Lincoln Lane, Moonlight, and Temporary 167th Lift Station.

Table 4-4 Comparison of Projected Peak to Actual Peak Flows

Lift Station Name	Tributary Peak Flow for Existing Development (gpm)	Lift Station Peak Daily Flows (gpm)	Ratio of Tributary Peak Flow to Lift Station Peak Flows (gpm)
183rd Lift Station	332	536	0.62:1
Genesis Lift Station	764	131	5.83:1
Holtgravers Lift Station	504	42	12:1
Kill Creek Lift Station	0	*	*
Lincoln Lane Lift Station	119	12	9.92:1
Moonlight Lift Station	738	47	15.70:1
New Bull Creek Lift Station	5253	*	*
Nike Lift Station	12	13	0.92:1
Sheans Lift Station	20	12**	1.66:1
Sunset Lift Station	336	*	*
Temporary 167th Lift Station	160	10	16:1
Wal-Mart Lift Station	228	116	1.97:1
Willowbrooke Lift Station	233	109	2.14:1

* No available data

Excess Flow Holding Basin Storage System

Another component of the City's wastewater collection and conveyance system is excess flow holding basins. These basins are utilized to provide flow equalization during periods of peak wet weather flow to minimize and/or eliminate overloading of lift stations and gravity interceptors. The EFHBs are designed to either limit or eliminate the discharge from the conveyance system upstream of the basin during the wet weather peak flow event. After the wet weather wastewater flows subside, the flow is drained from the EFHB. Table 4-5 summarizes the existing EFHBs in the City.

Table 4-5 Excess Flow Holding Basins

Existing EFHB's	
Description	**Capacity (MG)**
East Lift Station EFHB	0.25
North Lift Station EFHB	1.00

4.2 Existing Wastewater Treatment Facility Evaluation

The City owns and operates the Kill Creek Wastewater Treatment Facility (WWTF) located along 159th Street. This facility was designed for an average daily flow capacity of 2.5 million gallons per day (MGD) and has peak capacity of 9.0 MGD. Based upon the original plan of the site, the plant can be expanded to treat an average flow of 7.5 MGD.

4.2.1 Existing Flows and Loadings

A current average daily flow of 1.59 MGD and peak flow of 3.7 MGD was calculated. Historical data was used for the following average wastewater characteristics, as summarized in Table 4-6.

Table 4-6 Annual Average Wastewater Characteristics

	Influent	Effluent
BOD, mg/L	168	3
TSS, mg/L	294	4
Nitrate, mg/L	N /A	3
TKN, mg/L	N /A	5.8
Total P, mg/L	N /A	1.8
Total N, mg/L	N /A	<10

The Kill Creek WWTP's NPDES permit was renewed October 20, 2016. Table 4-7 is a summary of the effluent discharge limits for the wastewater treatment plant. A copy of the permit is contained in Appendix D.

Table 4-7 Effluent Discharge Limits

	Weekly Average	Monthly Average
BOD, mg/l		
(May through September)	30	20
(March, April, October, and November)	40	25
(December through February)	45	30
TSS, mg/l	45	30
Ammonia Nitrogen (as N), mg/l		
(January, February, and December)	8.6	4.9
(March, April, and October)	8.6	3.0
(May)	8.6	2.5
(June and September)	8.6	1.9
(July and August)	8.6	1.4
(November)	8.6	4.1
E. Coli, colonies/100 mL	Weekly/Monthly Geometric Average	
(April 1 through October 31)	4348	262
(November 1 through March 31)		2358

4.2.2 Existing Wastewater Treatment Facility

The Kill Creek WWTF is comprised of the following components:

- Influent Pump Station
- Headworks
- Oxidation Ditches

- Clarifiers
- UV Disinfection System
- Cascade Aerator
- Gravity Sludge Thickener
- Aerobic Digesters
- Sludge Belt Filter Press

4.2.3 Component Summary

The following is a brief description of the components associated with each unit process:

4.2.3.1 INFLUENT PUMP STATION

The Influent Pump Station, located northeast of the Headworks Structure and west of Kill Creek, houses four submersible influent pumps, three firm and one standby. Provisions were made during construction of the plant for the installation of a future fifth pump. Influent is collected by the City's conveyance system and discharged to the Influent Pump Station wetwell. The influent pumps discharge through two 16-inch forcemains, with provisions for a third forcemain in the future. The speed of each influent pump is controlled via variable frequency drives and is based on a signal from the submersible level transducer located within the wetwell. Each pump has a capacity of 3 MGD, for a total firm capacity of 9 MGD for the pump station.

4.2.3.2 HEADWORKS

The Influent Pump Station directs the plant influent to the Headworks Building, where the flow is metered before passing through mechanical screening equipment. The screening equipment consists of two Huber mechanical step screens with a conveyor system to transfer screenings to a wash/press to clean and dewater the screenings. Each mechanical screen is rated for a maximum flow capacity of 19 MGD with 6 feet of water in front of the screen.

After passing through the mechanical screens, the wastewater flows into one of two grit vortex chambers. Each vortex chamber is 14-feet in diameter and rated for 18 MGD. The vortex chambers discharge degritted wastewater into a common diversion structure before flowing to the Oxidation Ditches. Grit is pumped out of the vortex chambers by two 250-gpm pumps and is dewatered before being discharged into a dumpster. This dumpster also collects screenings and, when full, is disposed to the landfill.

4.2.3.3 OXIDATION DITCHES

Screened and degritted wastewater is directed to the Oxidation Ditches, which are a part of the activated sludge process. This is an aerobic process that achieves high biomass concentrations through the recycle of biological sludge solids. The Oxidation Ditches contain an aerobic bacterial biomass in suspension that carries out the breakdown and treatment of the organic pollutants of the waste. After the wastewater is treated in the Oxidation Ditches, it is conveyed to the clarifiers where the biomass is settled. A portion of the biomass is returned to the aeration basins to maintain the Mixed Liquor Suspended Solids (MLSS), or the biomass suspension, levels and the remaining biomass is wasted to the sludge digestion process. Waste Activated Sludge (WAS) is removed from the bottom of the Oxidation Ditch through an 8-inch pipe and transported to the pre-mix basin for the Gravity Thickener.

Each Oxidation Ditch structure is 72-feet wide and 201-feet long and has a 12.5-foot side water depth. The total volume of the Oxidation Ditches is approximately 2.6 million gallons. At the current average flow of 1.5 MGD the hydraulic retention time is 40 hours. The combined Oxidation Ditches have a hydraulic retention time of approximately 25 hours at the design flow of 2.5 MGD.

The two Oxidation Ditches have the ability to operate in alternating nitrification or denitrification cycles. The nitrification / denitrification cycle is completed in four phases. Phase A is accomplished as flow enters one ditch that is kept mixed in an anoxic condition. This environment forces the microorganisms to use the nitrate as an oxygen source, thereby releasing the nitrogen to the atmosphere and denitrifying the wastewater. During Phase A the second Oxidation Ditch is oxygenated using the rotors and operated in an oxic condition. This condition allows the microorganisms to convert ammonia to nitrate to complete the nitrification cycle. Phase B is a brief intermediate phase where wastewater is fed to the basin that oxygen is introduced. During this phase, oxygen is introduced into the anoxic basin from Phase A to reduce the content of ammonia before the wastewater is discharged to the Clarifier. Phase C and D correlate to Phase A and B, respectively, although the flow and oxygenation pattern are reversed.

Each ditch is equipped with two rotors that span the width of the basin and have a shallow submergence into the wastewater. The rotating motion of the rotors introduces oxygen into the wastewater.

Oxygen Required (Based upon Design Influent BOD Concentration of 200 mg/l and Ammonia Concentration of 35 mg/l)

Actual Oxygen Requirement (AOR):

BOD_5 Removed = (200 mg/l - 10 mg/l) x 8.34 x 2.5 MGD x 1.4 lbs O_2 lb BOD

BOD_5 Removed = 5,546 lbs/day

Ammonia Removed = (35 mg/l – 0 mg/l) x 8.34 x 2.5 MGD x 4.6 lbs O_2 lb NH_3

Ammonia Removed = 3,360 lbs/day

Total AOR = 8,906 lbs/day

OR

= 371 lbs/hr

Standard Oxygen Requirement (SOR):

$$SOR = \frac{(AOR)\,(C^*_{s20})}{(\alpha)\,[\,(C_{SW})\,(\beta) - (C_o)\,]\,(1.024^{(T-20)})}$$

Where:	SOR		Standard Oxygen Requirement
	AOR	332	Actual Oxygen Requirement
	α	0.90	Alpha
	T	12	° C Temperature of Water
	C_{SW}	10.5	Correction for temp from chart
	C^*_{s20}	9.02	C at standard conditions
	(β)	0.95	Beta
	C_o	2.00	Dissolved Oxygen Concentration

$$SOR = \frac{(371\ lb/hr)\,(9.02)}{0.90[(10.5)(0.95) - (2.00)](1.024^{(12-20)})}$$

SOR = 564 lb/hr

The rotors provide a firm capacity of 705 lbs O2/hr. Therefore, the rotors should be capable of providing adequate oxygen to the Oxidation Ditches.

4.2.3.4 CLARIFIERS

The clarifiers are fed from the Oxidation Ditches by two 20" pipes located at the bottom of the distribution box in the Oxidation Ditches. In the clarifiers, the biomass is settled and the return settled sludge is pulled from the bottom of the clarifiers and sent to the head of the Oxidation Ditches. The Clarifiers are 88.5 feet in diameter. The weir loading rate at the peak design flow of 9 MGD is 32,370 gal/ft/day. The Kansas Department of Health and Environment (KDHE) requirement for weir loading is 30,000 gal/ft/day. The surface loading rate at the peak design flow of 9 MGD is 1,463 gal/day/ft^2, which exceeds KDHE's required maximum 1,400 gal/day/ft^2. The solids loading at the peak design flow of 9 MGD and an assumed MLSS of 2,500 mg/l is 30.5 lbs/ft^2/day, exceeding KDHE's 25 pounds per square foot per day limit. However, KDHE has provisions that allow solids loadings above the 25 pounds per square foot per day limit for clarifiers with diameters larger than 50 feet. Scum is collected by a baffle around the perimeter of the clarifier and diverted to a scum beach in the center of the basin. From here, scum is pumped to the pre-mix basin for the Gravity Thickener. Effluent wastewater flows over a weir and is sent to UV disinfection through an 18-inch pipe.

4.2.3.5 GRAVITY THICKENER

Gravity thickening of waste sludge and scum is completed in a 35-foot diameter basin similar to the Clarifiers. However, the rake mechanism has vertical pickets to gently stir the sludge and allow water to escape as supernatant flow. Supernatant flow is removed from the top of the basin and directed to the Sludge Dewatering Beds. Thickened sludge is drawn from the bottom of the Gravity Thickener and sent to the aerobic digesters.

4.2.3.6 AEROBIC DIGESTERS

The two Aerobic Digesters are comprised of 51-foot by 62-foot 1-inch basins with a 21-foot depth. Each basin has two air diffuser headers that span the length of the basin and are spaced equally to provide even distribution. Aerobic Digestion is similar to the activated sludge process in the Oxidation Ditches, although the food source is depleted. Therefore, the microorganisms begin to oxidize their own cell walls to form carbon dioxide, water, and ammonia. Remaining solid compounds in the sludge are composed of inert organic compounds that are not biodegradable. This sludge is wasted to the Sludge Dewatering Beds.

4.2.3.7 UV DISINFECTION SYSTEM

The UV Disinfection System is located in the UV and Cascade Aerator Building. Ultraviolet light disinfects wastewater by altering the genetic (DNA) material in the cells so that bacteria, viruses, and other microorganisms can no longer reproduce. The UV disinfection unit contains two units capable each capable of treating 4.5 MGD with room for an additional future UV disinfection unit. The UV disinfection units discharge to the Cascade Aerators or recycle water system.

4.2.3.8 CASCADE AERATORS

The two Cascade Aerators are each 10-feet 8-inches wide and are comprised of a 30-foot stair structure. Each aerator is capable of flowing 2.5 MGD and there is room for an additional cascade aerator in the future. Flow from the aerators discharges through a Parshall flume and ultimately the outfall structure.

4.2.3.9 SLUDGE BELT FILTER PRESS

Sludge wasted from the Aerobic Digesters is mixed with supernatant from the Gravity Thickener and sent to the sludge belt filter press before disposal. The belt press is a 1.5M press, which has an approximate capacity of 1,625 dry pounds per hour. Sludge is discharged from the belt filter press and disposed of by a contract hauler. The City currently contracts with Synagro for their hauling needs.

SUMMARY

The capacities for the existing plant components are as listed in Table 4-8.

Table 4-8 Hydraulic and Biological Capacities

Equipment/Structure	Process Capacity
Influent Pump Station	
Peak Flow	9 MGD
Headworks	
Peak Flow (Screen Capacity)	38 MGD (19 MGD Each)
Oxidation Ditches	
Average Flow	2.5 MGD
BOD Loading	> 200 mg/l
Ammonia Loading	> 35 mg/l
Clarifier	
Peak Flow	9 MGD
UV Disinfection	
Peak Flow	9 MGD (Both units in operation)
Belt Filter Press	
Peak Loading	1,625 lbs/hr

LEGEND

- Gardner City Limits
- WWTP
- EFHBs
- Lift Station
- Force Main
- Modeled Gravity Main
- Collection Lines
- Sewershed Boundary

Kill Creek LS
Kill Creek WWTP
North EFHB
North LS
167th LS
Genesis LS
Sunset LS
Willow Brooke LS
Lincoln Lane LS
Walmart LS
Bull Creek LS
Bull Creek LS 5
East EFHB
East LS
Holtgravers LS
Moonlight LS
183rd LS
Horizon Trails Apt. LS
Waverly Rd. LS
South LS
Sheans LS
Nike LS

W 143rd St
W 151st St
W 152nd St
W 159th St
W 167th St
W 183rd St
W 191st St
W 199th St
Gardner Lake
Gardner Golf Course
Prairie Highlands Golf Course
New Century Business Park
New Century Aircenter
Naval Air Park
Celebration Park
KCP&L Wetlands
Logistics Park Kansas City
Burlington Northern Santa Fe
Four Corners Rd
Oak Valley Dr
Kill Creek Rd
Gardner Rd
Moonlight Rd
S Waverly Rd
Homestead Ln
Cedar Niles Rd
Little Bull Creek
Gardner East Rd
S Gardner Pl
N New Century Pkwy
New Century Pkwy
Roeland Park Dr
Gardner Dr
University Dr
Conestoga St
North Loop Rd
W Old US-56
US-56E
S Ward Cliff
S Wycliffe Rd
S St Andrews Ave
Lakeshore Dr
Cedar Creek
900 ft
1000 ft
1070 ft
1094 ft

0 Feet 3,200

CITY OF GARDNER, KANSAS

FIGURE 4-1: EXISTING COLLECTION SYSTEM

GENERAL LEGEND

FENCE

W POTABLE WATER

NPW NON-POTABLE WATER

EXISTING PIPING

STRUCTURE LEGEND

① PLANT LIFT STATION

② OXIDATION DITCH

③ CLARIFIERS

④ AEROBIC DIGESTER

⑤ U.V. DISTRIBUTION BUILDING/CASCADE AERATOR

⑥ SLUDGE DEWATERING

⑦ LABORATORY BUILDING

⑧ VEHICLE STORAGE BUILDING

⑨ HEADWORKS BUILDING

HORIZONTAL SCALE

50 25 0 50

1 INCH = 50 FEET

HDR

City of Gardner, Kansas
Wastewater Master Plan Update
Kill Creek WWTP

Figure 4-3
Existing Site Layout

5 Collection, Conveyance, and Treatment Facilities Evaluation

This section of the Master Plan identifies the basis for planning wastewater collection and treatment facilities to serve the existing and ultimate build out of the City of Gardner. The basis of this effort is that all future improvements are made with the consideration of what is needed at the ultimate development condition. In some cases, the future improvements are new sewers and/or pumping facilities that will be sized for the ultimate growth at the time the facilities are constructed. However, many of improvements represent upgrades to existing facilities as these facilities play a significant role in serving the City at full build out. Phased improvements to match growth have been considered.

The City's major interceptors were evaluated to assess the impacts of growth on the existing facilities. A hydraulic model was created in Excel to evaluate the impact of aging sewers, with increasing extraneous flow, as well as the impact of development of undeveloped land on the existing infrastructure. The same model was used to predict the size of facilities that will be constructed in the future to serve the ultimate growth condition.

5.1 Collection and Conveyance System Evaluation

Collection and conveyance system planning is based upon projected land use and wastewater flow rates generated by these land uses. The peak flow rates (experienced during wet weather storm events) are the most critical for pipe line sizing since the major purpose of the sewer network is to collect and convey wastewater from its sources to the location of storage and/or treatment facilities without causing overflows and sewer backups. Gravity collection and conveyance systems are designed to convey wastewater by gravity flow with no more than a full pipe. However, when the wastewater flow rate exceeds the full-pipe capacity of the system, the system becomes surcharged and the wastewater level builds up in the manholes to a level above the top of the pipe. Wastewater systems normally have the ability, due primarily to the pipelines depth, to withstand low to moderate surcharging. However, at some point, excessive surcharging of wastewater collection and conveyance systems may cause the back up of wastewater into residences and/or businesses connected to the system. Also, excessive surcharging may cause the wastewater to surcharge to a level at or above the tops of manholes and overflow into adjacent drainage courses. These are referred to as sanitary sewer overflows (SSO).

The proper design and operation of the City's wastewater collection system should allow the City to eliminate excessive surcharging that could cause basement backups and sanitary sewer overflows. To that end, the City adopted Section DC2, Design Criteria for Sanitary Sewers and Appurtenances, of the City of Gardner's Technical Specifications for Public Improvement Projects which requires new sewers to be constructed according to specific design criteria.

5.1.1 Existing Development

A land use plan and hydraulic model were completed for the existing development condition. Figure 3-1 depicts this land use and Figure 5-1 shows the results of the hydraulic model under this condition. The model included the following proposed changes by watershed in the way the lift station flows are routed. Improvements required to meet this condition are indicated in Figure 5.2.

Recommended improvements for the lift stations are discussed below:

Parallel Pipe Improvements to meet capacity requirements for the existing collection system. The hydraulic model highlighted those segments that were exceeding the pipe capacity. Only those segments that had projected peak flows 115% over the capacity of the pipe were recommended for improvements.

Genesis - The proposed improvements include installing gravity interceptors to allow the decommissioning of the Genesis Lift Station to convey the flows generated by the watershed to the North Lift Station by gravity.

Temporary 167th - The proposed improvements include decommissioning the Temporary 167th Lift Station and installing a gravity interceptor to convey the flows generated by the watershed to the North Lift Station's interceptor system.

Willowbrooke - The proposed improvements include installing gravity interceptors to allow the decommissioning of the Willowbrooke Lift Station to convey the flows generated by the watershed to the interceptor system discharging to the gravity system to the Kill Creek Wastewater Treatment Plant.

Sunset - The proposed improvements include installing gravity interceptors to allow the decommissioning of the Sunset Lift Station to convey the flows generated by the watershed to the interceptor system discharging to the gravity system to the Kill Creek Wastewater Treatment Plant

Sheans - The proposed improvements include rerouting of the forcemain to allow the lift station to discharge directly to the New Bull Creek Lift Station.

5.1.2 Ultimate Development

Figure 3-2 represents the projected land use at the ultimate buildout condition within the city limits. Figure 5-3 and 5-4 show the results of the hydraulic model and recommended improvements under this scenario.

East - The proposed capacity of the existing lift station does not accommodate the peak flows projected under ultimate build out conditions. The proposed improvements include lift station and forcemain improvements to be able to lift all flow to the North Lift Station by gravity (with no flow to the South Lift Station as currently being pumped.)

5.1.3 Ultimate Development plus Short-term Growth

The projected land use for this scenario is indicated in Figure 3-3. It includes the ultimate development within the city limits as well as the projected short-term growth areas along the US 56 Highway corridor on the west side of town. The impacts on the hydraulic model and resulting improvements are shown in Figures 5-5 and 5-6. This area can be served with new gravity interceptors.

5.1.4 Ultimate Development plus Mid-term Growth

Figure 3-4 depicts the land use at full buildout within city limits and includes the projected mid-term growth areas at the 175th Street and I-35 interchange and the 191st Street and I-35 interchange. Figures 5-6 and 5-7 contain the results of the hydraulic model and the recommended improvements for this alternative.

Ultimate flows shown are in excess of current Kill Creek Lift Station and Wastewater Treatment Plant capacity due to the inclusion of additional watershed area outside the city limits. However, no lift station improvements were included in the recommendations at this time. Flows should be monitored as growth occurs to determine need.

The area south of I-35 can be served through a number of alternatives:

The current preliminary site plan for the proposed development of 262 acres at 175th and I-35 includes approximately 2,337,000 square feet of building area, which consists of warehouses, retail shops, a hotel, home improvement store, and pad sites.

Based upon typical flows per building square foot, the estimated average day sanitary flow for the proposed development is 60,000 gallons per day. These estimates are preliminary and should be verified by the developer's engineer.

The proposed site located south of I-35 drains to the south while the nearest sanitary sewer infrastructure is on the north side of I-35. The proposed development is part of a larger unsewered service area that is comprised of over 2,380 acres. A long-term plan to serve this area is under evaluation as a part of the Update to the Gardner Wastewater Master Plan, but could consist of conveying all sanitary flows via a new lift station to the City's existing South Lift Station or conveying all sanitary flows to a new wastewater treatment facility located south of I-35. Concerns about building permanent infrastructure to serve such a small portion of the total service have led to the consideration of interim options to serve the initial development.

Three interim options to serve the initial development were considered:

- Pump flows to the Wal-Mart Lift Station
- Construct holding tanks
- Construct package wastewater treatment plant

The City had previously estimated the construction cost of a lift station and forcemain to convey the flow to the City's existing East Lift Station, which has the capacity for the proposed sanitary flow from the development. The City estimated the construction cost at approximately $950,000.

Constructing holding tanks to store the wastewater flows generated by the proposed development until such time as the waste can be hauled off to a treatment facility was evaluated. The proposed average day flow is 60,000 gallons per day. This does not consider any impact of increased flows typically seen with wet weather conditions.

A package plant could be installed on the project site to serve the proposed development until enough buildout was achieved. The package plant would be sized to serve an average daily flow of 60,000 gallons per day with a peak to average day ratio of 4 to 1. An equalization basin would

be required if peak flows will be in excess of the 4 to 1 ratio. The package plant could be operated by the existing City's operators and would not require additional labor. The estimated price of a package plant is approximately $700,000 to $1,000,000, depending upon effluent limits negotiated with KDHE. An antidegradation review would be required by KDHE. With the TMDL's on the Kansas River, we can expect that the plant will likely get a nutrient limit of a 10 mg/l Total Nitrogen and 1 mg/l Total Phosphorous.

South - It is recommended that a 360,000 gallon excess flow holding basin be constructed to store peak flows during storm events. Additionally, one of the existing 750 gpm pumps should be replaced with a 2,500 gpm pump and the existing 750 gpm pump should be used as a shelved spare.

5.1.5 Ultimate Development plus Long-term Growth

Figure 3-4 depicts the land use at full buildout within city limits and includes the projected long-term growth areas. These areas are located to the north of the existing city limits and to the southeast of I-35. Figures 5-8 and 5-9 contain the results of the hydraulic model and the recommended improvements for this alternative.

Northern Expansion - Install lift station and forcemain to collect the wastewater and pump directly to the Kill Creek Waste Water Treatment Plant. Capacity upgrades to the Kill Creek WWTP will more than likely be required but the size of the capacity increase will be directly related to the selected alternative for the new growth to the south of I-35. Construction of a new WWTP could reduce the demand on the existing WWTP.

New Bull Creek - It is proposed that an excess flow holding basin be constructed at the New Bull Creek Lift Station to store peak flows during storm events and to mitigate future upgrades to the lift station required by growth. The lift station and forcemain capacity must be increased to handle flows from the new growth.

Southern Expansion - Two alternatives were evaluated: Constructing lift stations and sending flow to the existing Kill Creek WWTP and constructing a new treatment plant to the south. Either option will include modifications to the South Lift Station. Cost estimates for these options and other alternatives are included in Appendix G.

5.2 Wastewater Treatment Plant Evaluation

5.2.1 Operating Permit

The Kill Creek WWTF operates under Permit Number M-KS20-OO01 and is effective between December 1, 2016 and October 31, 2021. This evaluation incorporates the required information, including:

- Operational changes (if feasible).
- Physical and chemical treatment additions.
- Biological treatment additions to meet the stated goals.

The permit did not set nutrient limits but stated that the permittee should operate the treatment facility to maximize the level of nutrient removal with the intent of achieving either of two goals:

1. TN of 10.0 mg/l and TP of 1.0 mg/l
2. TN of 8 mg/l and TP of 1.5 mg/l

Based upon the plant's historic data, it is advisable that they consider the first goal.

This is the first of three potential phases to further restrict discharge limits for nitrogen and phosphorous. The second phase will likely require the Total Nitrogen and Phosphorus annual average discharge limits to 5 mg/L and 0.5 mg/L, respectively. In addition, if the State determines a more aggressive restriction a third phase of discharge limits could be set at 3 mg/L for Total Nitrogen and 0.3 mg/L for Total Phosphorus. The following sections detail the process improvements required to meet the three levels of future discharge limits described above.

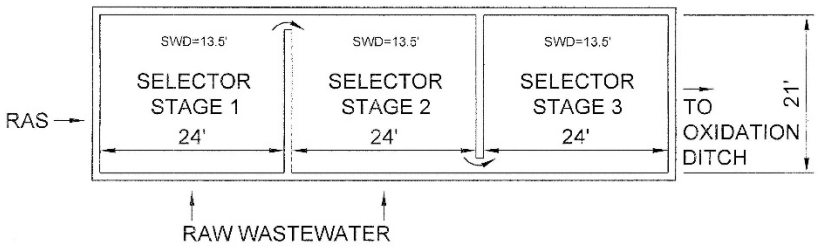
5.2.2 Scenario 1: TN=10.0 mg/L and TP=1.5 mg/L

The existing treatment facility is capable of reducing the Total Nitrogen (TN) concentration below 8.0 mg/L on an annual average. However, improvements and operational changes will be necessary to consistently remove Total Phosphorus (TP) to an effluent concentration of 1.5 mg/L. Recommended improvements and theory of operation is discussed below.

Biological Phosphorous Removal – Anaerobic Selector Basin and SCADA Improvement

Biological phosphorous removal can be increased by installing an anaerobic selector basin between the headworks building and oxidation ditches. The anaerobic selector is comprised of three chambers, or stages, that operate under anoxic or anaerobic conditions. Return activated sludge (RAS) from the clarifier is fed into the first chamber of the selector basin, as shown in Figure 5.11. RAS entering this chamber contains dissolved oxygen, which is biologically depleted in the first chamber to form an anaerobic environment before flowing into the second chamber.

Figure 5.11 Schematic of Anaerobic Selector Basin



Influent wastewater enters the basin in either the first or second stage and supplies carbon for bacteria colonies to process under anoxic / anaerobic conditions. The presence of a carbon source in anaerobic conditions causes the bacteria to release phosphorous and store the carbon as energy. The anaerobic process and energy storage continues within the third chamber before the process flows into the oxidation ditch. Upon exposure to the oxic condition in the oxidation ditch, the bacteria utilize the stored energy to reproduce. The increased bacterial population uptake phosphorus at higher than normal levels. The bacteria containing the excess phosphorus is wasted from the process as sludge to eliminate phosphorus from the treatment stream.

The SCADA system needs to be upgraded to the employ automatic ammonia and nitrate monitoring within the oxidation ditch. The control system for the oxidation ditch would use this information to automatically control and optimize the oxic and anoxic phases within the ditch.

A chemical feed system described below should also be installed as a backup to remove phosphorous during upset conditions where biological activity is not sufficient.

Chemical Phosphorous Removal

The chemical system feeds metal salts, such as alum or ferric chloride, into the clarifier basins to aid coagulation of bacteria colonies and other insoluble constituents. Since bacteria store phosphorus, this system reduces effluent concentrations of phosphorus. This system should be capable of dosing 60 mg Alum / L. The following calculation is used to size the chemical feed pumps and storage tank.

Alum Dosing Calculation:

Max Dose Required (ppd) = Peak Flow, MGD x Target Concentration, mg/L x 8.34

= 9.0 MGD x 60 mg Alum/L x 8.34

= 4,500 pounds alum per day

Using liquid alum density: = 4,500 lbs/day x 1 gallon/11 lbs x day/24 hours

= 17 gallons per hour (rounded to 20 gallons per hour)

Alum Storage Calculation:

Storage is recommended to be equivalent to 30 days of chemical demand during average flow conditions at the WWTF. Therefore, the average chemical demand and storage are calculated as follows:

Avg. Dose Required (ppd) = 2.5 MGD x 60 mg Alum/L x 8.34

= 1,250 pounds alum per day = 115 gallons per day

= 3,450 gallons for 30-day supply

Bulk liquid alum is typically delivered using 5,000-gallon tanker trucks. Since the delivery fee is the same for partial deliveries, the storage should be able to accommodate 1.5 tanker deliveries to enable the WWTF to accept a full delivery when the tank is not completely empty. Therefore, a 7,500-gallon storage tank is recommended.

5.2.3 Scenario 2: TN=5.0 mg/L and TP=0.5 mg/L

Future discharge limits may require annual average TN and TP concentrations below 5 mg/L and 0.5 mg/L, respectively. It is recommended that a post anoxic and post aeration basin be added to the treatment stream.

A post-anoxic basin will be required to meet TN concentrations below 5 mg/L. This basin receives flow from the oxidation ditches and discharges to the clarifier. The post-anoxic basin is comprised of two anoxic zones that force the microorganisms to utilize nitrate in lieu of oxygen to breakdown carbonaceous organics. This reduces nitrates to gaseous nitrogen (N2), nitric oxide (NO), and nitrous oxide (N_2O). Gaseous nitrogen is released to the atmosphere.

The two anoxic zones are followed by a reaeration zone using course bubble diffusers. This zone provides a buffer to limit the microorganisms from releasing phosphorus into the effluent water. Such an event would occur if anaerobic conditions prevailed, in which microorganisms begin purging phosphorus and storing carbonaceous organics. Operating with the same biological mechanism as the anaerobic selector basin, the reaeration zone provides an oxic condition to allow microorganisms to uptake any purged phosphorus.

Additionally, tertiary filtration is recommended to consistently meet the discharge limits. Media filters remove insoluble particles from the clarifier effluent. They have the added benefit of removing nitrates from the system. A deep bed configuration develops colonies of microorganisms within the media. This biological activity depletes oxygen as the wastewater flows down through the media and creates an anoxic condition. The nitrates are reduced and performance is enhanced with an external carbon source such as methanol. This equipment requires backwashes to dislodge particles from the media, which are accomplished by reversing the flow through the filters by pumping effluent water.

5.2.4 Scenario 3: TN=3.0 mg/L and TP=0.3 mg/L

The most stringent future discharge limits currently being discussed would require annual averages of TN to be 3 mg/L and TP to be 0.3 mg/L. This would require additional biological nitrogen removal, which can be achieved with a post-anoxic basin located between the oxidation ditch and clarifier or the installation of a denitrifying filter after the clarifier and before the UV disinfection units. This type of filter was considered in Section 5.2.3.

The extent of denitrification is limited by the influent concentration of carbonaceous organics to the post-anoxic basin. Therefore, an external carbon source such as methanol can be dosed into the basin to increase the carbonaceous supply for additional denitrification. Further analysis of the oxidation ditch effluent characteristics are required to determine if an external carbon source will be required. For the purpose of providing a complete cost opinion to meet discharge limits, this evaluation will assume methanol dosing is required.

SUMMARY

The costs are used to determine the lowest-cost combination of alternatives and scenarios, Table 5-1 provides a summary of these costs.

Table 5-1 Estimated Costs for Improvements to Meet Future KDHE Discharge Limits

	Probable Cost
Scenario 1: TN=10.0 mg/L & TP=1.0 mg/L	
Anaerobic Selector Basin and SCADA	$1,950,800
Scenario 2: TN=5.0 mg/L & TP=0.5 mg/L	
Post-Anoxic and Aeration Basin	$1,730,400
Deep-Bed Media Filter	$4,120,100
Scenario 3: TN=3.0 mg/L & TP=0.3 mg/L	
Methanol Dosing	$215,000

5.2.5 Alternatives to Increase Facility Capacity

The original plant design planned for expanding the treatment facility with two additional trains that are each capable of treating an average flow of 2.5 MGD for a total future average flow of 7.5 MGD and a peak flow of 27.0 MGD, which provides a 3.6:1 peak to average ratio. This ratio exceeds the peak flow ratio experienced at the wastewater treatment plant. It is however, less than the amount of peak flows predicted by the City's sanitary sewer sizing criteria. The future facilities at the wastewater treatment plant have been sized for the 3.6:1 peak flow ratio.

The existing hydraulic and biological capacities of the each component of the WWTF were outlined in Table 4-8 of the previous section. Table 5-2 summarizes the improvements required for each 2.5 MGD expansion.

Table 5-2 Unit Process Expansion Items

Unit Process	Expansion to 5.0 mgd Average / 18.0 mgd Peak	Expansion to 7.5 mgd Average / 27.0 mgd Peak
Influent Pump Station	Replace pumps, Install 3rd Forcemain	Replace pumps, Replace Forcemain
Headworks	N/A	N/A
Oxidation Ditches	Install 2nd Pair of Oxidation Ditches	Install 3rd Pair of Oxidation Ditches
Clarifier	Install 2nd Pair of Clarifiers	Install 3rd Pair of Clarifiers
UV Disinfection	Install 3rd UV Module in Existing Building, Construct 2nd UV Building	Construct additional UV module
Biosolids	Install 2nd Belt Filter Press	Install 3rd Belt Filter Press

Growth projections from Section 3.4 indicate the Kill Creek WWTF will require an expansion to support an average flow of 5.0 MGD before the year 2035. Therefore, the following Table 5-3 summarizes the estimated cost to construct a 2.5 MGD expansion. Improvements required to meet each discharge limit scenario were outlined in Section 5.2 and considered are present and future costs, assuming 3.0% inflation.

Table 5-3 2.5 MGD Plant Expansion Summary

Scenario	2018 Cost
1 (TN=10.0 mg/L & TP=1.0 mg/L)	$16,820,000
2 (TN=5.0 mg/L & TP=0.5 mg/L)	$19,106,000
3 (TN=3.0 mg/L & TP=0.3 mg/L)	$21,831,000

LEGEND

- Gardner City Limits
- WWTP
- EFHBs
- Lift Station
- Force Main
- Modeled Gravity Main
- Collection Lines
- Sewershed Boundary
- Bottlenecks - Scenario #1

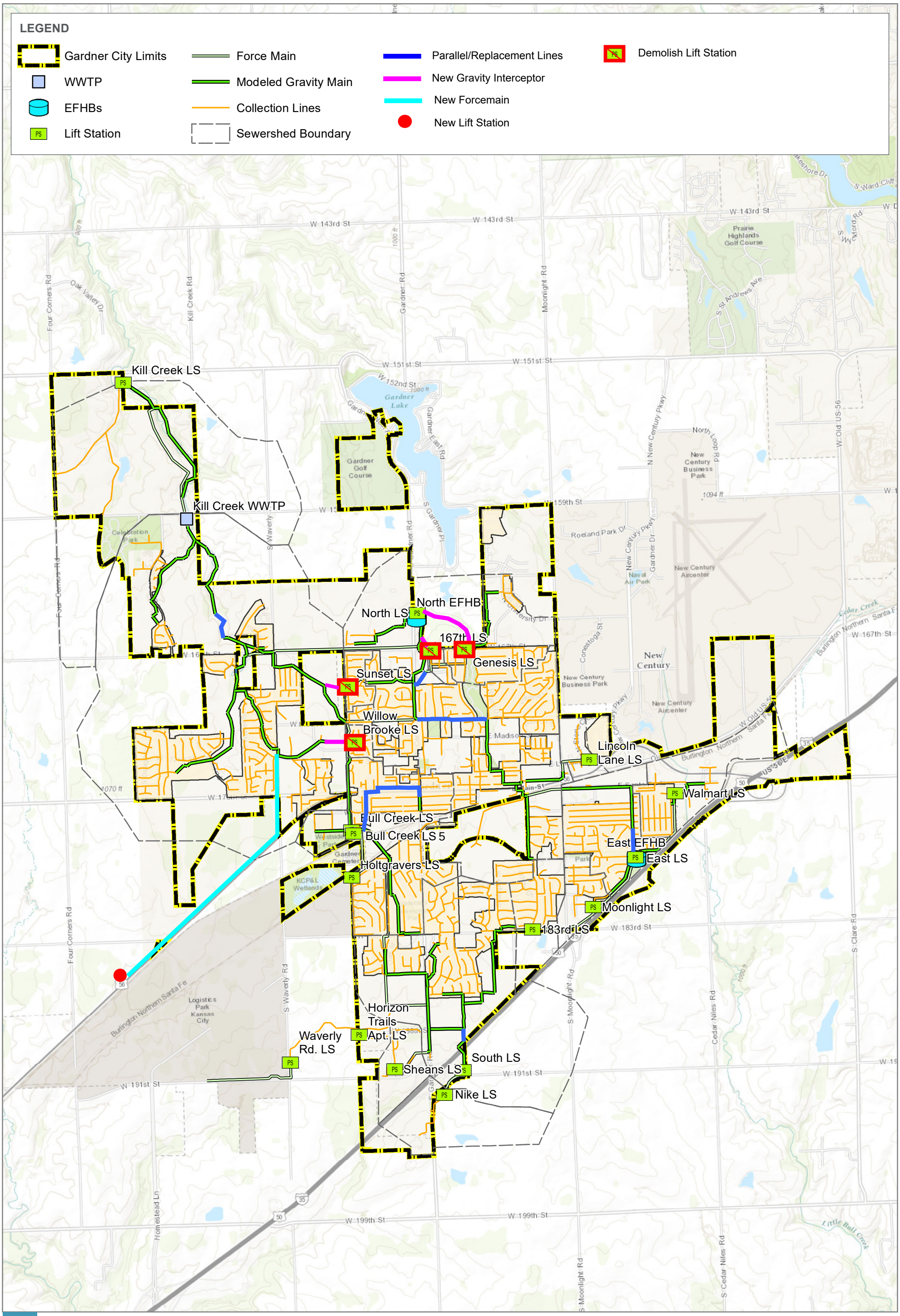
Kill Creek LS
Kill Creek WWTP
North EFHB
North LS
167th LS
Genesis LS
Sunset LS
Willow Brooke LS
Lincoln Lane LS
Walmart LS
Bull Creek LS
Bull Creek LS 5
East EFHB
East LS
Holtgravers LS
Moonlight LS
183rd LS
Horizon Trails Apt. LS
Waverly Rd. LS
Sheans LS
South LS
Nike LS

W 143rd St
W 151st St
W 152nd St
W 159th St
W 167th St
W 183rd St
W 191st St
W 199th St
Gardner Lake
Gardner Golf Course
Prairie Highlands Golf Course
New Century Business Park
New Century Aircenter
Naval Air Park
Celebration Park
KCP&L Wetlands
Logistics Park Kansas City
Burlington Northern Santa Fe
Four Corners Rd
Oak Valley Dr
Kill Creek Rd
Gardner Rd
Moonlight Rd
S Waverly Rd
Homestead Ln
Cedar Niles Rd
Little Bull Creek
US-56E

0 Feet 3,200

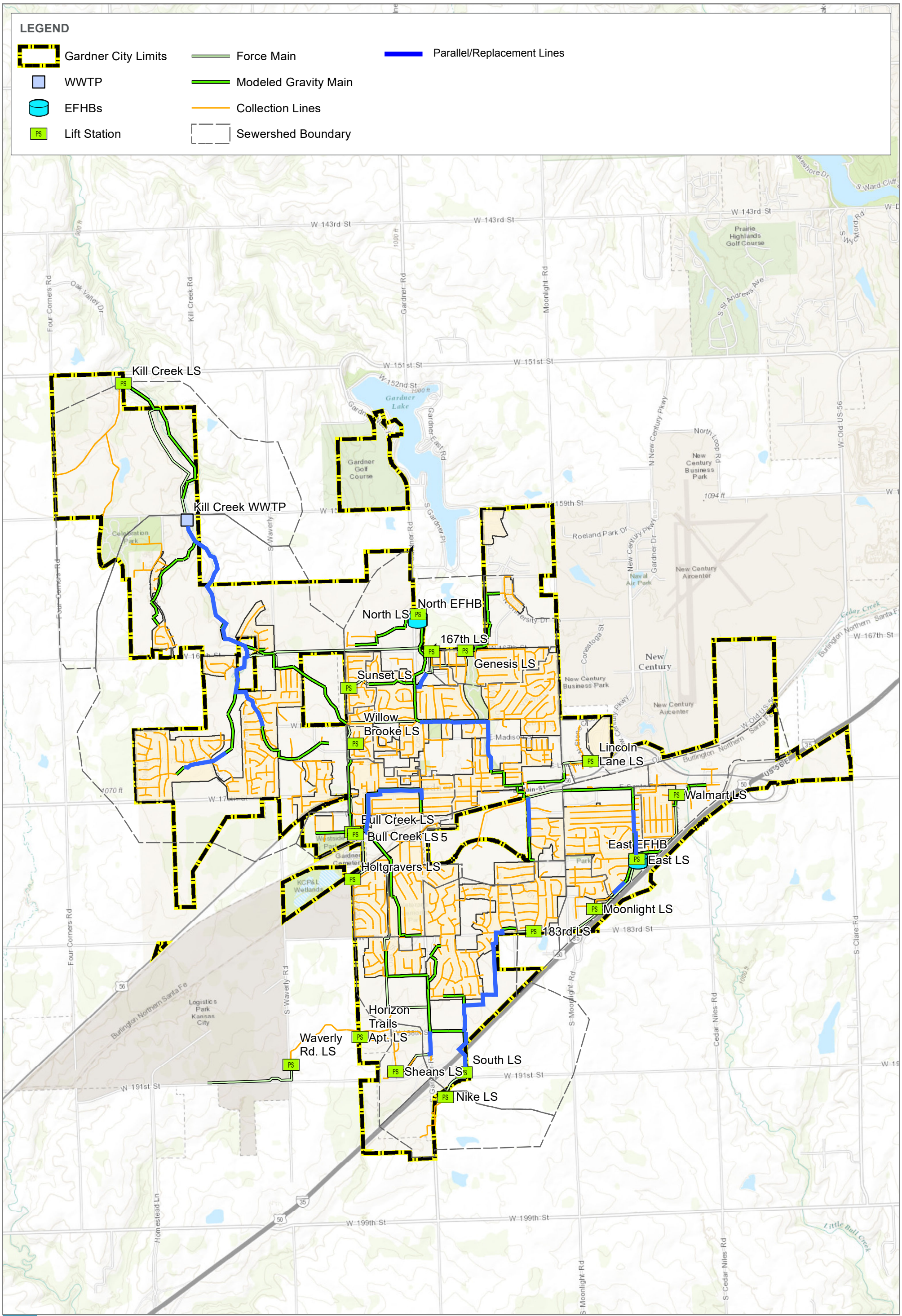
CITY OF GARDNER, KANSAS

FIGURE 5-1: SCENARIO 1 BOTTLENECKS



CITY OF GARDNER, KANSAS

FIGURE 5-2: SCENARIO 1 RECOMMENDED IMPROVEMENTS



CITY OF GARDNER, KANSAS

FIGURE 5-4: SCENARIO 2 RECOMMENDED IMPROVEMENTS

LEGEND

Gardner City Limits
WWTP
EFHBs
Lift Station
Force Main
Modeled Gravity Main
Collection Lines
Sewershed Boundary
Bottlenecks - Scenario #3

Kill Creek LS
Kill Creek WWTP
North EFHB
North LS
167th LS
Genesis LS
Sunset LS
Willow Brooke LS
Lincoln Lane LS
Walmart LS
Bull Creek LS
Bull Creek LS 5
East EFHB
East LS
Holtgravers LS
Moonlight LS
183rd LS
Horizon Trails Apt. LS
Waverly Rd. LS
South LS
Sheans LS
Nike LS

W 143rd St
W 151st St
W 152nd St
W 159th St
W 167th St
W 183rd St
W 191st St
W 199th St
Gardner Lake
Gardner Golf Course
Prairie Highlands Golf Course
New Century Business Park
New Century Aircenter
Naval Air Park
Celebration Park
Logistics Park Kansas City
Four Corners Rd
Oak Valley Dr
Kill Creek Rd
Gardner Rd
Moonlight Rd
S Waverly Rd
S Gardner Rd
S Gardner East Rd
N New Century Pkwy
New Century Pkwy
Roeland Park Dr
Gardner Dr
North Loop Rd
W Old US-56
S Ward Cliff
S Wycliffe Rd
S St Andrews Ave
Cedar Creek
Burlington Northern Santa Fe
Homestead Ln
Cedar Niles Rd
Little Bull Creek
KCP&L Wetlands
Gardner Cemetery
Westside Park
1000 ft
1070 ft
1094 ft

HDR
GARDNER KANSAS Blazing New Trails

0 Feet 3,200

CITY OF GARDNER, KANSAS
FIGURE 5-5: SCENARIO 3 BOTTLENECKS

LEGEND

- Gardner City Limits
- WWTP
- EFHBs
- Lift Station
- Force Main
- Modeled Gravity Main
- Collection Lines
- Sewershed Boundary
- Parallel/Replacement Lines
- New Gravity Interceptor

Kill Creek LS
Kill Creek WWTP
North EFHB
North LS
167th LS
Genesis LS
Sunset LS
Willow Brooke LS
Lincoln Lane LS
Walmart LS
Bull Creek LS
East EFHB
East LS
Holtgravers LS
Bull Creek LS 5
Moonlight LS
183rd LS
Horizon Trails Apt. LS
Waverly Rd. LS
South LS
Sheans LS
Nike LS

0 Feet 3,200

CITY OF GARDNER, KANSAS

FIGURE 5-6: SCENARIO 3 RECOMMENDED IMPROVEMENTS

LEGEND

- Gardner City Limits
- WWTP
- EFHBs
- Lift Station
- Force Main
- Modeled Gravity Main
- Collection Lines
- Sewershed Boundary
- Bottlenecks - Scenario #4

Kill Creek LS
Kill Creek WWTP
North EFHB
North LS
167th LS
Genesis LS
Sunset LS
Willow Brooke LS
Lincoln Lane LS
Walmart LS
Bull Creek LS
Bull Creek LS 5
East EFHB
East LS
Holtgravers LS
Moonlight LS
183rd LS
Horizon Trails Apt. LS
Waverly Rd. LS
Sheans LS
South LS
Nike LS

0 Feet 3,200

CITY OF GARDNER, KANSAS

FIGURE 5-7: SCENARIO 4 BOTTLENECKS

LEGEND

- Gardner City Limits
- WWTP
- EFHBs
- Lift Station
- Force Main
- Modeled Gravity Main
- Collection Lines
- Sewershed Boundary
- Parallel/Replacement Lines
- New Gravity Interceptor
- New Forcemain
- New Lift Station

Kill Creek LS
Kill Creek WWTP
North EFHB
North LS
167th LS
Genesis LS
Sunset LS
Willow Brooke LS
Lincoln Lane LS
Walmart LS
Bull Creek LS
East EFHB
East LS
Holtgravers LS
Moonlight LS
183rd LS
Horizon Trails Apt. LS
Waverly Rd. LS
Sheans LS
South LS
Nike LS

W 143rd St
W 151st St
W 152nd St
W 159th St
W 167th St
W 183rd St
W 191st St
W 199th St
Gardner Lake
Gardner Golf Course
Prairie Highlands Golf Course
New Century Business Park
New Century Aircenter
Naval Air Park
Celebration Park
KCP&L Wetlands
Logistics Park Kansas City
Burlington Northern Santa Fe
Four Corners Rd
Oak Valley Dr
Kill Creek Rd
Gardner Rd
Moonlight Rd
S Waverly Rd
S Gardner Rd
S Gardner East Rd
S Gardner Pl
N New Century Pkwy
New Century Pkwy
Roeland Park Dr
North Loop Rd
W Old US-56
S Ward Cliff
S Wycliffe Rd
S St Andrews Ave
Conestoga St
University Dr
Homestead Ln
Cedar Niles Rd
S Clare Rd
Little Bull Creek
900 ft
1000 ft
1070 ft
1094 ft

0 Feet 3,200

CITY OF GARDNER, KANSAS

FIGURE 5-8: SCENARIO 4 RECOMMENDED IMPROVEMENTS

LEGEND

- Gardner City Limits
- WWTP
- EFHBs
- Lift Station
- Force Main
- Modeled Gravity Main
- Collection Lines
- Sewershed Boundary
- Bottlenecks - Scenario #5

Kill Creek LS
Kill Creek WWTP
North EFHB
North LS
Genesis LS
167th LS
Sunset LS
Willow Brooke LS
Lincoln Lane LS
Walmart LS
Bull Creek LS
Bull Creek LS 5
East EFHB
East LS
Holtgravers LS
Moonlight LS
183rd LS
Horizon Trails Apt. LS
Waverly Rd. LS
Sheans LS
South LS
Nike LS

W 143rd St
W 151st St
W 152nd St
W 159th St
W 167th St
W 175th St
W 183rd St
W 191st St
W 199th St
Gardner Rd
Moonlight Rd
Kill Creek Rd
Four Corners Rd
Oak Valley Dr
S Waverly Rd
Gardner East Rd
S Gardner Pl
N New Century Pkwy
New Century Business Park
New Century Aircenter
Prairie Highlands Golf Course
Gardner Golf Course
Celebration Park
Roeland Park Dr
Madison St
Burlington Northern Santa Fe
Logistics Park Kansas City
Homestead Ln
Cedar Niles Rd
S Clare Rd
Little Bull Creek

0 Feet 3,200

CITY OF GARDNER, KANSAS

FIGURE 5-9: SCENARIO 5 BOTTLENECKS

LEGEND

- Gardner City Limits
- WWTP
- EFHBs
- Lift Station
- Force Main
- Modeled Gravity Main
- Collection Lines
- Sewershed Boundary
- Parallel/Replacement Lines
- New Gravity Interceptor
- New Forcemain
- New Lift Station

Kill Creek LS
Kill Creek WWTP
North EFHB
North LS
Genesis LS
167th LS
Sunset LS
Willow Brooke LS
Lincoln Lane LS
Walmart LS
Bull Creek LS
Bull Creek LS 5
East EFHB
East LS
Holtgravers LS
Moonlight LS
183rd LS
Horizon Trails Apt. LS
Waverly Rd. LS
Sheans LS
South LS
Nike LS
New Cedar Niles LS

0 Feet 3,200

CITY OF GARDNER, KANSAS

FIGURE 5-10: SCENARIO 5 RECOMMENDED IMPROVEMENTS

6 Collection System Sustainability

A well run collection system as one that practices the following:

- Operation and Maintenance (O&M) considerations during design and construction
- Knowing what comprises the system (inventory and physical attributes)
- Knowing where the system is (maps and locations)
- Knowing the condition of the system (assessment)
- Planning and scheduling work based on condition and performance
- Effective maintenance activities
- Repairing, replacing, and rehabilitating system components based on condition and performance
- Managing timely, relevant information to establish and prioritize appropriate activities
- Training of personnel

Each program is individually tailored to the municipality that is operating the collection system, however, the practices listed above are included in the key elements of the program.

A meeting was held with operations staff to discuss their current practices and to make recommendations for improving collection system performance. The City owns and operates one cleaning truck. The City sees approximately five overflows or blockages annually, with the majority of them attributed to Fats, Oils, and Grease (FOG).

6.1 Performance and Maintenance Measures

Some additional considerations for an effective maintenance program for the City is to measure and annually track performance and maintenance measures. Performance measures which would be useful for the City to track include:

- Pipe failure rate
- Sanitary sewer overflows frequency
- Customer complaints (related to collection system performance) frequency
- Lift station failure frequency
- Peak hourly to average annual flow

Maintenance measures that would be useful for the City to track include:

- System cleaning frequency
- Lift station service frequency
- CCTV frequency
- Root removal frequency

- Flow monitoring
- Manhole inspections
- Smoke testing
- Dye water testing
- Private sector inspections
- System rehabilitation
- System capacity enhancements

6.2 System Renewal

The City is responsible for maintaining its sanitary sewer system. Aging and deteriorating infrastructure is a challenge facing utilities throughout the United States; a plan for adequate system reinvestment and renewal is crucial for sustainability of the collection system. The intent of this section of the Master Plan is to provide the City with an initial budget estimate for renewal and replacement of the City's collection system

How long pipes last depend on many factors including pipe material, soil conditions, outside forces such as construction, and other environmental factors. The concept of useful life can be used to estimate needed annual infrastructure renewal budget requirements. The useful life of a pipe system can be expressed as a survival function where the probability of survival decreases over time. In other words, as pipe systems age, more and more of the system will require repair and/or replacement. Different survival functions can be used to estimate the survival of a particular group or class of pipe. Survival functions were defined for groups of pipe based on literature values and known pipe condition data collected in the City's system. These survival functions used in concert with replacement costs were used to estimate annual reinvestment needs.

Pipeline reinvestment planning requires knowledge of the system inventory and condition. From this information, projections can be made for identified and unidentified reinvestment needs to maintain the system in good operating condition prior to failure. Specific tasks for pipeline planning include:

- Characterization of the system inventory.
- Collection and analysis of condition data.
- Definition of acceptable service level.
- Definition of pipe survival functions.
- Definition, costing, and prioritization of identified projects and unidentified projects.

Since removal of extraneous flows such as infiltration and inflow (I/I) is also a major need for the City's collection system, and removal of I/I in the public sector is a reinvestment that may involve replacement of some aging and deteriorated infrastructure, it is important that the plan consider both reinvestment due to condition of the system and cost for removal of I/I. The costs for I/I removal are analyzed in the following section which is then followed by development of a plan for overall system rehabilitation considering both aging infrastructure and I/I removal.

6.3 I/I Removal

Cost-effective removal of I/I is an important element of any collection system improvement program in areas that experience high groundwater and wet weather conditions. Cost-effective I/I removal requires that the cost for finding and fixing the system is less than the cost to transport and treat I/I flows.

In the past, the City has conducted field inspection activities in the East Lift Station Drainage Area and the Manor Drainage Area (southern portion of the New Bull Creek Watershed) including manhole inspections, smoke testing, visual pipe inspection, and closed circuit television inspection. Defects, contributing I/I to the collection system were discovered by these inspections. Additional basins, by age of facility, should be inspected to continue to locate and remove sources of I/I. The areas with sewers constructed prior to 1980 should be the focus of future I/I studies.

6.3.1 Flow Monitoring

Based upon historical data of the pump runtimes, it can be concluded that some of the lift stations see peak flows at a rate greater than 4 to 1 of their average daily flow. These areas are recommended for further I/I investigations. The first recommended step is to conduct flow monitoring. Flow and rainfall monitoring is important to establish system flows and system response to wet weather conditions. The monitoring program may include two types of monitoring;

- Permanent – these should be at key points in the system
- Temporary – these should be used for project level evaluations

Flow monitoring data should be processed to identify three components as follows:

- Base (wastewater production) flow
- Infiltration
- Inflow

6.3.2 System Rehabilitation

Based on the previous I/I analyses, it was estimated that system rehabilitation in both the public and private sectors will be cost effective to remove.

6.3.3 Recommendations

Based on the I/I analysis, the following recommendations are made:

1. Incorporate I/I removal into the overall system plan.
2. Investigate sources of I/I in the high older portions of town.
3. Investigate private sector I/I and the potential impact of removal in existing areas.
4. Establish a total budget of $ 2.5 million for I/I removal and replacement of aging infrastructure and review on an annual basis.

6.3.4 Private Sewer Policies

6.3.4.1 PRIVATE SECTOR I/I ISSUES

The City has conducted detailed inspections for sources of I/I. The previous studies indicate that there are private sector sources of I/I that can be cost-effectively removed from the system. Field inspections performed during the study of these basins include manhole inspections, visual pipe (line lamping), field investigations, and CCTV inspection. Of the tests performed, only smoke testing identifies I/I sources from the private sector. Furthermore, the flow that was monitored indicates that inflow exists that was not located by the smoke testing. It is likely that the sources of the additional inflow are rainfall entering the system through system defects or illicit direct connections and lateral defects from the private sector.

Based on prior analyses and the experience of other communities around the country and locally, private sector inflow is likely a major contributor to the overall system inflow during wet weather events. Furthermore, it is unlikely that I/I can be reduced to acceptable standards without addressing the private sector I/I in a comprehensive manner.

6.3.4.2 PRIVATE PROPERTY ISSUES

Inspection, maintenance, and/or construction on private property will require both the authority to access private property and the responsibility to issue work orders for private property improvements. The

Accessing Private Property

The City attorney should be consulted in order to develop a private sector program.

Damages

If any damage is done to the property during the inspection, identification process or construction of improvements, most agencies accept the liability and either reimburse the property owner or repair the damage. Some cities have insurance that covers these costs.

Some cities have avoided legal responsibility by including a disclaimer on the right of entry form or by having third party contractors perform the work.

Inspection and Maintenance of Laterals

For municipalities, where the definition of private lateral includes the entire lateral all the way to the saddle on the main the property owner is normally responsible for any inspection and maintenance of the service lateral.

Rehabilitation

Responsibility for the rehabilitation of the lateral usually is the same as the responsibility for the maintenance and inspection.

Identification of Inflow Sources

The identification of inflow sources such as downspouts, driveway drains, area drains, stairwell drains and foundation drains is often the responsibility of the municipality. This is often accomplished as part of a larger identification and removal program and requires that the policy and legal aspects of a private sector I/I removal program be clearly defined.

Removal of Inflow Sources

Municipalities that have established I/I identification and removal programs have several different methods for payment of this work. These options include:

- Municipality performing the work with private contractors and paying for the improvement
- Municipality performing the work with private contractors and billing the property owner
- Property owner performing the work with inspection by the municipality
- Property owner hiring private contractors to perform the work with inspection by the municipality

Enforcement

Enforcement measures are often necessary for successful removal of inflow and infiltration sources. Enforcement measures include:

- Disconnection of water service
- Fines
- Property liens
- Perform the work and bill the property owner using these mechanisms:
    - Monthly surcharge on utility bill
    - Adding the amount to the property tax
    - Summoning the property owner to court

PUBLIC FUNDS SPENT ON PRIVATE PROPERTY IMPROVEMENTS

Many municipalities do not have the authorization to spend public funds on private property; many of those that do have this authority have passed legislation for this approval. Some municipalities that have paid for the improvement are then faced with the responsibility of ongoing maintenance and replacement of the improvement. This issue should be addressed prior to the start of a removal program.

RECOMMENDATIONS

Based on the findings of this report and the experiences of other utilities, it is recommended that the City:

- Implement a private sector I/I removal program and regularly evaluate the effectiveness of this program.
- Develop a plan to address the legal and financial aspects of the program. Items that need to be considered are the legal and enforcement authority to require corrections on private property and the approach for paying for these improvements.
- Develop and implement a public awareness campaign relative to private sector I/I removal.
- Review construction standards and inspection procedures for new building laterals and for buildings being sold. Consider the following for all new construction:
    - Improved foundation drains that direct groundwater and inflow away from the building, avoiding the illegal use of sanitary sewers for drains,
    - Trench-checks outside the building excavation on the lateral line to avoid inflow from traveling along the lateral bedding material to the public sewers,

- Inspection of basement floor drains and sump pumps prior to occupancy to eliminate illegal connections.

6.4 Sewer Cleaning and Fats, Oils, and Grease Control

The causes of blockages in sewer pipes can be attributed to the following:

- Structural defects
- Poor design
- Poor construction
- Grease buildup
- Root intrusion
- Protruding laterals

There are three types of sewer cleaning; hydraulic, mechanical, and chemical. Hydraulic cleaning uses water, such as from a jet truck. Mechanical cleaning using physical devices to scrape or cut the material, such as a root cutter or a cleaning machine. Chemical cleaning refers to the use of chemical, such as for root intrusion or grease buildup.

An integral part of sewer cleaning is accurate record keeping. This will enable the evaluation of the results and planning for future cleaning.

The scheduling of sewer cleaning should take into account the type of system, the problem areas and the pipe material. For example PVC pipe needs to be cleaned less than vitrified clay pipe. An area with many restaurants may need to be cleaned for grease more often. The area with PVC pipe may be on a once every-five-years schedule, where the grease prone area may need to be cleaned every six months.

In addition to sewer cleaning, control of fats, oils, and greases (FOG) is an important part of collection system maintenance. FOG control can be achieved through education of restaurant owners regarding proper disposal of grease and grease trap use and cleaning.

RECOMMENDATIONS

Based on the discussions with the City, the following recommendations are made:

- Refine and set maintenance, performance and reinvestment measures. Definitions should be developed that are easily understood by the City for clarity of reporting.
- Improve reporting and data collection for SSOs. This includes improved estimates of SSO volumes and actions to determine SSO causes.
- Continue ongoing collection system analysis and rehabilitation, and evaluate the impact of these activities on system flows and performance.
- Based on new flow data collected in rehabilitated and in newer construction, continue to review the appropriateness of the existing design flow curve.
- Regularly (annually) review and analyze performance and maintenance measures.
- Make program adjustments as appropriate to optimize the overall program effort and costs.

6.4.1 FOG Program Plan

Fats, oil and grease (FOG), primarily generated from restaurants and other food service facilities (FSFs), can be contributors to wastewater collection system blockages and overflows. FSFB's include, but are not limited to, food processors, food packagers, restaurants, grocery and convenience stores, bakeries, nursing homes, and schools. Residential apartment complexes and mobile food cantinas can also be sources of FOG in wastewater. Though not associated with food generation, preparation or serving, other commercial and or industrial facilities may also contribute oils and greases to the collection system.

As the City attributes the majority of their sewer overflows or blockages to FOG, it is recommended that the City set forth policies, procedures, and requirements for food service establishments governing the installation, maintenance, and use of grease traps, grease interceptors or other comparable devices which represent the best practicable control technology for oil/grease removal, and to establish procedures regarding implementation and enforcement of the regulations. In effect, the City should consider implementing a FOG Control Program.

The FOG Control Program is the overall program that exists to minimize the occurrence of fats, oil, and grease within the collection system. The purpose of the FOG Control Program is providing protection for the wastewater collection system, lift stations, and treatment plants. The FOG Plan will formalize and enhance the effectiveness of the current grease control practices. The objectives of the FOG Plan include:

1. The reduction of the introduction of and/or removal of FOG associated with food preparation and other FOG generators that discharge to the collection system
2. Provide effective means of interception and removal of FOG through grease interceptors and Grease Recovery Units (GRUs)
3. Identify the various components of the FOG Program and its implementation
4. Inform and disseminate information to FSFs and FOG Generating facilities on Best Management Practices (BMPs) to reduce FOG
5. Educate the public on the impacts of FOG in the collection system and how kitchen practices, food preparation and disposal can alter those impacts.

The program will be applicable to food preparation facilities, commercial or industrial facilities that are connected to the collection system and waste haulers that service any FOG generator within the service area and/or discharge FOG-related wastes to septage receiving stations that may existing within the collection system.

FOG control devices include the following:

- Automatic Grease Recovery Unit (AGRU) – A device designed to separate grease from wastewater within the unit and automatically discharge accumulated grease material to a separate container for disposal.
- Grease Interceptor – An external device to which grease wastes are directed from more than one food service facility. The device functions to separate and retain grease from the normal sewage flows while allowing the balance of the liquid wastewater to discharge to the collection system by gravity.

- Grease Interceptor – An external device designed for flows in excess of fifty gallons per minute. The device is installed outside of the building and functions to separate and retain grease from the normal sewage flows while allowing the balance of the liquid wastewater to discharge to the collection system by gravity.
- Grease Recovery Unit (GRU) – All active indoor mechanical systems designed to remove fats, oils, and grease by physical separation from flowing wastewater. The grease recover unit shall be certified by and conform to applicable standards.
- Grease Trap – An indoor device designed for smaller quantities of flow, typically designed for flow up to fifty gallons per minute installed to separate and retain all fats, oil and grease from wastewater flow while allowing the balance of the liquid wastewater to discharge to the collection system by gravity.

Grease wastes pumped or discharged from any grease generator should be subject to inspection, sampling, and analysis to determine compliance with all applicable provisions of this FOG Program and rules and regulation of the City.

Under the program, all new FSFs or FOG generating commercial or industrial facilities will be required to install a FOG interceptor, subject to the following exceptions and exclusions described herein. All wastewater and/or waste containing FOG from a FSF or other commercial or industrial facility shall be directed to and through an approved FOG control device. All new facilities requiring grease interceptors shall submit the design and specifications for review as part of the City's building and code enforcement process. The size and capacity of the FOG control equipment shall be as required by the City's Building Inspection Department. The department shall also be granted the ability to grant variances. Grease interceptors shall be sized on a total flow-through rating.

It is recommended that since little to no information is maintained on the existing FSFs, that a questionnaire be submitted to all existing locations to gather information. The City should maintain a database of the existing FSFs, being sure to note the locations of all existing grease interceptor locations. The database shall be updated as new facilities are constructed. The database should include the name of the facility, location, contact person and details, type of business/facility, size and type of FOG control device.

The City will need to develop policies for existing FSFs or other existing FOG generating facilities without FOG control devices. It is common practice to grant these facilities a conditional waiver that will allow them to continue operations without a grease interceptor. This conditional waiver shall remain in force until either the FSF leaves that location/facility or a grease problem arises that can be attributed to the facility. The waiver may be allowed to continue at the discretion of the Program Director depending on the type and size of the facility that will replace it.

If a grease problem can be attributed to a particular FSF that has an existing grease interceptor, then the cost of the clean-up will be assessed to that facility. The FSF or FOG generator will be notified in writing of the cost of the clean-up.

If a grease problem is attributed to a particular FSF or FOG generator that does not have a grease interceptor, then the cost of the clean-up should be assessed to that facility and/or the FSF may be required to install a grease interceptor. If required to install a grease interceptor, the FSF or FOG

generator will be notified in writing and allowed a specified time period, such as 45 days, to compete the installation. If a second grease problem is attributed to the FSF or FOG generator, a second notice should be sent with a shorter period of compliance. If the terms are not met, disciplinary action, as defined within the City's Code of Ordinances should be pursued. Additionally, it is recommended that the ordinance be crafted to allow for situations in which after investigation by the City that a grease interceptor cannot be installed due to physical limitations or other circumstances and a variance be granted. The facilities should still be required to comply with other program elements such as kitchen BMPs. All costs and related expenses associated with the installation and connection of the grease interceptor shall be borne by the FSF or commercial/industrial facility. Property operation, maintenance and repair shall be accomplished solely at the user's expense.

The facilities should continue to properly operate, maintain, and clean their grease interceptors and traps as needed, or as a minimum, every three months. The City will locate and identify these facilities through the FOG Questionnaire, waste hauler records, and submission of annual grease reports, grease interceptor service inspection forms and interviews with hauling companies and their drivers.

It is recommended that if the City intends to fully implement a FOG Control Program, that they consider appointing a Program Administrator. The Program Administrator will have primary responsibility for recording, reviewing, tracking, monitoring, and administering all aspects of the FOG Program. This individual will act as the liaison between all other entities that are part of the FOG Program.

The Building Inspection Department should require and review all design and specifications for grease interceptors as required by the UPC. The Building Inspection Department should inspect new grease interceptors as part of their building inspection of new or renovated facilities within the City's service area.

Operations staff should complete sewer cleaning, being sure to prioritize areas where grease build-up occurs. When in response to backups that are determined to be associated with grease, they should be sure to notate it and add it to their priority list.

It is recommended that the following forms be created and implemented with the FOG Control Program:

- FSF Questionnaire – One of the first steps the City should consider in the implementation of a FOG Control Program is to distribute a questionnaire to all identified existing FSF and FOG generating facilities to assist in determining locations and other data for grease generators and existing FOG equipment. The questionnaire can be required to be submitted by new FSF and FOG generating facilities and be required as a part of the annual reporting.
- Food Service Facility (FSF) Inventory List – The City should maintain a current inventory list of all FSFs that are regulated by the State of Kansas and any industrial and commercial FOG generators.
- Grease Generator Annual Report – It would be beneficial to have all FSF and FOG generators to submit an annual grease report to the Program Administrator. The annual

grease report could contain information concerning the grease generator contact information, copy of the grease trap/interceptor maintenance log, record of the dates of the cleaning/pumping of grease traps/interceptors, contact information of the grease hauler, quantity of grease hauled, copy of kitchen BMPs and training logs, and updated questionnaire. Should the City implement a policy or policies concerning an annual report, they should consider establishing enforcement action in the event that a FSF fails to submit their annual report.

- Grease Interceptor Service Inspection Report for Licensed Grease Haulers – The FOG Control Program should require all waste haulers that service, pump, clean, or provide related services to grease interceptors within the City's service area to submit a grease interceptor service inspection report and submit to the Program Administrator on a monthly basis. The inspection report would be submitted for each grease interceptor serviced.
- Grease Trap/Interceptor Maintenance Log – Each FOG generator shall maintain a grease interceptor/trap maintenance log, a copy of which shall be submitted to the FOG Program Administrator with each annual grease report. The log shall contain the record of the dates the grease trap/interceptor was cleaned, name and contact information of the grease hauler, quantity of waste removed, and disposal location. The log shall be maintained for a specified time period, such as three years and the City should consider enforcement action in the event of failure to maintain the log.
- Kitchen Best Management Practices (BMP) – Training on kitchen BMPs to all employees at an FSF will provide knowledge and education on the impact of FOG on the City's collection system. Each FSF should maintain a kitchen BMP that could be provided to all employees at the start of their training. A log should be maintained by each FSF for a period of three years and indicate the each employee's name and the training performed during the three year time period.

Additionally, the City should consider implementing a public education and outreach program on FOG and its impacts on the sewer system. The information, including BMPs for residences, could be distributed to the public via the City's website, mailers with the monthly sewer bill, newsletters, and brochures available at City Hall.

7 Recommended Capital Improvements Plan

Section 5 of this Master Plan described the ultimate plan for conveyance of wastewater for the City. Implementation of this plan will be a combination of improvements funded and constructed by the City and future developers.

Many of the improvements identified in this Master Plan will be the responsibility of the developers of the undeveloped land remaining in the City and the potential annexation areas outside of the City. Major interceptors and trunk extensions, new lift station and force mains, and collection systems to serve this undeveloped property will be needed as shown in Figures 5-2, 5-4, 5-6, 5-8, and 5-10 to provide wastewater collection and conveyance from these areas.

The remaining capital improvements will require City funding and are represented in two categories, based on the methodology used to finance these improvements.

Maintenance Fees Improvements are those that are needed to upsize facilities to address growth of the City and those that are needed to relieve overloaded collection and trunk sewers in fully-developed parts of the City. These improvements include lift station and force main improvements, interceptor and trunk line improvements, and expansion of or new excess flow holding basins to relieve overloading of existing trunk lines and interceptors.

Annual Rate Improvements are those associated with identifying and removing excessive inflow sources as described in Section 6 and rehabilitation of existing facilities. These include costs for improvements on public and private property. It is assumed that these improvements will be funded by City funds and/or debt and paid for by user rates. Consideration should be given to private property owner participation in some of these costs.

7.1 Capital Improvements

Figures 5-2, 5-4, 5-6, 5-8, and 5-10 depict the recommended improvements for each scenario; existing development, ultimate development within the existing city limits, ultimate development within the existing city limits plus short-term growth, ultimate development within the city limits plus mid-term growth, and ultimate development within the city limits plus long-term. From these scenarios, a prioritized capital improvements plan was developed. Table 1-1, in the Executive Summary, is a list of these recommended capital improvement projects and provides the estimated project costs by improvement.

The capital improvements plan includes the projects that are necessary to be completed within the next twenty years. The collection system capital improvements were scheduled to first address those conveyance bottlenecks identified by the model under existing conditions. The improvements scheduled next are those that will serve to accommodate the projected growth. These projects are required to avoid future bottlenecks and the potential risk of backups and overflows. These growth areas were identified through discussions with City staff and the improvement projects were scheduled according to anticipated growth. Finally, a portion of the projects are listed to be completed at the City's discretion. These projects have been identified to either increase the reliability of the collection system by eliminating lift stations or rehabilitate aged infrastructure and eliminate infiltration and inflow within the collection system.

The capital improvement projects relating to the wastewater treatment plant were scheduled first for those projects to increase the reliability/redundancy of the disinfection system and those required to meet the future anticipated discharge limits that the City will likely receive with the renewal of the discharge permit at the wastewater treatment plant. The next scheduled treatment plant project is the completion of upgrades to meet future anticipated capacity requirements.

Appendix A – City of Gardner, Section DC2, Design Criteria for Sanitary Sewers and Appurtenances

DESIGN CRITERIA FOR

SANITARY SEWERS AND APPURTENANCES

DC2-001 DESIGN FACTORS. Sanitary sewers shall be designed for the ultimate tributary population. Due consideration should be given to current zoning regulations and approved planning and zoning reports where applicable. Sewer capacities shall be adequate to handle the anticipated maximum hourly quantities of sewerage and industrial waste together with reasonable consideration given to infiltration/inflow.

DC2-002 SEWER DESIGN. Sewers shall be designed for the total tributary area using the following minimum criteria:

The table below should be used to establish the Peak Flow for a project. Low density residential shall be considered as up to and including 3.5 residences/acre. Above that value will be considered high density residential. Extrapolations to determine the Peak Flow/Acre may be made for the specific size of the development (acres).

Peak Flows for Design

Area	Residential		Commercial / Industrial
	High Density	Low Density	
(acres)	(cfs/acre)	(cfs/acre)	(cfs/acre)
Up to 100	0.022	0.019	0.0175
200	0.021	0.018	0.0165
500	0.017	0.014	0.0125
1000	0.014	0.0118	0.01
1500	0.0135	0.0108	0.009
2000	0.013	0.01	0.008

Peak Flows can be increased by outside circumstances, such as other watershed contributions flowing by gravity or being pumped into the design watershed. If this is the case, the system design shall include these external factors.

Using this criteria, interceptor or main sewers and relief interceptor sewers 18-inch and larger pipes are to be sized flowing **three-fourths** full; up to 18-inch pipes are to be sized flowing **two-thirds** full. Lateral sewers may be designed to flow at capacity. All sewers are to be designed for anticipated flows from a 50-year return interval storm. Design calculations for proposed pipe, as well as existing pipe the proposed pipe will tie into, shall be included in the plans or provided as a separate submittal. In addition to the design calculations, a map must be included which shows the entire tributary area.

DC2-003 MAXIMUM SIZE. The diameter of sewers proposed shall not exceed the diameter of the existing or proposed outlet, whichever is applicable.

DC2-004 MINIMUM SIZE. No public sewer shall be less than eight inches (8") in diameter. Stublines for service connections shall not be less than six inches (6") in diameter.

DC2-005 MATERIALS OF CONSTRUCTION. Sanitary sewers shall be constructed of pipe material resistant to or protected from bacterial degradation, acid and alkaline solutions, normal sewer temperature variation, abrasion, and industrial wastes or other materials which may be transmitted by the collection system.

The following types of commercial pipe are approved for gravity sanitary sewer systems constructed in the City of Gardner:

*PVC Pipe
*Reinforced Concrete Pipe
*Ductile Iron Pipe

* See Standard Specifications Section 3000 for material and lining specifications.

For PVC pipe, PVC SDR-35 shall be used for depth to invert up to 15 feet and PVC SDR-26 used for depths greater than 15 feet.

DC2-006 MINIMUM SLOPE. All sewers shall be designed to give mean velocities when flowing one-half full of not less than 2.0 feet per second.

All velocity and flow calculations shall be based on the Manning Formula using an N value of 0.013. The following slopes shall be minimum for the size indicated.

	MINIMUM SLOPE IN PERCENT
SEWER SIZE	FULL AND HALF FULL FLOW
8"	0.40
10"	0.28
12"	0.22
15"	0.15
18"	0.12
21"	0.10
24"	0.08
27"	0.065
30"	0.058

Exceptions to these minimum slopes shall be made at the upper end of the lateral sewers serving under 30 houses. Said sewers shall have a minimum slope of 0.76 percent. All sewers larger than 30 inches in diameter shall have the slope approved by the city engineer.

Where lateral sewers serve less than 10 houses, the minimum slope shall not be less than 1 percent (1%).

DC2-007 INCREASING PIPE SIZE. When a sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain a continuous energy gradient.

DC2-008 HIGH VELOCITY PROTECTION. In situations where flow is continuous and grit is a problem, or where velocities greater than 10 feet per second are possible, special provisions shall be made to protect against abrasion damage to the pipe and manhole. Such protection may be attained utilizing ductile iron pipe.

DC2-009 ALIGNMENT. All sewers shall be laid with straight alignment between manholes. The interior angle between incoming and outgoing lines for both existing and new mains shall be clearly labeled at all manholes in the plan view in degrees, minutes, and seconds at each manhole. Interior angles less than 90 degrees shall not be accepted.

DC2-010 MANHOLE CONSTRUCTION. Manholes shall be installed at the end of each line; at all changes in grade, size, or alignment; at all intersections; and at a distance not greater than four hundred feet (400') for sewers eighteen inches (18") or less in diameter and not greater than six hundred feet (600') for larger sewers.

DC2-011 MANHOLES. The construction of all manholes shall conform to the details shown on Standard Details 31-1 through 31-4. A standard manhole shall be four feet in diameter for depths up to 20 feet deep, 5 feet diameter for depths 20 to 25 feet deep and/or pipes entering and exiting the manhole with diameter 24 inches to 30 inches, and 6 feet diameter for depths over 25 feet deep and/or pipes entering and exiting the manhole with diameter greater than 30 inches. All manholes over 20 feet deep must be approved by the City Engineer.

Drop manholes should be avoided as much as possible. However, an outside drop pipe shall be provided for a sewer entering a manhole at an elevation of twenty-four (24) inches or more above the manhole invert. The outside drop pipe shall be protected against breaking or settling by the use of concrete encasement. When PVC pipe is used for the drop pipe, gravel may be substituted for the concrete encasement around the drop pipe and fittings. The drop pipe shall have the same nominal diameter as that of the incoming sewer.

Without utilizing drop manholes, the difference in elevation between the invert of any incoming sewer and the invert of the outgoing sewer should not exceed twenty-four (24) inches except where required to match crowns. When a sewer joins a larger one, the crown of the smaller sewer shall not be lower than the crown of the larger one. The minimum drop through manholes shall be 0.2 feet for manholes with greater than 45^{o} turns and 0.1 feet for straight-through trough and up to 45^{o} turns.

Where manholes are to be built in close proximity to streets, the top of manhole elevation shall be set within the following limits:

Minimum Elevation	1/4" per foot rise above top back of curb
Maximum Elevation	1/2" per foot rise above top back of curb

All other sanitary sewer lines (sewer lines across unplatted land, etc.) shall have the tops of manholes set flush with the existing ground elevation except for manholes located within the floodplain. The top of all manholes located in a floodplain shall be 1.0 foot above the 100-year floodplain and shall be constructed with bolt-down lids.

Any variation from the above top of manhole criteria will require a letter of explanation to be submitted with the drawings and be subject to approval by the city engineer.

DC2-012 SEWER LOCATIONS. Sanitary sewers shall be located within street or alley rights-of-way unless topography dictates otherwise. Sanitary sewers should also be located outside of pavement when at all possible. When located in easements on private property, access shall be provided to all manholes. A manhole shall be provided at each street or alley crossing. End lines shall be extended to provide access from street or alley rights-of-way where possible. Imposed loading shall be considered in all locations. Not less than eight feet (8') cover shall be provided over top of pipe in street and alley rights-of-way and five feet (5') in all other areas.

Sanitary sewer mains shall be extended to property lines and a manhole provided at the edge of property lines to accommodate future main extensions.

DC2-013 CLEANOUTS AND LAMPHOLES. Cleanouts and lampholes will not be permitted except on service lines.

DC2-014 PROTECTION OF WATER SUPPLIES. There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenance thereto, which would permit the passage of any wastewater or polluted water into the potable water supply.

GRAVITY SANITARY SEWERS: When potable water pipes and gravity sanitary sewers are laid parallel to each other, the horizontal distance between them shall be not less than 10 feet. The distance shall be measured from edge to edge. The laying of water pipes and sanitary sewers shall be in separate trenches with undisturbed earth between them. In cases where it is not practical to maintain a 10 ft separation, KDHE will consider proposals providing equivalent protection by other methods on a case-by-case basis, if supported by data from the design engineer. Equivalent protection may require sanitary sewer construction with one of the following additional protective features: concrete encasement, vacuum sewers, or jointless pipe such as polyethylene or cured-in-place.

When a water pipe and a sanitary sewer cross and the sewer is 2 ft or more (clear space) below the water pipe, no special requirements or limitations are provided herein. At all other crossings, the sanitary sewer is to be constructed of one of the following materials (or approved equal) and pressure tested to assure water tightness pursuant to Chapter VI of the KDHE Minimum Standards of Design of Water Pollution Control Facilities.

- Ductile iron pipe conforming to ASTM A536 or ANSI/AWWA C151/A21.51 with minimum thickness class 50, and gasketed, push-on or mechanical joints in conformance with ANSI/AWWA C110/A21.10 or ANSI/AWWA c111/A21.11.

- PVC pipe conforming to ASTM D3034 with minimum wall thickness of SDR41, ASTM F679, ASTM F789, or ASTM F794, with gasketed push-on joints in conformance with ASTM D3212.

- Reinforced concrete pipe conforming to ASTM C76 with gasketed joints in conformance with ASTM C361 or ASTM C443.

Joints in the sewer pipe shall be located as far as practical from the intersected water main.

Where a water main is laid across or through an area where there is an existing sanitary sewer, which is not constructed of one of the above specified materials and is 2 feet or less below the water pipe, the existing sewer shall be encased in concrete with a minimum of six inches thickness for a 10 foot distance on each side of the crossing or the crossed section of sewer replaced to meet the above specified construction requirements. KDHE will consider proposals providing equivalent protection by other means on a case-by-case basis, if supported by data from the design engineer.

Where sanitary sewer lines are to be installed under and across water lines and a two foot (2') clearance cannot be obtained because of limiting grades or grades of existing structures, then the sewer line shall be constructed of ductile iron pipe for a distance of at least ten feet (10') in each direction from the crossing.

DC2-015 SEPARATION FROM OTHER UTILITIES. A minimum of 5 feet horizontal separation shall be provided between the outer wall of sanitary sewer mains and all other utilities (except as noted for water as discussed above in Section DC2-014). In addition, utilities shall not be located in a common trench, but separated by a minimum of 3' undisturbed earth. The separation between the outside walls of sanitary sewers and all other utilities that are within 10 feet of each other must be labeled on the plans.

DC2-016 AERIAL CROSSINGS. Adequate support shall be provided at all joints in pipes utilized for aerial crossings. All aerial crossings shall be approved by the city engineer.

DC2-017 UNSEWERED DWELLINGS. All existing addresses that will be provided access to the sewer that previously did not have sewer service available shall be identified. This identification shall include the approximate distance from the dwelling to the sewer.

DC2-018 MAXIMUM SLOPE. All sewers which are designed to flow at 10 feet per second or greater shall be reviewed by the city engineer for approval or alternate design considerations. Concrete collars for steep slopes shall be proposed when pipe slopes are 10% or greater.

DC2-019 STUB LINES. Stub lines will not be permitted in manholes except for manholes at the end of a line. Stub lines will be provided for all service lines requiring street crossings. Service lines for properties not requiring street crossings will be tapped at the time of building construction. If necessary, risers shall be installed so that stubs are no deeper than 8 feet below ground surface.

Stub lines shall be constructed no closer than 10 feet from property lines, but should be placed so that they are not in conflict with existing infrastructure and/or future driveways.

DC2-020 LIFT STATIONS. All lift stations shall be manufactured by Smith and Loveless, Inc. (classic style) and shall be wetwell mounted. The lift station must meet firm pumping capacity and shall be designed in accordance with the design criteria as specified under Sewer Design (Section 5-1, Item B). Any variation from the specified lift station or design must be approved by the city engineer.

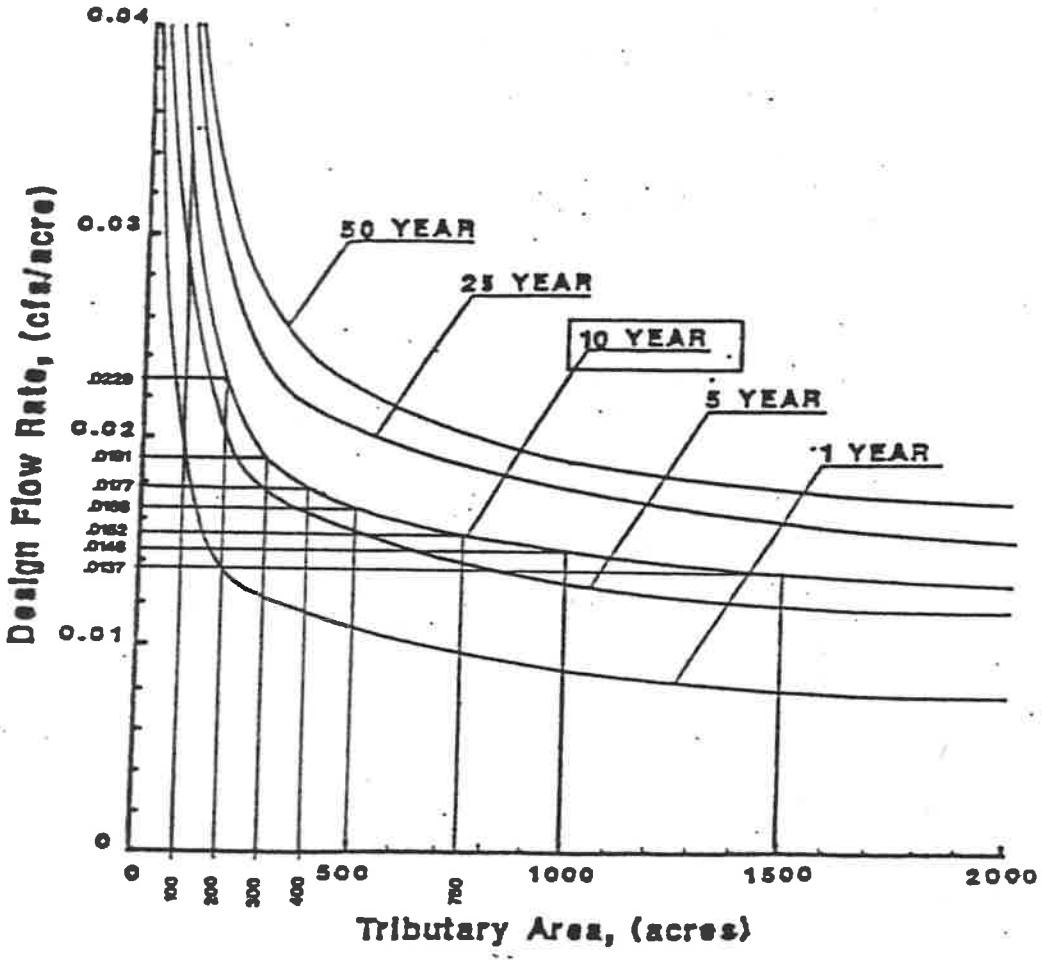
DC2-021 LOW PRESSURE FORCE MAIN. Low pressure force mains are not recommended. If a low pressure force main is necessary, the engineer must submit plans and specifications along with a cost/benefit analysis prior to approval. All low pressure force mains must be approved by the city engineer.

DC2-022 EASEMENTS. Permanent easements must be provided for all sanitary sewer mains. Permanent easements for sanitary sewer mains shall be centered on the main. The minimum easement width shall be 15 feet; however, easement widths may be increased depending upon the depth of the sewer main.

Appendix B – JCUWD Design Flow Curves

JCUWD Design Flow Curves

$$\text{cfs/acre} = (0.11385) \times \left[(\text{tributary acres})^{(-0.29735)} \right]$$



Extrapolation between acreage breakpoints unnecessary

Design flow for areas less than 100 acres need not exceed .025 cfs/acre

Appendix C – Projected Flows by Drainage Basin

Appendix C
Table C-1
Drainage Basin Projected Peak Flows

	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5	
Drainage Basin	Developed Acreage	Flow (MGD)	Developed Acreage	Flow (MGD)	Developed Acreage	Flow (MGD)	Developed Acreage	Flow (MGD)	Developed Acreage	Flow (MGD)
183rd	75	0.48	144	1.85	144	1.85	144	1.85	144	1.85
Bull Creek	30	0.06	58	0.47	58	0.47	58	0.47	58	0.47
East	228	2.23	260	2.93	260	2.93	260	2.93	260	2.93
Genesis	126	1.10	216	2.49	216	2.49	216	2.49	216	2.49
Holtgravers	71	0.73	87	1.06	87	1.06	87	1.06	87	1.06
Kill Creek	67	0.35	1118	10.6	1118	10.6	1118	10.6	1118	10.6
Lincoln Lane	28	0.17	59	0.67	59	0.67	59	0.67	59	0.67
Moonlight	89	1.06	89	1.06	89	1.06	89	1.06	89	1.06
New Bull Creek	322	3.10	414	4.81	414	4.81	414	4.81	414	4.81
Nike	22	0.02	332	2.68	332	2.68	332	2.68	332	2.68
North	631	4.85	1327	13.01	1327	13.01	1327	13.01	1327	13.01
Sheans	2	0.00	111	1.29	111	1.29	111	1.29	111	1.29
South	337	2.98	1082	11.24	1082	11.24	1082	11.24	1082	11.24
Sunset	39	0.48	39	0.48	39	0.48	39	0.48	39	0.48
Temporary 167th	19	0.23	19	0.23	19	0.23	19	0.23	19	0.23
Wal-Mart	67	0.33	264	2.77	264	2.77	264	2.77	264	2.77
Willowbrooke	28	0.34	28	0.34	28	0.34	28	0.34	28	0.34
WWTP	673	2.92	2424	24.92	2424	24.92	2424	24.92	2424	24.92

Appendix D – Kill Creek WWTP NPDES Permit

..eau of Water
1000 SW Jackson St., Suite 420
Topeka, KS 66612-1367

Kansas
Department of Health & Environment

Phone: 785-296-5504
Fax: 785-296-0086
jgaggero@kdheks.gov
www.kdheks.gov

Susan Mosier, MD, Secretary

Sam Brownback, Governor

October 24, 2016

City Clerk
Scott Millholland
120 East Main
Gardner, KS 66030

RE: Kansas Water Pollution Control
Permit No. M-KS20-OO01
Gardner, City of

Dear Permittee:

You have fulfilled all the filing requirements for a Kansas Water Pollution Control Permit and Authorization to Discharge under the National Pollutant Discharge Elimination System (NPDES). We are pleased to forward your new permit. While it is permissible to make as many copies as needed for monitoring and reporting purposes, you need to retain the original permit for your files.

We suggest you carefully read the terms and conditions of your permit and understand these terms and conditions are enforceable under both State and Federal law. Also, please notice the reporting paragraph on page 2 of your permit, where all reports are due by the 28th day of the schedule noted.

KDHE will be contacting you to assist you in signing into our new electronic discharge monitoring report (eDMR) tool. Recently, EPA promulgated a new rule requiring all discharge monitoring reports to be transmitted to the state agencies via electronic means. KDHE has developed an electronic discharge monitoring report (eDMR) tool that will help you comply with the EPA requirement. To access this tool, you will first need to sign into the KEAP (Kansas Environmental Application Portal) and get the appropriate authorizations, user ID and password as discussed in the instructions to be provided.

If you have any questions concerning this permit, contact Shelly Shores-Miller at 785.296.2856. For questions concerning the eDMR tool, contact Debbie Mildfelt at 785.296.5561 or dmildfelt@kdheks.gov.

Sincerely,

Jaime Gaggero

Jaime Gaggero
Director, Bureau of Water

pc: NE - District
RG- Permit File
DLM – eDMR

Kansas Permit No. M-KS20-0001

Federal Permit No. KS0095605

KANSAS WATER POLLUTION CONTROL PERMIT AND
AUTHORIZATION TO DISCHARGE UNDER
THE NATIONAL POLLUTANT DISCHARGE
ELIMINATION SYSTEM

Pursuant to the Provisions of Kansas Statutes Annotated 65-164 and 65-165, the Federal Water Pollution Control Act as amended, (33 U.S.C. 1251 et seq; the "Act"),

Owner:	Gardner, City of
Owner's Address:	120 East Main Gardner, Kansas 66030
Facility Name:	Gardner (Kill Creek) Wastewater Treatment Facility
Facility Location:	32101 W. 159th Street Gardner, Kansas 66030 NE¼, NW¼, Section 15, Township 14S, Range 22E Johnson County, Kansas Latitude: 38.8381, Longitude: -94.95757
Outfall:	Latitude: 38.83756, Longitude: -94.95625
Receiving Stream:	Kansas River via Kill Creek
Basin:	Kansas River Basin

is authorized to discharge from the wastewater treatment facility described herein, in accordance with effluent limits and monitoring requirements as set forth herein.

This permit is effective December 1, 2016, supersedes the previously issued water pollution control permit M-KS20-0001, and expires October 31, 2021.

FACILITY DESCRIPTION:

1. Lift Station
2. Two Step Screens
3. Grit Removal
4. Activated Sludge Process
5. Final Clarification
6. Ultraviolet Disinfection
7. Cascade Aeration
8. Aerobic Sludge Storage
9. Belt Press
10. Effluent Irrigation of Public Use Ball Fields/Parks
11. Average Daily Flow = 2.5 MGD

Susan K Mosier

Secretary, Kansas Department of Health and Environment

October 20, 2016
Date

A. EFFLUENT LIMITS AND MONITORING REQUIREMENTS

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in this permit. The limits shall become effective on the dates specified herein. Such discharges shall be controlled, limited, and monitored by the permittee as specified. There shall be no discharge of floating solids or visible foam in other than trace amounts.

Monitoring reports shall be submitted on or before the 28th day of the following month. In the event no discharge occurs, written notification is still required.

Parameter	Final Limits	Measurement Frequency	Sample Type
Monitoring Location 001ZG (EDMR code: INF001ZG) - Influent Flow to the Treatment Plant			
Flow to Plant - MGD	Monitor	Daily*	Flow Meter Or Calculate
Biochemical Oxygen Demand (5-Day)-mg/l	Monitor	Twice Monthly	24-Hour Composite
Total Suspended Solids-mg/l	Monitor	Twice Monthly	24-Hour Composite
Total Phosphorus (as P)-mg/l	Monitor	Once Monthly	24-Hour Composite
Total Kjeldahl Nitrogen (as N)-mg/l	Monitor	Once Monthly	24-Hour Composite
Outfall 001A1 (EDMR code: EFF001A1)- Effluent at effluent sampling point near the bottom of the cascade			
Biochemical Oxygen Demand (5-Day)**		Twice Monthly	24-Hour Composite
May thru September			
Weekly Average-mg/l	30		
Monthly Average-mg/l	20		
March, April, October, and November			
Weekly Average-mg/l	40		
Monthly Average-mg/l	25		
December thru February			
Weekly Average-mg/l	45		
Monthly Average-mg/l	30		
Total Suspended Solids*		Twice Monthly	24-Hour Composite
Weekly Average-mg/l	45		
Monthly Average-mg/l	30		

A. EFFLUENT LIMITS AND MONITORING REQUIREMENTS (continued)

Ammonia Nitrogen (as N)-mg/l		Twice Monthly	24-Hour Composite
January, February and December			
Daily Maximum	8.6		
Monthly Average	4.9		
March, April, and October			
Daily Maximum	8.6		
Monthly Average	3.0		
May			
Daily Maximum	8.6		
Monthly Average	2.5		
June and September			
Daily Maximum	8.6		
Monthly Average	1.9		
July and August			
Daily Maximum	8.6		
Monthly Average	1.4		
November			
Daily Maximum	8.6		
Monthly Average	4.1		
E.coli - Colonies/100ml		Twice Monthly	Grab
April 1 through October 31			
Weekly Geometric Average	4348		
Monthly Geometric Average	262		
November 1 through March 31			
Monthly Geometric Average	2358		
pH - Standard Units	6.0 - 9.0	Twice Monthly	Grab
Dissolved Oxygen-mg/l	Monitor	Daily	Grab
Total Phosphorus (as P)-mg/l	Monitor	Once Monthly	24-Hour Composite
Total Phosphorus (as P)-lbs/day	Calculate	Once Monthly	Calculate
Nitrate (NO3) + Nitrite (NO2) as N-mg/l***	Monitor	Once Monthly	24-Hour Composite
Total Kjeldahl Nitrogen (TKN) as N-mg/l***	Monitor	Once Monthly	24-Hour Composite
Total Nitrogen as N - mg/l*** (TKN + NO3 + NO2)	Calculate	Once Monthly	Calculate
Total Nitrogen (as N)-lbs/day (TKN + NO3 + NO2)	Calculate	Once Monthly	Calculate
Flow to Stream - MGD	Calculate	Daily	Calculate
Whole Effluent Toxicity Test	See Supplemental Condition #2		
Priority Pollutant Scan	See Supplemental Condition #3		

A. EFFLUENT LIMITS AND MONITORING REQUIREMENTS (continued)

Internal Monitoring Location 002A1 (EDMR Code BFHP002A1) - Treated Effluent to Irrigation Holding Pond

Monitoring and testing of the treated wastewater must be conducted for any calendar month during which effluent is pumped to the irrigation holding pond.

Flow - MGD	Monitor	Daily	Flow Meter
E.coli - Colonies/100 ml		Twice Monthly	Grab
Monthly Geometric Average	262		

* Flow to Plant = Flow to Stream + Flow to Irrigation Holding Pond

** Minimum removal of 85% required for Biochemical Oxygen Demand (5-Day) and Total Suspended Solids.

*** Permittee shall sample for these tests on the same day and calculate the total nitrogen only when both test values are available. The Minimum Reportable Limit (MRL) for TKN is 1 mg/l and for nitrate + nitrite is 0.1 mg/l. Values less than the MRL shall be reported using the less than sign (<) with the MRL value but for purposes of calculating and reporting the total nitrogen result, less than values shall be defaulted to zero.

B. STANDARD CONDITIONS

In addition to the specified conditions stated herein, the permittee shall comply with the attached Standard Conditions dated June 20, 2016.

C. SPECIAL CONDITIONS

This wastewater treatment facility is NOT designed and built to provide for nutrient removal. However, the permittee will operate the treatment facility to maximize the level of nutrient removal with the intent of achieving either of the following goals as annual average target effluent levels from the mechanical plant:

	Goal 1	Goal 2
1. Total Nitrogen (as N) - mg/l	10.0	8.0
2. Total Phosphorus (as P)- mg/l	1.0	1.5

These target values are not to be considered as effluent limits for this permit. KDHE reserves the right to reopen this permit to impose limits for nutrients pursuant to Kansas law when such criteria are adopted in the Kansas Surface Water Quality Standards.

D. SLUDGE USE AND DISPOSAL

Sludge disposal shall be in accordance with the 40 CFR Part 503 Sludge Regulations.

E. SCHEDULE OF COMPLIANCE

None

F. SUPPLEMENTAL CONDITIONS

1. PARK/BALL FIELD IRRIGATION:

The following management and monitoring requirements apply for treated wastewater from the Kill Creek Wastewater Treatment Facility utilized for irrigation purposes at the park (baseball/softball fields and soccer fields). Monitoring and testing of the treated wastewater must be conducted for any calendar month during which effluent is pumped to the irrigation holding ponds. The monitoring and effluent limits are addressed in Section A above.

a. Irrigation using wastewater effluent shall occur only at times when public access to the irrigated area is restricted.

b. Irrigation of crops produced for direct human consumption shall be prohibited.

c. Irrigation shall be limited in such a manner as to avoid runoff of effluent to adjacent landowners.

d. Irrigation shall be conducted in such a manner as to prevent ponding of treated wastewater on the ground surface.

e. Irrigation spray shall not be allowed to fall or drift on areas used for picnicking, public drinking fountains, potable water hose bibs, private residences or any other areas where food or drink is routinely prepared or served.

f. Signs bearing the following warning must be posted around any treated wastewater holding pond: RECLAIMED WASTEWATER DO NOT DRINK OR SWIM.

g. Signs bearing the following warning must be posted at any hose bibbs which can discharge treated wastewater: RECLAIMED WASTEWATER DO NOT DRINK.

h. Cross-connections between treated wastewater water lines and potable water supply lines are prohibited.

i. For parks, ball fields, cemeteries, recreational areas, etc., signs shall be placed at the entrance or other suitable conspicuous places indicating the area is irrigated with treated wastewater.

j. All monitoring of the treated wastewater shall be conducted using EPA approved methods and KDHE certified laboratories if applicable.

k. The results of the analyses shall be reported in conjunction with the monthly discharge monitoring reports.

l. Maintenance repairs to the system may be tested at any time provided public access to the irrigated area is restricted and the system operator (or maintenance personnel) is present at the irrigated site during the entire test.

2. Whole Effluent Toxicity Testing:

a. Chronic Whole Effluent Toxicity (WET) testing on a 24-hr composite sample of the effluent shall be conducted once in calendar year 2012 and annually thereafter. The 25% Inhibition Concentration, IC25, shall be equal to or greater than 79% effluent. Test results less than 79% are violations of this permit. The test procedures shall use the 7-day short term 3-sample daily static renewal test method in accordance with the EPA document, Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, fourth edition, October 2002 using test organisms *Pimephales promelas* (fathead minnow) and *Ceriodaphnia dubia* (water flea) within a dilution series containing 0%, 12.5%, 25%, 50%, 79%, and 100% effluent. KDHE reserves the right to increase or decrease testing frequency based upon compliance history and toxicity testing results.

b. If the WET test results indicate the IC25 is equal to or greater than 79% effluent, the effluent has passed the toxicity test and a copy of the test report shall be due with the next scheduled Discharge Monitoring Report.

c. If the WET test results indicate the IC25 is less than 79% effluent, the effluent has failed the toxicity test and the permittee shall immediately notify KDHE by telephone at (785) 296-5517 and submit to KDHE a copy of the test report within five days of receipt of the information. KDHE reserves the right to require the permittee to take such actions as are reasonable to identify and remedy any identified or predicted toxic conditions in the receiving stream outside of the mixing zone which is caused by the permittee's effluent.

d. Permittee shall also test a portion of the same effluent sample used for the WET test for the following substances (required minimum reportable detection levels are in parenthesis):

Antimony (10 µg/L)*	Nickel (10 µg/L)*
Arsenic (10 µg/L)*	Selenium (5 µg/L)*
Beryllium (5 µg/L)*	Silver (2 µg/L)*
Cadmium (2 µg/L)*	Thallium (10 µg/L)*
Chromium (10 µg/L)*	Zinc (20 µg/L)*
Copper (10 µg/L)*	Ammonia as N (0.2 mg/L)
Lead (5 µg/L)*	Total Hardness as $CaCO_3$ mg/L
Mercury (0.2 µg/L-Cold Vapor Method)	pH

* Parameter shall be tested and reported as Atotal recoverable@ metals.

e. The permittee shall coordinate sampling for this test with other requirements of this permit. The permittee shall use a laboratory approved by KDHE for Whole Effluent Toxicity testing.

3. Priority Pollutant Scan:

Permittee shall conduct a Priority Pollutant Scan on the effluent for the parameters listed in Table I: Priority Pollutant Scan on the following pages. The Priority Pollutant Scan shall be conducted within 18 months of the expiration date of this permit and the results reported to KDHE prior to 6 months of the expiration date of this permit.

Sample type shall be 24-hour composite except for Volatile Organic Compounds which shall be a grab sample.

See Supplemental Condition F.2.d. for minimum detection limits for certain metals in the Priority Pollutant Scan.

G. ADDITIONAL INFORMATION

EPA has promulgated a final rule requiring regulated entities to report DMR data electronically by December 21, 2016. Also, KAR 28-16-63 requires permittees to report NPDES data in a form required by KDHE. KDHE has developed electronic reporting tools to assist permittees in complying with the EPA electronic reporting rule and KAR 28-61-63. Unless a waiver has been approved by KDHE, permittees are required to submit reports electronically when these tools are made available to them by KDHE.

Table I - Priority Pollutant Scan*

Metals (µg/l)
- Total Antimony
- Total Beryllium
- Total Cadmium
- Total Chromium
- Total Copper
- Total Lead
- Total Mercury
- Total Nickel
- Total Selenium
- Total Silver
- Total Thallium
- Total Zinc

Pesticides (µg/l)
- Aldrin
- Alpha-BHC**
- Beta-BHC**
- Gamma-BHC**
- Delta-BHC**
- Chlordane
- 4,4-DDT
- 4,4-DDD
- 4,4-DDE
- Dieldrin
- Alpha-endosulfan
- Beta-endosulfan
- Endosulfan sulfate
- Endrin
- Endrin aldehyde
- Heptachlor
- Heptachlor epoxide
- Toxaphene

Polychlorinated Biphenyls (µg/l)
- PCB-1242
- PCB-1254
- PCB-1221
- PCB-1232
- PCB-1248
- PCB-1260
- PCB-1016

Base/Neutral (µg/l)
- Acenaphthene
- Acenaphthylene
- Anthracene
- Benzidine
- Benzo(a) anthracene
- Benzo(a)pyrene
- Benzo(k)fluoranthene
- Benzo (ghi) perylene
- Benzo (b) fluoranthene
- Bis(2-chloroethoxy)methane
- Bis(2-chloroethyl)ether
- Bis(2-ethylhexyl)phthalate
- Bis(2-chloroisopropyl) ether
- 1,2-diphenylhydrazine
- Fluoranthene
- Fluorene
- Nitrobenzene
- N-nitrosodimethylamine
- N-nitrosodi-n-propylamine
- N-nitrosodiphenylamine
- Phenanthrene
- Pyrene
- 1,2,4-trichlorobenzene
- 4-bromophenyl phenyl ether
- Butyl benzyl phthalate
- 2-chloronaphthalene
- 4-chlorophenyl phenyl ether
- Chrysene
- Dibenzo(a,h) anthracene
- 1,2-dichlorobenzene
- 1,3-dichlorobenzene
- 1,4-dichlorobenzene
- 3,3-dichlorobenzidine
- Dimethyl phthalate
- Diethyl phthalate
- Di-n-butyl phthalate
- 2,4-dinitrotoluene
- 2,6-dinitrotoluene
- Di-n-octyl phthalate
- Hexachlorobenzene
- Hexachlorobutadiene
- Hexachlorocyclopentadiene
- Hexachloroethane
- Indeno (1,2,3-cd) pyrene
- Naphthalene
- Isophorone

Acid Compounds (µg/l)
- 2-chlorophenol
- 2,4-dichlorophenol
- 2,4-dimethylphenol
- 2,4-dinitrophenol
- 2-nitrophenol
- 4-nitrophenol
- Parachlorometa cresol
- Pentachlorophenol
- Phenol
- 4,6-dinitro-o-cresol
- 2,4,6-trichlorophenol

Volatiles (µg/l)
- Acrolein
- Acrylonitrile
- Benzene
- Bromoform
- Carbon Tetrachloride
- Chlorobenzene
- Chlorodibromomethane
- Chloroethane
- 2-chloroethylvinyl ether
- Chloroform
- Dichlorobromomethane
- 1,1-dichloroethane
- 1,2-dichloroethane
- 1,1-dichloroethylene
- 1,2-dichloropropane
- 1,3-dichloropropylene
- Ethylbenzene
- Methyl bromide
- Methyl chloride
- Methylene chloride
- 1,1,2,2-tetrachloroethane
- Tetrachloroethylene
- Toluene
- 1,2 trans-dichloroethylene
- 1,1,1-trichloroethane
- 1,1,2-trichloroethane
- Trichloroethylene
- Vinyl chloride

Miscellaneous
- Total Cyanide (mg/l)***
- ~~Asbestos (cnt/l)~~
- ~~2,3,7,8-TCDD (Dioxin) (µg/l)~~

* Testing not required for pollutants with a strike-through.

** Scientific name is hexachlorocyclohexane

*** The total cyanide analysis must include preliminary treatment of the sample to avoid NO_2^- interference. See Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 4500-CN^- B. Preliminary Treatment of Samples.

STANDARD CONDITIONS FOR

KANSAS WATER POLLUTION CONTROL AND
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMITS

1. Representative Sampling and Discharge Monitoring Report Submittals:

A. Samples and measurements taken as required herein shall be representative of the quality and quantity of the monitored discharge. Test results shall be recorded for the day the samples were taken. If sampling for a parameter was conducted across more than one calendar day, the test results may be recorded for the day sampling was started or ended. All samples shall be taken at the locations designated in this permit, and unless specified, at the outfall/monitoring location(s) before the wastewater joins or is diluted by any other water or substance.

B. Monitoring results shall be recorded and reported on forms acceptable to the Division and submitted no later than the 28th day of the month following the completed reporting period. Signed and certified copies of other reports, required herein, prepared in accordance with KAR 28-16-59, may be faxed to 785.296.0086, e-mailed as scanned attachments to dmr4kdhe@kdheks.gov , or sent by U.S. mail to:

Kansas Department of Health & Environment
Bureau of Water-Technical Services Section
1000 SW Jackson Street, Suite 420
Topeka, KS 66612-1367

2. Definitions:

A. Unless otherwise specifically defined in this permit, the following definitions apply:

1. The "Daily Maximum" is the total discharge by weight or average concentration, measurement taken, or value calculated during a 24-hour period. The parameter, pH, is limited as a range between and including the values shown.

2. The "Weekly Average" is the arithmetic mean of the value of test results from samples collected, measurements taken or values calculated during four monitoring periods in each month consisting of calendar days 1-7, 8-14, 15-21 and 22 through the end of the month.

3. The "Monthly Average", other than for E. coli bacteria, is the arithmetic mean of the value of test results from samples collected, measurements taken or values calculated during a calendar month. The monthly average is determined by the summation of all calculated values or measured test results divided by the number of calculated values or test results reported for that parameter during the calendar month. The monthly average for E. coli bacteria is the geometric average of the value of the test results from samples collected in a calendar month. The geometric average can be calculated by using a scientific calculator to multiply all the E. coli test results together and then taking the nth root of the product where n is the number of test results. Non-detect values shall be reported using the less than symbol (<) and the minimum detection or reportable value. To calculate average values, non-detects shall be defaulted to zero (or one for geometric averages). Greater than values shall be reported using the greater than symbol (>) and the reported value. To calculate average values, the greater than reported value shall be used in the averaging calculation.

B. A "grab sample" is an individual sample collected in less than 15 minutes. A "composite sample" is a combination of individual samples in which the volume of each individual sample is proportional to the flow, or the sample frequency is proportioned to the flow rate over the sample period, or the sample frequency is proportional to time.

C. The terms "Director", "Division", and "Department" refer to the Director, Division of Environment, Kansas Department of Health and Environment, respectively.

D. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of an in-plant diversion. Severe property damage does not mean economic loss caused by delays in production.

E. "Bypass" means the intentional diversion of waste streams from any portion of the treatment facility.

3. Schedule of Compliance: No later than 14 calendar days following each date identified in the "Schedule of Compliance," the permittee shall submit via mail, e-mail or fax per paragraph 1.B above, either a report of progress or, in the case of specific action being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirements, or, if there are no more scheduled requirements, when such noncompliance will be corrected.

4. Test Procedures: All analyses required by this permit shall conform to the requirements of 40 CFR Part 136, unless otherwise specified, and shall be conducted in a laboratory accredited by the Department. For each measurement or sample, the permittee shall record the exact place, date, and time of measuring/sampling; the date and time of the analyses, the analytical techniques or methods used, minimum detection or reportable level, and the individual(s) who performed the measuring/sampling and analysis and, the results. If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved procedures, the results shall be included in the Discharge Monitoring Report form required in 1.B. above. Such increased frequencies shall also be indicated.

5. Change in Discharge: All discharges authorized herein shall be consistent with the permit requirements. The discharge of any pollutant not authorized by this permit or of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of this permit. Any anticipated facility expansions, production or flow increases, or production or wastewater treatment system modifications which result in a new, different, or increased discharge of pollutants shall be reported to the Division at least one hundred eighty (180) days before such change.

6. Facilities Operation: The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the requirements of this permit and Kansas and Federal law. Proper operation and maintenance also include adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the requirements of this permit. The permittee shall take all necessary steps to minimize or prevent any adverse impact to human health or the environment resulting from noncompliance with any effluent limits specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge. When necessary to maintain compliance with the permit requirements, the permittee shall halt or reduce those activities under its control which generate wastewater routed to this facility.

7. Incidents:

"Collection System Diversion" means the diversion of wastewater from any portion of the collection system.

"In-Plant Diversion" means routing the wastewater around any treatment unit in the treatment facility through which it would normally flow.

"In-Plant Flow Through" means an incident in which the wastewater continues to be routed through the equipment even though full treatment is not being accomplished because of equipment failure for any reason.

"Spill" means any discharge of wastewater, sludge or other materials from the treatment facility other than effluent or as more specifically described by other "Incidents" terms.

"Upset" means an exceptional incident in which there is unintentional and temporary noncompliance or anticipated noncompliance with permit effluent limits because of factors beyond the reasonable control of the permittee, as described by 40 C.F.R. 122.41(n).

8. Diversions not Exceeding Limits: The permittee may allow any diversion to occur which does not cause effluent limits to be exceeded, but only if it also is for essential maintenance to assure efficient operation. Such diversions are not subject to the Incident Reporting requirements shown below.

9. Prohibition of an In-Plant Diversion: Any in-plant diversion from facilities necessary to maintain compliance with this permit is prohibited, except: (a) where the in-plant diversion was unavoidable to prevent loss of life, personal injury, or severe property damage; (b) where there were no feasible alternatives to the in-plant diversion, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime and (c) the permittee submitted a notice as required in the Incident Reporting paragraph below. The Director may approve an anticipated in-plant diversion, after considering its adverse effects, if the Director determines that it will meet the three conditions listed above.

10. Incident Reporting: The permittee shall report any unanticipated collection system diversion, in-plant diversion, in-plant flow through occurrences, spill, upset or any violation of a permitted daily maximum limit within 24 hours from the time the permittee became aware of the incident. A written submission shall be provided within 5 days of the time the permittee became aware of the incident. The written submission shall contain a description of the noncompliance and its cause, the period of noncompliance, including exact dates and times; and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance. An Incident Report form is available at www.kdheks.gov/water/tech.html.

    For an anticipated incident or any planned changes or activities in the permitted facility that may result in noncompliance with the permit requirements, the permittee shall submit written notice, if possible, at least ten days before the date of the event.

    For other noncompliance, the above information shall be provided with the next Discharge Monitoring Report.

11. Removed Substances: Solids, sludges, filter backwash, or other pollutants removed in the course of treatment of water shall be utilized or disposed of in a manner acceptable to the Division.

12. Power Failures: The permittee shall provide an alternative power source sufficient to operate the wastewater control facilities or otherwise control pollution and all discharges upon the loss of the primary source of power to the wastewater control facilities.

13. Right of Entry: The permittee shall allow authorized representatives of the Division of Environment or the Environmental Protection Agency upon the presentation of credentials, to enter upon the permittee's premises where an effluent source is located, or in which are located any records required by this permit, and at reasonable times, to have access to and copy any records required by this permit, to inspect any facilities, monitoring equipment or monitoring method required in this permit, and to sample any influents to, discharges from or materials in the wastewater facilities.

14. Transfer of Ownership: The permittee shall notify the succeeding owner or controlling person of the existence of this permit by certified letter, a copy of which shall be forwarded to the Division. The succeeding owner shall secure a new permit. This permit is not transferable to any person except after notice and approval by the Director. The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary.

15. Records Retention: Unless otherwise specified, all records and information resulting from the monitoring activities required by this permit, including all records of analyses and calibration and maintenance of instruments and recordings from continuous monitoring instruments, shall be retained for a minimum of 3 years, or longer if requested by the Division. Biosolids/sludge records and information are required to be kept for a minimum of 5 years , or longer if requested by the Division. Groundwater monitoring data, including background samples results, shall be kept for the life of the facility regardless of ownership.

16. Availability of Records: Except for data determined to be confidential under 33 USC Section 1318, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Department. Effluent data shall not be considered confidential. Knowingly making any false statement on any such report or tampering with equipment to falsify data may result in the imposition of criminal penalties as provided for in 33 USC Section 1319 and KSA 65-170c.

17. Permit Modifications and Terminations: As provided by KAR 28-16-62, after notice and opportunity for a hearing, this permit may be modified, suspended or revoked or terminated in whole or in part during its term for cause as provided, but not limited to those set forth in KAR 28-16-62 and KAR 28-16-28b through g. The permittee shall furnish to the Director, within a reasonable amount of time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish upon request, copies of all records required to be kept by this permit. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

18. Toxic Pollutants: Notwithstanding paragraph 17 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified at such effluent standards) is established under 33 USC Section 1317(a) for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition. Nothing in this permit relieves the permittee from complying with federal toxic effluent standards as promulgated pursuant to 33 USC Section 1317.

19. Administrative, Civil and Criminal Liability: The permittee shall comply with all requirements of this permit. Except as authorized in paragraph 9 above, nothing in this permit shall be construed to relieve the permittee from administrative, civil or criminal penalties for noncompliance as provided for in KSA 65-161 et seq., and 33 USC Section 1319.

20. Oil and Hazardous Substance Liability: Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities or penalties to which the permittee is or may be subject to under 33 USC Section 1321 or KSA 65-164 et seq. A municipal permittee shall promptly notify the Division by telephone upon discovering crude oil or any petroleum derivative in its sewer system or wastewater treatment facilities.

21. Industrial Users: A municipal permittee shall require any industrial user of the treatment works to comply with 33 USC Section 1317, 1318 and any industrial user of storm sewers to comply with 33 USC Section 1308.

22. Property Rights: The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights nor any infringements of or violation of federal, state or local laws or regulations.

23. Operator Certification: The permittee shall, if required, ensure the wastewater facilities are under the supervision of an operator certified by the Department. If the permittee does not have a certified operator or loses its certified operator, appropriate steps shall be taken to obtain a certified operator as required by KAR 28-16-30 et seq.

24. Severability: The provisions of this permit are severable. If any provision of this permit or any circumstance is held invalid, the application of such provision to other circumstances and the remainder of the permit shall not be affected thereby.

25. Removal from Service: The permittee shall inform the Division at least three months before a pumping station, treatment unit, or any other part of the treatment facility permitted by this permit is to be removed from service and shall make arrangements acceptable to the Division to decommission the facility or part of the facility being removed from service such that the public health and waters of the state are protected.

26. Duty to Reapply: A permit holder wishing to continue any activity regulated by this permit after the expiration date, must apply for a new permit at least 180 days prior to expiration of the permit.

Appendix E – Edgerton Agreement

FILE

Edgerton

CONTRACT FOR SERVICES FOR CONSTRUCTION OF WASTEWATER IMPROVEMENTS AND TRANSPORTATION AND TREATMENT OF WASTEWATER IN AN AREA BETWEEN THE CITY OF EDGERTON, KANSAS, AND GARDNER, KANSAS

This Agreement, made and entered into this 10th day of May, 2012, by and between the City of Edgerton, Kansas, hereinafter referred to as "Edgerton", and the City of Gardner, Kansas, hereinafter referred to as "Gardner"(collectively referred to as "the Parties"), each Party having been organized and now existing under the laws of the State of Kansas.

WITNESSETH:

WHEREAS, under the provisions of Title 13 of the Gardner Municipal Code andChapter XV of the Edgerton Municipal Code,Gardner and Edgertonare empowered to construct, maintain, govern, administer, and provide sewage treatment services for properties located within each city to secure proper sanitary conditions for the preservation of public health and the protection of the environment; and

WHEREAS, pursuant to the provisions of K.S.A. 12-2908, the Parties hereto may enter into cooperative agreements to promote the planning, development, construction, acquisition, and operation of public improvements or sewage facilities in a mutually advantageous manner; and

WHEREAS, Edgerton and Gardner desire to enter into this cooperative agreement to provide for the transportation and treatment of wastewater in a manner that will preserve public health, meet regulations of local, state, and federal authorities, provide for the orderly growth and development of wastewater facilities and promote efficiency and coordination in the administration of sanitary sewer systems;

WHEREAS, Edgerton desires to constructlift stations, force main, gravity sewer mains, sewage treatment facilities, and related sanitary sewer improvements as more fully shown on**Exhibit A** (the "Cooperative Facilities"); and

WHEREAS, Gardner desires to construct a force main, gravity sewer mains and sewer force mains as more fully shown on **Exhibit B**(the "Gardner Facilities"), which will enable Gardner to send sewage to the Cooperative Facilities; and

WHEREAS, the Parties agree, pursuant to K.S.A. 12-2908, that Edgerton will design and construct the Cooperative Facilities and the Gardner Facilities; and

WHEREAS, Edgerton seeks reimbursement for a portion of the costs of the Cooperative Facilities and all of the costs of the Gardner Facilities through payments from Gardner pursuant to this Agreement; and

WHEREAS, Edgerton and Gardner desire to enter into this contract for services whereby Gardner, as the Cooperative Facilities and Gardner Facilities are constructed in various phases, will pay for itsportion of the costs of the Cooperative Facilities (its"Development Share" as further defined herein), and the Full Development cost of the Gardner Facilities plus a 2% administrative fee;

WHEREAS, the estimated cost of each phase of the Cooperative Facilities and Gardner Facilities, and the Development Share areshown on **Exhibit C.**

NOW, THEREFORE, for and in consideration of the mutual covenants, agreements, and conditions contained herein, it is agreed by and between Edgerton and Gardner as follows:

ARTICLE I
GENERAL INTENT AND TERMS OF AGREEMENT

The intent of this agreement is to permit the more economical construction, operation and maintenance of Edgerton's Big Bull Creek Wastewater Treatment Plant through intergovernmental cooperation.This Agreement will enable Gardner to transport a projected flow of wastewater from Gardner (via the Waverly Lift Station) to the Edgerton sewer system for transportation and treatment purposes, and to establish mutually acceptable standards, cost arrangements, and billing procedures related thereto.

Cooperation of the Partieswill create significant current and future economic savings for each community. Edgerton will benefit from the development of a more efficient Wastewater Treatment Plant with shared capital investment and a reliable source of existing flow, improving the operation of the plant. Gardner will be able to defer significant sewer infrastructure capital investment in the southwest area of thecommunity, as well as preservetreatment capacity at its Kill Creek Wastewater Treatment Plant.

The presence of Gardner and its commitment to provide immediate minimum wastewater flows will permit the development of a more efficient 0.5MGD plant initially, as well as at the point capacity needs to be expanded to 1.0MGD, which is estimated to be about five years under current projections.

The effective date of this Agreement (the "Effective Date") shall be the first date written above, and expiration of the Agreement shall be the later of the 35th anniversary of the Agreement, or on the third anniversary of the date on which all debt (which may include

bonds, loans, notes or other instruments) issued by Edgerton to finance, enhance or maintain the Cooperative Facilities is paid at maturity or no longer outstanding under the provisions of the terms of such debt, which may include retirement of the debtthrough redemption or legal defeasance.

ARTICLE II
DEFINITIONS

Base Cost. The Full Development Cost, as certified by the Initial Design-Builders, of any Cooperative Facility to be constructed under a Standalone Scenario.

Capacity Reduction Amount. The amount of flow as measured at the Homestead Lane Lift Station in MGD that Edgerton projects it will need during the subsequent rolling quarter to serve its customers, which amount will initially be 0.05MGD.

Capacity Reduction Notification Date. The earlier of the Key Development Point or the final day of the first full calendar quarter following Edgerton's written notice to Gardner that it has modified the Capacity Reduction Amount.

Cooperative Facility. Any individual component of the Cooperative Facilities.

Cooperative Facilities. The WWTP, Interceptor, Force Main Trench and real estate held in fee simple title, and temporary and permanent easements related thereto,for any of the WWTP, Interceptor, or Force Main Trench.

Default Flow Rate. Prior to the Key Development Point, monthly average daily flows equal to 0.09MGD. From and after the Key Development Point until Gardner's approval of the Phase II WWTP Improvements, none. Following Gardner's approval of Phase II WWTP Improvements, monthly average daily flows equal to 0.20MGD.

Development Share. Each Party's total of its share of the Full Development Cost for the Cooperative Facilities.

Disbursement Agent. A bank trust department or comparable entity responsible for making payments to the Initial Design-Builders and others related to the development of the Cooperative Facilities and Gardner Facilities. Initially, UMB Bank, Kansas City, Missouri.

Edgerton Municipal Code. The compiled ordinances of the City of Edgerton, Kansas, as shall be maintained and updated by the Edgerton City Clerk from time to time.

Emergency Repairs. Repairs to Cooperative Facilities requiring immediate action to avoid a threat to the health, safety and welfare of the public or to prevent imminent damage to the Cooperative Facilities.

Force Main Trench. A shared trench, sufficient in size to accommodate the Individual Force Mains, commencing from a point west of the intersection of 191st and Waverly Road in Edgerton and terminating at the upstream end of the Interceptor. See Exhibit A.

Full Development Cost. The total cost of acquiring land and easements, siting, permitting, designing, constructing, testing and bringing to Full Initial Operation any Cooperative Facility and Gardner Facility.

Full Initial Operation. The date, certified by the Initial Design-Builders, upon which any Cooperative Facility is legally and technically ready to accept sewage from retail customers.

Gardner Facility *or*Gardner Facilities. Gardner's Individual Force Main to be set in the Force Main Trench, the Waverly Lift Station, force main and trenching necessary to span the Waverly Lift Station and the Force Main Trench, and roughly one-half mile of gravity sewer and/or force main constructed between the South Lift Station and the Waverly Lift Station. See Exhibit B.

Gardner Facility Completion Date. The date by which the Gardner Facilities must be operational to permit Full Initial Operation, which date is currently June 1, 2013.

Homestead Lane Lift Station. Means the sewage lift station owned by Edgerton located at the Southeast corner of 191st Street and Homestead Lane.

Incremental Development Cost. The excess of the Full Development Costs for the Joint Scenario over the Standalone Scenario to bring any Cooperative Facility to Full Initial Operation, all as certified by the Initial Design-Builders.

Independent Rate Consultant. An engineering firm, accounting firm or municipal advisor with expertise in the establishment of rates for municipal wastewater facilities as appointed by Edgerton from time to time and approved by Gardner, such approval shall not be unreasonably withheld.

Individual Force Mains. The force mains, each owned and operated individually by each Party, located in the Force Main Trench.

Initial Design-Builders. The design-build team of Burns & McDonnell and CAS Construction, or their successors, and the firm of BG Consultants, Inc., hereby approved by the Parties.

Initial Development Plan. The written plan of the Initial Design-Builders to develop the Cooperative Facilities as described in **Exhibit D.**

Initial Flow Rate. 0.15MGD of monthly average daily flow as measured at the Waverly Lift Station.

Initial Independent Rate Consultant.Springsted, Inc.

Initial Wholesale O&M Charge. The Wholesale Operating and Maintenance Charge established by the Initial Independent Rate Consultant and approved by the Edgerton City Council, and the Gardner City Council, which shall be applicable to this Agreement as of the effective date. Such approvals shall not be unreasonably withheld.

Interceptor. The 30- and 36-inch (preliminary size) gravity sewer interceptor running from a point adjacent to Homestead Lane in unincorporated Johnson County, Kansas, roughly equidistant from West 199th Street and the intersection of Interstate 35 and Homestead Lane, including a 36" pipeline under Interstate 35.

Joint Scenario. Edgerton's plans, as recommended by the Initial Design-Builders, to construct the WWTP, the Interceptor and the Force Main Trench with the participation and cooperation of Gardner as contemplated by this Agreement.

Key Development Point. The 90th day following anymeasurement dateat whichEdgerton's average daily flows for the 90-day period next precedingsuch measurement, as measured at the Homestead Lane Lift Station, exceed 0.20 MGD.

Low Flow Surcharge. From and after Full Initial Operation and through the Key Development Date it shall be 110%. After the Key Development Pointand until Gardner's approval of the Phase II Improvementsthere shall be no Low Flow Surcharge. From and after Gardner's approval of the Phase II Improvements it shall be 110%.

Major Maintenance. Maintenance activities related to the Cooperative Facilities that are not usual or customary, as determined by the System Engineer in its reasonable discretion, and exceed $50,000 per instance.

MGD. Millions of gallons per day of Normal Strength Sewage.

Normal Strength Sewage. As defined by the Ordinance.

Ordinance. The City of Edgerton Wastewater Pretreatment Ordinance or its successors, as may be amended from time to time and codified in the Edgerton Municipal Code.

Phase I WWTP Improvements. The capital improvements necessary, as certified by the Initial Design-Builders, to produce the WWTP on or about September 1, 2013that has a design average day capacity of 0.50MGD.

Phase II WWTP Improvements. The capital improvements necessary, as certified by the System Engineer, to increase design average day capacity of the WWTP to at least 1.00MGD.

South Lift Station. Gardner's existing lift station located roughly at the intersection of 191st and Center Street.

Standalone Scenario. Edgerton's plans, as recommended by the Initial Design-Builders, to construct any Cooperative Facility without the participation of Gardner.

System Engineer. One or more consulting engineers or firms of consulting engineers, appointed by Edgerton, with significant experience in the design and operation of sewage handling and treatment systems responsible for advising Edgerton on the timing and scope of major maintenance and capital investment related to the Cooperative Facilities, which Engineer shall initially be Burns & McDonnell.

Waverly Lift Station. The lift station constructed and owned by Gardner located in the general vicinity of 191st and Waverly Road in currently unincorporated Johnson County, Kansas.

Wholesale O&M Charge. The fees per thousand gallons of Normal Strength Sewage delivered by Gardner from the Waverly Lift Station, as determined by the Independent Rate Consultant. Such charges shall include the normal operations and regular maintenance charges billed to any Edgerton sewer customer, as identified in the Edgerton Municipal Code, plus a component for Major Maintenance, but shall not include charges related to the initial capital investment in the Cooperative Facilities.

WWTP. The Big Bull Creek Wastewater Treatment Plant and all improvements and appurtenances thereto.

ARTICLE III
DEVELOPMENT, CONSTRUCTION AND FINANCING

Edgerton shall be responsible for developing the Cooperative Facilities and the Gardner Facilities and shall be responsible for managing all contracts executed therefor. Gardner hereby affirms its approval of the Initial Design-Builders, the Initial Independent Rate Consultant, and the System Engineer. Gardner hereby ratifies its acceptance of the Initial Development Plan.

Because the design/build process will not produce full plans until the Cooperative Facilities are under construction, Gardner acknowledges that it will have limited opportunities to review the design of such facilities. Recognizing the importance of its partnership with Gardner, Edgerton will make the Initial Design-Builders available to Gardner representatives on a regular basis, but not less than monthly, from the effective dateof this Agreement through substantial completion of the Cooperative Facilities or the Gardner Facilities, whichever is later, for review and consultation regarding the Initial

Development Plan. Gardner will have the opportunity to identify design elements or oversights that might adversely impact the conveyance or treatment of sewage flows.

The parties shall share equally in the Full Development Costs for the WWTP.Gardner shall pay the Incremental Development Cost for the Interceptor. Gardner shall pay the Incremental Development Cost for the Force Main Trench. Edgerton shall be responsible for the Base Cost of the Interceptor and the Force Main Trench. Gardner shall pay the Full Development Costs for the Gardner Facilities, plus a two (2) percent administrative fee calculated on the Full Development Costs of the Gardner Facilities.

Each party shall be responsible for financing its Development Share.

Each party shall make funds available for its Full Development Share not later than September 1, 2012. "Available" means cash-on-hand or an agreement with a bank or other lender to provide draws against a firm credit commitment in an amount equal to or exceeding its Development Share.Gardner acknowledges that Edgerton intends to use State Revolving Fund loan(s) to finance the costs of constructing the Cooperative Facilities, and Gardner agrees it will not take any action to jeopardize said loans or otherwise impair Edgerton's eligibility to obtain the loans.

Gardner hereby agrees to contract with Edgerton for the delivery of the Gardner Facilities by the Gardner Facility Completion Date. Gardner will be responsible for 102% of the costs associated with the Gardner Facilities as certified by the Initial Design-Builders and agrees to make payments to theDisbursement Agentwithin 15 days of presentation of invoices for all expenditures attributable to the Full Development Costs, plus 2%, for the Gardner Facilities. Edgerton agrees to use the Initial Design-Builders to complete the Gardner Facilities and to extend the per unit costs for labor and materials as provided in its agreement with the Initial Design-Builders, plus a two (2) percent administration fee to be retained by Edgerton.

At its sole discretion, Edgerton may, at any time, advance funds for Gardner's Development Share, to be reimbursed by Gardner within 15 days of demand following September 1, 2012. The Parties expect that this provision will be used to cover design costs, engineering, easement acquisition and land acquisition, permitting development of the Cooperative Facilities between the time of execution of this Agreement and the availability of financing. Gardner's responsibility for reimbursing Edgerton shall be absolute.

Edgerton will engage a bank corporate trust department or similar entity to serve as Disbursement Agent for payments for work completed on the Cooperative Facilities and the Gardner Facilities. Upon demand for partial payment, Gardner shall wire funds to the Disbursement Agent which, along with funds paid to it by Edgerton, will disburse funds in satisfaction of invoices against the Full Development Cost. The fees and expensesof the Disbursement Agent shall be considered part of the Full Development Cost.Within 30 days of execution of this Agreement, Gardner shall deposit the sum of $60,000 with the

Disbursement Agent.Edgerton shall be entitled to present invoices to the Disbursement Agent for Gardner's Development share to be paid by the $60,000 deposit.

Gardner agrees to pay its share of progress payments against its Development Share. Gardner agrees to make funds available to the Disbursement Agent within 15 days of demand by Edgerton in order to permit progress payments within the time constraints specified in K.S.A. 16-1903. Each party will be responsible for the interest and other late payment costs charged on the full amount of the progress payment if it causes a late payment. Edgerton shall not demand payment from Gardner for its share of contract retainage until substantial completion for the applicable Cooperative Facility or Gardner Facility is certified by the Initial Design-Builders and the completion punch list is developed and costed.

ARTICLE IV
INSPECTION OF FACILITIES

Edgerton and Gardner will jointly retain a qualified inspector, and/or inspection company ("Inspector"), to inspect all aspects of the construction of the Cooperative Facilities and the Gardner Facilities. The Inspector will serve Edgerton and Gardner in the capacity of an independent contractor. The costs for the Inspector shall be included in the Full Development Cost. The Parties hereby agree to appoint the Inspector jointly through a competitive process administered by Edgerton and including Gardner staff on the selection team.

ARTICLE V
OWNERSHIP AND OPERATION

Edgerton and Gardner shall continue to control, own, operate, and maintain their respective sewerage systems, now existing or constructed in the future. No provision of this Agreement shall be construed to create any type of joint ownership of any property, any partnership or joint venture, or create any property or other rights or liabilities except as may be otherwise expressly set forth herein.

Edgerton shall maintain fee simple title to the Cooperative Facilities, and shall be solely responsible for their regular operation and maintenance. Gardner shall compensate Edgerton for such activities through the payment of the Wholesale O&M Charge.

Gardner shall maintain fee simple title to the Gardner Facilities.

Edgerton agrees to provide unlimited access easements to Gardner related to the Force Main Trench.Edgerton agrees to make the Cooperative Facilities available to Gardner for inspection upon reasonable notice.Gardner agrees to make the Waverly Lift Station accessible to authorized Edgerton staff members and consultants with reasonable same-day

notice on any day for auditing of flow, sampling of wastewater strength and verification of access of flow measurement devices.

The Gardner Facilities shall include flow monitoring devices at the Waverly Lift Station sufficient, in the reasonable opinion of the Initial Design-Builders, to accurately measure the amount of sewage flow transmittedto the Cooperative Facilities. Ownership, maintenance, and replacement, as may be necessary, of both the vaults and measurement devices shall remain with Gardner. Gardner shall perform a calibration of the measurement devices not less than semi-annually and provide Edgerton the calibration results within five (5) business days of such testing. Edgerton retains the right to periodically verify the accuracy of the flow measurement devices. Gardner shall collect and record the continuous flow data obtained at the Waverly Lift Station. All of the collected flow data shall be reported by Gardner to Edgerton on a monthly basis for the purpose of verifying compliance with the quality and quantity provisions of this Agreement and for the preparation of the monthly billing information.

ARTICLE VI
CONTINUED COOPERATION AND DIALOGUE

Each party agrees to appoint knowledgeable staff members to meet periodically, but not less than quarterly, during the life of the Agreement to discuss and resolve operational issues and to provide updates on the pace of wastewater flow growth from each community. Additionally, each party agrees to appoint two (2) governing body members to serve on a Big Bull WWTP task force to meet at least one (1) time each calendar year for the life of the Agreement to discuss concerns related to growth management and the shared financing of future cooperative facilities and to make recommendations for action on such topics, as needed, to the governing bodies of each community.

The Parties agree to pass such ordinances, resolutions, or other legislation and execute such instruments from time to time as may be necessary to effectuate the terms and conditions of this Agreement.

ARTICLE VII
RIGHT TO USE IMPROVEMENTS

Upon notification in writing from Edgerton that the Cooperative Facilities have been substantially completed and are ready to accept flows, and as long as Gardner is in good standing under this Agreement, Gardner shall have the right to connect to and discharge untreated sanitary sewage and wastes to the Cooperative Facilities, subject to the quantity and quality limitations set forth herein and subject to the right of Edgerton to be compensated for its costs and expenses pursuant to the terms of this Agreement. Except to the extent provided by this Agreement, Edgerton shall not impair Gardner's rights to send such flows to the Cooperative Facility.

ARTICLE VIII
FLOW RATES

Recognizing that the WWTP design contemplated by this Agreement requires sufficient minimum average flows, Gardner agrees, from and after Full Initial Operation of the WWTP and until the Key Development Point, to deliver sewage flows of not less than 0.15 MGD from the Waverly Lift Station. The parties agree that, from and after Full Initial Operation of the WWTP and until the Key Development Point, they shall work cooperatively to ensure total average day flows at the WWTP headworks do not exceed 80% of design capacity.

From and after Full Initial Operation of the WWTP and until the Key Development point, and subject to the minimum flow requirements provided herein, Gardner may send maximum average day flows from the Waverly Lift Station not to exceed the amount produced by the formula below:

(Design Capacity * 80%) - Capacity Reduction Amount (which Capacity Reduction Amount shall not exceed 0.2MGD)

On and after the Key Development Point, each Party shall be limited to maximum average day flows as produced by the formula below:

(Design Capacity * 80%) * 50%

On any date after the Key Development Point until such time as it approves the development of the Phase II WWTP Improvements, Gardner may, upon written notice to Edgerton, propose to permanently terminate sending flow to the WWTP (the "Termination Notice"). Upon the certification by the System Engineer (and such certification shall not be unreasonably withheld) that Gardner has met all financial obligations under this Agreement and that such diversion would not have a materially adverse impact on the ability of Edgerton to operate the plant within usual and customary operating parameters for similar facilities and in full compliance with its regulatory requirements (the "Certification Date"), Gardner shall, at its sole expense, cause its Individual Force Main connection at the Waverly Lift Station to be capped within 60 days following the second anniversary of such certification by the System Engineer (the "Termination Date").From the Certification Date and until the Termination Date, Edgerton may, but is not required to, accept Gardner's rescission of such Termination Notice. In the event of a rescission, the parties will continue to be governed by this Agreement.After paying all outstanding charges not yet billed and/or collected by the Termination Date, Gardner's obligation to make Wholesale O&M Charge payments shall end on the Termination Date.

ARTICLE IX
BILLING

Edgerton shall bill Gardner monthly for its sewer flow for the prior month as measured at the Waverly Lift Station. Gardner agrees to provide, and Edgerton agrees to bill Gardner for, Normal Strength Sewage. Such billings for Normal Strength Sewage shall be at the Wholesale O&M Charge.

Gardner agrees to make payment to Edgerton within 15 days of delivery of such monthly bill.

If Gardner has not approved construction of the Phase II WWTP Improvements, for any month afterFull Initial Operationand until the first month following the Key Development Point for which Gardner's average daily flows do not equal or exceed the Initial Flow Rate, Edgerton shall calculate Gardner's bill for that month using the larger of:

```
Wholesale O&M Rate * Low Flow Surcharge * Actual Usage
                          or
Wholesale O&M Rate * Low Flow Surcharge * Default Flow Rate
```

If Gardner has approved construction of the Phase II WWTP Improvements, for any month following the first month afterthe placed-in-service date of the Phase II WWTP Improvements, as certified by the System Engineer,for which Gardner's average daily flows do not equal or exceed the Default Flow Rate then in effect, Edgerton shall calculate Gardner's bill for that month by applying the formula below:

```
Wholesale O&M Rate * Low Flow Surcharge * Default Flow Rate
```

Gardner's failure to provide flows exceeding the Default Flow Rate for two consecutive months or for more than six months in any rolling 12-month period shall constitute an event of default under thisAgreement. The parties acknowledge that the unique nature of the Cooperative Facilities may require unique remedies, such as a court of competent jurisdiction directing Gardner to provide flow sufficient to maintain minimal plant operations or compensating Edgerton for documented, increased operations and maintenance costs stemming from insufficient sewer flows.

In the event a malfunctioning flow meter causes a short term loss of data, Gardner shall take appropriate action to repair the malfunctioning flow meter and the flow values for billing purposes during the period when actual data are not available shall be estimated by Edgerton in its reasonable discretion based on flow values or the sum of individual customer water use readings derived from the same period during the prior year or other flow projection agreed upon by both parties.

ARTICLE X
MAJOR MAINTENANCE

The Parties agree, within 60 days of the date the Initial Design-Builders declare the Cooperative Facilities to be substantially complete, that each shall deposit the sum of $50,000 (the "Initial Deposit") into the Big Bull Major Maintenance Repair Fund (the "Repair Fund"), held in the Edgerton treasury. The Repair Fund shall be a separate fund on Edgerton's books and records.

Until such time as the Initial Deposit is depleted, the Parties will share equally in the costs, as certified by the System Engineer, of Major Maintenance on the Cooperative Facilities. Major Maintenance includes repairs and improvements recommended by the System Engineer exceeding $50,000 that are necessary to protect the health, safety and welfare of the public and/or to ensure continued regulatory compliance.

From and after Full Initial Operation, the Rate Consultant shall include in the Wholesale O&M Charge such amount as shall be necessary, in the opinion of the System Engineer, to cover Major Maintenance costs over the subsequent five (5) year period, based upon projected total flow to the WWTPduring such five (5) year period. Edgerton hereby agrees to deposit the moneys derived each fiscal year from the Major Maintenance portion of Wholesale O&M Charge receipts into the Repair Fund. Within 30 days of the end of each calendar quarter, Edgerton shall deposit into the Repair Fund an amount equal to the Major Maintenance component of the Wholesale O&M Charge multiplied by the aggregate flow for the calendar quarter measured at its Homestead Lane Lift Station; provided that Edgerton shall be credited for any amounts it paid for a Major Maintenance item during the quarter to the extent any portion of the cost of such Major Maintenance item was not paid by the Repair Fund. If the amount of such credit exceeds the amount Edgerton would be required to pay into the Repair Fund for the quarter, the excess balance shall be carried forward to subsequent quarters.

From and after the time at which the Initial Deposit is depleted, Edgerton will finance Major Maintenance repairs from the Repair Fund. The Rate Consultant shall be responsible for adjusting the Major Maintenance component of the Wholesale O&M Charge to produce sufficient funds to meet future demands on the Repair Fund as described above.

Until the Initial Deposit is depleted, except for Emergency Repairs constituting Major Maintenance, Edgerton agrees to provide Gardner with 60 days' notice prior to commencing Major Maintenance.

Upon termination of this Agreement, the balance of the Repair Fund, if any, will be distributed equally to the parties.

Edgerton agrees to provide to Gardner upon demand, but not more frequently than monthly, a report detailing the balance held in the Repair Fund plus a detailed list of

revenues and expenditures in such fund. Edgerton's reporting requirement under this Article shall expire on the Termination Date.

ARTICLE XI
PHASE II IMPROVEMENTS

On any date following the Key Development Point, either party may propose, with written notice to the other, the commencement of development of Phase II WWTP Improvements. The party proposing such development shall cause, at its cost (or with the consent of the other party, at the shared cost of the parties), (a) the System Engineer to evaluate the improvements required and to estimate the total development cost of such improvements and (b) the Independent Rate Consultant to estimate the impact of such improvements, if built, on retail rates and the Wholesale O&M Charge, presuming the cost of such improvements were split equally by the parties.

Within 90 days of initial written notice, the System Engineer and the Independent Rate Consultant will provide their written reports simultaneously to each party.

Within 45 days of the date of delivery of the latest of the two reports of the System Engineer and the Independent Rate Consultant, the governing body of each party shall take formal action to accept or reject the proposal of the proposing party to develop the Phase II WWTP Improvements. The governing body may provide its acceptance contingent upon it being able to secure financing for such improvements at then-market rates for communities in Kansas with similar credit quality and withsimilar bond/note/loanholder security.

If both Parties' governing bodies approve the proposal to construct Phase II WWTP Improvements, Edgerton agrees that within 30 days of the final approval to commence procurement of the professionals necessary to design, permit and construct such Phase II WWTP Improvements. All costs of such Phase II WWTP Improvements will be shared by the Parties equally in the manner prescribed for the WWTP Improvements herein.

If Gardner proposes construction of Phase II WWTP Improvements, it will agree to provide not less than 0.2MGD average daily flow during the life of the Agreement, from and after the date full operation of the Phase II WWTP Improvements, such date shall be determined by the System Engineer in its reasonable discretion.

If Gardner's governing body fails to approve Edgerton's proposal to construct Phase II WWTP Improvements, Edgerton may choose to construct Phase II WWTP Improvements at Edgerton's cost. Edgerton shall have full access to the incremental new plant capacity until the Gardner Buy-In (described below), at which time incremental new plant capacity shall be shared equally.

At any point subsequent to its initial failure to approve construction of Phase II WWTP Improvements, Gardner may, in addition to providing a commitment to provide not

less than 0.3MGD monthly average flow during the life of the Agreement, from and after the date full operation of the Phase II WWTP Improvements (such date shall be determined by the System Engineer in its reasonable discretion) purchase a 50% share of the Phase II capacity using the formula below (the "Gardner Buy-In"):

(50% * (Full Development Cost of Phase II WWTP Improvements * 105%)) - ((Number of Years Elapsed from Notice to Proceed on Phase II WWTP Improvements to Today / 40) * 50% of Full Development Cost of Phase II WWTP Improvements))

plus

(50% * Cumulative Major Maintenance Costs Incurred related to Phase II WWTP Improvements) - ((Number of Years Elapsed from Notice to Proceed on Phase II WWTP Improvements to Today / 40) * 50% of Cumulative Major Maintenance Costs Incurred on Phase II WWTP Improvements))

plus

50% * Cumulative Interest Costs to the later of the Buy-In Date or the Next Available Call Date on debt incurred by Edgertonfor Phase II WWTP Improvements

where

Cumulative Interest Costs do not include interest paid by bond proceeds (e.g., capitalized interest) and are offset by actual or expected interest earnings on bond funds (e.g., constructionfund earnings)

If Edgerton's governing body fails to approve Gardner's proposal to construct Phase II WWTP Improvements, Gardner may choose to require Edgerton to construct Phase II WWTP Improvements at Gardner's cost plus a 2% administrative fee on the total development costs actually incurred, which fee shall be retained by Edgerton. Gardner shall have full access to the incremental new plant capacity until the Edgerton Buy-In (described below), at which time incremental new plant capacity shall be shared equally.

At any point subsequent to its initial failure to approve construction of Phase II WWTP Improvements, Edgerton may purchase a 50% share of the Phase II capacity using the formula below (the "Edgerton Buy-In"):

(50% * (Full Development Cost of Phase II WWTP Improvements * 105%)) - ((Number of Years Elapsed from Notice to Proceed on Phase II WWTP Improvements to Today / 40) * 50% of Full Development Cost of Phase II WWTP Improvements))

plus

(50% * Cumulative Major Maintenance Costs Incurred related to Phase II WWTP Improvements) - ((Number of Years Elapsed from Notice to Proceed on Phase II WWTP Improvements to Today / 40) * 50% of Cumulative Major Maintenance Costs Incurred on Phase II WWTP Improvements))

plus

50% * Cumulative Interest Costs to the later of the Buy-In Date or the Next Available Call Date on Gardner Phase II WWTP Improvements Debt

where

Cumulative Interest Costs do not include interest paid by bond proceeds (e.g., capitalized interest) and are offset by actual or expected interest earnings on bond funds (e.g., constructionfund earnings)

The parties agree to continuous dialogue about the development of shared facilities for plant capacities in excess of 1.0MGD at such time as it becomes apparent that plant expansion beyond the Phase II Improvements shall be necessary.

ARTICLE XII
SAMPLING, TESTING, AND VIOLATIONS

Nothing herein shall be construed as changing any wastewater standards or reporting requirements that EPA and KDHE impose on the Parties. Gardner agrees to make reasonable efforts to preventinfiltration and inflow to the Cooperative Facilities.

Either party may sample and analyze flows at its own expense at, if for Edgerton, the Homestead Lane Lift Station, and, if for Gardner, the Waverly Lift Station. Gardner shall sample and analyze flows at its sole expense at the Waverly Lift Station at a frequency based upon the schedule indicated on **Exhibit E.** Additional samples may be collected from the Waverly Lift Station by Edgerton at Edgerton's sole discretion and expense (except that staff time for Gardner employees and contractors to provide access to the Waverly Lift Station shall not be charged) for the purpose of verifying the accuracy of the information reported by Gardner. Any and all results and analysis from samples collected pursuant to this Article, by either party, shall be shared with the other party within five (5) business days of testing.

All samples, unless otherwise mutually agreed upon, shall be obtained using methods as found in the most current edition of "Standard Methods for the Examination of Water and Wastewater". Analysis shall be conducted by standard methodology as found in the most current edition of "Standard Methods for the Examination of Water and Wastewater". Laboratories performing analysis must hold certification from state or other certification agencies.Samples collected for Biochemical Oxygen Demand ("BOD5")or the Total Suspended Solids ("TSS") analysis shall be twenty-four (24) hour flow composite. Samples collected for Fats, Oil and Grease ("FOG") or pH analysis shall be a grab sample. Time composite samples may be used in lieu of flow composite samples in the event of maintenance, operational, or laboratory difficulties. Grab samples may be used in lieu of time composites for similar cause.All samples and analysis obtained at the connection point by either party shall be reported to the other party. Either party shall have the opportunity to split samples collected by the other party.

Samples found to be not representative of the flow by mutual agreement shall not be used in calculations of charges. Split samples varying by more than 20% for BOD5 or TSS will not be used in the calculations for determining loadings or charges. Should any sample

results be discarded for any reason, additional samples will be collected as necessary to provide the minimum number of sample results required by **Exhibit E** of this Agreement.

Subject to the requirements of the EPA, if any, the quality (excluding the 5-Day BOD5 and the TSS) of the wastewater received by Edgerton under this Agreement shall be within the parameters set forth in the Ordinance. Gardner shall be subject to remedial actions as provided in the Ordinance if it fails to comply with this provision.

With the exception of discharges from the Waverly Lift Station that result in a major disruption of the Edgerton collection system or treatment system as described herein below, any costs or actual damages incurred by Edgerton as the result of the discharge of wastes from the Waverly Lift Station to Edgerton's sewer system, which discharge is prohibited underthe Ordinance, including but not limited to fines assessed by KDHE or other regulatory agencies, shall be paidby Gardner within thirty (30) days from the date written notice of such costs or damages is delivered by Edgerton to Gardner.Either Partyshall have the right to appeal or contest any fines assessed by KDHE or other regulatory agency.

In the event violations of wastewater quantity or quality limitations occur from flow from the Waverly Lift Stationthat are in sufficient magnitude to cause a major disruption to the Edgerton collection and/or treatment system such that health, safety or water quality are seriously threatened or impaired, Gardner shall take corrective action to eliminate the violations immediately upon receipt of written notice from Edgerton. Should Edgerton determine in its sole discretion that Gardner is not acting in a manner to correct the violation(s) in a time frame that is appropriate for the urgency of the situation, Edgerton may take whatever action it deems necessary to restore proper transport and/or treatment at its facilities and Gardner agrees to permit unrestricted access to its sewer related facilities to employees and /or the third party agents of Edgerton in order to accomplish such action. Should Edgerton's intervention be required, Gardner shall pay to Edgerton an amount equal to 125% of Edgerton's actual costs, including any fines or damages resulting from the major disruption. In the event of persistent violations, Edgerton may refuse to accept further wastewater flows from Gardner.

ARTICLE XIII
DISPUTES

The Parties recognize that protection of the health of citizens and quality of the waters are paramount to monetary or proprietary issues, and agree that any disputes arising between the Parties subsequent to the Effective Date of this Agreement concerning monetary or proprietary issues shall not constitute grounds for its immediate termination.

The intent of this Agreement is to facilitate the resolution of disputes at the staff level in a cooperative manner. This procedure, however, shall not limit either party from seeking other remedies consistent with other provisions of this Agreement, or when the issue in dispute requires immediate involvement by the District Court of Johnson County, Kansas.

Nothing in this Agreement section shall prevent either Party from seeking immediate legal recourse in the District Court of Johnson County, Kansas to recover costs due under this Agreement or to obtain specific performance or to enjoin noncompliance with the terms of this Agreement where such relief is necessary to protect the health, safety, and welfare of the residents of either Edgerton or Gardner, in each Party's reasonable judgment, or to prevent damage to either the Cooperative Facilities or the Gardner Facilities, in each Party's reasonable judgment.

ARTICLE XIV
FORCE MAJEURE

Edgerton reserves the right, without relieving Gardner of its obligations hereunder, to stop providing sewage treatment services when necessary by reason of force majeure. "Force Majeure" as used herein shall mean without limitation: acts of nature, strikes, lockouts or industrial disturbances; acts of public enemies, riots, domestic terrorism, fires, storms, floods, or explosions; mandate or order of the EPA, KDHE, or other governmental authority; or other causes beyond the control of Edgerton. Gardner agrees to hold Edgerton harmless for any damage or loss resulting from such interruption or suspension of service. If a force majeure condition occurs, Edgerton shall provide notice to Gardner as soon as reasonably possible under the circumstances, stating the nature of the condition and the action being taken to avoid or minimize its effect.

ARTICLE XV
INDEMNIFICATION AND HOLD HARMLESS

Gardner agrees to indemnify, defend, and hold Edgerton harmless from any and all suits, liabilities, claims, losses, costs, and expenses, including reasonable attorneys fees, which Edgerton might otherwise incur as a result of any acts or omissions (including but not limited to acts or omissions constituting negligence or misrepresentation) committed by Gardner, its employees, agents, or contractors, in connection with transactions or activities related to the performance of or failure to comply with any of the provisions of this Agreement. Edgerton agrees to indemnify, defend, and hold Gardner harmless from any and all suits, liabilities, claims, losses, costs, and expenses including reasonable attorneys fees which Gardner might otherwise incur as a result of any acts or omissions (including but not limited to acts or omissions constituting negligence or misrepresentation) committed by Edgerton, its employees, agents, or contractors, in connection with transactions or activities related to the performance of or failure to comply with any of the provisions of this Agreement.

ARTICLE XVI
NOTICES AND ADMINISTRATION

The Edgerton City Administrator, or designee, shall be the administrative officer for Edgerton respecting this Agreement, and any approvals or other decisions necessary under this Agreement will be made by the City Administrator, or designee. The Gardner City Administrator, or designee, shall be the administrative officer for Gardner respecting this Agreement, and any approvals or other decisions necessary under this Agreement will be made by the City Administrator, or designee. Any notice required by this Agreement shall be deemed to be well given when delivered to such officers respectively.

Any notices, demands or request required by this Agreement, other than routine correspondence and billings, shall be made in writing and shall be sent by certified U.S.Mail postage prepaid, to the following addresses:

City of Gardner:
City Administrator
City of Gardner
120 E. Main Street
Gardner, Kansas 66030

City of Edgerton:
City Administrator
City of Edgerton
PO Box 255
404 E. Nelson Street
Edgerton, Kansas

Either Party may change the address to which notices, demands, or request required under this Agreement shall be sent by providing five (5) days written notice to the other party of the new address.

ARTICLE XVII
AGREEMENT NOT ASSIGNABLE

Gardner shall not assign, transfer, convey, sublet or otherwise dispose of this Agreement or any of its rights and obligations hereunder by legal process or otherwise without the prior written consent of Edgerton and in no event shall such consent relieve Gardner from its obligations accrued under the terms of this Agreement. Violation of this provision shall result in the immediate termination of this Agreement. In the event of such termination, Gardner shall remain liable to Edgerton for any obligations incurred for services provided prior to the termination of the Agreement.

ARTICLE XVIII
AGREEMENT COMPLETE BUT SEVERABLE

This written Agreement constitutes the complete understanding of the parties and except as otherwise indicated, can only be modified or terminated in writing by mutual agreement of the parties. However, should any provision of the Agreement for any reason be deemed or ruled illegal, invalid or unconstitutional by any court of competent jurisdiction, no other provision of this Agreement shall be affected, and this Agreement shall then be construed and enforced as if such illegal or invalid or unconstitutional provision had not been contained herein.

ARTICLE XIX
APPLICABLE LAW

Except as otherwise specifically indicated herein, Edgerton and Gardner hereby expressly agree that this Agreement shall be governed by and interpreted according to the laws of the State of Kansas.

IN WITNESS THEREOF, the Parties hereto, acting under the authority of their respective governing bodies, have caused this Agreement to be duly executed in the date and year first above written.

CITY OF EDGERTON, KANSAS

Donald R. Roberts, Mayor

ATTEST:

Janeice Rawles, City Clerk

[SEAL]

CITY OF EDGERTON JOHNSON COUNTY KANSAS

APPROVED AS TO FORM:

Patrick G. Reavey, City Attorney

CITY OF GARDNER, KANSAS

David C. Drovetta, Mayor

ATTEST:

Doreen Pesek, City Clerk

[SEAL]

CITY OF GARDNER SEAL KANSAS

APPROVED AS TO FORM:

James R. Hubbard, City Attorney

EXHIBIT LIST

EXHIBIT A	Cooperative Facilities
EXHIBIT B	Gardner Facilities
EXHIBIT C	Cost estimates for each Phase of Cooperative Facilities, Gardner Facilities, and the respective Development Shares
EXHIBIT D	Initial Development Plan
EXHIBIT E	Sampling Schedule

EXHIBIT A
COOPERATIVE FACILITIES

The Cooperative Facilities shall include those items listed below, located as reflected on the map made part of this Exhibit A.

1. *Wastewater Treatment Plant*—TheWWTP, its physical site and all improvements and appurtenances thereto.
   a. Phase One—Plant with 0.50 MGD average day treatment capacity as provided in the Initial Development Plan
   b. Phase Two—Upgrade to Phase One plant to provide a total 1.0 MGD average day treatment capacity as provided in the Initial Development Plan
2. *Force Main Trench*—A shared trench, sufficient in size to accommodate the Individual Force Mains, commencing from a point west of the intersection of 191st and Waverly Road in Edgerton and terminating at the upstream end of the Interceptor.
3. *Interceptor*—The 30- and 36-inch (preliminary size) gravity sewer interceptor running from a point adjacent to Homestead Lane in unincorporated Johnson County, Kansas, roughly equidistant from West 199th Street and the intersection of Interstate 35 and Homestead Lane, including a 36" pipeline under Interstate 35.
4. *Land and Easements*—Real estate held in fee simple title, temporary and permanent easements and related for any of the WWTP, Interceptor, or Force Main Trench.

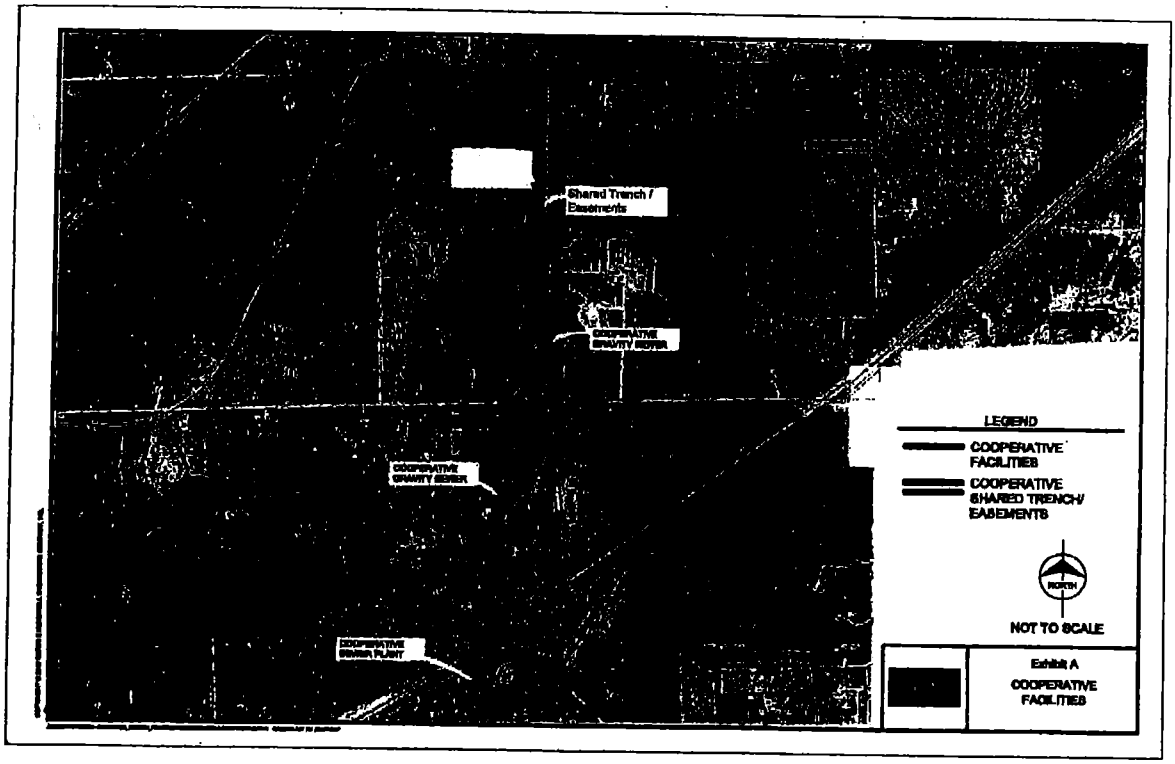

Shared Trench / Easements
COOPERATIVE GRAVITY SEWER
COOPERATIVE GRAVITY SEWER
COOPERATIVE SEWER PLANT
LEGEND
COOPERATIVE FACILITIES
COOPERATIVE SHARED TRENCH/ EASEMENTS
NORTH
NOT TO SCALE
Exhibit A
COOPERATIVE FACILITIES

EXHIBIT B
GARDNER FACILITIES

The Cooperative Facilities shall include those items listed below, located as reflected on the map made part of this Exhibit B.

1. *Waverly Road Lift Station* – The lift station will, its physical site, and all appurtenances thereto. Flow metering at the Lift Station will be used for billing purposes and to assure flow from Gardner facilities do not exceed the available capacity of the Big Bull Creek WWTP.
   a. Phase 1 – lift station with a firm capacity of 500,000 gallons per day
   b. Phase 2 – Upgrade lift station as needed, capacity anticipated to be no larger than 1.5 million gallons per day firm capacity

2. *Gardner Interceptor* – A dedicated interceptor, tentatively sized as 15-inches in diameter and sufficient to convey up to 1.5 million gallons per day, from the South Gardner Force Main to the Waverly Road Lift Station. The interceptor facility includes manholes tentatively spaced at 400 feet apart, a motor-actuated valve designed to allow flow from the existing South Gardner Force Main to be diverted into the Interceptor, and a metering flume used in the control of the motor-actuated diversion valve.

3. *Gardner Force Main* – A dedicated force main, tentatively sized as 8-inches and sized to convey flows up to 1.5 million gallons per day, from the Waverly Road Lift Station to the upper manhole of the Cooperative Facilities' Interceptor. The Force Main will be buried in its own trench from the Lift Station to a point along 191st Street and midway between Waverly Road and Homestead Lane, where it will be installed in the shared Force Main Trench described in the Cooperative Facilities.

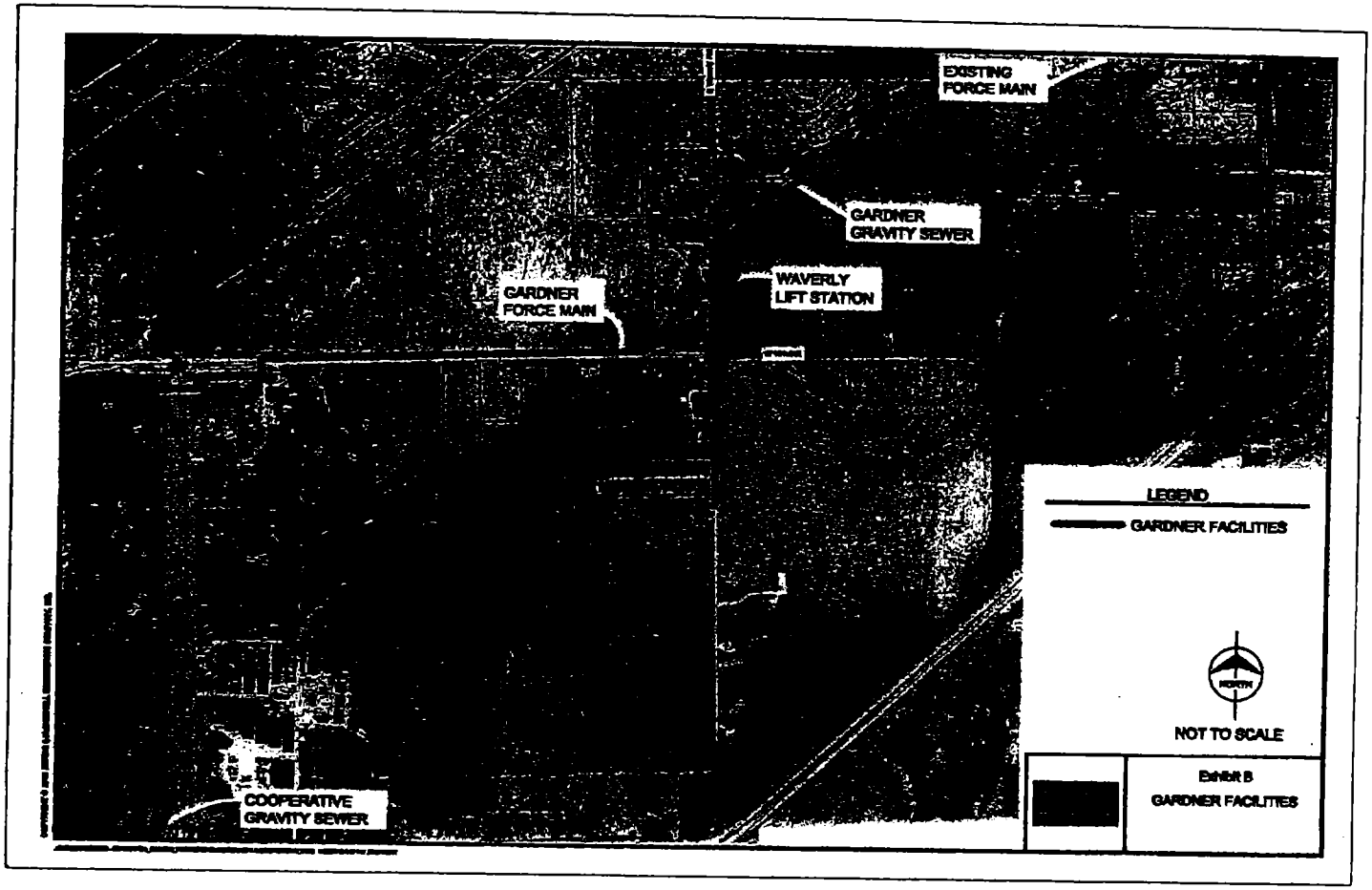

EXISTING
FORCE MAIN
GARDNER
GRAVITY SEWER
WAVERLY
LIFT STATION
GARDNER
FORCE MAIN
COOPERATIVE
GRAVITY SEWER
LEGEND
GARDNER FACILITIES
NORTH
NOT TO SCALE
Exhibit B
GARDNER FACILITIES

EXHIBIT C
COST ESTIMATES

Exhibit C - Opinion of Probable Costs for Facilities

	Phasing		
	Phase I	Phase 2	Phase 3
Capacity (avg/peak)	0.5/1.5	1/3	3/9
Development Share - Edgerton	$9.50	$3.50	$11.30
Development Share - Gardner	$6.50	$3.50	$11.30
Total Cooperative Facilities	$16.00	$7.00	$22.60
Total Gardner Facilities	$2.5-$3.5	$0.1-$0.3	NA

Notes:

1. Price range on Gardner infrastructure is due to uncertainties in subsurface conditions and depth of sewer construction.

2. Please note that these costs are projections and do not include any property acquisition, utility extention, or mitigation costs

3. Phase III costs are a function of technlogy costs at the time and water quality requirements at the time of construction. These projections are highly variable.

EXHIBIT D
INITIAL DEVELOPMENT PLAN

WWTP.

Phase I:0.50 MGD Average Day Treatment Capacity.

This facility will have an average day treatment capacity of 0.5 million gallons per day plus a peak flow headworks treatment capacity of 1.5 MGD and secondary and tertiary treatment peak flow capacity of 1.0 MGD. A minimum equalization/wet weather storage capacity of 0.5 million gallons will be provided. Specific facilities include:

1. 30-inch diameter gravity interceptor sized to convey flow from force mains provided by Gardner and Edgerton.
2. 36-inch diameter crossing of I-35.
3. Influent pump station including electrical controls to convey flow to headworks treatment
4. Headworks facility including screening and grit removal.
5. Biological treatment system including tank, aeration equipment, and electrical controls.
6. Effluent building including polishing filters, ultraviolet disinfection equipment, equipment piping and valves, parshall flume for measuring effluent flowrate, HVAC and electrical controls.
7. Chemical feed storage pumping facilities for alum and carbon supply.
8. Backup generator and diesel tank.
9. Primary 3-phase site power to be provided by KCPL.
10. 0.5 million gallons of equalization storage of screened and degritted wastewater.
11. Splitter boxes, roads, fencing, etc.
12. All other required ancillary facilities and utilities.

Phase II: Expansion from 0.5 to 1.0 MGD Average Day Treatment Capacity

This expansion would effectively double the capacity of the plant while continuing to use the existing treatment technology. Peak treatment capacity would be 3.0 MGD for the headworks and 2.0 MGD for secondary and tertiary treatment. Equalization/wet weather storage capacity would be 1.0 million gallons. This information is contingent on information provided by the Kansas Department of Health and Environment regarding effluent water quality needs. Upgrades include:

1. Doubling the pumping capacity of the influent pump station, with additional electrical upgrades and piping improvements as needed.
2. Doubling the capacity of the headworks facility with additional electrical and HVAC upgrades and piping improvement as needed.
3. Construction of a fermentation/anaerobic basin with mixing as needed plus electrical controls.
4. Construction of an identical 0.5 MGD biological treatment system aeration basin with aeration equipment, piping, and electrical controls as needed.

5. Installation of additional filters, disinfection equipment, system piping and valves, and electrical controls and HVAC as needed at the Effluent building.
6. Construction of additional chemical storage and feed facilities.
7. Construction of a second aerobic digester tank, with blowers, diffusers, piping, valves and electrical controls as needed.
8. Construction of additional solids dewatering equipment, process piping and valves, and electrical and HVAC improvements as needed.
9. Upgrades to the non-potable and potable water systems to support the facility as needed.
10. Doubling the onsite backup power capacity
11. Construction of an additional 0.5 million gallons of equalization storage.
12. All other required upgrades to ancillary facilities and utilities.

Interceptor.
A combined 30- and 36-inch PVC pipeline running from a point adjacent to Homestead Lane in unincorporated Johnson County, Kansas, roughly equidistant from West 199th Street and the intersection of Interstate 35 and Homestead Lane and terminating at the headworks of the WWTP, including securing of easements and/or land in fee simple, trenching, backfilling and restoration, and boring a 36" conduit per KDOT requirements under Interstate 35.

Force Main Trench.
The acquisition of construction easements and a 15' permanent easement and the construction of a trench of sufficient size to accommodate the Individual Force Mains of each party, commencing from a point west of the intersection of 191st and Waverly Road in Edgerton and terminating at the upstream terminus of the Interceptor, plus backfilling and restoration.

EXHIBIT E
SAMPLING SCHEDULE

Sampling Frequency Date	**Analysis Parameters**	**Reporting Sample**
Semi-annually During 1st Quarter Using: 1 Composite 2 Grab	BOD, TSS O & G and pH	15th of April
Semi-annually During 3rd Quarter Using: 1 Composite 2 Grab	BOD, TSS O & G and pH	15th of October

Appendix F – Hydraulic Calculations

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
East Line A										
	30SE06_EAST	21	32.50	0.0100	15.85	5.81		0	0	
	30SW01A_30SE06	18	78.20	0.0100	10.50	5.81		0	0	
	30NW105_30SW01A	12	367.30	0.0036	2.14	3.97	YES	12	12	$ 79,337
	30NW01_30NW105	12	37.70	0.0036	2.14	1.98		0	0	
	30NW104_30NW01	10	193.40	0.0033	1.26	1.78	YES	8	8	$ 30,944
	30NW92_30NW104	10	27.00	0.0033	1.26	1.78	YES	8	8	$ 4,320
	30NW02_30NW92	10	160.40	0.0033	1.26	1.78	YES	8	8	$ 25,664
	30NW103_30NW02	10	36.60	0.0035	1.30	1.78	YES	8	8	$ 5,856
	30NW03_30NW103	10	220.40	0.0035	1.30	1.78	YES	8	8	$ 35,264
	30NW04_30NW03	10	122.20	0.0035	1.30	1.33	YES	8	0	
	30NW102_30NW04	10	113.80	0.0035	1.30	1.33	YES	8	0	
	30NW05_30NW102	10	68.60	0.0035	1.30	1.33	YES	8	0	
	30NW06_30NW05	10	109.90	0.0035	1.30	1.33	YES	8	0	
	30NW07_30NW06	10	56.10	0.0035	1.30	1.33	YES	8	0	
	30NW08_30NW07	10	39.00	0.0035	1.30	1.33	YES	8	0	
	30NW09_30NW08	10	319.70	0.0032	1.24	1.33	YES	8	0	
	30NW10_30NW09	10	211.40	0.0026	1.12	0.89		0	0	
	30NW11_30NW10	10	105.20	0.0026	1.12	0.89		0	0	
	30NW12_30NW11	10	118.00	0.0035	1.30	0.89		0	0	
	30NW13_30NW12	10	37.30	0.0035	1.30	0.89		0	0	
	30NW14_30NW13	10	347.20	0.0025	1.10	0.89		0	0	
	30NW15_30NW14	10	381.00	0.0021	1.00	0.44		0	0	
	30NW15A_30NW15	10	211.40	0.0025	1.10	0.44		0	0	
	30NW16_30NW15A	10	163.60	0.0025	1.10	0.44		0	0	
	30NW17_30NW16	10	374.50	0.0033	1.26	0.44		0	0	
	30NW18_30NW17	10	374.00	0.0019	0.96	0.44		0	0	
	30NW19_30NW18	10	374.00	0.0025	1.10	0.44		0	0	
	30NW20_30NW19	10	373.00	0.0025	1.10	0.44		0	0	
	25NE33_30NW20	10	373.00	0.0028	1.16	0.44		0	0	
East Line B										
	30NE73_30SE06	21	60.00	0.0010	5.01	1.84		0	0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	30NE74_30NE73	21	214.70	0.0012	5.49	1.84		0	0	
	30NE75_30NE74	21	304.60	0.0010	5.01	1.84		0	0	
	30NE76_30NE75	21	230.00	0.0015	6.14	1.84		0	0	
	30NE77_30NE76	21	152.90	0.0010	5.01	0.17		0	0	
	30NE78_30NE77	21	100.50	0.0021	7.26	0.17		0	0	
East Line C										
	30SW04_30SW01A	10	103.60	0.0082	1.98	1.99	YES	8	0	
	30SW32_30SW04	8	125.10	0.0116	1.30	0.99		0	0	
	30SW33_30SW32	8	193.60	0.0105	1.24	0.99		0	0	
	30SW34_30SW33	8	293.00	0.0160	1.53	0.99		0	0	
	30SW43_30SW34	8	213.40	0.0158	1.52	0.99		0	0	
	30SW44_30SW43	8	124.90	0.0168	1.57	0.99		0	0	
	30SW45_30SW44	8	280.00	0.0080	1.08	0.99		0	0	
	30SW46_30SW45	8	311.30	0.0080	1.08	0.99		0	0	
Genesis Line A										
	24NW50_GENESIS	15	135.80	0.0030	3.54	1.40		0	0	
	24NW51_24NW50	15	221.90	0.0030	3.54	1.40		0	0	
	13SW08_24NW51	12	143.10	0.0092	3.42	0.17		0	0	
	13SW09_13SW08	12	233.50	0.0072	3.02	0.17		0	0	
	13SE01_13SW09	12	160.20	0.0056	2.67	0.17		0	0	
	13SE02_13SE01	12	304.60	0.0041	2.28	0.17		0	0	
	13SE03_13SE02	12	79.40	0.0035	2.11	0.17		0	0	
	13SE04_13SE03	12	278.40	0.0035	2.11	0.17		0	0	
	13SE05_13SE04	12	222.60	0.0027	1.85	0.17		0	0	
	13SE06_13SE05	12	115.20	0.0028	1.89	0.17		0	0	
	13SE07_13SE06	12	141.40	0.0025	1.78	0.17		0	0	
	13SE08_13SE07	12	285.40	0.0026	1.82	0.17		0	0	
	13SE09_13SE08	10	40.20	0.0030	1.20	0.17		0	0	
	13SE10_13SE09	10	302.10	0.0028	1.16	0.12		0	0	
	13SE11_13SE10	10	302.90	0.0029	1.18	0.12		0	0	
	13SE12_13SE11	10	227.60	0.0029	1.18	0.12		0	0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	13SE13_13SE12	10	259.80	0.0025	1.10	0.12		0	0	
Kill Creek Line A										
	9NE01_Kill Creek	24	215.40	0.0040	14.31	0.00		0	0	
	9NE02_9NE01	24	305.30	0.0040	14.31	0.00		0	0	
	9NE03_9NE02	21	305.30	0.0100	15.85	0.00		0	0	
	9NE04_9NE03	21	305.30	0.0070	13.26	0.00		0	0	
	9NE05_9NE04	18	231.60	0.0140	12.43	0.00		0	0	
	9NE06_9NE05	18	231.60	0.0140	12.43	0.00		0	0	
	9NE07_9NE06	18	237.70	0.0120	11.51	0.00		0	0	
	9NE08_9NE07	18	237.70	0.0120	11.51	0.00		0	0	
	9NE10_9NE08	12	292.20	0.0140	4.22	0.00		0	0	
	9NE11_9NE10	12	292.20	0.0140	4.22	0.00		0	0	
	9SE10_9NE11	10	377.10	0.0200	3.10	0.00		0	0	
	9SE11_9SE10	10	377.10	0.0220	3.25	0.00		0	0	
Kill Creek Line B										
	9NE09_9NE08	18	388.20	0.0180	14.09	0.00		0	0	
	9SE01_9NE09	18	388.20	0.0220	15.58	0.00		0	0	
	9SE02_9SE01	18	388.20	0.0160	13.29	0.00		0	0	
	9SE03_9SE02	18	289.90	0.0060	8.14	0.00		0	0	
	9SE04_9SE03	18	255.10	0.0060	8.14	0.00		0	0	
	9SE05_9SE04	18	255.10	0.0060	8.14	0.00		0	0	
	9SE06_9SE05	18	370.20	0.0060	8.14	0.00		0	0	
	9SE07_9SE06	18	370.20	0.0060	8.14	0.00		0	0	
	9SE08_9SE07	18	349.80	0.0080	9.40	0.00		0	0	
	9SE09_9SE08	18	308.80	0.0080	9.40	0.00		0	0	
Kill Creek Line C										
	10NW01_Kill Creek	21	23.40	0.0070	13.26	0.00		0	0	
	10NW02_10NW01	21	379.20	0.0070	13.26	0.00		0	0	
	10NW03_10NW02	21	379.20	0.0070	13.26	0.00		0	0	
	10NW04_10NW03	21	379.20	0.0070	13.26	0.00		0	0	
	10NW05_10NW04	21	366.10	0.0070	13.26	0.00		0	0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	10NW06_10NW05	21	204.40	0.0070	13.26	0.00		0	0	
	10NW07_10NW06	21	263.40	0.0070	13.26	0.00		0	0	
	10NW08_10NW07	21	263.40	0.0070	13.26	0.00		0	0	
	10NW09_10NW08	21	260.30	0.0040	10.02	0.00		0	0	
	10NW10_10NW09	21	260.30	0.0040	10.02	0.00		0	0	
	10NW11_10NW10	21	381.20	0.0040	10.02	0.00		0	0	
	10SW01_10NW11	21	381.20	0.0040	10.02	0.00		0	0	
	10SW02_10SW01	21	381.20	0.0040	10.02	0.00		0	0	
	10SW03_10SW02	21	381.20	0.0040	10.02	0.00		0	0	
	10SW04_10SW03	21	213.00	0.0040	10.02	0.00		0	0	
	10SW05_10SW04	12	213.00	0.0040	2.25	0.00		0	0	
	10SW06_10SW05	12	313.70	0.0060	2.76	0.00		0	0	
	10SW07_10SW06	10	317.50	0.0080	1.96	0.00		0	0	
	10SW08_10SW07	10	317.50	0.0080	1.96	0.00		0	0	
New Bull Creek Line A										
	26NE54_26NE55/ New Bull Creek	21	367.60	0.0010	5.01	0.69		0	0	
	26NW21_26NE54	21	17.00	0.0010	5.01	0.69		0	0	
	26NW22_26NW21	21	314.40	0.0010	5.01	0.69		0	0	
	26NW23_26NW22	21	264.30	0.0010	5.01	0.69		0	0	
	26NW24_26NW23	21	133.40	0.0010	5.01	0.69		0	0	
	26NW25_26NW24	18	114.90	0.0014	3.93	0.65		0	0	
	26NW26_26NW25	18	405.40	0.0014	3.93	0.65		0	0	
	23SW01_26NW26	18	117.20	0.0014	3.93	0.65		0	0	
	23SW02_23SW01	18	400.00	0.0014	3.93	0.65		0	0	
	23SW03_23SW02	18	400.80	0.0014	3.93	0.65		0	0	
	23SW04_23SW03	18	248.00	0.0014	3.93	0.65		0	0	
	23SW05_23SW04	18	15.62	0.0014	3.93	0.27		0	0	
	23SE36_23SW05	8	144.00	0.0047	0.83	0.27		0	0	
	23SE39_23SE36	8	110.00	0.0064	0.97	0.27		0	0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
New Bull Creek Line B										
	26NE56_26NE55/ New Bull Creek	24	114.40	0.0020	10.12	4.95		0	0	
	26NE01_26NE56	24	184.26	0.0001	2.36	3.65	YES	21	21	$ 53,067
	26NE02_26NE01	10	188.68	0.0004	0.45	2.35	YES	18	18	$ 46,793
	26NE03_26NE02	10	134.00	0.0020	0.98	2.35	YES	12	12	$ 28,944
	26NE04_26NE03	10	303.00	0.0020	0.98	2.35	YES	12	12	$ 65,448
	26NE05_26NE04	10	386.00	0.0020	0.98	1.76	YES	10	10	$ 77,200
	23SE01_26NE05	10	370.00	0.0020	0.98	1.76	YES	10	10	$ 74,000
	23SE02_23SE01	10	25.00	0.0020	0.98	1.76	YES	10	10	$ 5,000
	23SE03_23SE02	10	295.00	0.0020	0.98	1.76	YES	10	10	$ 59,000
	23SE04_23SE03	10	144.00	0.0020	0.98	1.76	YES	10	10	$ 28,800
	23SE05_23SE04	10	143.00	0.0020	0.98	1.76	YES	10	10	$ 28,600
	23SE06_23SE05	10	390.00	0.0020	0.98	1.76	YES	10	10	$ 78,000
	23SE07_23SE06	10	388.00	0.0020	0.98	1.76	YES	10	10	$ 77,600
	23SE08_23SE07	10	391.00	0.0020	0.98	1.76	YES	10	10	$ 78,200
	24SW64_23SE08	10	381.00	0.0020	0.98	1.76	YES	10	10	$ 76,200
	25NW14_24SW64	10	351.00	0.0020	0.98	1.76	YES	10	10	$ 70,200
New Bull Creek Line C										
	26NE57_26NE56	24	248.30	0.0020	10.12	1.30		0	0	
	26NE58_26NE57	24	217.10	0.0020	10.12	1.30		0	0	
	26NE59_26NE58	24	405.30	0.0020	10.12	1.30		0	0	
	26NE60_26NE59	24	325.20	0.0130	25.79	1.30		0	0	
	26NE61_26NE60	24	268.60	0.0128	25.59	1.30		0	0	
	26NE62_26NE61	24	214.00	0.0040	14.31	1.30		0	0	
	26SE93_26NE62	24	62.70	0.0040	14.31	1.30		0	0	
New Bull Creek Line C2										
	26NE34_26NE01	12	253.00	0.0022	1.67	1.31		0	0	
	26NE35_26NE34	12	221.90	0.0022	1.67	1.31		0	0	
	26NE47_26NE35	12	400.00	0.0022	1.67	1.31		0	0	
	26NE48_26NE47	12	325.10	0.0022	1.67	1.31		0	0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	26NE49_26NE48	12	287.90	0.0022	1.67	1.31		0	0	
	26SE14_26NE49	12	222.10	0.0022	1.67	1.31		0	0	
	26SE15_26SE14	12	406.60	0.0022	1.67	1.19		0	0	
	26SE16_26SE15	12	393.40	0.0022	1.67	1.19		0	0	
	26SE17_26SE16	12	337.70	0.0022	1.67	1.19		0	0	
	26SE32_26SE17	12	120.00	0.0022	1.67	1.19		0	0	
	26SE33_26SE32	12	253.00	0.0022	1.67	1.19		0	0	
	26SE34_26SE33	12	179.70	0.0022	1.67	1.19		0	0	
	26SE35_26SE34	12	353.30	0.0022	1.67	1.19		0	0	
	26SE36_26SE35	12	406.20	0.0022	1.67	1.19		0	0	
	26SE37_26SE36	12	273.10	0.0022	1.67	1.19		0	0	
	26SE38_26SE37	10	212.50	0.0032	1.24	0.42		0	0	
	26SE42_26SE38	10	24.00	0.0030	1.20	0.42		0	0	
	26SE43_26SE42	10	276.00	0.0030	1.20	0.42		0	0	
	26SE44_26SE43	10	312.50	0.0030	1.20	0.42		0	0	
North Line A										
	13SW01_NORTH	36	23.60	0.0649	169.92	11.42		0	0	
	13SW10_13SW01	10	77.60	0.0492	4.86	0.04		0	0	
	14SE01_13SW10	10	278.30	0.0028	1.16	0.03		0	0	
	14SE02_14SE01	10	106.10	0.0028	1.16	0.03		0	0	
	14SE03_14SE02	10	113.90	0.0300	3.79	0.02		0	0	
	14SE04_14SE03	10	71.00	0.0100	2.19	0.02		0	0	
	14SE05_14SE04	10	213.00	0.0500	4.90	0.02		0	0	
	14SE06_14SE05	10	213.20	0.0028	1.16	0.02		0	0	
	14SE07_14SE06	10	379.70	0.0028	1.16	0.02		0	0	
	14SE08_14SE07	10	362.30	0.0028	1.16	0.02		0	0	
	14SE09_14SE08	10	161.80	0.0028	1.16	0.02		0	0	
	14SE10_14SE09	10	239.60	0.0028	1.16	0.02		0	0	
	14SE11_14SE10	10	70.00	0.0488	4.84	0.01		0	0	
	14SE12_14SE11	10	238.80	0.0100	2.19	0.01		0	0	
	14SE13_14SE12	10	365.00	0.0028	1.16	0.01		0	0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	14SE14_14SE13	10	226.80	0.0028	1.16	0.01		0	0	
	14SE15_14SE14	10	218.00	0.0028	1.16	0.01		0	0	
	14SE16_14SE15	10	148.00	0.0076	1.91	0.01		0	0	
North Line B										
	13SW02_13SW01	36	227.10	0.0030	36.53	11.37		0	0	
	13SW03_13SW02	36	144.20	0.0030	36.53	11.37		0	0	
	13SW04_13SW03	36	124.90	0.0030	36.53	11.37		0	0	
	13SW05_13SW04	36	273.80	0.0030	36.53	11.37		0	0	
	13SW06_13SW05	36	320.20	0.0030	36.53	11.37		0	0	
	13SW07_13SW06	36	194.40	0.0030	36.53	11.37		0	0	
	24NW77_13SW07	36	146.80	0.0030	36.53	11.37		0	0	
	24NW83_24NW77	36	129.60	0.0030	36.53	11.37		0	0	
	24NW78_24NW83	36	124.30	0.0030	36.53	11.37		0	0	
	24NW79_24NW78	36	176.10	0.0195	93.14	11.37		0	0	
	24NW80_24NW79	36	197.10	0.0030	36.53	11.37		0	0	
	24NW81_24NW80	36	204.20	0.0030	36.53	11.37		0	0	
	23NE126_24NW81	36	354.40	0.0030	36.53	11.37		0	0	
	23NE127_23NE126	36	109.00	0.0030	36.53	11.37		0	0	
	23NE128_23NE127	36	166.30	0.0171	87.22	11.37		0	0	
	23NE09_23NE128	15	33.60	0.02	9.14	1.07		0	0	
	23NE13_23NE09	10	291.80	0.0072	1.86	1.07		0	0	
	23NE14_23NE13	8	122.80	0.0103	1.23	1.01		0	0	
	23NE15_23NE14	8	197.20	0.0101	1.21	1.01		0	0	
	23NE24_23NE15	8	198.20	0.0107	1.25	1.01		0	0	
	23NE25_23NE24	8	353.40	0.0082	1.09	1.01		0	0	
	23NE26_23NE25	8	354.00	0.0085	1.11	1.01		0	0	
	23NE27_23NE26	8	204.00	0.008	1.08	1.01		0	0	
North Line C										
	23NE129_23NE128	36	110.00	0.0030	36.53	10.27		0	0	
	23NE130_23NE129	36	235.40	0.0030	36.53	8.20		0	0	
	23NE131_23NE130	36	306.40	0.0030	36.53	8.20		0	0	
	23NE132_23NE131	36	244.20	0.0030	36.53	7.86		0	0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	23NE133_23NE132	36	443.00	0.0030	36.53	7.52		0	0	
	24NW103_23NE133	24	117.00	0.0181	30.44	6.22		0	0	
	24NW01_24NW103	24	167.80	-0.0066	0.00	6.22	YES	15	0	
	24NW02_24NW01	20	144.70	0.0018	5.97	5.61		0	0	
	24NW03_24NW02	20	186.20	0.0018	5.97	5.61		0	0	
	24NW04_24NW03	20	180.40	0.0006	3.44	5.61	YES	18	21	$ 51,955
	24NW05_24NW04	20	149.60	0.0006	3.44	5.61	YES	18	21	$ 43,085
	24NW06_24NW05	20	160.40	0.0001	1.59	5.61	YES	30	21	$ 46,195
	24NW07_24NW06	20	149.60	0.0001	1.59	5.00	YES	27	21	$ 43,085
	24SW01_24NW07	20	130.80	0.0021	6.31	5.00		0	18	
	24SW02_24SW01	20	411.70	0.0015	5.44	5.00		0	18	
	24SW03_24SW02	20	401.11	0.0011	4.61	5.00	YES	8	18	
	24SW04_24SW03	20	398.60	0.0003	2.41	4.40	YES	21	18	$ 98,853
	24SW05_24SW04	20	126.50	0.0006	3.49	4.40	YES	15	15	$ 29,348
	24SW06_24SW05	18	283.60	0.0017	4.29	2.68		0	0	
	24SW07_24SW06	18	408.50	0.0025	5.22	2.49		0	0	
	24SW08_24SW07	18	234.00	0.0021	4.80	2.49		0	0	
	24SW09_24SW08	18	323.60	0.0020	4.71	2.36		0	0	
	24SE27_24SW09	15	130.90	0.0009	1.94	2.36	YES	10	10	$ 26,180
	24SE28_24SE27	15	342.80	0.0011	2.12	2.36	YES	8	10	
	24SE78_24SE28	15	134.70	0.0017	2.66	2.36		0	10	
	24SE01_24SE78	30	102.40	0.0040	25.94	2.36		0	10	
	24SE02_24SE01	30	203.00	0.0040	25.94	2.10		0	0	
	24SE03_24SE02	30	273.00	0.0040	25.94	2.10		0	0	
	24SE04_24SE03	30	197.00	0.0040	25.94	2.10		0	0	
	24SE05_24SE04	30	304.00	0.0040	25.94	2.10		0	0	
	24SE06_24SE05	30	163.00	0.0040	25.94	2.10		0	0	
	24SE07_24SE06	30	376.00	0.0060	31.77	2.10		0	0	
	25NE03_24SE07	30	216.40	0.0040	25.94	1.26		0	0	
	25NE04_25NE03	30	34.90	0.0172	53.79	1.26		0	8	
	25NE05_25NE04	30	210.00	0.0062	32.30	1.14		0	0	
	25NE06_25NE05	24	85.00	0.0198	31.83	1.14		0	8	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	25NE07_25NE06	24	26.00	0.0055	16.78	1.14		0	0	
	25NE08_25NE07	24	113.00	0.0077	19.85	1.14		0	0	
	25NE09_25NE08	18	158.00	0.0081	9.45	0.88		0	0	
	25NE10_25NE09	8	400.00	0.0049	0.85	0.26		0	0	
	25NE11_25NE10	8	400.00	0.0052	0.87	0.26		0	0	
	25NE22_25NE11	8	353.00	0.0052	0.87	0.26		0	0	
	25NE23_25NE22	8	395.00	0.0052	0.87	0.26		0	0	
	25NE47_25NE23	10	214.60	0.0024	1.07	0.13		0	0	
	25NE48_25NE47	10	376.50	0.0032	1.24	0.13		0	0	
	25NE49_25NE48	10	276.80	0.0028	1.16	0.13		0	0	
	25NE50_25NE49	10	178.20	0.0031	1.22	0.13		0	0	
North Line D										
	24NW45_23NE129	8	138.30	-0.0034	0.00	2.08	YES	12	0	
	24NW46_24NW45	8	224.30	0.0035	0.71	2.08	YES	12	0	
	24NW47_24NW46	8	339.90	0.0041	0.77	2.08	YES	10	0	
North Line E										
	24SE08_24SE07	8	55.00	0.006	0.94	0.84		0	0	
	24SE09_24SE08	8	139.00	0.0055	0.90	0.84		0	0	
	24SE10_24SE09	8	95.70	0.006	0.94	0.84		0	0	
	24SE11_24SE10	8	400.00	0.006	0.94	0.84		0	0	
	24SE12_24SE11	8	275.00	0.005	0.85	0.84		0	0	
	24SE13_24SE12	8	275.00	0.0049	0.85	0.84		0	0	
	24SE14_24SE13	8	296.90	0.0059	0.93	0.84		0	0	
	24SE77_24SE14	8	177.00	0.0053	0.88	0.84		0	0	
	19SW04_24SE77	8	148.50	0.0046	0.82	0.84	YES	8	0	
	19SW05_19SW04	8	162.60	0.006	0.94	0.84		0	0	
	19SW07_19SW05	8	69.50	0.006	0.94	0.84		0	0	
South Line A										
	36SW01_SOUTH	24	40.00	0.0040	14.31	6.44		0	0	
	36SW02_36SW01	24	79.00	0.0040	14.31	6.44		0	0	
	36SW03_36SW02	24	85.00	0.0040	14.31	6.44		0	0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36SW04_36SW03	24	423.90	0.0020	10.12	6.44		0	0	
	36SW05_36SW04	21	319.30	0.0077	13.90	6.44		0	0	
	36SW06_36SW05	21	307.90	0.0030	8.68	6.44		0	0	
	36SW07_36SW06	21	203.80	0.0011	5.26	6.44	YES	15	15	$ 47,282
	36SW08_36SW07	21	272.30	0.0011	5.26	6.44	YES	15	15	$ 63,174
	36SW20_36SW08	15	30.00	0.0230	9.80	3.06		0	0	
	36SW21_36SW20	15	338.20	0.0067	5.29	3.06		0	0	
	36SW22_36SW21	15	125.30	0.0025	3.23	3.06		0	0	
	36SW23_36SW22	15	179.00	0.0025	3.23	3.06		0	0	
	36NW52_36SW23	15	300.00	0.0025	3.23	3.06		0	0	
	36NW68_36NW52	12	357.60	0.0064	2.85	2.21		0	0	
	36NW69_36NW68	12	350.00	0.0036	2.14	2.21	YES	8	0	
	36NW70_36NW69	12	360.50	0.0036	2.14	2.21	YES	8	0	
	36NW71_36NW70	12	163.00	0.0136	4.15	1.98		0	0	
	36NW72_36NW71	12	235.50	0.0168	4.62	1.98		0	0	
	36NW73_36NW72	12	91.00	0.0172	4.67	1.98		0	0	
	36NW74_36NW73	12	329.50	0.0060	2.76	1.98		0	0	
	36NW75_36NW74	12	348.00	0.0084	3.27	1.98		0	0	
	36NW76_36NW75	12	379.50	0.0092	3.42	1.98		0	0	
	36NW77_36NW76	12	350.00	0.0025	1.78	1.74		0	0	
	36NW78_36NW77	12	339.30	0.0025	1.78	1.74		0	0	
	36NW79_36NW78	12	141.00	0.0025	1.78	1.74		0	0	
	36NW80_36NW79	12	144.70	0.0025	1.78	1.74		0	0	
	25SW63_36NW80	12	385.70	0.0025	1.78	1.74		0	0	
	25SE02_25SW63	12	245.50	0.0025	1.78	1.50		0	0	
	25SE03_25SE02	12	129.10	0.0025	1.78	1.50		0	0	
	25SE04_25SE03	12	240.40	0.0128	4.03	1.27		0	0	
	25SE05_25SE04	12	283.70	0.0180	4.78	1.27		0	0	
	25SE06A_25SE05	12	112.00	0.0200	5.04	1.27		0	0	
	25SE06_25SE06A	12	15.50	0.0200	5.04	0.16		0	0	
South Line B										
	36NW53_36NW52	10	217.00	0.0032	1.24	0.85		0	0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36NW54_36NW53	10	156.00	0.0032	1.24	0.85		0	0	
	36NW55_36NW54	10	346.00	0.0032	1.24	0.85		0	0	
	36NW56_36NW55	10	281.00	0.0032	1.24	0.85		0	0	
	36NW57_36NW56	10	133.70	0.0032	1.24	0.85		0	0	
South Line C										
	36SW09_36SW08	18	220.50	0.0019	4.58	3.39		0	0	
	36SW10_36SW09	18	351.10	0.0019	4.58	3.39		0	0	
	36SW11_36SW10	18	344.00	0.0019	4.58	3.39		0	0	
	36SW12_36SW11	18	356.70	0.0019	4.58	3.39		0	0	
	36SW16_36SW12	8	214.10	0.0050	0.85	0.60		0	0	
	36SW17_36SW16	8	352.20	0.0050	0.85	0.60		0	0	
	36SW18_36SW17	8	263.50	0.0050	0.85	0.60		0	0	
	35SE01_36SW18	8	100.00	0.0050	0.85	0.60		0	0	
South Line D										
	36SW13_36SW12	15	289.20	0.0160	8.17	2.78		0	0	
	36SW14_36SW13	15	276.00	0.0034	3.77	2.78		0	0	
	36NW48A_36SW14	15	365.00	0.0034	3.77	2.78		0	0	
	36NW48_36NW48A	15	313.36	0.0027	3.36	2.78		0	0	
	36NW49_36NW48	15	339.40	0.0027	3.36	2.78		0	0	
	36NW50_36NW49	15	275.30	0.0022	3.03	2.78		0	0	
	36NW51_36NW50	15	225.30	0.0022	3.03	2.78		0	0	
	35NE03_36NW51	10	312.70	0.0030	1.20	0.81		0	0	
	35NE04_35NE03	10	213.70	0.0028	1.16	0.81		0	0	
	35NE05_35NE04	10	297.60	0.0028	1.16	0.81		0	0	
	35NE06_35NE05	10	213.00	0.0028	1.16	0.81		0	0	
	35NE07_35NE06	10	187.50	0.0028	1.16	0.81		0	0	
	35NE08_35NE07	10	277.90	0.0028	1.16	0.81		0	0	
	35NE09_35NE08	10	375.00	0.0028	1.16	0.81		0	0	
	35NE36_35NE09	10	213.10	0.0028	1.16	0.81		0	0	
	35NE10_35NE36	10	158.00	0.0028	1.16	0.81		0	0	
	35NE11_35NE10	10	212.00	0.0030	1.20	0.81		0	0	
South Line E										

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36NW01_36NW50	12	23.60	0.0047	2.44	1.97		0	0	
	36NW10_36NW01	12	31.00	0.0470	7.72	1.97		0	0	
	36NW11_36NW10	12	167.60	0.0057	2.69	1.97		0	0	
	36NW12_36NW11	12	65.90	0.0102	3.60	1.97		0	0	
	36NW13_36NW12	12	105.90	0.0052	2.57	1.97		0	0	
	36NW14_36NW13	12	214.40	0.0051	2.54	1.97		0	0	
	36NW15_36NW14	12	297.30	0.0039	2.22	1.97		0	0	
	36NW16_36NW15	12	71.10	0.0048	2.47	1.97		0	0	
	36NW17_36NW16	12	206.00	0.0032	2.02	1.97		0	0	
	36NW18_36NW17	12	400.00	0.0039	2.22	1.97		0	0	
	36NW19_36NW18	12	35.80	0.0059	2.74	1.97		0	0	
	36NW20_36NW19	12	126.10	0.0053	2.59	1.97		0	0	
Walmart Line A										
	30NE64_30NE61/ Walmart	18	89.10	0.0035	6.21	0.50		0	0	
	30NE65_30NE64	18	238.20	0.0012	3.64	0.50		0	0	
	30NE66_30NE65	18	58.90	0.0044	6.97	0.50		0	0	
	30NE67_30NE66	18	95.40	0.0016	4.20	0.50		0	0	
	30NE68_30NE67	18	258.50	0.0015	4.07	0.50		0	0	
	30NE69_30NE68	18	61.30	0.0007	2.78	0.50		0	0	
	30NE70_30NE69	18	12.70	0.0024	5.15	0.50		0	0	
	30NE42_30NE70	15	331.78	0.0048	4.48	0.10		0	0	
	29NW01_30NE42	15	360.00	0.0044	4.28	0.10		0	0	
Walmart Line B								0		
	30NE62_30NE61/ Walmart	12	36.70	0.0147	4.32	0.004		0	0	
	30NE63_30NE62	12	396.70	0.0236	5.47	0.004		0	0	
	30NE01_30NE63	12	120.00	-0.0032	0.00	0.004	YES	8	0	
WWTP Line A										
	15NW01_WWTP	30	376.50	0.0045	27.52	18.78		0	0	
	15NW02_15NW01	30	479.70	0.0045	27.52	18.78		0	0	
	15NW03_15NW02	15	235.90	0.0263	10.48	0.29		0	0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	15NW04_15NW03	15	187.90	0.0114	6.90	0.29		0	0	
	15NW05_15NW04	15	241.00	0.0091	6.16	0.29		0	0	
	15NW06_15NW05	15	194.20	0.0105	6.62	0.20		0	0	
	15NW07_15NW06	15	228.50	0.0095	6.30	0.20		0	0	
	15NW08_15NW07	15	350.30	0.0104	6.59	0.20		0	0	
	15NW09_15NW08	15	191.90	0.0097	6.36	0.11		0	0	
	15NW10_15NW09	15	173.40	0.0086	5.99	0.11		0	0	
	15NW11_15NW10	15	162.30	0.0094	6.26	0.11		0	0	
	15NW12_15NW11	15	288.70	0.0087	6.03	0.11		0	0	
	15SW01_15NW12	15	256.50	0.0094	6.26	0.11		0	0	
	15SW02_15SW01	15	223.50	0.0041	4.14	0.11		0	0	
	15SW03_15SW02	15	161.40	0.0065	5.21	0.11		0	0	
	15SW04_15SW03	12	131.40	0.0048	2.47	0.02		0	0	
	15SW05_15SW04	12	80.40	0.0040	2.25	0.02		0	0	
	15SW06_15SW05	12	183.00	0.0039	2.22	0.02		0	0	
	15SW07_15SW06	12	248.40	0.0045	2.39	0.02		0	0	
	15SW08_15SW07	12	202.30	0.0037	2.17	0.02		0	0	
	15SW09_15SW08	12	319.30	0.0033	2.05	0.02		0	0	
WWTP Line B										
	15NE01_15NW02	30	500.00	0.0045	27.52	18.25		0	0	
	15NE02_15NE01	30	301.10	0.0039	25.62	18.25		0	0	
	15NE03_15NE02	30	161.40	0.0048	28.42	18.25		0	0	
	15NE04_15NE03	30	302.30	0.0044	27.21	18.25		0	0	
	15NE05_15NE04	30	148.40	0.0019	17.88	18.25	YES	8	0	
	15NE06_15NE05	30	209.80	0.0023	19.67	18.25		0	0	
	15NE07_15NE06	30	302.50	0.0019	17.88	18.25	YES	8	0	
	15SE01_15NE07	30	257.00	0.0028	21.70	18.25		0	0	
	15SE02_15SE01	30	356.60	0.0025	20.51	18.25		0	0	
	15SE03_15SE02	27	500.00	0.0069	25.73	18.25		0	0	
	15SE04_15SE03	27	274.10	0.0044	20.54	18.25		0	0	
	15SE05_15SE04	27	422.30	0.0019	13.50	18.25	YES	21	18	$ 104,730
	15SE06_15SE05	27	977.71	0.0023	14.85	18.25	YES	18	18	$ 242,472

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	15SE07_15SE06	27	405.80	0.0019	13.50	18.24	YES	21	18	$ 100,638
	15SE08_15SE07	27	180.50	0.0028	16.39	18.24	YES	12	18	
	15SE09_15SE08	27	360.00	0.0039	19.34	18.24		0	18	
	15SE10_15SE09	27	290.10	0.0031	17.24	18.24	YES	10	0	
	15SE14_15SE10	21	210.30	0.0093	15.28	3.96		0	0	
	22NE03_15SE14	21	205.60	0.0055	11.75	3.83		0	0	
	22NE04_22NE03	21	127.40	0.0050	11.20	3.83		0	0	
	22NE05_22NE04	21	317.60	0.0034	9.24	3.83		0	0	
	22NE06_22NE05	21	308.90	0.0049	11.09	3.83		0	0	
	22NE07_22NE06	21	176.20	NEG. SLOPE	0.00	3.77	YES	15	0	
	22NE08_22NE07	21	190.60	0.0037	9.64	3.77		0	0	
	22NE09_22NE08	21	275.60	0.0036	9.51	3.77		0	0	
	22NE15_22NE09	21	194.40	0.0042	10.27	3.77		0	0	
	22NE10_22NE15	21	79.60	0.0042	10.27	3.72		0	0	
	22NE11_22NE10	21	275.40	0.0038	9.77	1.95		0	0	
	22NE12_22NE11	21	260.80	0.0035	9.37	1.95		0	0	
	22NE13_22NE12	21	262.40	0.0032	8.96	1.95		0	0	
	22NE14_22NE13	21	310.10	0.0034	9.24	1.95		0	0	
	22SE76_22NE14	21	353.00	0.0030	8.68	1.93		0	0	
	22SE77_22SE76	21	318.70	0.0031	8.82	1.93		0	0	
	22SE78_22SE77	21	318.70	0.0035	9.37	1.93		0	0	
	22SE79_22SE78	18	275.10	0.0040	6.64	1.90		0	0	
	22SE80_22SE79	12	284.90	0.0037	2.17	1.90		0	0	
	22SE81_22SE80	12	275.90	0.0036	2.14	1.90		0	0	
	22SE82_22SE81	12	246.10	0.0034	2.08	1.90		0	0	
	22SW01_22SE82	12	246.10	0.0035	2.11	1.90		0	0	
	22SW70_22SW01	10	118.80	0.0037	1.33	1.40	YES	8	0	
	22SW02_22SW70	10	243.60	0.0037	1.33	1.26		0	0	
	22SW03_22SW02	10	153.70	0.0027	1.14	1.26	YES	8	0	
	22SW04_22SW03	10	131.40	0.0038	1.35	1.26		0	0	
	22SW05_22SW04	10	400.00	0.0033	1.26	1.26	YES	8	0	
WWTP Line C										

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	15SE11_15SE10	15	387.10	0.0094	6.26	0.14		0	0	
	15SE28_15SE11	15	149.60	0.0097	6.36	0.14		0	0	
	15SE12_15SE28	15	227.90	0.0097	6.36	0.14		0	0	
	15SE13_15SE12	15	356.40	0.0067	5.29	0.14		0	0	
	22NE01_15SE13	15	270.00	0.0061	5.05	0.14		0	0	
	22NE02_22NE01	15	270.00	0.0066	5.25	0.14		0	0	
	23NW01_22NE02	15	227.80	0.0065	5.21	0.14		0	0	
	23NW16_23NW01	15	207.50	0.0065	5.21	0.14		0	0	
	23NW02_23NW16	15	280.80	0.0065	5.21	0.14		0	0	
	23NW37_23NW02	15	270.00	0.0135	7.51	0.14		0	0	
	23NW03_23NW37	15	116.40	0.0135	7.51	0.14		0	0	
	23NW04_23NW03	18	424.10	0.0043	6.89	0.14		0	0	
	23NW05_23NW04	18	257.60	0.0043	6.89	0.14		0	0	
	23NW06_23NW05	15	345.00	0.0053	4.70	0.14		0	0	
	23NW07_23NW06	15	276.80	0.0053	4.70	0.14		0	0	
	23NW08_23NW07	15	391.60	0.0053	4.70	0.14		0	0	
	23NW09_23NW08	15	235.70	0.0103	6.56	0.14		0	0	
	23NW10_23NW09	15	433.60	0.0103	6.56	0.14		0	0	
	23NW11_23NW10	15	299.50	0.0052	4.66	0.14		0	0	
WWTP Line D										
	22NE16_22NE15	15	369.40	0.0020	2.89	1.76		0	0	
	22NE17_22NE16	15	124.40	0.0020	2.89	1.76		0	0	
	22NE18_22NE17	15	137.60	0.0020	2.89	1.76		0	0	
	22NE19_22NE18	15	189.60	0.0020	2.89	1.76		0	0	
	22NE20_22NE19	15	181.10	0.0020	2.89	1.76		0	0	
	22NE21_22NE20	15	158.80	0.0020	2.89	1.76		0	0	
	22NE46_22NE21	15	165.20	0.0035	3.82	1.76		0	0	
	22NE47_22NE46	15	270.60	0.0013	2.33	1.76		0	0	
	22NE52_22NE47	15	253.20	0.0016	2.58	1.76		0	0	
	22SE97_22NE52	15	100.20	0.0029	3.48	1.76		0	0	
	22SE98_22SE97	15	400.00	0.0030	3.54	1.76		0	0	
	22SE99_22SE98	15	270.80	0.0030	3.54	0.88		0	0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 1

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Bottleneck Parallel Pipe Diameter (in)	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	22SE100_22SE99	15	240.20	0.0030	3.54	0.88		0	0	
	22SE101_22SE100	15	136.90	0.0029	3.48	0.88		0	0	
	23SW54_22SE101	15	98.20	0.0029	3.48	0.88		0	0	
	23SW53_23SW54	15	255.90	0.0028	3.42	0.88		0	0	
	23SW52_23SW53	15	16.80	0.0030	3.54	0.88		0	0	
	23SW06_23SW52	10	10.00	0.0400	4.38	0.00		0	0	
	23SW07_23SW06	10	224.40	0.0056	1.64	0.00		0	0	
	23SW08_23SW07	10	223.90	0.0072	1.86	0.00		0	0	
	23SW20_23SW08	8	257.40	0.0109	1.26	0.00		0	0	
	23SW21_23SW20	8	215.80	0.0076	1.05	0.00		0	0	
	23SW22_23SW21	8	275.90	0.0081	1.09	0.00		0	0	
	23SW23_23SW22	8	295.80	0.0081	1.09	0.00		0	0	
	23SW24_23SW23	8	237.40	0.0074	1.04	0.00		0	0	
	23SW25_23SW24	8	296.20	0.0093	1.17	0.00		0	0	
Bull Creek Line A										
	26NW01_Bull Creek	12	365.00	0.0022	1.67	0.09		0	0	
	26NW02_26NW01	12	365.80	0.0022	1.67	0.09		0	0	
	26NW03_26NW02	12	303.30	0.0024	1.75	0.09		0	0	
	26NW04_26NW03	12	350.00	0.0024	1.75	0.09		0	0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
East Line A									
	30SE06_EAST	21	32.50	0.0100	15.85	5.39		0	
	30SW01A_30SE06	18	78.20	0.0100	10.50	5.39		0	
	30NW105_30SW01A	*12*	*367.30*	*0.0036*	*2.14*	*5.39*	*YES*	*15*	$ 85,214
	30NW01_30NW105	*12*	*37.70*	*0.0036*	*2.14*	*2.64*	*YES*	*8*	$ 6,032
	30NW104_30NW01	*10*	*193.40*	*0.0033*	*1.26*	*2.11*	*YES*	*10*	$ 38,680
	30NW92_30NW104	*10*	*27.00*	*0.0033*	*1.26*	*2.11*	*YES*	*10*	$ 5,400
	30NW02_30NW92	*10*	*160.40*	*0.0033*	*1.26*	*2.11*	*YES*	*10*	$ 32,080
	30NW103_30NW02	*10*	*36.60*	*0.0035*	*1.30*	*2.11*	*YES*	*10*	$ 7,320
	30NW03_30NW103	*10*	*220.40*	*0.0035*	*1.30*	*2.11*	*YES*	*10*	$ 44,080
	30NW04_30NW03	*10*	*122.20*	*0.0035*	*1.30*	*1.58*	*YES*	*8*	$ 19,552
	30NW102_30NW04	*10*	*113.80*	*0.0035*	*1.30*	*1.58*	*YES*	*8*	$ 18,208
	30NW05_30NW102	*10*	*68.60*	*0.0035*	*1.30*	*1.58*	*YES*	*8*	$ 10,976
	30NW06_30NW05	*10*	*109.90*	*0.0035*	*1.30*	*1.58*	*YES*	*8*	$ 17,584
	30NW07_30NW06	*10*	*56.10*	*0.0035*	*1.30*	*1.58*	*YES*	*8*	$ 8,976
	30NW08_30NW07	*10*	*39.00*	*0.0035*	*1.30*	*1.58*	*YES*	*8*	$ 6,240
	30NW09_30NW08	*10*	*319.70*	*0.0032*	*1.24*	*1.58*	*YES*	*8*	$ 51,152
	30NW10_30NW09	10	211.40	0.0026	1.12	1.05		0	
	30NW11_30NW10	10	105.20	0.0026	1.12	1.05		0	
	30NW12_30NW11	10	118.00	0.0035	1.30	1.05		0	
	30NW13_30NW12	10	37.30	0.0035	1.30	1.05		0	
	30NW14_30NW13	10	347.20	0.0025	1.10	1.05		0	
	30NW15_30NW14	10	381.00	0.0021	1.00	0.53		0	
	30NW15A_30NW15	10	211.40	0.0025	1.10	0.53		0	
	30NW16_30NW15A	10	163.60	0.0025	1.10	0.53		0	
	30NW17_30NW16	10	374.50	0.0033	1.26	0.53		0	
	30NW18_30NW17	10	374.00	0.0019	0.96	0.53		0	
	30NW19_30NW18	10	374.00	0.0025	1.10	0.53		0	
	30NW20_30NW19	10	373.00	0.0025	1.10	0.53		0	
	25NE33_30NW20	10	373.00	0.0028	1.16	0.53		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
East Line B									
	30NE73_EAST	21	60.00	0.0010	5.01	5.42	YES	0	
	30NE74_30NE73	21	214.70	0.0012	5.49	5.42		0	
	30NE75_30NE74	21	304.60	0.0010	5.01	5.28	YES	0	
	30NE76_30NE75	21	230.00	0.0015	6.14	5.28		0	
	30NE77_30NE76	21	152.90	0.0010	5.01	5.28	YES	0	
	30NE78_30NE77	21	100.50	0.0021	7.26	5.28		0	
East Line C									
	30SW04_30SW01A	*10*	*103.60*	*0.0082*	*1.98*	*2.76*	*YES*	*8*	$ 16,576
	30SW32_30SW04	8	125.10	0.0116	1.30	1.52	YES	0	
	30SW33_30SW32	8	193.60	0.0105	1.24	1.52	YES	8	$ 30,976
	30SW34_30SW33	8	293.00	0.0160	1.53	1.52		0	
	30SW43_30SW34	8	213.40	0.0158	1.52	1.48		0	
	30SW44_30SW43	8	124.90	0.0168	1.57	1.48		0	
	30SW45_30SW44	8	280.00	0.0080	1.08	1.48	YES	8	$ 44,800
	30SW46_30SW45	8	311.30	0.0080	1.08	1.48	YES	8	$ 49,808
Genesis Line A									
	24NW50_GENESIS	15	135.80	0.0030	3.54	3.33		0	
	24NW51_24NW50	15	221.90	0.0030	3.54	3.33		0	
	13SW08_24NW51	12	143.10	0.0092	3.42	2.03		0	
	13SW09_13SW08	12	233.50	0.0072	3.02	2.03		0	
	13SE01_13SW09	12	160.20	0.0056	2.67	2.03		0	
	13SE02_13SE01	12	304.60	0.0041	2.28	2.03		0	
	13SE03_13SE02	12	79.40	0.0035	2.11	0.74		0	
	13SE04_13SE03	12	278.40	0.0035	2.11	0.74		0	
	13SE05_13SE04	12	222.60	0.0027	1.85	0.74		0	
	13SE06_13SE05	12	115.20	0.0028	1.89	0.74		0	
	13SE07_13SE06	12	141.40	0.0025	1.78	0.74		0	
	13SE08_13SE07	12	285.40	0.0026	1.82	0.74		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	13SE09_13SE08	10	40.20	0.0030	1.20	0.74		0	
	13SE10_13SE09	10	302.10	0.0028	1.16	0.28		0	
	13SE11_13SE10	10	302.90	0.0029	1.18	0.28		0	
	13SE12_13SE11	10	227.60	0.0029	1.18	0.28		0	
	13SE13_13SE12	10	259.80	0.0025	1.10	0.28		0	
Kill Creek Line A									
	9NE01_Kill Creek	24	215.40	0.0040	14.31	3.94		0	
	9NE02_9NE01	24	305.30	0.0040	14.31	3.94		0	
	9NE03_9NE02	21	305.30	0.0100	15.85	3.78		0	
	9NE04_9NE03	21	305.30	0.0070	13.26	3.78		0	
	9NE05_9NE04	18	231.60	0.0140	12.43	3.25		0	
	9NE06_9NE05	18	231.60	0.0140	12.43	3.25		0	
	9NE07_9NE06	18	237.70	0.0120	11.51	3.25		0	
	9NE08_9NE07	18	237.70	0.0120	11.51	3.25		0	
	9NE10_9NE08	12	292.20	0.0140	4.22	1.05		0	
	9NE11_9NE10	12	292.20	0.0140	4.22	1.05		0	
	9SE10_9NE11	10	377.10	0.0200	3.10	0.67		0	
	9SE11_9SE10	10	377.10	0.0220	3.25	0.67		0	
Kill Creek Line B									
	9NE09_9NE08	18	388.20	0.0180	14.09	1.93		0	
	9SE01_9NE09	18	388.20	0.0220	15.58	1.93		0	
	9SE02_9SE01	18	388.20	0.0160	13.29	1.93		0	
	9SE03_9SE02	18	289.90	0.0060	8.14	1.93		0	
	9SE04_9SE03	18	255.10	0.0060	8.14	1.93		0	
	9SE05_9SE04	18	255.10	0.0060	8.14	1.93		0	
	9SE06_9SE05	18	370.20	0.0060	8.14	1.93		0	
	9SE07_9SE06	18	370.20	0.0060	8.14	1.93		0	
	9SE08_9SE07	18	349.80	0.0080	9.40	1.93		0	
	9SE09_9SE08	18	308.80	0.0080	9.40	1.93		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
Kill Creek Line C									
	10NW01_Kill Creek	21	23.40	0.0070	13.26	12.11		0	
	10NW02_10NW01	21	379.20	0.0070	13.26	12.11		0	
	10NW03_10NW02	21	379.20	0.0070	13.26	12.11		0	
	10NW04_10NW03	21	379.20	0.0070	13.26	12.11		0	
	10NW05_10NW04	21	366.10	0.0070	13.26	12.11		0	
	10NW06_10NW05	21	204.40	0.0070	13.26	0.28		0	
	10NW07_10NW06	21	263.40	0.0070	13.26	0.28		0	
	10NW08_10NW07	21	263.40	0.0070	13.26	0.28		0	
	10NW09_10NW08	21	260.30	0.0040	10.02	0.28		0	
	10NW10_10NW09	21	260.30	0.0040	10.02	0.28		0	
	10NW11_10NW10	21	381.20	0.0040	10.02	0.28		0	
	10SW01_10NW11	21	381.20	0.0040	10.02	0.28		0	
	10SW02_10SW01	21	381.20	0.0040	10.02	0.28		0	
	10SW03_10SW02	21	381.20	0.0040	10.02	0.28		0	
	10SW04_10SW03	21	213.00	0.0040	10.02	0.28		0	
	10SW05_10SW04	12	213.00	0.0040	2.25	0.26		0	
	10SW06_10SW05	12	313.70	0.0060	2.76	0.26		0	
	10SW07_10SW06	10	317.50	0.0080	1.96	0.10		0	
	10SW08_10SW07	10	317.50	0.0080	1.96	0.10		0	
New Bull Creek Line A									
	26NE54_26NE55/ New Bull Creek	21	367.60	0.0010	5.01	0.36		0	
	26NW21_26NE54	21	17.00	0.0010	5.01	0.36		0	
	26NW22_26NW21	21	314.40	0.0010	5.01	0.36		0	
	26NW23_26NW22	21	264.30	0.0010	5.01	0.36		0	
	26NW24_26NW23	21	133.40	0.0010	5.01	0.36		0	
	26NW25_26NW24	18	114.90	0.0014	3.93	0.13		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	26NW26_26NW25	18	405.40	0.0014	3.93	0.13		0	
	23SW01_26NW26	18	117.20	0.0014	3.93	0.13		0	
	23SW02_23SW01	18	400.00	0.0014	3.93	0.13		0	
	23SW03_23SW02	18	400.80	0.0014	3.93	0.13		0	
	23SW04_23SW03	18	248.00	0.0014	3.93	0.13		0	
	23SW05_23SW04	18	15.62	0.0014	3.93	0.03		0	
	23SE36_23SW05	8	144.00	0.0047	0.83	0.03		0	
	23SE39_23SE36	8	110.00	0.0064	0.97	0.03		0	
New Bull Creek Line B									
	26NE56_26NE55/ New Bull Creek	24	114.40	0.0020	10.12	4.91		0	
	26NE01_26NE56	24	184.26	0.0001	2.36	2.80	YES	15	$ 42,748
	26NE02_26NE01	10	188.68	0.0004	0.45	1.42	YES	15	$ 43,774
	26NE03_26NE02	10	134.00	0.0020	0.98	1.42	YES	8	$ 21,440
	26NE04_26NE03	10	303.00	0.0020	0.98	1.42	YES	8	$ 48,480
	26NE05_26NE04	10	386.00	0.0020	0.98	1.42	YES	8	$ 61,760
	23SE01_26NE05	10	370.00	0.0020	0.98	1.42	YES	8	$ 59,200
	23SE02_23SE01	10	25.00	0.0020	0.98	1.42	YES	8	$ 4,000
	23SE03_23SE02	10	295.00	0.0020	0.98	1.42	YES	8	$ 47,200
	23SE04_23SE03	10	144.00	0.0020	0.98	1.42	YES	8	$ 23,040
	23SE05_23SE04	10	143.00	0.0020	0.98	1.42	YES	8	$ 22,880
	23SE06_23SE05	10	390.00	0.0020	0.98	0.65		0	
	23SE07_23SE06	10	388.00	0.0020	0.98	0.65		0	
	23SE08_23SE07	10	391.00	0.0020	0.98	0.65		0	
	24SW64_23SE08	10	381.00	0.0020	0.98	0.65		0	
	25NW14_24SW64	10	351.00	0.0020	0.98	0.00		0	
New Bull Creek Line C									
	26NE57_26NE56	24	248.30	0.0020	10.12	2.11		0	
	26NE58_26NE57	24	217.10	0.0020	10.12	2.11		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	26NE59_26NE58	24	405.30	0.0020	10.12	2.11		0	
	26NE60_26NE59	24	325.20	0.0130	25.79	2.11		0	
	26NE61_26NE60	24	268.60	0.0128	25.59	2.11		0	
	26NE62_26NE61	24	214.00	0.0040	14.31	2.11		0	
	26SE93_26NE62	24	62.70	0.0040	14.31	2.11		0	
New Bull Creek Line C2									
	26NE34_26NE01	12	253.00	0.0022	1.67	0.62		0	
	26NE35_26NE34	12	221.90	0.0022	1.67	0.62		0	
	26NE47_26NE35	12	400.00	0.0022	1.67	0.62		0	
	26NE48_26NE47	12	325.10	0.0022	1.67	0.62		0	
	26NE49_26NE48	12	287.90	0.0022	1.67	0.62		0	
	26SE14_26NE49	12	222.10	0.0022	1.67	0.62		0	
	26SE15_26SE14	12	406.60	0.0022	1.67	0.50		0	
	26SE16_26SE15	12	393.40	0.0022	1.67	0.50		0	
	26SE17_26SE16	12	337.70	0.0022	1.67	0.50		0	
	26SE32_26SE17	12	120.00	0.0022	1.67	0.50		0	
	26SE33_26SE32	12	253.00	0.0022	1.67	0.50		0	
	26SE34_26SE33	12	179.70	0.0022	1.67	0.50		0	
	26SE35_26SE34	12	353.30	0.0022	1.67	0.50		0	
	26SE36_26SE35	12	406.20	0.0022	1.67	0.50		0	
	26SE37_26SE36	12	273.10	0.0022	1.67	0.50		0	
	26SE38_26SE37	10	212.50	0.0032	1.24	0.25		0	
	26SE42_26SE38	10	24.00	0.0030	1.20	0.25		0	
	26SE43_26SE42	10	276.00	0.0030	1.20	0.25		0	
	26SE44_26SE43	10	312.50	0.0030	1.20	0.25		0	
North Line A									
	13SW01_NORTH	36	23.60	0.0649	169.92	24.79		0	
	13SW10_13SW01	10	77.60	0.0492	4.86	1.64		0	
	14SE01_13SW10	*10*	*278.30*	*0.0028*	*1.16*	*1.64*	*YES*	*8*	$ 44,528

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	14SE02_14SE01	*10*	*106.10*	*0.0028*	*1.16*	*1.64*	*YES*	*8*	$ 16,976
	14SE03_14SE02	10	113.90	0.0300	3.79	1.64		0	
	14SE04_14SE03	10	71.00	0.0100	2.19	0.29		0	
	14SE05_14SE04	10	213.00	0.0500	4.90	0.19		0	
	14SE06_14SE05	10	213.20	0.0028	1.16	0.19		0	
	14SE07_14SE06	10	379.70	0.0028	1.16	0.19		0	
	14SE08_14SE07	10	362.30	0.0028	1.16	0.19		0	
	14SE09_14SE08	10	161.80	0.0028	1.16	0.19		0	
	14SE10_14SE09	10	239.60	0.0028	1.16	0.19		0	
	14SE11_14SE10	10	70.00	0.0488	4.84	0.10		0	
	14SE12_14SE11	10	238.80	0.0100	2.19	0.10		0	
	14SE13_14SE12	10	365.00	0.0028	1.16	0.10		0	
	14SE14_14SE13	10	226.80	0.0028	1.16	0.10		0	
	14SE15_14SE14	10	218.00	0.0028	1.16	0.10		0	
	14SE16_14SE15	10	148.00	0.0076	1.91	0.10		0	
North Line B									
	13SW02_13SW01	36	227.10	0.0030	36.53	23.15		0	
	13SW03_13SW02	36	144.20	0.0030	36.53	23.15		0	
	13SW04_13SW03	36	124.90	0.0030	36.53	23.15		0	
	13SW05_13SW04	36	273.80	0.0030	36.53	23.15		0	
	13SW06_13SW05	36	320.20	0.0030	36.53	23.15		0	
	13SW07_13SW06	36	194.40	0.0030	36.53	23.15		0	
	24NW77_13SW07	36	146.80	0.0030	36.53	23.15		0	
	24NW83_24NW77	36	129.60	0.0030	36.53	23.15		0	
	24NW78_24NW83	36	124.30	0.0030	36.53	22.85		0	
	24NW79_24NW78	36	176.10	0.0195	93.14	22.85		0	
	24NW80_24NW79	36	197.10	0.0030	36.53	22.85		0	
	24NW81_24NW80	36	204.20	0.0030	36.53	22.85		0	
	23NE126_24NW81	36	354.40	0.0030	36.53	22.85		0	
	23NE127_23NE126	36	109.00	0.0030	36.53	22.85		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	23NE128_23NE127	36	166.30	0.0171	87.22	22.85		0	
	23NE09_23NE128	15	33.60	0.02	9.14	1.38		0	
	23NE13_23NE09	10	291.80	0.0072	1.86	1.38		0	
	23NE14_23NE13	8	122.80	0.0103	1.23	0.85		0	
	23NE15_23NE14	8	197.20	0.0101	1.21	0.85		0	
	23NE24_23NE15	8	198.20	0.0107	1.25	0.85		0	
	23NE25_23NE24	8	353.40	0.0082	1.09	0.85		0	
	23NE26_23NE25	8	354.00	0.0085	1.11	0.85		0	
	23NE27_23NE26	8	204.00	0.008	1.08	0.85		0	
North Line C									
	23NE129_23NE128	36	110.00	0.0030	36.53	21.43		0	
	23NE130_23NE129	36	235.40	0.0030	36.53	16.86		0	
	23NE131_23NE130	36	306.40	0.0030	36.53	16.86		0	
	23NE132_23NE131	36	244.20	0.0030	36.53	16.86		0	
	23NE133_23NE132	36	443.00	0.0030	36.53	16.86		0	
	24NW103_23NE133	24	117.00	0.0181	30.44	15.07		0	
	24NW01_24NW103	*24*	*167.80*	*-0.0066*	*0.00*	*15.07*	*YES*	*0*	
	24NW02_24NW01	*20*	*144.70*	*0.0018*	*5.97*	*15.07*	*YES*	*24*	$ 47,462
	24NW03_24NW02	*20*	*186.20*	*0.0018*	*5.97*	*13.73*	*YES*	*24*	$ 61,074
	24NW04_24NW03	*20*	*180.40*	*0.0006*	*3.44*	*13.73*	*YES*	*33*	$ 90,200
	24NW05_24NW04	*20*	*149.60*	*0.0006*	*3.44*	*13.73*	*YES*	*33*	$ 74,800
	24NW06_24NW05	*20*	*160.40*	*0.0001*	*1.59*	*13.73*	*YES*	*48*	$ 116,771
	24NW07_24NW06	*20*	*149.60*	*0.0001*	*1.59*	*13.73*	*YES*	*48*	$ 108,909
	24SW01_24NW07	*20*	*130.80*	*0.0021*	*6.31*	*13.73*	*YES*	*24*	$ 42,902
	24SW02_24SW01	*20*	*411.70*	*0.0015*	*5.44*	*13.73*	*YES*	*24*	$ 135,038
	24SW03_24SW02	*20*	*401.11*	*0.0011*	*4.61*	*13.73*	*YES*	*27*	$ 157,235
	24SW04_24SW03	*20*	*398.60*	*0.0003*	*2.41*	*13.73*	*YES*	*36*	$ 216,838
	24SW05_24SW04	*20*	*126.50*	*0.0006*	*3.49*	*13.73*	*YES*	*30*	$ 57,684
	24SW06_24SW05	*18*	*283.60*	*0.0017*	*4.29*	*10.84*	*YES*	*24*	$ 93,021
	24SW07_24SW06	*18*	*408.50*	*0.0025*	*5.22*	*10.84*	*YES*	*21*	$ 117,648

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	24SW08_24SW07	*18*	*234.00*	*0.0021*	*4.80*	*10.84*	*YES*	*21*	$ 67,392
	24SW09_24SW08	*18*	*323.60*	*0.0020*	*4.71*	*9.47*	*YES*	*21*	$ 93,197
	24SE27_24SW09	*15*	*130.90*	*0.0009*	*1.94*	*9.47*	*YES*	*27*	$ 51,313
	24SE28_24SE27	*15*	*342.80*	*0.0011*	*2.12*	*9.47*	*YES*	*24*	$ 112,438
	24SE78_24SE28	*15*	*134.70*	*0.0017*	*2.66*	*9.47*	*YES*	*24*	$ 44,182
	24SE01_24SE78	30	102.40	0.0040	25.94	9.47		0	
	24SE02_24SE01	30	203.00	0.0040	25.94	7.50		0	
	24SE03_24SE02	30	273.00	0.0040	25.94	7.50		0	
	24SE04_24SE03	30	197.00	0.0040	25.94	7.50		0	
	24SE05_24SE04	30	304.00	0.0040	25.94	7.50		0	
	24SE06_24SE05	30	163.00	0.0040	25.94	7.50		0	
	24SE07_24SE06	30	376.00	0.0060	31.77	7.50		0	
	25NE03_24SE07	30	216.40	0.0040	25.94	6.67		0	
	25NE04_25NE03	30	34.90	0.0172	53.79	6.67		0	
	25NE05_25NE04	30	210.00	0.0062	32.30	6.01		0	
	25NE06_25NE05	24	85.00	0.0198	31.83	6.01		0	
	25NE07_25NE06	24	26.00	0.0055	16.78	6.01		0	
	25NE08_25NE07	24	113.00	0.0077	19.85	6.01		0	
	25NE09_25NE08	18	158.00	0.0081	9.45	4.70		0	
	25NE10_25NE09	*8*	*400.00*	*0.0049*	*0.85*	*1.31*	*YES*	*8*	$ 64,000
	25NE11_25NE10	*8*	*400.00*	*0.0052*	*0.87*	*1.31*	*YES*	*8*	$ 64,000
	25NE22_25NE11	*8*	*353.00*	*0.0052*	*0.87*	*1.31*	*YES*	*8*	$ 56,480
	25NE23_25NE22	*8*	*395.00*	*0.0052*	*0.87*	*1.31*	*YES*	*8*	$ 63,200
	25NE47_25NE23	10	214.60	0.0024	1.07	0.66		0	
	25NE48_25NE47	10	376.50	0.0032	1.24	0.66		0	
	25NE49_25NE48	10	276.80	0.0028	1.16	0.66		0	
	25NE50_25NE49	10	178.20	0.0031	1.22	0.66		0	
North Line D									
	24NW45_23NE129	*8*	*138.30*	*-0.0034*	*0.00*	*4.57*	*YES*	*18*	$ 34,298
	24NW46_24NW45	*8*	*224.30*	*0.0035*	*0.71*	*4.57*	*YES*	*18*	$ 55,626

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	24NW47_24NW46	*8*	*339.90*	*0.0041*	*0.77*	*4.57*	*YES*	*15*	$ 78,857
North Line E									
	24SE08_24SE07	8	55.00	0.006	0.94	0.83		0	
	24SE09_24SE08	8	139.00	0.0055	0.90	0.83		0	
	24SE10_24SE09	8	95.70	0.006	0.94	0.83		0	
	24SE11_24SE10	8	400.00	0.006	0.94	0.83		0	
	24SE12_24SE11	8	275.00	0.005	0.85	0.83		0	
	24SE13_24SE12	8	275.00	0.0049	0.85	0.83		0	
	24SE14_24SE13	8	296.90	0.0059	0.93	0.83		0	
	24SE77_24SE14	8	177.00	0.0053	0.88	0.83		0	
	19SW04_24SE77	8	148.50	0.0046	0.82	0.83	YES	0	
	19SW05_19SW04	8	162.60	0.006	0.94	0.83		0	
	19SW07_19SW05	8	69.50	0.006	0.94	0.83		0	
South Line A									
	36SW01_SOUTH	24	40.00	0.0040	14.31	12.61		0	
	36SW02_36SW01	24	79.00	0.0040	14.31	12.34		0	
	36SW03_36SW02	24	85.00	0.0040	14.31	12.34		0	
	36SW04_36SW03	24	423.90	0.0020	10.12	12.34	YES	15	$ 98,345
	36SW05_36SW04	21	319.30	0.0077	13.90	12.23		0	
	36SW06_36SW05	*21*	*307.90*	*0.0030*	*8.68*	*12.23*	*YES*	*18*	$ 76,359
	36SW07_36SW06	*21*	*203.80*	*0.0011*	*5.26*	*12.23*	*YES*	*24*	$ 66,846
	36SW08_36SW07	*21*	*272.30*	*0.0011*	*5.26*	*12.23*	*YES*	*24*	$ 89,314
	36SW20_36SW08	15	30.00	0.0230	9.80	6.78		0	
	36SW21_36SW20	*15*	*338.20*	*0.0067*	*5.29*	*6.78*	*YES*	*10*	$ 67,640
	36SW22_36SW21	*15*	*125.30*	*0.0025*	*3.23*	*6.78*	*YES*	*18*	$ 31,074
	36SW23_36SW22	*15*	*179.00*	*0.0025*	*3.23*	*6.78*	*YES*	*18*	$ 44,392
	36NW52_36SW23	*15*	*300.00*	*0.0025*	*3.23*	*6.78*	*YES*	*18*	$ 74,400
	36NW68_36NW52	*12*	*357.60*	*0.0064*	*2.85*	*4.42*	*YES*	*10*	$ 71,520
	36NW69_36NW68	*12*	*350.00*	*0.0036*	*2.14*	*4.42*	*YES*	*15*	$ 81,200

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36NW70_36NW69	*12*	*360.50*	*0.0036*	*2.14*	*4.42*	*YES*	*15*	$ 83,636
	36NW71_36NW70	12	163.00	0.0136	4.15	4.00		0	
	36NW72_36NW71	12	235.50	0.0168	4.62	4.00		0	
	36NW73_36NW72	12	91.00	0.0172	4.67	4.00		0	
	36NW74_36NW73	12	329.50	0.0060	2.76	4.00	YES	10	$ 65,900
	36NW75_36NW74	12	348.00	0.0084	3.27	4.00	YES	8	$ 55,680
	36NW76_36NW75	12	379.50	0.0092	3.42	4.00	YES	8	
	36NW77_36NW76	*12*	*350.00*	*0.0025*	*1.78*	*3.58*	*YES*	*15*	$ 81,200
	36NW78_36NW77	*12*	*339.30*	*0.0025*	*1.78*	*3.58*	*YES*	*15*	$ 78,718
	36NW79_36NW78	*12*	*141.00*	*0.0025*	*1.78*	*3.58*	*YES*	*15*	$ 32,712
	36NW80_36NW79	*12*	*144.70*	*0.0025*	*1.78*	*3.58*	*YES*	*15*	$ 33,570
	25SW63_36NW80	*12*	*385.70*	*0.0025*	*1.78*	*3.58*	*YES*	*15*	$ 89,482
	25SE02_25SW63	12	245.50	0.0025	1.78	3.16	YES	12	$ 53,028
	25SE03_25SE02	12	129.10	0.0025	1.78	3.16	YES	12	$ 27,886
	25SE04_25SE03	12	240.40	0.0128	4.03	2.75		0	
	25SE05_25SE04	12	283.70	0.0180	4.78	2.75		0	
	25SE06A_25SE05	12	112.00	0.0200	5.04	2.75		0	
	25SE06_25SE06A	12	15.50	0.0200	5.04	0.85		0	
South Line B									
	36NW53_36NW52	10	217.00	0.0032	1.24	1.23		0	
	36NW54_36NW53	10	156.00	0.0032	1.24	1.23		0	
	36NW55_36NW54	10	346.00	0.0032	1.24	1.23		0	
	36NW56_36NW55	10	281.00	0.0032	1.24	1.23		0	
	36NW57_36NW56	10	133.70	0.0032	1.24	1.23		0	
South Line C									
	36SW09_36SW08	18	220.50	0.0019	4.58	5.03	YES	8	
	36SW10_36SW09	18	351.10	0.0019	4.58	5.03	YES	8	
	36SW11_36SW10	18	344.00	0.0019	4.58	5.03	YES	8	
	36SW12_36SW11	18	356.70	0.0019	4.58	5.03	YES	8	
	36SW16_36SW12	8	214.10	0.0050	0.85	1.41	YES	8	$ 34,256

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36SW17_36SW16	8	352.20	0.0050	0.85	1.41	YES	8	$ 56,352
	36SW18_36SW17	8	263.50	0.0050	0.85	1.41	YES	8	$ 42,160
	35SE01_36SW18	8	100.00	0.0050	0.85	1.41	YES	8	$ 16,000
South Line D									
	36SW13_36SW12	15	289.20	0.0160	8.17	3.11		0	
	36SW14_36SW13	15	276.00	0.0034	3.77	3.11		0	
	36NW48A_36SW14	15	365.00	0.0034	3.77	3.11		0	
	36NW48_36NW48A	15	313.36	0.0027	3.36	3.11		0	
	36NW49_36NW48	15	339.40	0.0027	3.36	3.11		0	
	36NW50_36NW49	*15*	*275.30*	*0.0022*	*3.03*	*3.11*	*YES*	*8*	
	36NW51_36NW50	*15*	*225.30*	*0.0022*	*3.03*	*3.11*	*YES*	*8*	
	35NE03_36NW51	10	312.70	0.0030	1.20	1.08		0	
	35NE04_35NE03	10	213.70	0.0028	1.16	1.08		0	
	35NE05_35NE04	10	297.60	0.0028	1.16	1.08		0	
	35NE06_35NE05	10	213.00	0.0028	1.16	1.08		0	
	35NE07_35NE06	10	187.50	0.0028	1.16	1.08		0	
	35NE08_35NE07	10	277.90	0.0028	1.16	0.62		0	
	35NE09_35NE08	10	375.00	0.0028	1.16	0.15		0	
	35NE36_35NE09	10	213.10	0.0028	1.16	0.15		0	
	35NE10_35NE36	10	158.00	0.0028	1.16	0.15		0	
	35NE11_35NE10	10	212.00	0.0030	1.20	0.15		0	
South Line E									
	36NW01_36NW50	12	23.60	0.0047	2.44	1.56		0	
	36NW10_36NW01	12	31.00	0.0470	7.72	1.56		0	
	36NW11_36NW10	12	167.60	0.0057	2.69	1.56		0	
	36NW12_36NW11	12	65.90	0.0102	3.60	1.56		0	
	36NW13_36NW12	12	105.90	0.0052	2.57	1.56		0	
	36NW14_36NW13	12	214.40	0.0051	2.54	1.56		0	
	36NW15_36NW14	12	297.30	0.0039	2.22	1.56		0	
	36NW16_36NW15	12	71.10	0.0048	2.47	1.56		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36NW17_36NW16	12	206.00	0.0032	2.02	1.56		0	
	36NW18_36NW17	12	400.00	0.0039	2.22	1.56		0	
	36NW19_36NW18	12	35.80	0.0059	2.74	1.56		0	
	36NW20_36NW19	12	126.10	0.0053	2.59	1.56		0	
Walmart Line A									
	30NE64_30NE61/ Walmart	18	89.10	0.0035	6.21	4.08		0	
	30NE65_30NE64	*18*	*238.20*	*0.0012*	*3.64*	*4.08*	*YES*	*10*	
	30NE66_30NE65	18	58.90	0.0044	6.97	4.08		0	
	30NE67_30NE66	18	95.40	0.0016	4.20	4.08		0	
	30NE68_30NE67	*18*	*258.50*	*0.0015*	*4.07*	*4.08*	*YES*	*8*	
	30NE69_30NE68	*18*	*61.30*	*0.0007*	*2.78*	*4.08*	*YES*	*15*	$ 14,222
	30NE70_30NE69	18	12.70	0.0024	5.15	4.08		0	
	30NE42_30NE70	15	331.78	0.0048	4.48	3.98		0	
	29NW01_30NE42	15	360.00	0.0044	4.28	3.98		0	
Walmart Line B									
	30NE62_30NE61/ Walmart	12	36.70	0.0147	4.32	1.062		0	
	30NE63_30NE62	12	396.70	0.0236	5.47	1.062		0	
	30NE01_30NE63	*12*	*120.00*	*-0.0032*	*0.00*	*1.062*	*YES*	*0*	
WWTP Line A									
	15NW01_WWTP	*30*	*376.50*	*0.0045*	*27.52*	*60.16*	*YES*	*33*	$ 188,250
	15NW02_15NW01	*30*	*479.70*	*0.0045*	*27.52*	*60.16*	*YES*	*33*	$ 239,850
	15NW03_15NW02	15	235.90	0.0263	10.48	1.93		0	
	15NW04_15NW03	15	187.90	0.0114	6.90	1.93		0	
	15NW05_15NW04	15	241.00	0.0091	6.16	1.93		0	
	15NW06_15NW05	15	194.20	0.0105	6.62	1.66		0	
	15NW07_15NW06	15	228.50	0.0095	6.30	1.66		0	
	15NW08_15NW07	15	350.30	0.0104	6.59	1.66		0	
	15NW09_15NW08	15	191.90	0.0097	6.36	1.39		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	15NW10_15NW09	15	173.40	0.0086	5.99	1.39		0	
	15NW11_15NW10	15	162.30	0.0094	6.26	1.39		0	
	15NW12_15NW11	15	288.70	0.0087	6.03	1.39		0	
	15SW01_15NW12	15	256.50	0.0094	6.26	1.39		0	
	15SW02_15SW01	15	223.50	0.0041	4.14	1.39		0	
	15SW03_15SW02	15	161.40	0.0065	5.21	1.39		0	
	15SW04_15SW03	12	131.40	0.0048	2.47	1.12		0	
	15SW05_15SW04	12	80.40	0.0040	2.25	1.12		0	
	15SW06_15SW05	12	183.00	0.0039	2.22	1.12		0	
	15SW07_15SW06	12	248.40	0.0045	2.39	1.12		0	
	15SW08_15SW07	12	202.30	0.0037	2.17	1.12		0	
	15SW09_15SW08	12	319.30	0.0033	2.05	1.12		0	
WWTP Line B									
	15NE01_15NW02	*30*	*500.00*	*0.0045*	*27.52*	*55.19*	*YES*	*33*	$ 250,000
	15NE02_15NE01	*30*	*301.10*	*0.0039*	*25.62*	*55.19*	*YES*	*33*	$ 150,550
	15NE03_15NE02	*30*	*161.40*	*0.0048*	*28.42*	*55.19*	*YES*	*30*	$ 73,598
	15NE04_15NE03	*30*	*302.30*	*0.0044*	*27.21*	*55.19*	*YES*	*33*	$ 151,150
	15NE05_15NE04	*30*	*148.40*	*0.0019*	*17.88*	*55.19*	*YES*	*0*	
	15NE06_15NE05	*30*	*209.80*	*0.0023*	*19.67*	*53.99*	*YES*	*42*	$ 134,272
	15NE07_15NE06	*30*	*302.50*	*0.0019*	*17.88*	*53.99*	*YES*	*0*	
	15SE01_15NE07	*30*	*257.00*	*0.0028*	*21.70*	*53.99*	*YES*	*36*	$ 139,808
	15SE02_15SE01	*30*	*356.60*	*0.0025*	*20.51*	*53.99*	*YES*	*42*	$ 228,224
	15SE03_15SE02	*27*	*500.00*	*0.0069*	*25.73*	*52.79*	*YES*	*30*	$ 228,000
	15SE04_15SE03	*27*	*274.10*	*0.0044*	*20.54*	*52.79*	*YES*	*33*	$ 137,050
	15SE05_15SE04	*27*	*422.30*	*0.0019*	*13.50*	*52.79*	*YES*	*42*	$ 270,272
	15SE06_15SE05	*27*	*977.71*	*0.0023*	*14.85*	*52.79*	*YES*	*42*	$ 625,734
	15SE07_15SE06	*27*	*405.80*	*0.0019*	*13.50*	*52.79*	*YES*	*42*	$ 259,712
	15SE08_15SE07	*27*	*180.50*	*0.0028*	*16.39*	*52.79*	*YES*	*42*	$ 115,520
	15SE09_15SE08	*27*	*360.00*	*0.0039*	*19.34*	*52.79*	*YES*	*36*	$ 195,840
	15SE10_15SE09	*27*	*290.10*	*0.0031*	*17.24*	*52.79*	*YES*	*36*	$ 157,814

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	15SE14_15SE10	21	210.30	0.0093	15.28	12.91		0	
	22NE03_15SE14	21	205.60	0.0055	11.75	11.14		0	
	22NE04_22NE03	21	127.40	0.0050	11.20	11.14		0	
	22NE05_22NE04	*21*	*317.60*	*0.0034*	*9.24*	*11.14*	*YES*	*12*	$ 68,602
	22NE06_22NE05	*21*	*308.90*	*0.0049*	*11.09*	*11.14*	*YES*	*0*	
	22NE07_22NE06	*21*	*176.20*	*NEG. SLOPE*	*0.00*	*11.14*	*YES*	*24*	$ 57,794
	22NE08_22NE07	*21*	*190.60*	*0.0037*	*9.64*	*11.14*	*YES*	*0*	
	22NE09_22NE08	*21*	*275.60*	*0.0036*	*9.51*	*11.14*	*YES*	*0*	
	22NE15_22NE09	*21*	*194.40*	*0.0042*	*10.27*	*11.14*	*YES*	*0*	
	22NE10_22NE15	21	79.60	0.0042	10.27	9.90		0	
	22NE11_22NE10	21	275.40	0.0038	9.77	4.97		0	
	22NE12_22NE11	21	260.80	0.0035	9.37	4.97		0	
	22NE13_22NE12	21	262.40	0.0032	8.96	4.97		0	
	22NE14_22NE13	21	310.10	0.0034	9.24	4.97		0	
	22SE76_22NE14	21	353.00	0.0030	8.68	4.95		0	
	22SE77_22SE76	21	318.70	0.0031	8.82	4.95		0	
	22SE78_22SE77	21	318.70	0.0035	9.37	4.95		0	
	22SE79_22SE78	18	275.10	0.0040	6.64	4.92		0	
	22SE80_22SE79	*12*	*284.90*	*0.0037*	*2.17*	*4.11*	*YES*	*12*	$ 61,538
	22SE81_22SE80	*12*	*275.90*	*0.0036*	*2.14*	*4.11*	*YES*	*12*	$ 59,594
	22SE82_22SE81	*12*	*246.10*	*0.0034*	*2.08*	*4.11*	*YES*	*12*	$ 53,158
	22SW01_22SE82	*12*	*246.10*	*0.0035*	*2.11*	*4.11*	*YES*	*12*	$ 53,158
	22SW70_22SW01	*10*	*118.80*	*0.0037*	*1.33*	*1.57*	*YES*	*0*	
	22SW02_22SW70	*10*	*243.60*	*0.0037*	*1.33*	*1.41*	*YES*	*0*	
	22SW03_22SW02	*10*	*153.70*	*0.0027*	*1.14*	*1.41*	*YES*	*0*	
	22SW04_22SW03	*10*	*131.40*	*0.0038*	*1.35*	*1.41*	*YES*	*0*	
	22SW05_22SW04	*10*	*400.00*	*0.0033*	*1.26*	*1.41*	*YES*	*0*	
WWTP Line C									
	15SE11_15SE10	15	387.10	0.0094	6.26	1.77		0	
	15SE28_15SE11	15	149.60	0.0097	6.36	1.77		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 2

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	15SE12_15SE28	15	227.90	0.0097	6.36	1.77		0	
	15SE13_15SE12	15	356.40	0.0067	5.29	1.77		0	
	22NE01_15SE13	15	270.00	0.0061	5.05	1.77		0	
	22NE02_22NE01	15	270.00	0.0066	5.25	1.77		0	
	23NW01_22NE02	15	227.80	0.0065	5.21	1.77		0	
	23NW16_23NW01	15	207.50	0.0065	5.21	1.77		0	
	23NW02_23NW16	15	280.80	0.0065	5.21	1.77		0	
	23NW37_23NW02	15	270.00	0.0135	7.51	1.77		0	
	23NW03_23NW37	15	116.40	0.0135	7.51	1.77		0	
	23NW04_23NW03	18	424.10	0.0043	6.89	1.77		0	
	23NW05_23NW04	18	257.60	0.0043	6.89	1.77		0	
	23NW06_23NW05	15	345.00	0.0053	4.70	1.77		0	
	23NW07_23NW06	15	276.80	0.0053	4.70	1.77		0	
	23NW08_23NW07	15	391.60	0.0053	4.70	1.77		0	
	23NW09_23NW08	15	235.70	0.0103	6.56	1.77		0	
	23NW10_23NW09	15	433.60	0.0103	6.56	1.77		0	
	23NW11_23NW10	15	299.50	0.0052	4.66	1.77		0	
WWTP Line D									
	22NE16_22NE15	*15*	*369.40*	*0.0020*	*2.89*	*4.93*	*YES*	*15*	$ 85,701
	22NE17_22NE16	*15*	*124.40*	*0.0020*	*2.89*	*4.93*	*YES*	*15*	$ 28,861
	22NE18_22NE17	*15*	*137.60*	*0.0020*	*2.89*	*3.45*	*YES*	*10*	$ 27,520
	22NE19_22NE18	*15*	*189.60*	*0.0020*	*2.89*	*3.45*	*YES*	*10*	$ 37,920
	22NE20_22NE19	*15*	*181.10*	*0.0020*	*2.89*	*3.45*	*YES*	*10*	$ 36,220
	22NE21_22NE20	*15*	*158.80*	*0.0020*	*2.89*	*3.45*	*YES*	*10*	$ 31,760
	22NE46_22NE21	*15*	*165.20*	*0.0035*	*3.82*	*3.45*		*0*	
	22NE47_22NE46	*15*	*270.60*	*0.0013*	*2.33*	*3.45*	*YES*	*12*	$ 58,450
	22NE52_22NE47	*15*	*253.20*	*0.0016*	*2.58*	*3.45*	*YES*	*10*	$ 50,640
	22SE97_22NE52	*15*	*100.20*	*0.0029*	*3.48*	*3.45*		*0*	
	22SE98_22SE97	*15*	*400.00*	*0.0030*	*3.54*	*3.45*		*0*	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
East Line A									
	30SE06_EAST	21	32.50	0.0100	15.85	5.39		0	
	30SW01A_30SE06	18	78.20	0.0100	10.50	5.39		0	
	30NW105_30SW01A	12	367.30	0.0036	2.14	5.39	YES	15	$ 85,214
	30NW01_30NW105	12	37.70	0.0036	2.14	2.64	YES	12	$ 8,143
	30NW104_30NW01	10	193.40	0.0033	1.26	2.11	YES	10	$ 38,680
	30NW92_30NW104	10	27.00	0.0033	1.26	2.11	YES	10	$ 5,400
	30NW02_30NW92	10	160.40	0.0033	1.26	2.11	YES	10	$ 32,080
	30NW103_30NW02	10	36.60	0.0035	1.30	2.11	YES	10	$ 7,320
	30NW03_30NW103	10	220.40	0.0035	1.30	2.11	YES	10	$ 44,080
	30NW04_30NW03	10	122.20	0.0035	1.30	1.58	YES	8	$ 19,552
	30NW102_30NW04	10	113.80	0.0035	1.30	1.58	YES	8	$ 18,208
	30NW05_30NW102	10	68.60	0.0035	1.30	1.58	YES	8	$ 10,976
	30NW06_30NW05	10	109.90	0.0035	1.30	1.58	YES	8	$ 17,584
	30NW07_30NW06	10	56.10	0.0035	1.30	1.58	YES	8	$ 8,976
	30NW08_30NW07	10	39.00	0.0035	1.30	1.58	YES	8	$ 6,240
	30NW09_30NW08	10	319.70	0.0032	1.24	1.58	YES	8	$ 51,152
	30NW10_30NW09	10	211.40	0.0026	1.12	1.05		0	
	30NW11_30NW10	10	105.20	0.0026	1.12	1.05		0	
	30NW12_30NW11	10	118.00	0.0035	1.30	1.05		0	
	30NW13_30NW12	10	37.30	0.0035	1.30	1.05		0	
	30NW14_30NW13	10	347.20	0.0025	1.10	1.05		0	
	30NW15_30NW14	10	381.00	0.0021	1.00	0.53		0	
	30NW15A_30NW15	10	211.40	0.0025	1.10	0.53		0	
	30NW16_30NW15A	10	163.60	0.0025	1.10	0.53		0	
	30NW17_30NW16	10	374.50	0.0033	1.26	0.53		0	
	30NW18_30NW17	10	374.00	0.0019	0.96	0.53		0	
	30NW19_30NW18	10	374.00	0.0025	1.10	0.53		0	
	30NW20_30NW19	10	373.00	0.0025	1.10	0.53		0	
	25NE33_30NW20	10	373.00	0.0028	1.16	0.53		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
East Line B									
	30NE73_30SE06	21	60.00	0.0010	5.01	5.42	YES	0	
	30NE74_30NE73	21	214.70	0.0012	5.49	5.42		0	
	30NE75_30NE74	21	304.60	0.0010	5.01	5.28	YES	0	
	30NE76_30NE75	21	230.00	0.0015	6.14	5.28		0	
	30NE77_30NE76	21	152.90	0.0010	5.01	0.14		0	
	30NE78_30NE77	21	100.50	0.0021	7.26	0.14		0	
East Line C									
	30SW04_30SW01A	10	103.60	0.0082	1.98	2.76	YES	8	$ 16,576
	30SW32_30SW04	8	125.10	0.0116	1.30	1.52	YES	0	
	30SW33_30SW32	8	193.60	0.0105	1.24	1.52	YES	8	$ 30,976
	30SW34_30SW33	8	293.00	0.0160	1.53	1.52		0	
	30SW43_30SW34	8	213.40	0.0158	1.52	1.48		0	
	30SW44_30SW43	8	124.90	0.0168	1.57	1.48		0	
	30SW45_30SW44	8	280.00	0.0080	1.08	1.48	YES	8	$ 44,800
	30SW46_30SW45	8	311.30	0.0080	1.08	1.48	YES	8	$ 49,808
Genesis Line A									
	24NW50_GENESIS	15	135.80	0.0030	3.54	3.33		0	
	24NW51_24NW50	15	221.90	0.0030	3.54	3.33		0	
	13SW08_24NW51	12	143.10	0.0092	3.42	2.03		0	
	13SW09_13SW08	12	233.50	0.0072	3.02	2.03		0	
	13SE01_13SW09	12	160.20	0.0056	2.67	2.03		0	
	13SE02_13SE01	12	304.60	0.0041	2.28	2.03		0	
	13SE03_13SE02	12	79.40	0.0035	2.11	0.74		0	
	13SE04_13SE03	12	278.40	0.0035	2.11	0.74		0	
	13SE05_13SE04	12	222.60	0.0027	1.85	0.74		0	
	13SE06_13SE05	12	115.20	0.0028	1.89	0.74		0	
	13SE07_13SE06	12	141.40	0.0025	1.78	0.74		0	
	13SE08_13SE07	12	285.40	0.0026	1.82	0.74		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	13SE09_13SE08	10	40.20	0.0030	1.20	0.74		0	
	13SE10_13SE09	10	302.10	0.0028	1.16	0.28		0	
	13SE11_13SE10	10	302.90	0.0029	1.18	0.28		0	
	13SE12_13SE11	10	227.60	0.0029	1.18	0.28		0	
	13SE13_13SE12	10	259.80	0.0025	1.10	0.28		0	
Kill Creek Line A									
	9NE01_Kill Creek	24	215.40	0.0040	14.31	3.94		0	
	9NE02_9NE01	24	305.30	0.0040	14.31	3.94		0	
	9NE03_9NE02	21	305.30	0.0100	15.85	3.78		0	
	9NE04_9NE03	21	305.30	0.0070	13.26	3.78		0	
	9NE05_9NE04	18	231.60	0.0140	12.43	3.25		0	
	9NE06_9NE05	18	231.60	0.0140	12.43	3.25		0	
	9NE07_9NE06	18	237.70	0.0120	11.51	3.25		0	
	9NE08_9NE07	18	237.70	0.0120	11.51	3.25		0	
	9NE10_9NE08	12	292.20	0.0140	4.22	1.05		0	
	9NE11_9NE10	12	292.20	0.0140	4.22	1.05		0	
	9SE10_9NE11	10	377.10	0.0200	3.10	0.67		0	
	9SE11_9SE10	10	377.10	0.0220	3.25	0.67		0	
Kill Creek Line B									
	9NE09_9NE08	18	388.20	0.0180	14.09	1.93		0	
	9SE01_9NE09	18	388.20	0.0220	15.58	1.93		0	
	9SE02_9SE01	18	388.20	0.0160	13.29	1.93		0	
	9SE03_9SE02	18	289.90	0.0060	8.14	1.93		0	
	9SE04_9SE03	18	255.10	0.0060	8.14	1.93		0	
	9SE05_9SE04	18	255.10	0.0060	8.14	1.93		0	
	9SE06_9SE05	18	370.20	0.0060	8.14	1.93		0	
	9SE07_9SE06	18	370.20	0.0060	8.14	1.93		0	
	9SE08_9SE07	18	349.80	0.0080	9.40	1.93		0	
	9SE09_9SE08	18	308.80	0.0080	9.40	1.93		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
Kill Creek Line C									
	10NW01_Kill Creek	21	23.40	0.0070	13.26	12.11		0	
	10NW02_10NW01	21	379.20	0.0070	13.26	12.11		0	
	10NW03_10NW02	21	379.20	0.0070	13.26	12.11		0	
	10NW04_10NW03	21	379.20	0.0070	13.26	12.11		0	
	10NW05_10NW04	21	366.10	0.0070	13.26	12.11		0	
	10NW06_10NW05	21	204.40	0.0070	13.26	0.28		0	
	10NW07_10NW06	21	263.40	0.0070	13.26	0.28		0	
	10NW08_10NW07	21	263.40	0.0070	13.26	0.28		0	
	10NW09_10NW08	21	260.30	0.0040	10.02	0.28		0	
	10NW10_10NW09	21	260.30	0.0040	10.02	0.28		0	
	10NW11_10NW10	21	381.20	0.0040	10.02	0.28		0	
	10SW01_10NW11	21	381.20	0.0040	10.02	0.28		0	
	10SW02_10SW01	21	381.20	0.0040	10.02	0.28		0	
	10SW03_10SW02	21	381.20	0.0040	10.02	0.28		0	
	10SW04_10SW03	21	213.00	0.0040	10.02	0.28		0	
	10SW05_10SW04	12	213.00	0.0040	2.25	0.26		0	
	10SW06_10SW05	12	313.70	0.0060	2.76	0.26		0	
	10SW07_10SW06	10	317.50	0.0080	1.96	0.10		0	
	10SW08_10SW07	10	317.50	0.0080	1.96	0.10		0	
New Bull Creek Line A									
	26NE54_26NE55/ New Bull Creek	21	367.60	0.0010	5.01	0.86		0	
	26NW21_26NE54	21	17.00	0.0010	5.01	0.86		0	
	26NW22_26NW21	21	314.40	0.0010	5.01	0.86		0	
	26NW23_26NW22	21	264.30	0.0010	5.01	0.86		0	
	26NW24_26NW23	21	133.40	0.0010	5.01	0.86		0	
	26NW25_26NW24	18	114.90	0.0014	3.93	0.63		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	26NW26_26NW25	18	405.40	0.0014	3.93	0.63		0	
	23SW01_26NW26	18	117.20	0.0014	3.93	0.63		0	
	23SW02_23SW01	18	400.00	0.0014	3.93	0.63		0	
	23SW03_23SW02	18	400.80	0.0014	3.93	0.63		0	
	23SW04_23SW03	18	248.00	0.0014	3.93	0.63		0	
	23SW05_23SW04	18	15.62	0.0014	3.93	0.53		0	
	23SE36_23SW05	8	144.00	0.0047	0.83	0.53		0	
	23SE39_23SE36	8	110.00	0.0064	0.97	0.53		0	
New Bull Creek Line B									
	26NE56_26NE55/ New Bull Creek	24	114.40	0.0020	10.12	4.93		0	
	26NE01_26NE56	24	184.26	0.0001	2.36	2.81	YES	15	$ 42,748
	26NE02_26NE01	10	188.68	0.0004	0.45	1.43	YES	15	$ 43,774
	26NE03_26NE02	10	134.00	0.0020	0.98	1.43	YES	8	$ 21,440
	26NE04_26NE03	10	303.00	0.0020	0.98	1.43	YES	8	$ 48,480
	26NE05_26NE04	10	386.00	0.0020	0.98	1.43	YES	8	$ 61,760
	23SE01_26NE05	10	370.00	0.0020	0.98	0.66		0	
	23SE02_23SE01	10	25.00	0.0020	0.98	0.66		0	
	23SE03_23SE02	10	295.00	0.0020	0.98	0.66		0	
	23SE04_23SE03	10	144.00	0.0020	0.98	0.66		0	
	23SE05_23SE04	10	143.00	0.0020	0.98	0.66		0	
	23SE06_23SE05	10	390.00	0.0020	0.98	0.66		0	
	23SE07_23SE06	10	388.00	0.0020	0.98	0.66		0	
	23SE08_23SE07	10	391.00	0.0020	0.98	0.66		0	
	24SW64_23SE08	10	381.00	0.0020	0.98	0.66		0	
	25NW14_24SW64	10	351.00	0.0020	0.98	0.00		0	
New Bull Creek Line C									
	26NE57_26NE56	24	248.30	0.0020	10.12	2.11		0	
	26NE58_26NE57	24	217.10	0.0020	10.12	2.11		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	26NE59_26NE58	24	405.30	0.0020	10.12	2.11		0	
	26NE60_26NE59	24	325.20	0.0130	25.79	2.11		0	
	26NE61_26NE60	24	268.60	0.0128	25.59	2.11		0	
	26NE62_26NE61	24	214.00	0.0040	14.31	2.11		0	
	26SE93_26NE62	24	62.70	0.0040	14.31	2.11		0	
New Bull Creek Line C2									
	26NE34_26NE01	12	253.00	0.0022	1.67	0.62		0	
	26NE35_26NE34	12	221.90	0.0022	1.67	0.62		0	
	26NE47_26NE35	12	400.00	0.0022	1.67	0.62		0	
	26NE48_26NE47	12	325.10	0.0022	1.67	0.62		0	
	26NE49_26NE48	12	287.90	0.0022	1.67	0.62		0	
	26SE14_26NE49	12	222.10	0.0022	1.67	0.62		0	
	26SE15_26SE14	12	406.60	0.0022	1.67	0.50		0	
	26SE16_26SE15	12	393.40	0.0022	1.67	0.50		0	
	26SE17_26SE16	12	337.70	0.0022	1.67	0.50		0	
	26SE32_26SE17	12	120.00	0.0022	1.67	0.50		0	
	26SE33_26SE32	12	253.00	0.0022	1.67	0.50		0	
	26SE34_26SE33	12	179.70	0.0022	1.67	0.50		0	
	26SE35_26SE34	12	353.30	0.0022	1.67	0.50		0	
	26SE36_26SE35	12	406.20	0.0022	1.67	0.50		0	
	26SE37_26SE36	12	273.10	0.0022	1.67	0.50		0	
	26SE38_26SE37	10	212.50	0.0032	1.24	0.25		0	
	26SE42_26SE38	10	24.00	0.0030	1.20	0.25		0	
	26SE43_26SE42	10	276.00	0.0030	1.20	0.25		0	
	26SE44_26SE43	10	312.50	0.0030	1.20	0.25		0	
North Line A									
	13SW01_NORTH	36	23.60	0.0649	169.92	26.33		0	
	13SW10_13SW01	10	77.60	0.0492	4.86	3.02		0	
	14SE01_13SW10	10	278.30	0.0028	1.16	3.02	YES	12	$ 60,113

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	14SE02_14SE01	10	106.10	0.0028	1.16	3.02	YES	12	$ 22,918
	14SE03_14SE02	10	113.90	0.0300	3.79	3.02		0	
	14SE04_14SE03	10	71.00	0.0100	2.19	1.67		0	
	14SE05_14SE04	10	213.00	0.0500	4.90	1.11		0	
	14SE06_14SE05	10	213.20	0.0028	1.16	1.11		0	
	14SE07_14SE06	10	379.70	0.0028	1.16	1.11		0	
	14SE08_14SE07	10	362.30	0.0028	1.16	1.11		0	
	14SE09_14SE08	10	161.80	0.0028	1.16	1.11		0	
	14SE10_14SE09	10	239.60	0.0028	1.16	1.11		0	
	14SE11_14SE10	10	70.00	0.0488	4.84	0.56		0	
	14SE12_14SE11	10	238.80	0.0100	2.19	0.56		0	
	14SE13_14SE12	10	365.00	0.0028	1.16	0.56		0	
	14SE14_14SE13	10	226.80	0.0028	1.16	0.56		0	
	14SE15_14SE14	10	218.00	0.0028	1.16	0.56		0	
	14SE16_14SE15	10	148.00	0.0076	1.91	0.56		0	
North Line B									
	13SW02_13SW01	36	227.10	0.0030	36.53	23.31		0	
	13SW03_13SW02	36	144.20	0.0030	36.53	23.31		0	
	13SW04_13SW03	36	124.90	0.0030	36.53	23.31		0	
	13SW05_13SW04	36	273.80	0.0030	36.53	23.31		0	
	13SW06_13SW05	36	320.20	0.0030	36.53	23.31		0	
	13SW07_13SW06	36	194.40	0.0030	36.53	23.31		0	
	24NW77_13SW07	36	146.80	0.0030	36.53	23.31		0	
	24NW83_24NW77	36	129.60	0.0030	36.53	23.31		0	
	24NW78_24NW83	36	124.30	0.0030	36.53	22.75		0	
	24NW79_24NW78	36	176.10	0.0195	93.14	22.75		0	
	24NW80_24NW79	36	197.10	0.0030	36.53	22.75		0	
	24NW81_24NW80	36	204.20	0.0030	36.53	22.75		0	
	23NE126_24NW81	36	354.40	0.0030	36.53	22.75		0	
	23NE127_23NE126	36	109.00	0.0030	36.53	22.75		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	23NE128_23NE127	36	166.30	0.0171	87.22	22.75		0	
	23NE09_23NE128	15	33.60	0.02	9.14	1.38		0	
	23NE13_23NE09	10	291.80	0.0072	1.86	1.38		0	
	23NE14_23NE13	8	122.80	0.0103	1.23	0.85		0	
	23NE15_23NE14	8	197.20	0.0101	1.21	0.85		0	
	23NE24_23NE15	8	198.20	0.0107	1.25	0.85		0	
	23NE25_23NE24	8	353.40	0.0082	1.09	0.85		0	
	23NE26_23NE25	8	354.00	0.0085	1.11	0.85		0	
	23NE27_23NE26	8	204.00	0.008	1.08	0.85		0	
North Line C									
	23NE129_23NE128	36	110.00	0.0030	36.53	21.33		0	
	23NE130_23NE129	36	235.40	0.0030	36.53	16.76		0	
	23NE131_23NE130	36	306.40	0.0030	36.53	16.76		0	
	23NE132_23NE131	36	244.20	0.0030	36.53	16.76		0	
	23NE133_23NE132	36	443.00	0.0030	36.53	16.76		0	
	24NW103_23NE133	24	117.00	0.0181	30.44	14.96		0	
	24NW01_24NW103	24	167.80	-0.0066	0.00	14.96	YES	21	$ 48,326
	24NW02_24NW01	20	144.70	0.0018	5.97	14.96	YES	24	$ 47,462
	24NW03_24NW02	20	186.20	0.0018	5.97	13.63	YES	24	$ 61,074
	24NW04_24NW03	20	180.40	0.0006	3.44	13.63	YES	33	$ 90,200
	24NW05_24NW04	20	149.60	0.0006	3.44	13.63	YES	33	$ 74,800
	24NW06_24NW05	20	160.40	0.0001	1.59	13.63	YES	48	$ 116,771
	24NW07_24NW06	20	149.60	0.0001	1.59	13.63	YES	48	$ 108,909
	24SW01_24NW07	20	130.80	0.0021	6.31	13.63	YES	24	$ 42,902
	24SW02_24SW01	20	411.70	0.0015	5.44	13.63	YES	24	$ 135,038
	24SW03_24SW02	20	401.11	0.0011	4.61	13.63	YES	27	$ 157,235
	24SW04_24SW03	20	398.60	0.0003	2.41	13.63	YES	36	$ 216,838
	24SW05_24SW04	20	126.50	0.0006	3.49	13.63	YES	30	$ 57,684
	24SW06_24SW05	18	283.60	0.0017	4.29	10.87	YES	24	$ 93,021
	24SW07_24SW06	18	408.50	0.0025	5.22	10.87	YES	21	$ 117,648

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	24SW08_24SW07	18	234.00	0.0021	4.80	10.87	YES	21	$ 67,392
	24SW09_24SW08	18	323.60	0.0020	4.71	9.47	YES	21	$ 93,197
	24SE27_24SW09	15	130.90	0.0009	1.94	9.47	YES	27	$ 51,313
	24SE28_24SE27	15	342.80	0.0011	2.12	9.47	YES	24	$ 112,438
	24SE78_24SE28	15	134.70	0.0017	2.66	9.47	YES	24	$ 44,182
	24SE01_24SE78	15	102.40	0.0040	4.09	9.47	YES	18	$ 25,395
	24SE02_24SE01	8	203.00	0.0040	0.76	7.50	YES	21	$ 58,464
	24SE03_24SE02	8	273.00	0.0040	0.76	7.50	YES	21	$ 78,624
	24SE04_24SE03	8	197.00	0.0040	0.76	7.50	YES	21	$ 56,736
	24SE05_24SE04	8	304.00	0.0040	0.76	7.50	YES	21	$ 87,552
	24SE06_24SE05	8	163.00	0.0040	0.76	7.50	YES	21	$ 46,944
	24SE07_24SE06	8	376.00	0.0060	0.94	7.50	YES	18	$ 93,248
	25NE03_24SE07	8	216.40	0.0040	0.76	6.67	YES	18	$ 53,667
	25NE04_25NE03	8	34.90	0.0172	1.58	6.67	YES	15	$ 8,097
	25NE05_25NE04	8	210.00	0.0062	0.95	6.01	YES	15	$ 48,720
	25NE06_25NE05	8	85.00	0.0198	1.70	6.01	YES	12	$ 18,360
	25NE07_25NE06	8	26.00	0.0055	0.90	6.01	YES	18	$ 6,448
	25NE08_25NE07	8	113.00	0.0077	1.06	6.01	YES	15	$ 26,216
	25NE09_25NE08	8	158.00	0.0081	1.09	4.70	YES	15	$ 36,656
	25NE10_25NE09	8	400.00	0.0049	0.85	1.31	YES	8	$ 64,000
	25NE11_25NE10	8	400.00	0.0052	0.87	1.31	YES	8	$ 64,000
	25NE22_25NE11	8	353.00	0.0052	0.87	1.31	YES	8	$ 56,480
	25NE23_25NE22	8	395.00	0.0052	0.87	1.31	YES	8	$ 63,200
	25NE47_25NE23	10	214.60	0.0024	1.07	0.66		0	
	25NE48_25NE47	10	376.50	0.0032	1.24	0.66		0	
	25NE49_25NE48	10	276.80	0.0028	1.16	0.66		0	
	25NE50_25NE49	10	178.20	0.0031	1.22	0.66		0	
North Line D									
	24NW45_23NE129	8	138.30	-0.0034	0.00	4.57	YES	0	
	24NW46_24NW45	8	224.30	0.0035	0.71	4.57	YES	18	$ 55,626

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	24NW47_24NW46	8	339.90	0.0041	0.77	4.57	YES	15	$ 78,857
North Line E									
	24SE08_24SE07	8	55.00	0.006	0.94	0.83		0	
	24SE09_24SE08	8	139.00	0.0055	0.90	0.83		0	
	24SE10_24SE09	8	95.70	0.006	0.94	0.83		0	
	24SE11_24SE10	8	400.00	0.006	0.94	0.83		0	
	24SE12_24SE11	8	275.00	0.005	0.85	0.83		0	
	24SE13_24SE12	8	275.00	0.0049	0.85	0.83		0	
	24SE14_24SE13	8	296.90	0.0059	0.93	0.83		0	
	24SE77_24SE14	8	177.00	0.0053	0.88	0.83		0	
	19SW04_24SE77	8	148.50	0.0046	0.82	0.83	YES	8	
	19SW05_19SW04	8	162.60	0.006	0.94	0.83		0	
	19SW07_19SW05	8	69.50	0.006	0.94	0.83		0	
South Line A									
	36SW01_SOUTH	24	40.00	0.0040	14.31	11.75		0	
	36SW02_36SW01	24	79.00	0.0040	14.31	11.48		0	
	36SW03_36SW02	24	85.00	0.0040	14.31	11.48		0	
	36SW04_36SW03	24	423.90	0.0020	10.12	11.48	YES	0	
	36SW05_36SW04	21	319.30	0.0077	13.90	11.37		0	
	36SW06_36SW05	21	307.90	0.0030	8.68	11.37	YES	0	
	36SW07_36SW06	21	203.80	0.0011	5.26	11.37	YES	0	
	36SW08_36SW07	21	272.30	0.0011	5.26	11.37	YES	0	
	36SW20_36SW08	15	30.00	0.0230	9.80	5.92		0	
	36SW21_36SW20	15	338.20	0.0067	5.29	5.92	YES	0	
	36SW22_36SW21	15	125.30	0.0025	3.23	5.92	YES	15	$ 29,070
	36SW23_36SW22	15	179.00	0.0025	3.23	5.92	YES	15	$ 41,528
	36NW52_36SW23	15	300.00	0.0025	3.23	5.92	YES	15	$ 69,600
	36NW68_36NW52	12	357.60	0.0064	2.85	3.56	YES	8	$ 57,216
	36NW69_36NW68	12	350.00	0.0036	2.14	3.56	YES	12	$ 75,600

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36NW70_36NW69	12	360.50	0.0036	2.14	3.56	YES	12	$ 77,868
	36NW71_36NW70	12	163.00	0.0136	4.15	3.14		0	
	36NW72_36NW71	12	235.50	0.0168	4.62	3.14		0	
	36NW73_36NW72	12	91.00	0.0172	4.67	3.14		0	
	36NW74_36NW73	12	329.50	0.0060	2.76	3.14	YES	8	
	36NW75_36NW74	12	348.00	0.0084	3.27	3.14		0	
	36NW76_36NW75	12	379.50	0.0092	3.42	3.14		0	
	36NW77_36NW76	12	350.00	0.0025	1.78	2.73	YES	10	$ 70,000
	36NW78_36NW77	12	339.30	0.0025	1.78	2.73	YES	10	$ 67,860
	36NW79_36NW78	12	141.00	0.0025	1.78	2.73	YES	10	$ 28,200
	36NW80_36NW79	12	144.70	0.0025	1.78	2.73	YES	10	$ 28,940
	25SW63_36NW80	12	385.70	0.0025	1.78	2.73	YES	10	$ 77,140
	25SE02_25SW63	12	245.50	0.0025	1.78	2.31	YES	8	$ 39,280
	25SE03_25SE02	12	129.10	0.0025	1.78	2.31	YES	8	$ 20,656
	25SE04_25SE03	12	240.40	0.0128	4.03	1.89		0	
	25SE05_25SE04	12	283.70	0.0180	4.78	1.89		0	
	25SE06A_25SE05	12	112.00	0.0200	5.04	1.89		0	
	25SE06_25SE06A	12	15.50	0.0200	5.04	0.00		0	
South Line B									
	36NW53_36NW52	10	217.00	0.0032	1.24	1.23		0	
	36NW54_36NW53	10	156.00	0.0032	1.24	1.23		0	
	36NW55_36NW54	10	346.00	0.0032	1.24	1.23		0	
	36NW56_36NW55	10	281.00	0.0032	1.24	1.23		0	
	36NW57_36NW56	10	133.70	0.0032	1.24	1.23		0	
South Line C									
	36SW09_36SW08	18	220.50	0.0019	4.58	5.03	YES	0	
	36SW10_36SW09	18	351.10	0.0019	4.58	5.03	YES	0	
	36SW11_36SW10	18	344.00	0.0019	4.58	5.03	YES	0	
	36SW12_36SW11	18	356.70	0.0019	4.58	5.03	YES	0	
	36SW16_36SW12	8	214.10	0.0050	0.85	1.41	YES	8	$ 34,256

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36SW17_36SW16	8	352.20	0.0050	0.85	1.41	YES	8	$ 56,352
	36SW18_36SW17	8	263.50	0.0050	0.85	1.41	YES	8	$ 42,160
	35SE01_36SW18	8	100.00	0.0050	0.85	1.41	YES	8	$ 16,000
South Line D									
	36SW13_36SW12	15	289.20	0.0160	8.17	3.11		0	
	36SW14_36SW13	15	276.00	0.0034	3.77	3.11		0	
	36NW48A_36SW14	15	365.00	0.0034	3.77	3.11		0	
	36NW48_36NW48A	15	313.36	0.0027	3.36	3.11		0	
	36NW49_36NW48	15	339.40	0.0027	3.36	3.11		0	
	36NW50_36NW49	15	275.30	0.0022	3.03	3.11	YES	0	
	36NW51_36NW50	15	225.30	0.0022	3.03	3.11	YES	0	
	35NE03_36NW51	10	312.70	0.0030	1.20	1.08		0	
	35NE04_35NE03	10	213.70	0.0028	1.16	1.08		0	
	35NE05_35NE04	10	297.60	0.0028	1.16	1.08		0	
	35NE06_35NE05	10	213.00	0.0028	1.16	1.08		0	
	35NE07_35NE06	10	187.50	0.0028	1.16	1.08		0	
	35NE08_35NE07	10	277.90	0.0028	1.16	0.62		0	
	35NE09_35NE08	10	375.00	0.0028	1.16	0.15		0	
	35NE36_35NE09	10	213.10	0.0028	1.16	0.15		0	
	35NE10_35NE36	10	158.00	0.0028	1.16	0.15		0	
	35NE11_35NE10	10	212.00	0.0030	1.20	0.15		0	
South Line E									
	36NW01_36NW50	12	23.60	0.0047	2.44	1.56		0	
	36NW10_36NW01	12	31.00	0.0470	7.72	1.56		0	
	36NW11_36NW10	12	167.60	0.0057	2.69	1.56		0	
	36NW12_36NW11	12	65.90	0.0102	3.60	1.56		0	
	36NW13_36NW12	12	105.90	0.0052	2.57	1.56		0	
	36NW14_36NW13	12	214.40	0.0051	2.54	1.56		0	
	36NW15_36NW14	12	297.30	0.0039	2.22	1.56		0	
	36NW16_36NW15	12	71.10	0.0048	2.47	1.56		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36NW17_36NW16	12	206.00	0.0032	2.02	1.56		0	
	36NW18_36NW17	12	400.00	0.0039	2.22	1.56		0	
	36NW19_36NW18	12	35.80	0.0059	2.74	1.56		0	
	36NW20_36NW19	12	126.10	0.0053	2.59	1.56		0	
Walmart Line A									
	30NE64_30NE61/ Walmart	18	89.10	0.0035	6.21	4.08		0	
	30NE65_30NE64	18	238.20	0.0012	3.64	4.08	YES	0	
	30NE66_30NE65	18	58.90	0.0044	6.97	4.08		0	
	30NE67_30NE66	18	95.40	0.0016	4.20	4.08		0	
	30NE68_30NE67	18	258.50	0.0015	4.07	4.08	YES	0	
	30NE69_30NE68	18	61.30	0.0007	2.78	4.08	YES	15	$ 14,222
	30NE70_30NE69	18	12.70	0.0024	5.15	4.08		0	
	30NE42_30NE70	15	331.78	0.0048	4.48	3.98		0	
	29NW01_30NE42	15	360.00	0.0044	4.28	3.98		0	
Walmart Line B									
	30NE62_30NE61/ Walmart	12	36.70	0.0147	4.32	1.06		0	
	30NE63_30NE62	12	396.70	0.0236	5.47	1.06		0	
	30NE01_30NE63	12	120.00	-0.0032	0.00	1.06	YES	0	
WWTP Line A									
	15NW01_WWTP	30	376.50	0.0045	27.52	64.30	YES	36	$ 204,816
	15NW02_15NW01	30	479.70	0.0045	27.52	64.30	YES	36	$ 260,957
	15NW03_15NW02	15	235.90	0.0263	10.48	1.93		0	
	15NW04_15NW03	15	187.90	0.0114	6.90	1.93		0	
	15NW05_15NW04	15	241.00	0.0091	6.16	1.93		0	
	15NW06_15NW05	15	194.20	0.0105	6.62	1.66		0	
	15NW07_15NW06	15	228.50	0.0095	6.30	1.66		0	
	15NW08_15NW07	15	350.30	0.0104	6.59	1.66		0	
	15NW09_15NW08	15	191.90	0.0097	6.36	1.39		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	15NW10_15NW09	15	173.40	0.0086	5.99	1.39		0	
	15NW11_15NW10	15	162.30	0.0094	6.26	1.39		0	
	15NW12_15NW11	15	288.70	0.0087	6.03	1.39		0	
	15SW01_15NW12	15	256.50	0.0094	6.26	1.39		0	
	15SW02_15SW01	15	223.50	0.0041	4.14	1.39		0	
	15SW03_15SW02	15	161.40	0.0065	5.21	1.39		0	
	15SW04_15SW03	12	131.40	0.0048	2.47	1.12		0	
	15SW05_15SW04	12	80.40	0.0040	2.25	1.12		0	
	15SW06_15SW05	12	183.00	0.0039	2.22	1.12		0	
	15SW07_15SW06	12	248.40	0.0045	2.39	1.12		0	
	15SW08_15SW07	12	202.30	0.0037	2.17	1.12		0	
	15SW09_15SW08	12	319.30	0.0033	2.05	1.12		0	
WWTP Line B									
	15NE01_15NW02	30	500.00	0.0045	27.52	59.45	YES	33	$ 250,000
	15NE02_15NE01	30	301.10	0.0039	25.62	59.45	YES	36	$ 163,798
	15NE03_15NE02	30	161.40	0.0048	28.42	59.45	YES	33	$ 80,700
	15NE04_15NE03	30	302.30	0.0044	27.21	59.45	YES	33	$ 151,150
	15NE05_15NE04	30	148.40	0.0019	17.88	59.45	YES	42	$ 94,976
	15NE06_15NE05	30	209.80	0.0023	19.67	58.25	YES	42	$ 134,272
	15NE07_15NE06	30	302.50	0.0019	17.88	58.25	YES	42	$ 193,600
	15SE01_15NE07	30	257.00	0.0028	21.70	58.25	YES	42	$ 164,480
	15SE02_15SE01	30	356.60	0.0025	20.51	58.25	YES	42	$ 228,224
	15SE03_15SE02	27	500.00	0.0069	25.73	57.05	YES	30	$ 228,000
	15SE04_15SE03	27	274.10	0.0044	20.54	57.05	YES	36	$ 149,110
	15SE05_15SE04	27	422.30	0.0019	13.50	57.05	YES	42	$ 270,272
	15SE06_15SE05	27	977.71	0.0023	14.85	57.05	YES	42	$ 625,734
	15SE07_15SE06	27	405.80	0.0019	13.50	57.05	YES	42	$ 259,712
	15SE08_15SE07	27	180.50	0.0028	16.39	57.05	YES	42	$ 115,520
	15SE09_15SE08	27	360.00	0.0039	19.34	57.05	YES	36	$ 195,840
	15SE10_15SE09	27	290.10	0.0031	17.24	57.05	YES	42	$ 185,664

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	15SE14_15SE10	21	210.30	0.0093	15.28	14.59		0	
	22NE03_15SE14	21	205.60	0.0055	11.75	12.82	YES	0	
	22NE04_22NE03	21	127.40	0.0050	11.20	12.82	YES	0	
	22NE05_22NE04	21	317.60	0.0034	9.24	12.82	YES	15	$ 73,683
	22NE06_22NE05	21	308.90	0.0049	11.09	12.82	YES	0	
	22NE07_22NE06	21	176.20	NEG. SLOPE	0.00	12.82	YES	24	$ 57,794
	22NE08_22NE07	21	190.60	0.0037	9.64	12.82	YES	15	$ 44,219
	22NE09_22NE08	21	275.60	0.0036	9.51	12.82	YES	15	$ 63,939
	22NE15_22NE09	21	194.40	0.0042	10.27	12.82	YES	15	$ 45,101
	22NE10_22NE15	21	79.60	0.0042	10.27	11.58	YES	0	
	22NE11_22NE10	21	275.40	0.0038	9.77	6.45		0	
	22NE12_22NE11	21	260.80	0.0035	9.37	6.45		0	
	22NE13_22NE12	21	262.40	0.0032	8.96	6.45		0	
	22NE14_22NE13	21	310.10	0.0034	9.24	6.45		0	
	22SE76_22NE14	21	353.00	0.0030	8.68	6.43		0	
	22SE77_22SE76	21	318.70	0.0031	8.82	6.43		0	
	22SE78_22SE77	21	318.70	0.0035	9.37	6.43		0	
	22SE79_22SE78	18	275.10	0.0040	6.64	6.40		0	
	22SE80_22SE79	12	284.90	0.0037	2.17	4.56	YES	15	$ 66,097
	22SE81_22SE80	12	275.90	0.0036	2.14	4.56	YES	15	$ 64,009
	22SE82_22SE81	12	246.10	0.0034	2.08	4.56	YES	15	$ 57,095
	22SW01_22SE82	12	246.10	0.0035	2.11	4.56	YES	15	$ 57,095
	22SW70_22SW01	10	118.80	0.0037	1.33	2.03	YES	8	$ 19,008
	22SW02_22SW70	10	243.60	0.0037	1.33	1.83	YES	8	$ 38,976
	22SW03_22SW02	10	153.70	0.0027	1.14	1.83	YES	10	$ 30,740
	22SW04_22SW03	10	131.40	0.0038	1.35	1.83	YES	8	$ 21,024
	22SW05_22SW04	10	400.00	0.0033	1.26	1.83	YES	8	$ 64,000
WWTP Line C									
	15SE11_15SE10	15	387.10	0.0094	6.26	1.77		0	
	15SE28_15SE11	15	149.60	0.0097	6.36	1.77		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	15SE12_15SE28	15	227.90	0.0097	6.36	1.77		0	
	15SE13_15SE12	15	356.40	0.0067	5.29	1.77		0	
	22NE01_15SE13	15	270.00	0.0061	5.05	1.77		0	
	22NE02_22NE01	15	270.00	0.0066	5.25	1.77		0	
	23NW01_22NE02	15	227.80	0.0065	5.21	1.77		0	
	23NW16_23NW01	15	207.50	0.0065	5.21	1.77		0	
	23NW02_23NW16	15	280.80	0.0065	5.21	1.77		0	
	23NW37_23NW02	15	270.00	0.0135	7.51	1.77		0	
	23NW03_23NW37	15	116.40	0.0135	7.51	1.77		0	
	23NW04_23NW03	18	424.10	0.0043	6.89	1.77		0	
	23NW05_23NW04	18	257.60	0.0043	6.89	1.77		0	
	23NW06_23NW05	15	345.00	0.0053	4.70	1.77		0	
	23NW07_23NW06	15	276.80	0.0053	4.70	1.77		0	
	23NW08_23NW07	15	391.60	0.0053	4.70	1.77		0	
	23NW09_23NW08	15	235.70	0.0103	6.56	1.77		0	
	23NW10_23NW09	15	433.60	0.0103	6.56	1.77		0	
	23NW11_23NW10	15	299.50	0.0052	4.66	1.77		0	
WWTP Line D									
	22NE16_22NE15	15	369.40	0.0020	2.89	5.13	YES	15	$ 85,701
	22NE17_22NE16	15	124.40	0.0020	2.89	5.13	YES	15	$ 28,861
	22NE18_22NE17	15	137.60	0.0020	2.89	3.59	YES	10	$ 27,520
	22NE19_22NE18	15	189.60	0.0020	2.89	3.59	YES	10	$ 37,920
	22NE20_22NE19	15	181.10	0.0020	2.89	3.59	YES	10	$ 36,220
	22NE21_22NE20	15	158.80	0.0020	2.89	3.59	YES	10	$ 31,760
	22NE46_22NE21	15	165.20	0.0035	3.82	3.59		0	
	22NE47_22NE46	15	270.60	0.0013	2.33	3.59	YES	12	$ 58,450
	22NE52_22NE47	15	253.20	0.0016	2.58	3.59	YES	12	$ 54,691
	22SE97_22NE52	15	100.20	0.0029	3.48	3.59	YES	8	
	22SE98_22SE97	15	400.00	0.0030	3.54	3.59	YES	8	
	22SE99_22SE98	15	270.80	0.0030	3.54	1.54		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 3

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	22SE100_22SE99	15	240.20	0.0030	3.54	1.54		0	
	22SE101_22SE100	15	136.90	0.0029	3.48	1.54		0	
	23SW54_22SE101	15	98.20	0.0029	3.48	1.54		0	
	23SW53_23SW54	15	255.90	0.0028	3.42	1.54		0	
	23SW52_23SW53	15	16.80	0.0030	3.54	1.54		0	
	23SW06_23SW52	10	10.00	0.0400	4.38	1.54		0	
	23SW07_23SW06	10	224.40	0.0056	1.64	1.54		0	
	23SW08_23SW07	10	223.90	0.0072	1.86	1.54		0	
	23SW20_23SW08	8	257.40	0.0109	1.26	0.51		0	
	23SW21_23SW20	8	215.80	0.0076	1.05	0.51		0	
	23SW22_23SW21	8	275.90	0.0081	1.09	0.51		0	
	23SW23_23SW22	8	295.80	0.0081	1.09	0.51		0	
	23SW24_23SW23	8	237.40	0.0074	1.04	0.51		0	
	23SW25_23SW24	8	296.20	0.0093	1.17	0.51		0	
Bull Creek Line A									
	26NW01_Bull Creek	12	365.00	0.0022	1.67	1.06		0	
	26NW02_26NW01	12	365.80	0.0022	1.67	1.06		0	
	26NW03_26NW02	12	303.30	0.0024	1.75	1.06		0	
	26NW04_26NW03	12	350.00	0.0024	1.75	1.06		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
East Line A									
	30SE06_EAST	21	32.50	0.0100	15.85	3.96		0	
	30SW01A_30SE06	18	78.20	0.0100	10.50	3.96		0	
	30NW105_30SW01A	12	367.30	0.0036	2.14	3.96	YES	12	$ 79,337
	30NW01_30NW105	12	37.70	0.0036	2.14	2.64	YES	12	$ 8,143
	30NW104_30NW01	10	193.40	0.0033	1.26	2.11	YES	10	$ 38,680
	30NW92_30NW104	10	27.00	0.0033	1.26	2.11	YES	10	$ 5,400
	30NW02_30NW92	10	160.40	0.0033	1.26	2.11	YES	10	$ 32,080
	30NW103_30NW02	10	36.60	0.0035	1.30	2.11	YES	10	$ 7,320
	30NW03_30NW103	10	220.40	0.0035	1.30	2.11	YES	10	$ 44,080
	30NW04_30NW03	10	122.20	0.0035	1.30	1.58	YES	8	$ 19,552
	30NW102_30NW04	10	113.80	0.0035	1.30	1.58	YES	8	$ 18,208
	30NW05_30NW102	10	68.60	0.0035	1.30	1.58	YES	8	$ 10,976
	30NW06_30NW05	10	109.90	0.0035	1.30	1.58	YES	8	$ 17,584
	30NW07_30NW06	10	56.10	0.0035	1.30	1.58	YES	8	$ 8,976
	30NW08_30NW07	10	39.00	0.0035	1.30	1.58	YES	8	$ 6,240
	30NW09_30NW08	10	319.70	0.0032	1.24	1.58	YES	8	$ 51,152
	30NW10_30NW09	10	211.40	0.0026	1.12	1.05		0	
	30NW11_30NW10	10	105.20	0.0026	1.12	1.05		0	
	30NW12_30NW11	10	118.00	0.0035	1.30	1.05		0	
	30NW13_30NW12	10	37.30	0.0035	1.30	1.05		0	
	30NW14_30NW13	10	347.20	0.0025	1.10	1.05		0	
	30NW15_30NW14	10	381.00	0.0021	1.00	0.53		0	
	30NW15A_30NW15	10	211.40	0.0025	1.10	0.53		0	
	30NW16_30NW15A	10	163.60	0.0025	1.10	0.53		0	
	30NW17_30NW16	10	374.50	0.0033	1.26	0.53		0	
	30NW18_30NW17	10	374.00	0.0019	0.96	0.53		0	
	30NW19_30NW18	10	374.00	0.0025	1.10	0.53		0	
	30NW20_30NW19	10	373.00	0.0025	1.10	0.53		0	
	25NE33_30NW20	10	373.00	0.0028	1.16	0.53		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
East Line B									
	30NE73_30SE06	21	60.00	0.0010	5.01	0.28		0	
	30NE74_30NE73	21	214.70	0.0012	5.49	0.28		0	
	30NE75_30NE74	21	304.60	0.0010	5.01	0.14		0	
	30NE76_30NE75	21	230.00	0.0015	6.14	0.14		0	
	30NE77_30NE76	21	152.90	0.0010	5.01	0.14		0	
	30NE78_30NE77	21	100.50	0.0021	7.26	0.14		0	
East Line C									
	30SW04_30SW01A	10	103.60	0.0082	1.98	1.32		0	
	30SW32_30SW04	8	125.10	0.0116	1.30	0.09		0	
	30SW33_30SW32	8	193.60	0.0105	1.24	0.09		0	
	30SW34_30SW33	8	293.00	0.0160	1.53	0.09		0	
	30SW43_30SW34	8	213.40	0.0158	1.52	0.04		0	
	30SW44_30SW43	8	124.90	0.0168	1.57	0.04		0	
	30SW45_30SW44	8	280.00	0.0080	1.08	0.04		0	
	30SW46_30SW45	8	311.30	0.0080	1.08	0.04		0	
Genesis Line A									
	24NW50_GENESIS	15	135.80	0.0030	3.54	3.33		0	
	24NW51_24NW50	15	221.90	0.0030	3.54	3.33		0	
	13SW08_24NW51	12	143.10	0.0092	3.42	2.03		0	
	13SW09_13SW08	12	233.50	0.0072	3.02	2.03		0	
	13SE01_13SW09	12	160.20	0.0056	2.67	2.03		0	
	13SE02_13SE01	12	304.60	0.0041	2.28	2.03		0	
	13SE03_13SE02	12	79.40	0.0035	2.11	0.74		0	
	13SE04_13SE03	12	278.40	0.0035	2.11	0.74		0	
	13SE05_13SE04	12	222.60	0.0027	1.85	0.74		0	
	13SE06_13SE05	12	115.20	0.0028	1.89	0.74		0	
	13SE07_13SE06	12	141.40	0.0025	1.78	0.74		0	
	13SE08_13SE07	12	285.40	0.0026	1.82	0.74		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	13SE09_13SE08	10	40.20	0.0030	1.20	0.74		0	
	13SE10_13SE09	10	302.10	0.0028	1.16	0.28		0	
	13SE11_13SE10	10	302.90	0.0029	1.18	0.28		0	
	13SE12_13SE11	10	227.60	0.0029	1.18	0.28		0	
	13SE13_13SE12	10	259.80	0.0025	1.10	0.28		0	
Kill Creek Line A									
	9NE01_Kill Creek	24	215.40	0.0040	14.31	3.94		0	
	9NE02_9NE01	24	305.30	0.0040	14.31	3.94		0	
	9NE03_9NE02	21	305.30	0.0100	15.85	3.78		0	
	9NE04_9NE03	21	305.30	0.0070	13.26	3.78		0	
	9NE05_9NE04	18	231.60	0.0140	12.43	3.25		0	
	9NE06_9NE05	18	231.60	0.0140	12.43	3.25		0	
	9NE07_9NE06	18	237.70	0.0120	11.51	3.25		0	
	9NE08_9NE07	18	237.70	0.0120	11.51	3.25		0	
	9NE10_9NE08	12	292.20	0.0140	4.22	1.05		0	
	9NE11_9NE10	12	292.20	0.0140	4.22	1.05		0	
	9SE10_9NE11	10	377.10	0.0200	3.10	0.67		0	
	9SE11_9SE10	10	377.10	0.0220	3.25	0.67		0	
Kill Creek Line B									
	9NE09_9NE08	18	388.20	0.0180	14.09	1.93		0	
	9SE01_9NE09	18	388.20	0.0220	15.58	1.93		0	
	9SE02_9SE01	18	388.20	0.0160	13.29	1.93		0	
	9SE03_9SE02	18	289.90	0.0060	8.14	1.93		0	
	9SE04_9SE03	18	255.10	0.0060	8.14	1.93		0	
	9SE05_9SE04	18	255.10	0.0060	8.14	1.93		0	
	9SE06_9SE05	18	370.20	0.0060	8.14	1.93		0	
	9SE07_9SE06	18	370.20	0.0060	8.14	1.93		0	
	9SE08_9SE07	18	349.80	0.0080	9.40	1.93		0	
	9SE09_9SE08	18	308.80	0.0080	9.40	1.93		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
Kill Creek Line C									
	10NW01_Kill Creek	21	23.40	0.0070	13.26	12.11		0	
	10NW02_10NW01	21	379.20	0.0070	13.26	12.11		0	
	10NW03_10NW02	21	379.20	0.0070	13.26	12.11		0	
	10NW04_10NW03	21	379.20	0.0070	13.26	12.11		0	
	10NW05_10NW04	21	366.10	0.0070	13.26	12.11		0	
	10NW06_10NW05	21	204.40	0.0070	13.26	0.28		0	
	10NW07_10NW06	21	263.40	0.0070	13.26	0.28		0	
	10NW08_10NW07	21	263.40	0.0070	13.26	0.28		0	
	10NW09_10NW08	21	260.30	0.0040	10.02	0.28		0	
	10NW10_10NW09	21	260.30	0.0040	10.02	0.28		0	
	10NW11_10NW10	21	381.20	0.0040	10.02	0.28		0	
	10SW01_10NW11	21	381.20	0.0040	10.02	0.28		0	
	10SW02_10SW01	21	381.20	0.0040	10.02	0.28		0	
	10SW03_10SW02	21	381.20	0.0040	10.02	0.28		0	
	10SW04_10SW03	21	213.00	0.0040	10.02	0.28		0	
	10SW05_10SW04	12	213.00	0.0040	2.25	0.26		0	
	10SW06_10SW05	12	313.70	0.0060	2.76	0.26		0	
	10SW07_10SW06	10	317.50	0.0080	1.96	0.10		0	
	10SW08_10SW07	10	317.50	0.0080	1.96	0.10		0	
New Bull Creek Line A									
	26NE54_26NE55/ New Bull Creek	21	367.60	0.0010	5.01	0.33		0	
	26NW21_26NE54	21	17.00	0.0010	5.01	0.33		0	
	26NW22_26NW21	21	314.40	0.0010	5.01	0.33		0	
	26NW23_26NW22	21	264.30	0.0010	5.01	0.33		0	
	26NW24_26NW23	21	133.40	0.0010	5.01	0.33		0	
	26NW25_26NW24	18	114.90	0.0014	3.93	0.10		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	26NW26_26NW25	18	405.40	0.0014	3.93	0.10		0	
	23SW01_26NW26	18	117.20	0.0014	3.93	0.10		0	
	23SW02_23SW01	18	400.00	0.0014	3.93	0.10		0	
	23SW03_23SW02	18	400.80	0.0014	3.93	0.10		0	
	23SW04_23SW03	18	248.00	0.0014	3.93	0.10		0	
	23SW05_23SW04	18	15.62	0.0014	3.93	0.00		0	
	23SE36_23SW05	8	144.00	0.0047	0.83	0.00		0	
	23SE39_23SE36	8	110.00	0.0064	0.97	0.00		0	
New Bull Creek Line B									
	26NE56_26NE55/ New Bull Creek	24	114.40	0.0020	10.12	4.93		0	
	26NE01_26NE56	24	184.26	0.0001	2.36	2.81	YES	15	$ 42,748
	26NE02_26NE01	10	188.68	0.0004	0.45	1.43	YES	15	$ 43,774
	26NE03_26NE02	10	134.00	0.0020	0.98	1.43	YES	8	$ 21,440
	26NE04_26NE03	10	303.00	0.0020	0.98	1.43	YES	8	$ 48,480
	26NE05_26NE04	10	386.00	0.0020	0.98	1.43	YES	8	$ 61,760
	23SE01_26NE05	10	370.00	0.0020	0.98	0.66		0	
	23SE02_23SE01	10	25.00	0.0020	0.98	0.66		0	
	23SE03_23SE02	10	295.00	0.0020	0.98	0.66		0	
	23SE04_23SE03	10	144.00	0.0020	0.98	0.66		0	
	23SE05_23SE04	10	143.00	0.0020	0.98	0.66		0	
	23SE06_23SE05	10	390.00	0.0020	0.98	0.66		0	
	23SE07_23SE06	10	388.00	0.0020	0.98	0.66		0	
	23SE08_23SE07	10	391.00	0.0020	0.98	0.66		0	
	24SW64_23SE08	10	381.00	0.0020	0.98	0.66		0	
	25NW14_24SW64	10	351.00	0.0020	0.98	0.00		0	
New Bull Creek Line C									
	26NE57_26NE56	24	248.30	0.0020	10.12	2.11		0	
	26NE58_26NE57	24	217.10	0.0020	10.12	2.11		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	26NE59_26NE58	24	405.30	0.0020	10.12	2.11		0	
	26NE60_26NE59	24	325.20	0.0130	25.79	2.11		0	
	26NE61_26NE60	24	268.60	0.0128	25.59	2.11		0	
	26NE62_26NE61	24	214.00	0.0040	14.31	2.11		0	
	26SE93_26NE62	24	62.70	0.0040	14.31	2.11		0	
New Bull Creek Line C2									
	26NE34_26NE01	12	253.00	0.0022	1.67	0.62		0	
	26NE35_26NE34	12	221.90	0.0022	1.67	0.62		0	
	26NE47_26NE35	12	400.00	0.0022	1.67	0.62		0	
	26NE48_26NE47	12	325.10	0.0022	1.67	0.62		0	
	26NE49_26NE48	12	287.90	0.0022	1.67	0.62		0	
	26SE14_26NE49	12	222.10	0.0022	1.67	0.62		0	
	26SE15_26SE14	12	406.60	0.0022	1.67	0.50		0	
	26SE16_26SE15	12	393.40	0.0022	1.67	0.50		0	
	26SE17_26SE16	12	337.70	0.0022	1.67	0.50		0	
	26SE32_26SE17	12	120.00	0.0022	1.67	0.50		0	
	26SE33_26SE32	12	253.00	0.0022	1.67	0.50		0	
	26SE34_26SE33	12	179.70	0.0022	1.67	0.50		0	
	26SE35_26SE34	12	353.30	0.0022	1.67	0.50		0	
	26SE36_26SE35	12	406.20	0.0022	1.67	0.50		0	
	26SE37_26SE36	12	273.10	0.0022	1.67	0.50		0	
	26SE38_26SE37	10	212.50	0.0032	1.24	0.25		0	
	26SE42_26SE38	10	24.00	0.0030	1.20	0.25		0	
	26SE43_26SE42	10	276.00	0.0030	1.20	0.25		0	
	26SE44_26SE43	10	312.50	0.0030	1.20	0.25		0	
North Line A									
	13SW01_NORTH	36	23.60	0.0649	169.92	27.18		0	
	13SW10_13SW01	10	77.60	0.0492	4.86	3.02		0	
	14SE01_13SW10	10	278.30	0.0028	1.16	3.02	YES	12	$ 60,113

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	14SE02_14SE01	10	106.10	0.0028	1.16	3.02	YES	12	$ 22,918
	14SE03_14SE02	10	113.90	0.0300	3.79	3.02		0	
	14SE04_14SE03	10	71.00	0.0100	2.19	1.67		0	
	14SE05_14SE04	10	213.00	0.0500	4.90	1.11		0	
	14SE06_14SE05	10	213.20	0.0028	1.16	1.11		0	
	14SE07_14SE06	10	379.70	0.0028	1.16	1.11		0	
	14SE08_14SE07	10	362.30	0.0028	1.16	1.11		0	
	14SE09_14SE08	10	161.80	0.0028	1.16	1.11		0	
	14SE10_14SE09	10	239.60	0.0028	1.16	1.11		0	
	14SE11_14SE10	10	70.00	0.0488	4.84	0.56		0	
	14SE12_14SE11	10	238.80	0.0100	2.19	0.56		0	
	14SE13_14SE12	10	365.00	0.0028	1.16	0.56		0	
	14SE14_14SE13	10	226.80	0.0028	1.16	0.56		0	
	14SE15_14SE14	10	218.00	0.0028	1.16	0.56		0	
	14SE16_14SE15	10	148.00	0.0076	1.91	0.56		0	
North Line B									
	13SW02_13SW01	36	227.10	0.0030	36.53	24.15		0	
	13SW03_13SW02	36	144.20	0.0030	36.53	24.15		0	
	13SW04_13SW03	36	124.90	0.0030	36.53	24.15		0	
	13SW05_13SW04	36	273.80	0.0030	36.53	24.15		0	
	13SW06_13SW05	36	320.20	0.0030	36.53	24.15		0	
	13SW07_13SW06	36	194.40	0.0030	36.53	24.15		0	
	24NW77_13SW07	36	146.80	0.0030	36.53	24.15		0	
	24NW83_24NW77	36	129.60	0.0030	36.53	24.15		0	
	24NW78_24NW83	36	124.30	0.0030	36.53	23.60		0	
	24NW79_24NW78	36	176.10	0.0195	93.14	23.60		0	
	24NW80_24NW79	36	197.10	0.0030	36.53	23.60		0	
	24NW81_24NW80	36	204.20	0.0030	36.53	23.60		0	
	23NE126_24NW81	36	354.40	0.0030	36.53	23.60		0	
	23NE127_23NE126	36	109.00	0.0030	36.53	23.60		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	23NE128_23NE127	36	166.30	0.0171	87.22	23.60		0	
	23NE09_23NE128	15	33.60	0.02	9.14	1.38		0	
	23NE13_23NE09	10	291.80	0.0072	1.86	1.38		0	
	23NE14_23NE13	8	122.80	0.0103	1.23	0.85		0	
	23NE15_23NE14	8	197.20	0.0101	1.21	0.85		0	
	23NE24_23NE15	8	198.20	0.0107	1.25	0.85		0	
	23NE25_23NE24	8	353.40	0.0082	1.09	0.85		0	
	23NE26_23NE25	8	354.00	0.0085	1.11	0.85		0	
	23NE27_23NE26	8	204.00	0.008	1.08	0.85		0	
North Line C									
	23NE129_23NE128	36	110.00	0.0030	36.53	22.17		0	
	23NE130_23NE129	36	235.40	0.0030	36.53	17.61		0	
	23NE131_23NE130	36	306.40	0.0030	36.53	17.61		0	
	23NE132_23NE131	36	244.20	0.0030	36.53	17.61		0	
	23NE133_23NE132	36	443.00	0.0030	36.53	17.61		0	
	24NW103_23NE133	24	117.00	0.0181	30.44	15.81		0	
	24NW01_24NW103	24	167.80	-0.0066	0.00	15.81	YES	21	$ 48,326
	24NW02_24NW01	20	144.70	0.0018	5.97	15.81	YES	27	$ 56,722
	24NW03_24NW02	20	186.20	0.0018	5.97	14.48	YES	24	$ 61,074
	24NW04_24NW03	20	180.40	0.0006	3.44	14.48	YES	33	$ 90,200
	24NW05_24NW04	20	149.60	0.0006	3.44	14.48	YES	33	$ 74,800
	24NW06_24NW05	20	160.40	0.0001	1.59	14.48	YES	48	$ 116,771
	24NW07_24NW06	20	149.60	0.0001	1.59	14.48	YES	48	$ 108,909
	24SW01_24NW07	20	130.80	0.0021	6.31	14.48	YES	24	$ 42,902
	24SW02_24SW01	20	411.70	0.0015	5.44	14.48	YES	27	$ 161,386
	24SW03_24SW02	20	401.11	0.0011	4.61	14.48	YES	27	$ 157,235
	24SW04_24SW03	20	398.60	0.0003	2.41	14.48	YES	42	$ 255,104
	24SW05_24SW04	20	126.50	0.0006	3.49	14.48	YES	33	$ 63,250
	24SW06_24SW05	18	283.60	0.0017	4.29	11.72	YES	24	$ 93,021
	24SW07_24SW06	18	408.50	0.0025	5.22	11.72	YES	21	$ 117,648

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	24SW08_24SW07	18	234.00	0.0021	4.80	11.72	YES	21	$ 67,392
	24SW09_24SW08	18	323.60	0.0020	4.71	10.32	YES	21	$ 93,197
	24SE27_24SW09	15	130.90	0.0009	1.94	10.32	YES	27	$ 51,313
	24SE28_24SE27	15	342.80	0.0011	2.12	10.32	YES	27	$ 134,378
	24SE78_24SE28	15	134.70	0.0017	2.66	10.32	YES	24	$ 44,182
	24SE01_24SE78	15	102.40	0.0040	4.09	10.32	YES	18	$ 25,395
	24SE02_24SE01	8	203.00	0.0040	0.76	8.35	YES	21	$ 58,464
	24SE03_24SE02	8	273.00	0.0040	0.76	8.35	YES	21	$ 78,624
	24SE04_24SE03	8	197.00	0.0040	0.76	8.35	YES	21	$ 56,736
	24SE05_24SE04	8	304.00	0.0040	0.76	8.35	YES	21	$ 87,552
	24SE06_24SE05	8	163.00	0.0040	0.76	8.35	YES	21	$ 46,944
	24SE07_24SE06	8	376.00	0.0060	0.94	8.35	YES	18	$ 93,248
	25NE03_24SE07	8	216.40	0.0040	0.76	7.52	YES	21	$ 62,323
	25NE04_25NE03	8	34.90	0.0172	1.58	7.52	YES	15	$ 8,097
	25NE05_25NE04	8	210.00	0.0062	0.95	6.86	YES	18	$ 52,080
	25NE06_25NE05	8	85.00	0.0198	1.70	6.86	YES	15	$ 19,720
	25NE07_25NE06	8	26.00	0.0055	0.90	6.86	YES	18	$ 6,448
	25NE08_25NE07	8	113.00	0.0077	1.06	6.86	YES	18	$ 28,024
	25NE09_25NE08	8	158.00	0.0081	1.09	5.55	YES	15	$ 36,656
	25NE10_25NE09	8	400.00	0.0049	0.85	1.31	YES	8	$ 64,000
	25NE11_25NE10	8	400.00	0.0052	0.87	1.31	YES	8	$ 64,000
	25NE22_25NE11	8	353.00	0.0052	0.87	1.31	YES	8	$ 56,480
	25NE23_25NE22	8	395.00	0.0052	0.87	1.31	YES	8	$ 63,200
	25NE47_25NE23	10	214.60	0.0024	1.07	0.66		0	
	25NE48_25NE47	10	376.50	0.0032	1.24	0.66		0	
	25NE49_25NE48	10	276.80	0.0028	1.16	0.66		0	
	25NE50_25NE49	10	178.20	0.0031	1.22	0.66		0	
North Line D									
	24NW45_23NE129	8	138.30	-0.0034	0.00	4.57	YES	0	
	24NW46_24NW45	8	224.30	0.0035	0.71	4.57	YES	18	$ 55,626

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	24NW47_24NW46	8	339.90	0.0041	0.77	4.57	YES	15	$ 78,857
North Line E									
	24SE08_24SE07	8	55.00	0.006	0.94	0.83		0	
	24SE09_24SE08	8	139.00	0.0055	0.90	0.83		0	
	24SE10_24SE09	8	95.70	0.006	0.94	0.83		0	
	24SE11_24SE10	8	400.00	0.006	0.94	0.83		0	
	24SE12_24SE11	8	275.00	0.005	0.85	0.83		0	
	24SE13_24SE12	8	275.00	0.0049	0.85	0.83		0	
	24SE14_24SE13	8	296.90	0.0059	0.93	0.83		0	
	24SE77_24SE14	8	177.00	0.0053	0.88	0.83		0	
	19SW04_24SE77	8	148.50	0.0046	0.82	0.83	YES	8	
	19SW05_19SW04	8	162.60	0.006	0.94	0.83		0	
	19SW07_19SW05	8	69.50	0.006	0.94	0.83		0	
South Line A									
	36SW01_SOUTH	24	40.00	0.0040	14.31	16.34	YES	0	
	36SW02_36SW01	24	79.00	0.0040	14.31	9.46		0	
	36SW03_36SW02	24	85.00	0.0040	14.31	9.46		0	
	36SW04_36SW03	24	423.90	0.0020	10.12	9.46		0	
	36SW05_36SW04	21	319.30	0.0077	13.90	9.36		0	
	36SW06_36SW05	21	307.90	0.0030	8.68	9.36	YES	0	
	36SW07_36SW06	21	203.80	0.0011	5.26	9.36	YES	21	$ 58,694
	36SW08_36SW07	21	272.30	0.0011	5.26	9.36	YES	21	$ 78,422
	36SW20_36SW08	15	30.00	0.0230	9.80	5.31		0	
	36SW21_36SW20	15	338.20	0.0067	5.29	5.31	YES	0	
	36SW22_36SW21	15	125.30	0.0025	3.23	5.31	YES	15	$ 29,070
	36SW23_36SW22	15	179.00	0.0025	3.23	5.31	YES	15	$ 41,528
	36NW52_36SW23	15	300.00	0.0025	3.23	5.31	YES	15	$ 69,600
	36NW68_36NW52	12	357.60	0.0064	2.85	2.95	YES	0	
	36NW69_36NW68	12	350.00	0.0036	2.14	2.95	YES	10	$ 70,000

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36NW70_36NW69	12	360.50	0.0036	2.14	2.95	YES	10	$ 72,100
	36NW71_36NW70	12	163.00	0.0136	4.15	2.53		0	
	36NW72_36NW71	12	235.50	0.0168	4.62	2.53		0	
	36NW73_36NW72	12	91.00	0.0172	4.67	2.53		0	
	36NW74_36NW73	12	329.50	0.0060	2.76	2.53		0	
	36NW75_36NW74	12	348.00	0.0084	3.27	2.53		0	
	36NW76_36NW75	12	379.50	0.0092	3.42	2.53		0	
	36NW77_36NW76	12	350.00	0.0025	1.78	2.11	YES	8	$ 56,000
	36NW78_36NW77	12	339.30	0.0025	1.78	2.11	YES	8	$ 54,288
	36NW79_36NW78	12	141.00	0.0025	1.78	2.11	YES	8	$ 22,560
	36NW80_36NW79	12	144.70	0.0025	1.78	2.11	YES	8	$ 23,152
	25SW63_36NW80	12	385.70	0.0025	1.78	2.11	YES	8	$ 61,712
	25SE02_25SW63	12	245.50	0.0025	1.78	1.69		0	
	25SE03_25SE02	12	129.10	0.0025	1.78	1.69		0	
	25SE04_25SE03	12	240.40	0.0128	4.03	1.28		0	
	25SE05_25SE04	12	283.70	0.0180	4.78	1.28		0	
	25SE06A_25SE05	12	112.00	0.0200	5.04	1.28		0	
	25SE06_25SE06A	12	15.50	0.0200	5.04	0.00		0	
South Line B									
	36NW53_36NW52	10	217.00	0.0032	1.24	1.23		0	
	36NW54_36NW53	10	156.00	0.0032	1.24	1.23		0	
	36NW55_36NW54	10	346.00	0.0032	1.24	1.23		0	
	36NW56_36NW55	10	281.00	0.0032	1.24	1.23		0	
	36NW57_36NW56	10	133.70	0.0032	1.24	1.23		0	
South Line C									
	36SW09_36SW08	18	220.50	0.0019	4.58	3.62		0	
	36SW10_36SW09	18	351.10	0.0019	4.58	3.62		0	
	36SW11_36SW10	18	344.00	0.0019	4.58	3.62		0	
	36SW12_36SW11	18	356.70	0.0019	4.58	3.62		0	
	36SW16_36SW12	8	214.10	0.0050	0.85	0.00		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36SW17_36SW16	8	352.20	0.0050	0.85	0.00		0	
	36SW18_36SW17	8	263.50	0.0050	0.85	0.00		0	
	35SE01_36SW18	8	100.00	0.0050	0.85	0.00		0	
South Line D									
	36SW13_36SW12	15	289.20	0.0160	8.17	3.11		0	
	36SW14_36SW13	15	276.00	0.0034	3.77	3.11		0	
	36NW48A_36SW14	15	365.00	0.0034	3.77	3.11		0	
	36NW48_36NW48A	15	313.36	0.0027	3.36	3.11		0	
	36NW49_36NW48	15	339.40	0.0027	3.36	3.11		0	
	36NW50_36NW49	15	275.30	0.0022	3.03	3.11	YES	0	
	36NW51_36NW50	15	225.30	0.0022	3.03	3.11	YES	0	
	35NE03_36NW51	10	312.70	0.0030	1.20	1.08		0	
	35NE04_35NE03	10	213.70	0.0028	1.16	1.08		0	
	35NE05_35NE04	10	297.60	0.0028	1.16	1.08		0	
	35NE06_35NE05	10	213.00	0.0028	1.16	1.08		0	
	35NE07_35NE06	10	187.50	0.0028	1.16	1.08		0	
	35NE08_35NE07	10	277.90	0.0028	1.16	0.62		0	
	35NE09_35NE08	10	375.00	0.0028	1.16	0.15		0	
	35NE36_35NE09	10	213.10	0.0028	1.16	0.15		0	
	35NE10_35NE36	10	158.00	0.0028	1.16	0.15		0	
	35NE11_35NE10	10	212.00	0.0030	1.20	0.15		0	
South Line E									
	36NW01_36NW50	12	23.60	0.0047	2.44	1.56		0	
	36NW10_36NW01	12	31.00	0.0470	7.72	1.56		0	
	36NW11_36NW10	12	167.60	0.0057	2.69	1.56		0	
	36NW12_36NW11	12	65.90	0.0102	3.60	1.56		0	
	36NW13_36NW12	12	105.90	0.0052	2.57	1.56		0	
	36NW14_36NW13	12	214.40	0.0051	2.54	1.56		0	
	36NW15_36NW14	12	297.30	0.0039	2.22	1.56		0	
	36NW16_36NW15	12	71.10	0.0048	2.47	1.56		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36NW17_36NW16	12	206.00	0.0032	2.02	1.56		0	
	36NW18_36NW17	12	400.00	0.0039	2.22	1.56		0	
	36NW19_36NW18	12	35.80	0.0059	2.74	1.56		0	
	36NW20_36NW19	12	126.10	0.0053	2.59	1.56		0	
Walmart Line A									
	30NE64_30NE61/ Walmart	18	89.10	0.0035	6.21	3.93		0	
	30NE65_30NE64	18	238.20	0.0012	3.64	3.93	YES	0	
	30NE66_30NE65	18	58.90	0.0044	6.97	3.93		0	
	30NE67_30NE66	18	95.40	0.0016	4.20	3.93		0	
	30NE68_30NE67	18	258.50	0.0015	4.07	3.93		0	
	30NE69_30NE68	18	61.30	0.0007	2.78	3.93	YES	0	
	30NE70_30NE69	18	12.70	0.0024	5.15	3.93		0	
	30NE42_30NE70	15	331.78	0.0048	4.48	3.83		0	
	29NW01_30NE42	15	360.00	0.0044	4.28	3.83		0	
Walmart Line B									
	30NE62_30NE61/ Walmart	12	36.70	0.0147	4.32	1.06		0	
	30NE63_30NE62	12	396.70	0.0236	5.47	1.06		0	
	30NE01_30NE63	12	120.00	-0.0032	0.00	1.06	YES	0	
WWTP Line A									
	15NW01_WWTP	30	376.50	0.0045	27.52	66.23	YES	36	$ 204,816
	15NW02_15NW01	30	479.70	0.0045	27.52	66.23	YES	36	$ 260,957
	15NW03_15NW02	15	235.90	0.0263	10.48	1.93		0	
	15NW04_15NW03	15	187.90	0.0114	6.90	1.93		0	
	15NW05_15NW04	15	241.00	0.0091	6.16	1.93		0	
	15NW06_15NW05	15	194.20	0.0105	6.62	1.66		0	
	15NW07_15NW06	15	228.50	0.0095	6.30	1.66		0	
	15NW08_15NW07	15	350.30	0.0104	6.59	1.66		0	
	15NW09_15NW08	15	191.90	0.0097	6.36	1.39		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	15NW10_15NW09	15	173.40	0.0086	5.99	1.39		0	
	15NW11_15NW10	15	162.30	0.0094	6.26	1.39		0	
	15NW12_15NW11	15	288.70	0.0087	6.03	1.39		0	
	15SW01_15NW12	15	256.50	0.0094	6.26	1.39		0	
	15SW02_15SW01	15	223.50	0.0041	4.14	1.39		0	
	15SW03_15SW02	15	161.40	0.0065	5.21	1.39		0	
	15SW04_15SW03	12	131.40	0.0048	2.47	1.12		0	
	15SW05_15SW04	12	80.40	0.0040	2.25	1.12		0	
	15SW06_15SW05	12	183.00	0.0039	2.22	1.12		0	
	15SW07_15SW06	12	248.40	0.0045	2.39	1.12		0	
	15SW08_15SW07	12	202.30	0.0037	2.17	1.12		0	
	15SW09_15SW08	12	319.30	0.0033	2.05	1.12		0	
WWTP Line B									
	15NE01_15NW02	30	500.00	0.0045	27.52	61.38	YES	33	$ 250,000
	15NE02_15NE01	30	301.10	0.0039	25.62	61.38	YES	36	$ 163,798
	15NE03_15NE02	30	161.40	0.0048	28.42	61.38	YES	33	$ 80,700
	15NE04_15NE03	30	302.30	0.0044	27.21	61.38	YES	33	$ 151,150
	15NE05_15NE04	30	148.40	0.0019	17.88	61.38	YES	42	$ 94,976
	15NE06_15NE05	30	209.80	0.0023	19.67	60.18	YES	42	$ 134,272
	15NE07_15NE06	30	302.50	0.0019	17.88	60.18	YES	42	$ 193,600
	15SE01_15NE07	30	257.00	0.0028	21.70	60.18	YES	42	$ 164,480
	15SE02_15SE01	30	356.60	0.0025	20.51	60.18	YES	42	$ 228,224
	15SE03_15SE02	27	500.00	0.0069	25.73	58.98	YES	30	$ 228,000
	15SE04_15SE03	27	274.10	0.0044	20.54	58.98	YES	36	$ 149,110
	15SE05_15SE04	27	422.30	0.0019	13.50	58.98	YES	48	$ 307,434
	15SE06_15SE05	27	977.71	0.0023	14.85	58.98	YES	42	$ 625,734
	15SE07_15SE06	27	405.80	0.0019	13.50	58.98	YES	48	$ 295,422
	15SE08_15SE07	27	180.50	0.0028	16.39	58.98	YES	42	$ 115,520
	15SE09_15SE08	27	360.00	0.0039	19.34	58.98	YES	36	$ 195,840
	15SE10_15SE09	27	290.10	0.0031	17.24	58.98	YES	42	$ 185,664

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	15SE14_15SE10	21	210.30	0.0093	15.28	14.59		0	
	22NE03_15SE14	21	205.60	0.0055	11.75	12.82	YES	0	
	22NE04_22NE03	21	127.40	0.0050	11.20	12.82	YES	0	
	22NE05_22NE04	21	317.60	0.0034	9.24	12.82	YES	15	$ 73,683
	22NE06_22NE05	21	308.90	0.0049	11.09	12.82	YES	0	
	22NE07_22NE06	21	176.20	NEG. SLOPE	0.00	12.82	YES	24	$ 57,794
	22NE08_22NE07	21	190.60	0.0037	9.64	12.82	YES	15	$ 44,219
	22NE09_22NE08	21	275.60	0.0036	9.51	12.82	YES	15	$ 63,939
	22NE15_22NE09	21	194.40	0.0042	10.27	12.82	YES	15	$ 45,101
	22NE10_22NE15	21	79.60	0.0042	10.27	11.58	YES	0	
	22NE11_22NE10	21	275.40	0.0038	9.77	6.45		0	
	22NE12_22NE11	21	260.80	0.0035	9.37	6.45		0	
	22NE13_22NE12	21	262.40	0.0032	8.96	6.45		0	
	22NE14_22NE13	21	310.10	0.0034	9.24	6.45		0	
	22SE76_22NE14	21	353.00	0.0030	8.68	6.43		0	
	22SE77_22SE76	21	318.70	0.0031	8.82	6.43		0	
	22SE78_22SE77	21	318.70	0.0035	9.37	6.43		0	
	22SE79_22SE78	18	275.10	0.0040	6.64	6.40		0	
	22SE80_22SE79	12	284.90	0.0037	2.17	4.56	YES	15	$ 66,097
	22SE81_22SE80	12	275.90	0.0036	2.14	4.56	YES	15	$ 64,009
	22SE82_22SE81	12	246.10	0.0034	2.08	4.56	YES	15	$ 57,095
	22SW01_22SE82	12	246.10	0.0035	2.11	4.56	YES	15	$ 57,095
	22SW70_22SW01	10	118.80	0.0037	1.33	2.03	YES	8	$ 19,008
	22SW02_22SW70	10	243.60	0.0037	1.33	1.83	YES	8	$ 38,976
	22SW03_22SW02	10	153.70	0.0027	1.14	1.83	YES	10	$ 30,740
	22SW04_22SW03	10	131.40	0.0038	1.35	1.83	YES	8	$ 21,024
	22SW05_22SW04	10	400.00	0.0033	1.26	1.83	YES	8	$ 64,000
WWTP Line C									
	15SE11_15SE10	15	387.10	0.0094	6.26	1.77		0	
	15SE28_15SE11	15	149.60	0.0097	6.36	1.77		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	15SE12_15SE28	15	227.90	0.0097	6.36	1.77		0	
	15SE13_15SE12	15	356.40	0.0067	5.29	1.77		0	
	22NE01_15SE13	15	270.00	0.0061	5.05	1.77		0	
	22NE02_22NE01	15	270.00	0.0066	5.25	1.77		0	
	23NW01_22NE02	15	227.80	0.0065	5.21	1.77		0	
	23NW16_23NW01	15	207.50	0.0065	5.21	1.77		0	
	23NW02_23NW16	15	280.80	0.0065	5.21	1.77		0	
	23NW37_23NW02	15	270.00	0.0135	7.51	1.77		0	
	23NW03_23NW37	15	116.40	0.0135	7.51	1.77		0	
	23NW04_23NW03	18	424.10	0.0043	6.89	1.77		0	
	23NW05_23NW04	18	257.60	0.0043	6.89	1.77		0	
	23NW06_23NW05	15	345.00	0.0053	4.70	1.77		0	
	23NW07_23NW06	15	276.80	0.0053	4.70	1.77		0	
	23NW08_23NW07	15	391.60	0.0053	4.70	1.77		0	
	23NW09_23NW08	15	235.70	0.0103	6.56	1.77		0	
	23NW10_23NW09	15	433.60	0.0103	6.56	1.77		0	
	23NW11_23NW10	15	299.50	0.0052	4.66	1.77		0	
WWTP Line D									
	22NE16_22NE15	15	369.40	0.0020	2.89	5.13	YES	15	$ 85,701
	22NE17_22NE16	15	124.40	0.0020	2.89	5.13	YES	15	$ 28,861
	22NE18_22NE17	15	137.60	0.0020	2.89	3.59	YES	10	$ 27,520
	22NE19_22NE18	15	189.60	0.0020	2.89	3.59	YES	10	$ 37,920
	22NE20_22NE19	15	181.10	0.0020	2.89	3.59	YES	10	$ 36,220
	22NE21_22NE20	15	158.80	0.0020	2.89	3.59	YES	10	$ 31,760
	22NE46_22NE21	15	165.20	0.0035	3.82	3.59		0	
	22NE47_22NE46	15	270.60	0.0013	2.33	3.59	YES	12	$ 58,450
	22NE52_22NE47	15	253.20	0.0016	2.58	3.59	YES	12	$ 54,691
	22SE97_22NE52	15	100.20	0.0029	3.48	3.59	YES	0	
	22SE98_22SE97	15	400.00	0.0030	3.54	3.59	YES	0	
	22SE99_22SE98	15	270.80	0.0030	3.54	1.54		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 4

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	22SE100_22SE99	15	240.20	0.0030	3.54	1.54		0	
	22SE101_22SE100	15	136.90	0.0029	3.48	1.54		0	
	23SW54_22SE101	15	98.20	0.0029	3.48	1.54		0	
	23SW53_23SW54	15	255.90	0.0028	3.42	1.54		0	
	23SW52_23SW53	15	16.80	0.0030	3.54	1.54		0	
	23SW06_23SW52	10	10.00	0.0400	4.38	1.54		0	
	23SW07_23SW06	10	224.40	0.0056	1.64	1.54		0	
	23SW08_23SW07	10	223.90	0.0072	1.86	1.54		0	
	23SW20_23SW08	8	257.40	0.0109	1.26	0.51		0	
	23SW21_23SW20	8	215.80	0.0076	1.05	0.51		0	
	23SW22_23SW21	8	275.90	0.0081	1.09	0.51		0	
	23SW23_23SW22	8	295.80	0.0081	1.09	0.51		0	
	23SW24_23SW23	8	237.40	0.0074	1.04	0.51		0	
	23SW25_23SW24	8	296.20	0.0093	1.17	0.51		0	
Bull Creek Line A									
	26NW01_Bull Creek	12	365.00	0.0022	1.67	1.06		0	
	26NW02_26NW01	12	365.80	0.0022	1.67	1.06		0	
	26NW03_26NW02	12	303.30	0.0024	1.75	1.06		0	
	26NW04_26NW03	12	350.00	0.0024	1.75	1.06		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
East Line A									
	30SE06_EAST	21	32.50	0.0100	15.85	5.39		0	
	30SW01A_30SE06	18	78.20	0.0100	10.50	5.39		0	
	30NW105_30SW01A	12	367.30	0.0036	2.14	5.39	YES	15	$ 85,214
	30NW01_30NW105	12	37.70	0.0036	2.14	2.64	YES	12	$ 8,143
	30NW104_30NW01	10	193.40	0.0033	1.26	2.11	YES	10	$ 38,680
	30NW92_30NW104	10	27.00	0.0033	1.26	2.11	YES	10	$ 5,400
	30NW02_30NW92	10	160.40	0.0033	1.26	2.11	YES	10	$ 32,080
	30NW103_30NW02	10	36.60	0.0035	1.30	2.11	YES	10	$ 7,320
	30NW03_30NW103	10	220.40	0.0035	1.30	2.11	YES	10	$ 44,080
	30NW04_30NW03	10	122.20	0.0035	1.30	1.58	YES	8	$ 19,552
	30NW102_30NW04	10	113.80	0.0035	1.30	1.58	YES	8	$ 18,208
	30NW05_30NW102	10	68.60	0.0035	1.30	1.58	YES	8	$ 10,976
	30NW06_30NW05	10	109.90	0.0035	1.30	1.58	YES	8	$ 17,584
	30NW07_30NW06	10	56.10	0.0035	1.30	1.58	YES	8	$ 8,976
	30NW08_30NW07	10	39.00	0.0035	1.30	1.58	YES	8	$ 6,240
	30NW09_30NW08	10	319.70	0.0032	1.24	1.58	YES	8	$ 51,152
	30NW10_30NW09	10	211.40	0.0026	1.12	1.05		0	
	30NW11_30NW10	10	105.20	0.0026	1.12	1.05		0	
	30NW12_30NW11	10	118.00	0.0035	1.30	1.05		0	
	30NW13_30NW12	10	37.30	0.0035	1.30	1.05		0	
	30NW14_30NW13	10	347.20	0.0025	1.10	1.05		0	
	30NW15_30NW14	10	381.00	0.0021	1.00	0.53		0	
	30NW15A_30NW15	10	211.40	0.0025	1.10	0.53		0	
	30NW16_30NW15A	10	163.60	0.0025	1.10	0.53		0	
	30NW17_30NW16	10	374.50	0.0033	1.26	0.53		0	
	30NW18_30NW17	10	374.00	0.0019	0.96	0.53		0	
	30NW19_30NW18	10	374.00	0.0025	1.10	0.53		0	
	30NW20_30NW19	10	373.00	0.0025	1.10	0.53		0	
	25NE33_30NW20	10	373.00	0.0028	1.16	0.53		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
East Line B									
	30NE73_30SE06	21	60.00	0.0010	5.01	5.27	YES	0	
	30NE74_30NE73	21	214.70	0.0012	5.49	5.27		0	
	30NE75_30NE74	21	304.60	0.0010	5.01	5.13	YES	0	
	30NE76_30NE75	21	230.00	0.0015	6.14	5.13		0	
	30NE77_30NE76	21	152.90	0.0010	5.01	0.14		0	
	30NE78_30NE77	21	100.50	0.0021	7.26	0.14		0	
East Line C						#N/A			
	30SW04_30SW01A	10	103.60	0.0082	1.98	2.76	YES	8	$ 16,576
	30SW32_30SW04	8	125.10	0.0116	1.30	1.52	YES	0	
	30SW33_30SW32	8	193.60	0.0105	1.24	1.52	YES	8	$ 30,976
	30SW34_30SW33	8	293.00	0.0160	1.53	1.52		0	
	30SW43_30SW34	8	213.40	0.0158	1.52	1.48		0	
	30SW44_30SW43	8	124.90	0.0168	1.57	1.48		0	
	30SW45_30SW44	8	280.00	0.0080	1.08	1.48	YES	8	$ 44,800
	30SW46_30SW45	8	311.30	0.0080	1.08	1.48	YES	8	$ 49,808

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
Genesis Line A									
	24NW50_GENESIS	15	135.80	0.0030	3.54	3.33		0	
	24NW51_24NW50	15	221.90	0.0030	3.54	3.33		0	
	13SW08_24NW51	12	143.10	0.0092	3.42	2.03		0	
	13SW09_13SW08	12	233.50	0.0072	3.02	2.03		0	
	13SE01_13SW09	12	160.20	0.0056	2.67	2.03		0	
	13SE02_13SE01	12	304.60	0.0041	2.28	2.03		0	
	13SE03_13SE02	12	79.40	0.0035	2.11	0.74		0	
	13SE04_13SE03	12	278.40	0.0035	2.11	0.74		0	
	13SE05_13SE04	12	222.60	0.0027	1.85	0.74		0	
	13SE06_13SE05	12	115.20	0.0028	1.89	0.74		0	
	13SE07_13SE06	12	141.40	0.0025	1.78	0.74		0	
	13SE08_13SE07	12	285.40	0.0026	1.82	0.74		0	
	13SE09_13SE08	10	40.20	0.0030	1.20	0.74		0	
	13SE10_13SE09	10	302.10	0.0028	1.16	0.28		0	
	13SE11_13SE10	10	302.90	0.0029	1.18	0.28		0	
	13SE12_13SE11	10	227.60	0.0029	1.18	0.28		0	
	13SE13_13SE12	10	259.80	0.0025	1.10	0.28		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
Kill Creek Line A									
	9NE01_Kill Creek	24	215.40	0.0040	14.31	3.94		0	
	9NE02_9NE01	24	305.30	0.0040	14.31	3.94		0	
	9NE03_9NE02	21	305.30	0.0100	15.85	3.78		0	
	9NE04_9NE03	21	305.30	0.0070	13.26	3.78		0	
	9NE05_9NE04	18	231.60	0.0140	12.43	3.25		0	
	9NE06_9NE05	18	231.60	0.0140	12.43	3.25		0	
	9NE07_9NE06	18	237.70	0.0120	11.51	3.25		0	
	9NE08_9NE07	18	237.70	0.0120	11.51	3.25		0	
	9NE10_9NE08	12	292.20	0.0140	4.22	1.05		0	
	9NE11_9NE10	12	292.20	0.0140	4.22	1.05		0	
	9SE10_9NE11	10	377.10	0.0200	3.10	0.67		0	
	9SE11_9SE10	10	377.10	0.0220	3.25	0.67		0	
Kill Creek Line B									
	9NE09_9NE08	18	388.20	0.0180	14.09	1.93		0	
	9SE01_9NE09	18	388.20	0.0220	15.58	1.93		0	
	9SE02_9SE01	18	388.20	0.0160	13.29	1.93		0	
	9SE03_9SE02	18	289.90	0.0060	8.14	1.93		0	
	9SE04_9SE03	18	255.10	0.0060	8.14	1.93		0	
	9SE05_9SE04	18	255.10	0.0060	8.14	1.93		0	
	9SE06_9SE05	18	370.20	0.0060	8.14	1.93		0	
	9SE07_9SE06	18	370.20	0.0060	8.14	1.93		0	
	9SE08_9SE07	18	349.80	0.0080	9.40	1.93		0	
	9SE09_9SE08	18	308.80	0.0080	9.40	1.93		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
Kill Creek Line C									
	10NW01_Kill Creek	21	23.40	0.0070	13.26	12.11		0	
	10NW02_10NW01	21	379.20	0.0070	13.26	12.11		0	
	10NW03_10NW02	21	379.20	0.0070	13.26	12.11		0	
	10NW04_10NW03	21	379.20	0.0070	13.26	12.11		0	
	10NW05_10NW04	21	366.10	0.0070	13.26	12.11		0	
	10NW06_10NW05	21	204.40	0.0070	13.26	0.28		0	
	10NW07_10NW06	21	263.40	0.0070	13.26	0.28		0	
	10NW08_10NW07	21	263.40	0.0070	13.26	0.28		0	
	10NW09_10NW08	21	260.30	0.0040	10.02	0.28		0	
	10NW10_10NW09	21	260.30	0.0040	10.02	0.28		0	
	10NW11_10NW10	21	381.20	0.0040	10.02	0.28		0	
	10SW01_10NW11	21	381.20	0.0040	10.02	0.28		0	
	10SW02_10SW01	21	381.20	0.0040	10.02	0.28		0	
	10SW03_10SW02	21	381.20	0.0040	10.02	0.28		0	
	10SW04_10SW03	21	213.00	0.0040	10.02	0.28		0	
	10SW05_10SW04	12	213.00	0.0040	2.25	0.26		0	
	10SW06_10SW05	12	313.70	0.0060	2.76	0.26		0	
	10SW07_10SW06	10	317.50	0.0080	1.96	0.10		0	
	10SW08_10SW07	10	317.50	0.0080	1.96	0.10		0	
New Bull Creek Line A									
	26NE54_26NE55/ New Bull Creek	21	367.60	0.0010	5.01	0.86		0	
	26NW21_26NE54	21	17.00	0.0010	5.01	0.86		0	
	26NW22_26NW21	21	314.40	0.0010	5.01	0.86		0	
	26NW23_26NW22	21	264.30	0.0010	5.01	0.86		0	
	26NW24_26NW23	21	133.40	0.0010	5.01	0.86		0	
	26NW25_26NW24	18	114.90	0.0014	3.93	0.63		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	26NW26_26NW25	18	405.40	0.0014	3.93	0.63		0	
	23SW01_26NW26	18	117.20	0.0014	3.93	0.63		0	
	23SW02_23SW01	18	400.00	0.0014	3.93	0.63		0	
	23SW03_23SW02	18	400.80	0.0014	3.93	0.63		0	
	23SW04_23SW03	18	248.00	0.0014	3.93	0.63		0	
	23SW05_23SW04	18	15.62	0.0014	3.93	0.53		0	
	23SE36_23SW05	8	144.00	0.0047	0.83	0.53		0	
	23SE39_23SE36	8	110.00	0.0064	0.97	0.53		0	
New Bull Creek Line B									
	26NE56_26NE55/ New Bull Creek	24	114.40	0.0020	10.12	4.93		0	
	26NE01_26NE56	24	184.26	0.0001	2.36	2.81	YES	15	$ 42,748
	26NE02_26NE01	10	188.68	0.0004	0.45	1.43	YES	15	$ 43,774
	26NE03_26NE02	10	134.00	0.0020	0.98	1.43	YES	8	$ 21,440
	26NE04_26NE03	10	303.00	0.0020	0.98	1.43	YES	8	$ 48,480
	26NE05_26NE04	10	386.00	0.0020	0.98	1.43	YES	8	$ 61,760
	23SE01_26NE05	10	370.00	0.0020	0.98	0.66		0	
	23SE02_23SE01	10	25.00	0.0020	0.98	0.66		0	
	23SE03_23SE02	10	295.00	0.0020	0.98	0.66		0	
	23SE04_23SE03	10	144.00	0.0020	0.98	0.66		0	
	23SE05_23SE04	10	143.00	0.0020	0.98	0.66		0	
	23SE06_23SE05	10	390.00	0.0020	0.98	0.66		0	
	23SE07_23SE06	10	388.00	0.0020	0.98	0.66		0	
	23SE08_23SE07	10	391.00	0.0020	0.98	0.66		0	
	24SW64_23SE08	10	381.00	0.0020	0.98	0.66		0	
	25NW14_24SW64	10	351.00	0.0020	0.98	0.00		0	
New Bull Creek Line C									
	26NE57_26NE56	24	248.30	0.0020	10.12	2.11		0	
	26NE58_26NE57	24	217.10	0.0020	10.12	2.11		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	26NE59_26NE58	24	405.30	0.0020	10.12	2.11		0	
	26NE60_26NE59	24	325.20	0.0130	25.79	2.11		0	
	26NE61_26NE60	24	268.60	0.0128	25.59	2.11		0	
	26NE62_26NE61	24	214.00	0.0040	14.31	2.11		0	
	26SE93_26NE62	24	62.70	0.0040	14.31	2.11		0	
New Bull Creek Line C2									
	26NE34_26NE01	12	253.00	0.0022	1.67	0.62		0	
	26NE35_26NE34	12	221.90	0.0022	1.67	0.62		0	
	26NE47_26NE35	12	400.00	0.0022	1.67	0.62		0	
	26NE48_26NE47	12	325.10	0.0022	1.67	0.62		0	
	26NE49_26NE48	12	287.90	0.0022	1.67	0.62		0	
	26SE14_26NE49	12	222.10	0.0022	1.67	0.62		0	
	26SE15_26SE14	12	406.60	0.0022	1.67	0.50		0	
	26SE16_26SE15	12	393.40	0.0022	1.67	0.50		0	
	26SE17_26SE16	12	337.70	0.0022	1.67	0.50		0	
	26SE32_26SE17	12	120.00	0.0022	1.67	0.50		0	
	26SE33_26SE32	12	253.00	0.0022	1.67	0.50		0	
	26SE34_26SE33	12	179.70	0.0022	1.67	0.50		0	
	26SE35_26SE34	12	353.30	0.0022	1.67	0.50		0	
	26SE36_26SE35	12	406.20	0.0022	1.67	0.50		0	
	26SE37_26SE36	12	273.10	0.0022	1.67	0.50		0	
	26SE38_26SE37	10	212.50	0.0032	1.24	0.25		0	
	26SE42_26SE38	10	24.00	0.0030	1.20	0.25		0	
	26SE43_26SE42	10	276.00	0.0030	1.20	0.25		0	
	26SE44_26SE43	10	312.50	0.0030	1.20	0.25		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
North Line A									
	13SW01_NORTH	36	23.60	0.0649	169.92	28.14		0	
	13SW10_13SW01	10	77.60	0.0492	4.86	3.02		0	
	14SE01_13SW10	10	278.30	0.0028	1.16	3.02	YES	12	$ 60,113
	14SE02_14SE01	10	106.10	0.0028	1.16	3.02	YES	12	$ 22,918
	14SE03_14SE02	10	113.90	0.0300	3.79	3.02		0	
	14SE04_14SE03	10	71.00	0.0100	2.19	1.67		0	
	14SE05_14SE04	10	213.00	0.0500	4.90	1.11		0	
	14SE06_14SE05	10	213.20	0.0028	1.16	1.11		0	
	14SE07_14SE06	10	379.70	0.0028	1.16	1.11		0	
	14SE08_14SE07	10	362.30	0.0028	1.16	1.11		0	
	14SE09_14SE08	10	161.80	0.0028	1.16	1.11		0	
	14SE10_14SE09	10	239.60	0.0028	1.16	1.11		0	
	14SE11_14SE10	10	70.00	0.0488	4.84	0.56		0	
	14SE12_14SE11	10	238.80	0.0100	2.19	0.56		0	
	14SE13_14SE12	10	365.00	0.0028	1.16	0.56		0	
	14SE14_14SE13	10	226.80	0.0028	1.16	0.56		0	
	14SE15_14SE14	10	218.00	0.0028	1.16	0.56		0	
	14SE16_14SE15	10	148.00	0.0076	1.91	0.56		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
North Line B									
	13SW02_13SW01	36	227.10	0.0030	36.53	25.12		0	
	13SW03_13SW02	36	144.20	0.0030	36.53	25.12		0	
	13SW04_13SW03	36	124.90	0.0030	36.53	25.12		0	
	13SW05_13SW04	36	273.80	0.0030	36.53	25.12		0	
	13SW06_13SW05	36	320.20	0.0030	36.53	25.12		0	
	13SW07_13SW06	36	194.40	0.0030	36.53	25.12		0	
	24NW77_13SW07	36	146.80	0.0030	36.53	25.12		0	
	24NW83_24NW77	36	129.60	0.0030	36.53	25.12		0	
	24NW78_24NW83	36	124.30	0.0030	36.53	24.56		0	
	24NW79_24NW78	36	176.10	0.0195	93.14	24.56		0	
	24NW80_24NW79	36	197.10	0.0030	36.53	24.56		0	
	24NW81_24NW80	36	204.20	0.0030	36.53	24.56		0	
	23NE126_24NW81	36	354.40	0.0030	36.53	24.56		0	
	23NE127_23NE126	36	109.00	0.0030	36.53	24.56		0	
	23NE128_23NE127	36	166.30	0.0171	87.22	24.56		0	
	23NE09_23NE128	15	33.60	0.02	9.14	1.38		0	
	23NE13_23NE09	10	291.80	0.0072	1.86	1.38		0	
	23NE14_23NE13	8	122.80	0.0103	1.23	0.85		0	
	23NE15_23NE14	8	197.20	0.0101	1.21	0.85		0	
	23NE24_23NE15	8	198.20	0.0107	1.25	0.85		0	
	23NE25_23NE24	8	353.40	0.0082	1.09	0.85		0	
	23NE26_23NE25	8	354.00	0.0085	1.11	0.85		0	
	23NE27_23NE26	8	204.00	0.008	1.08	0.85		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
North Line C									
	23NE129_23NE128	36	110.00	0.0030	36.53	23.14		0	
	23NE130_23NE129	36	235.40	0.0030	36.53	18.57		0	
	23NE131_23NE130	36	306.40	0.0030	36.53	18.57		0	
	23NE132_23NE131	36	244.20	0.0030	36.53	18.57		0	
	23NE133_23NE132	36	443.00	0.0030	36.53	18.57		0	
	24NW103_23NE133	24	117.00	0.0181	30.44	16.77		0	
	24NW01_24NW103	24	167.80	-0.0066	0.00	16.77	YES	21	$ 48,326
	24NW02_24NW01	20	144.70	0.0018	5.97	16.77	YES	27	$ 56,722
	24NW03_24NW02	20	186.20	0.0018	5.97	15.44	YES	24	$ 61,074
	24NW04_24NW03	20	180.40	0.0006	3.44	15.44	YES	33	$ 90,200
	24NW05_24NW04	20	149.60	0.0006	3.44	15.44	YES	33	$ 74,800
	24NW06_24NW05	20	160.40	0.0001	1.59	15.44	YES	48	$ 116,771
	24NW07_24NW06	20	149.60	0.0001	1.59	15.44	YES	48	$ 108,909
	24SW01_24NW07	20	130.80	0.0021	6.31	15.44	YES	24	$ 42,902
	24SW02_24SW01	20	411.70	0.0015	5.44	15.44	YES	27	$ 161,386
	24SW03_24SW02	20	401.11	0.0011	4.61	15.44	YES	30	$ 182,906
	24SW04_24SW03	20	398.60	0.0003	2.41	15.44	YES	42	$ 255,104
	24SW05_24SW04	20	126.50	0.0006	3.49	15.44	YES	33	$ 63,250
	24SW06_24SW05	18	283.60	0.0017	4.29	12.69	YES	24	$ 93,021
	24SW07_24SW06	18	408.50	0.0025	5.22	12.69	YES	21	$ 117,648
	24SW08_24SW07	18	234.00	0.0021	4.80	12.69	YES	24	$ 76,752
	24SW09_24SW08	18	323.60	0.0020	4.71	11.28	YES	21	$ 93,197
	24SE27_24SW09	15	130.90	0.0009	1.94	11.28	YES	30	$ 59,690
	24SE28_24SE27	15	342.80	0.0011	2.12	11.28	YES	27	$ 134,378
	24SE78_24SE28	15	134.70	0.0017	2.66	11.28	YES	24	$ 44,182
	24SE01_24SE78	15	102.40	0.0040	4.09	11.28	YES	21	$ 29,491
	24SE02_24SE01	8	203.00	0.0040	0.76	8.95	YES	21	$ 58,464
	24SE03_24SE02	8	273.00	0.0040	0.76	8.95	YES	21	$ 78,624
	24SE04_24SE03	8	197.00	0.0040	0.76	8.95	YES	21	$ 56,736

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	24SE05_24SE04	8	304.00	0.0040	0.76	8.95	YES	21	$ 87,552
	24SE06_24SE05	8	163.00	0.0040	0.76	8.95	YES	21	$ 46,944
	24SE07_24SE06	8	376.00	0.0060	0.94	8.95	YES	18	$ 93,248
	25NE03_24SE07	8	216.40	0.0040	0.76	8.12	YES	21	$ 62,323
	25NE04_25NE03	8	34.90	0.0172	1.58	8.12	YES	15	$ 8,097
	25NE05_25NE04	8	210.00	0.0062	0.95	7.35	YES	18	$ 52,080
	25NE06_25NE05	8	85.00	0.0198	1.70	7.35	YES	15	$ 19,720
	25NE07_25NE06	8	26.00	0.0055	0.90	7.35	YES	18	$ 6,448
	25NE08_25NE07	8	113.00	0.0077	1.06	7.35	YES	18	$ 28,024
	25NE09_25NE08	8	158.00	0.0081	1.09	5.79	YES	15	$ 36,656
	25NE10_25NE09	8	400.00	0.0049	0.85	1.55	YES	8	$ 64,000
	25NE11_25NE10	8	400.00	0.0052	0.87	1.55	YES	8	$ 64,000
	25NE22_25NE11	8	353.00	0.0052	0.87	1.55	YES	8	$ 56,480
	25NE23_25NE22	8	395.00	0.0052	0.87	1.55	YES	8	$ 63,200
	25NE47_25NE23	10	214.60	0.0024	1.07	0.78		0	
	25NE48_25NE47	10	376.50	0.0032	1.24	0.78		0	
	25NE49_25NE48	10	276.80	0.0028	1.16	0.78		0	
	25NE50_25NE49	10	178.20	0.0031	1.22	0.78		0	
North Line D									
	24NW45_23NE129	8	138.30	-0.0034	0.00	4.57	YES	0	
	24NW46_24NW45	8	224.30	0.0035	0.71	4.57	YES	18	$ 55,626
	24NW47_24NW46	8	339.90	0.0041	0.77	4.57	YES	15	$ 78,857

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
North Line E									
	24SE08_24SE07	8	55.00	0.006	0.94	0.83		0	
	24SE09_24SE08	8	139.00	0.0055	0.90	0.83		0	
	24SE10_24SE09	8	95.70	0.006	0.94	0.83		0	
	24SE11_24SE10	8	400.00	0.006	0.94	0.83		0	
	24SE12_24SE11	8	275.00	0.005	0.85	0.83		0	
	24SE13_24SE12	8	275.00	0.0049	0.85	0.83		0	
	24SE14_24SE13	8	296.90	0.0059	0.93	0.83		0	
	24SE77_24SE14	8	177.00	0.0053	0.88	0.83		0	
	19SW04_24SE77	8	148.50	0.0046	0.82	0.83	YES	8	
	19SW05_19SW04	8	162.60	0.006	0.94	0.83		0	
	19SW07_19SW05	8	69.50	0.006	0.94	0.83		0	
South Line A									
	36SW01_SOUTH	24	40.00	0.0040	14.31	18.92	YES	18	$ 9,920
	36SW02_36SW01	24	79.00	0.0040	14.31	10.87		0	
	36SW03_36SW02	24	85.00	0.0040	14.31	10.87		0	
	36SW04_36SW03	24	423.90	0.0020	10.12	10.87	YES	0	
	36SW05_36SW04	21	319.30	0.0077	13.90	10.76		0	
	36SW06_36SW05	21	307.90	0.0030	8.68	10.76	YES	15	$ 71,433
	36SW07_36SW06	21	203.80	0.0011	5.26	10.76	YES	24	$ 66,846
	36SW08_36SW07	21	272.30	0.0011	5.26	10.76	YES	24	$ 89,314
	36SW20_36SW08	15	30.00	0.0230	9.80	5.31		0	
	36SW21_36SW20	15	338.20	0.0067	5.29	5.31	YES	0	
	36SW22_36SW21	15	125.30	0.0025	3.23	5.31	YES	15	$ 29,070
	36SW23_36SW22	15	179.00	0.0025	3.23	5.31	YES	15	$ 41,528
	36NW52_36SW23	15	300.00	0.0025	3.23	5.31	YES	15	$ 69,600
	36NW68_36NW52	12	357.60	0.0064	2.85	2.95	YES	0	
	36NW69_36NW68	12	350.00	0.0036	2.14	2.95	YES	10	$ 70,000
	36NW70_36NW69	12	360.50	0.0036	2.14	2.95	YES	10	$ 72,100

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36NW71_36NW70	12	163.00	0.0136	4.15	2.53		0	
	36NW72_36NW71	12	235.50	0.0168	4.62	2.53		0	
	36NW73_36NW72	12	91.00	0.0172	4.67	2.53		0	
	36NW74_36NW73	12	329.50	0.0060	2.76	2.53		0	
	36NW75_36NW74	12	348.00	0.0084	3.27	2.53		0	
	36NW76_36NW75	12	379.50	0.0092	3.42	2.53		0	
	36NW77_36NW76	12	350.00	0.0025	1.78	2.11	YES	8	$ 56,000
	36NW78_36NW77	12	339.30	0.0025	1.78	2.11	YES	8	$ 54,288
	36NW79_36NW78	12	141.00	0.0025	1.78	2.11	YES	8	$ 22,560
	36NW80_36NW79	12	144.70	0.0025	1.78	2.11	YES	8	$ 23,152
	25SW63_36NW80	12	385.70	0.0025	1.78	2.11	YES	8	$ 61,712
	25SE02_25SW63	12	245.50	0.0025	1.78	1.69		0	
	25SE03_25SE02	12	129.10	0.0025	1.78	1.69		0	
	25SE04_25SE03	12	240.40	0.0128	4.03	1.28		0	
	25SE05_25SE04	12	283.70	0.0180	4.78	1.28		0	
	25SE06A_25SE05	12	112.00	0.0200	5.04	1.28		0	
	25SE06_25SE06A	12	15.50	0.0200	5.04	0.00		0	
South Line B									
	36NW53_36NW52	10	217.00	0.0032	1.24	1.23		0	
	36NW54_36NW53	10	156.00	0.0032	1.24	1.23		0	
	36NW55_36NW54	10	346.00	0.0032	1.24	1.23		0	
	36NW56_36NW55	10	281.00	0.0032	1.24	1.23		0	
	36NW57_36NW56	10	133.70	0.0032	1.24	1.23		0	
South Line C									
	36SW09_36SW08	18	220.50	0.0019	4.58	5.03	YES	8	
	36SW10_36SW09	18	351.10	0.0019	4.58	5.03	YES	8	
	36SW11_36SW10	18	344.00	0.0019	4.58	5.03	YES	8	
	36SW12_36SW11	18	356.70	0.0019	4.58	5.03	YES	8	
	36SW16_36SW12	8	214.10	0.0050	0.85	1.41	YES	8	$ 34,256
	36SW17_36SW16	8	352.20	0.0050	0.85	1.41	YES	8	$ 56,352

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36SW18_36SW17	8	263.50	0.0050	0.85	1.41	YES	8	$ 42,160
	35SE01_36SW18	8	100.00	0.0050	0.85	1.41	YES	8	$ 16,000

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
South Line D									
	36SW13_36SW12	15	289.20	0.0160	8.17	3.11		0	
	36SW14_36SW13	15	276.00	0.0034	3.77	3.11		0	
	36NW48A_36SW14	15	365.00	0.0034	3.77	3.11		0	
	36NW48_36NW48A	15	313.36	0.0027	3.36	3.11		0	
	36NW49_36NW48	15	339.40	0.0027	3.36	3.11		0	
	36NW50_36NW49	15	275.30	0.0022	3.03	3.11	YES	8	
	36NW51_36NW50	15	225.30	0.0022	3.03	3.11	YES	8	
	35NE03_36NW51	10	312.70	0.0030	1.20	1.08		0	
	35NE04_35NE03	10	213.70	0.0028	1.16	1.08		0	
	35NE05_35NE04	10	297.60	0.0028	1.16	1.08		0	
	35NE06_35NE05	10	213.00	0.0028	1.16	1.08		0	
	35NE07_35NE06	10	187.50	0.0028	1.16	1.08		0	
	35NE08_35NE07	10	277.90	0.0028	1.16	0.62		0	
	35NE09_35NE08	10	375.00	0.0028	1.16	0.15		0	
	35NE36_35NE09	10	213.10	0.0028	1.16	0.15		0	
	35NE10_35NE36	10	158.00	0.0028	1.16	0.15		0	
	35NE11_35NE10	10	212.00	0.0030	1.20	0.15		0	
South Line E									
	36NW01_36NW50	12	23.60	0.0047	2.44	1.56		0	
	36NW10_36NW01	12	31.00	0.0470	7.72	1.56		0	
	36NW11_36NW10	12	167.60	0.0057	2.69	1.56		0	
	36NW12_36NW11	12	65.90	0.0102	3.60	1.56		0	
	36NW13_36NW12	12	105.90	0.0052	2.57	1.56		0	
	36NW14_36NW13	12	214.40	0.0051	2.54	1.56		0	
	36NW15_36NW14	12	297.30	0.0039	2.22	1.56		0	
	36NW16_36NW15	12	71.10	0.0048	2.47	1.56		0	
	36NW17_36NW16	12	206.00	0.0032	2.02	1.56		0	
	36NW18_36NW17	12	400.00	0.0039	2.22	1.56		0	
	36NW19_36NW18	12	35.80	0.0059	2.74	1.56		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	36NW20_36NW19	12	126.10	0.0053	2.59	1.56		0	
Walmart Line A									
	30NE64_30NE61/ Walmart	18	89.10	0.0035	6.21	3.93		0	
	30NE65_30NE64	18	238.20	0.0012	3.64	3.93	YES	8	
	30NE66_30NE65	18	58.90	0.0044	6.97	3.93		0	
	30NE67_30NE66	18	95.40	0.0016	4.20	3.93		0	
	30NE68_30NE67	18	258.50	0.0015	4.07	3.93		0	
	30NE69_30NE68	18	61.30	0.0007	2.78	3.93	YES	15	$ 14,222
	30NE70_30NE69	18	12.70	0.0024	5.15	3.93		0	
	30NE42_30NE70	15	331.78	0.0048	4.48	3.83		0	
	29NW01_30NE42	15	360.00	0.0044	4.28	3.83		0	
Walmart Line B									
	30NE62_30NE61/ Walmart	12	36.70	0.0147	4.32	1.06		0	
	30NE63_30NE62	12	396.70	0.0236	5.47	1.06		0	
	30NE01_30NE63	12	120.00	-0.0032	0.00	1.06	YES	0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
WWTP Line A									
	15NW01_WWTP	30	376.50	0.0045	27.52	77.58	YES	42	$ 240,960
	15NW02_15NW01	30	479.70	0.0045	27.52	77.58	YES	42	$ 307,008
	15NW03_15NW02	15	235.90	0.0263	10.48	8.59		0	
	15NW04_15NW03	15	187.90	0.0114	6.90	8.59	YES	10	$ 37,580
	15NW05_15NW04	15	241.00	0.0091	6.16	8.59	YES	12	$ 52,056
	15NW06_15NW05	15	194.20	0.0105	6.62	8.32	YES	10	$ 38,840
	15NW07_15NW06	15	228.50	0.0095	6.30	8.32	YES	10	$ 45,700
	15NW08_15NW07	15	350.30	0.0104	6.59	8.32	YES	10	$ 70,060
	15NW09_15NW08	15	191.90	0.0097	6.36	8.05	YES	10	$ 38,380
	15NW10_15NW09	15	173.40	0.0086	5.99	8.05	YES	12	$ 37,454
	15NW11_15NW10	15	162.30	0.0094	6.26	8.05	YES	10	$ 32,460
	15NW12_15NW11	15	288.70	0.0087	6.03	8.05	YES	10	$ 57,740
	15SW01_15NW12	15	256.50	0.0094	6.26	8.05	YES	10	$ 51,300
	15SW02_15SW01	15	223.50	0.0041	4.14	8.05	YES	15	$ 51,852
	15SW03_15SW02	15	161.40	0.0065	5.21	8.05	YES	12	$ 34,862
	15SW04_15SW03	12	131.40	0.0048	2.47	7.78	YES	18	$ 32,587
	15SW05_15SW04	12	80.40	0.0040	2.25	7.78	YES	18	$ 19,939
	15SW06_15SW05	12	183.00	0.0039	2.22	7.78	YES	18	$ 45,384
	15SW07_15SW06	12	248.40	0.0045	2.39	7.78	YES	18	$ 61,603
	15SW08_15SW07	12	202.30	0.0037	2.17	7.78	YES	18	$ 50,170
	15SW09_15SW08	12	319.30	0.0033	2.05	7.78	YES	18	$ 79,186

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
WWTP Line B									
	15NE01_15NW02	30	500.00	0.0045	27.52	64.16	YES	36	$ 272,000
	15NE02_15NE01	30	301.10	0.0039	25.62	64.16	YES	36	$ 163,798
	15NE03_15NE02	30	161.40	0.0048	28.42	64.16	YES	33	$ 80,700
	15NE04_15NE03	30	302.30	0.0044	27.21	64.16	YES	36	$ 164,451
	15NE05_15NE04	30	148.40	0.0019	17.88	64.16	YES	48	$ 108,035
	15NE06_15NE05	30	209.80	0.0023	19.67	62.79	YES	42	$ 134,272
	15NE07_15NE06	30	302.50	0.0019	17.88	62.79	YES	48	$ 220,220
	15SE01_15NE07	30	257.00	0.0028	21.70	62.79	YES	42	$ 164,480
	15SE02_15SE01	30	356.60	0.0025	20.51	62.79	YES	42	$ 228,224
	15SE03_15SE02	27	500.00	0.0069	25.73	61.41	YES	33	$ 250,000
	15SE04_15SE03	27	274.10	0.0044	20.54	61.41	YES	36	$ 149,110
	15SE05_15SE04	27	422.30	0.0019	13.50	61.41	YES	48	$ 307,434
	15SE06_15SE05	27	977.71	0.0023	14.85	61.41	YES	42	$ 625,734
	15SE07_15SE06	27	405.80	0.0019	13.50	61.41	YES	48	$ 295,422
	15SE08_15SE07	27	180.50	0.0028	16.39	61.41	YES	42	$ 115,520
	15SE09_15SE08	27	360.00	0.0039	19.34	61.41	YES	42	$ 230,400
	15SE10_15SE09	27	290.10	0.0031	17.24	61.41	YES	42	$ 185,664
	15SE14_15SE10	21	210.30	0.0093	15.28	16.06	YES	0	
	22NE03_15SE14	21	205.60	0.0055	11.75	12.82	YES	0	
	22NE04_22NE03	21	127.40	0.0050	11.20	12.82	YES	0	
	22NE05_22NE04	21	317.60	0.0034	9.24	12.82	YES	15	$ 73,683
	22NE06_22NE05	21	308.90	0.0049	11.09	12.82	YES	0	
	22NE07_22NE06	21	176.20	NEG. SLOPE	0.00	12.82	YES	24	$ 57,794
	22NE08_22NE07	21	190.60	0.0037	9.64	12.82	YES	15	$ 44,219
	22NE09_22NE08	21	275.60	0.0036	9.51	12.82	YES	15	$ 63,939
	22NE15_22NE09	21	194.40	0.0042	10.27	12.82	YES	15	$ 45,101
	22NE10_22NE15	21	79.60	0.0042	10.27	11.58	YES	0	
	22NE11_22NE10	21	275.40	0.0038	9.77	6.45		0	
	22NE12_22NE11	21	260.80	0.0035	9.37	6.45		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	22NE13_22NE12	21	262.40	0.0032	8.96	6.45		0	
	22NE14_22NE13	21	310.10	0.0034	9.24	6.45		0	
	22SE76_22NE14	21	353.00	0.0030	8.68	6.43		0	
	22SE77_22SE76	21	318.70	0.0031	8.82	6.43		0	
	22SE78_22SE77	21	318.70	0.0035	9.37	6.43		0	
	22SE79_22SE78	18	275.10	0.0040	6.64	6.40		0	
	22SE80_22SE79	12	284.90	0.0037	2.17	4.56	YES	15	$ 66,097
	22SE81_22SE80	12	275.90	0.0036	2.14	4.56	YES	15	$ 64,009
	22SE82_22SE81	12	246.10	0.0034	2.08	4.56	YES	15	$ 57,095
	22SW01_22SE82	12	246.10	0.0035	2.11	4.56	YES	15	$ 57,095
	22SW70_22SW01	10	118.80	0.0037	1.33	2.03	YES	8	$ 19,008
	22SW02_22SW70	10	243.60	0.0037	1.33	1.83	YES	8	$ 38,976
	22SW03_22SW02	10	153.70	0.0027	1.14	1.83	YES	10	$ 30,740
	22SW04_22SW03	10	131.40	0.0038	1.35	1.83	YES	8	$ 21,024
	22SW05_22SW04	10	400.00	0.0033	1.26	1.83	YES	8	$ 64,000

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
WWTP Line C									
	15SE11_15SE10	15	387.10	0.0094	6.26	3.24		0	
	15SE28_15SE11	15	149.60	0.0097	6.36	3.24		0	
	15SE12_15SE28	15	227.90	0.0097	6.36	3.24		0	
	15SE13_15SE12	15	356.40	0.0067	5.29	3.24		0	
	22NE01_15SE13	15	270.00	0.0061	5.05	3.24		0	
	22NE02_22NE01	15	270.00	0.0066	5.25	3.24		0	
	23NW01_22NE02	15	227.80	0.0065	5.21	3.24		0	
	23NW16_23NW01	15	207.50	0.0065	5.21	3.24		0	
	23NW02_23NW16	15	280.80	0.0065	5.21	3.24		0	
	23NW37_23NW02	15	270.00	0.0135	7.51	3.24		0	
	23NW03_23NW37	15	116.40	0.0135	7.51	3.24		0	
	23NW04_23NW03	18	424.10	0.0043	6.89	3.24		0	
	23NW05_23NW04	18	257.60	0.0043	6.89	3.24		0	
	23NW06_23NW05	15	345.00	0.0053	4.70	3.24		0	
	23NW07_23NW06	15	276.80	0.0053	4.70	3.24		0	
	23NW08_23NW07	15	391.60	0.0053	4.70	3.24		0	
	23NW09_23NW08	15	235.70	0.0103	6.56	3.24		8	
	23NW10_23NW09	15	433.60	0.0103	6.56	3.24		8	
	23NW11_23NW10	15	299.50	0.0052	4.66	3.24		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
WWTP Line D									
	22NE16_22NE15	15	369.40	0.0020	2.89	5.13	YES	15	$ 85,701
	22NE17_22NE16	15	124.40	0.0020	2.89	5.13	YES	15	$ 28,861
	22NE18_22NE17	15	137.60	0.0020	2.89	3.59	YES	10	$ 27,520
	22NE19_22NE18	15	189.60	0.0020	2.89	3.59	YES	10	$ 37,920
	22NE20_22NE19	15	181.10	0.0020	2.89	3.59	YES	10	$ 36,220
	22NE21_22NE20	15	158.80	0.0020	2.89	3.59	YES	10	$ 31,760
	22NE46_22NE21	15	165.20	0.0035	3.82	3.59		0	
	22NE47_22NE46	15	270.60	0.0013	2.33	3.59	YES	12	$ 58,450
	22NE52_22NE47	15	253.20	0.0016	2.58	3.59	YES	12	$ 54,691
	22SE97_22NE52	15	100.20	0.0029	3.48	3.59	YES	0	
	22SE98_22SE97	15	400.00	0.0030	3.54	3.59	YES	0	
	22SE99_22SE98	15	270.80	0.0030	3.54	1.54		0	
	22SE100_22SE99	15	240.20	0.0030	3.54	1.54		0	
	22SE101_22SE100	15	136.90	0.0029	3.48	1.54		0	
	23SW54_22SE101	15	98.20	0.0029	3.48	1.54		0	
	23SW53_23SW54	15	255.90	0.0028	3.42	1.54		0	
	23SW52_23SW53	15	16.80	0.0030	3.54	1.54		0	
	23SW06_23SW52	10	10.00	0.0400	4.38	1.54		0	
	23SW07_23SW06	10	224.40	0.0056	1.64	1.54		0	
	23SW08_23SW07	10	223.90	0.0072	1.86	1.54		0	
	23SW20_23SW08	8	257.40	0.0109	1.26	0.51		0	
	23SW21_23SW20	8	215.80	0.0076	1.05	0.51		0	
	23SW22_23SW21	8	275.90	0.0081	1.09	0.51		0	
	23SW23_23SW22	8	295.80	0.0081	1.09	0.51		0	
	23SW24_23SW23	8	237.40	0.0074	1.04	0.51		0	
	23SW25_23SW24	8	296.20	0.0093	1.17	0.51		0	
Bull Creek Line A									
	26NW01_Bull Creek	12	365.00	0.0022	1.67	1.06		0	

CITY OF GARDNER
WASTEWATER MASTER PLAN UPDATE
HYDRAULIC ANALYSIS RESULTS - SCENARIO 5

Watershed /Lift Station	Line Name US MH_DS MH	Pipe Diameter (in)	Length (ft)	Slope	Existing Pipe Capacity (cfs)	Cumulative Required Tributary Peak Flow (cfs)	Required Flow Exceeds Existing Capacity?	Recommended Parallel Pipe Diameter (in)	Parallel Pipe Cost (2016$)
	26NW02_26NW01	12	365.80	0.0022	1.67	1.06		0	
	26NW03_26NW02	12	303.30	0.0024	1.75	1.06		0	
	26NW04_26NW03	12	350.00	0.0024	1.75	1.06		0	

Appendix G – Cost Estimates

City of Gardner, Kansas

Options to Serve the Proposed Development at 175th and I-35

Interim Options	Estimated Construction Cost	Estimated Annual O&M Cost	20-year Present Value Cost
Pump Flows to the Wal-Mart Lift Station[1]	$1,259,000	$6,000	$1,350,000
Construct Onsite Holding Tanks[2]	$185,000	$310,000	$6,991,600
Construct Package WWTP[3]	$1,687,000	$75,000	$3,333,800
Construct Gravity Interceptor to the south[4]	$6,100,000	$19,000	$6,517,200

[1] Includes engineering and construction of pump station and forcemain.

[2] Includes engineering and construction of one tank, pump station to tank, and wash down facilities.

[3] Includes engineering and construction of package plant, including equipment, insallation, concrete, site piping, electrical, and I&C.

[4] Includes engineering and construction of interceptor (for full buildout of service area), pump station, and forcemain.

Long-term Options	Estimated Construction Cost
Upgrades to Existing Facilities for Gravity Interceptor to the South LS[1]	$19,800,000
New South WWTP[2]	$21,450,000

[1] Includes upgrades to the South LS and capacity upgrades to the Kill Creek WWTP. Does not include gravity interceptors and pump station.

[2] Includes engineering and construction of new WWTP. Does not include gravity interceptors and pump station.

COST ESTIMATE OF MECHANICAL TREATMENT SYSTEM				
ITEM	**QUANTITY**	**UNIT**	**UNIT PRICE**	**EXTENSION**
DIVISION 03 - CONCRETE				
Concrete - Tanks	1	LS	$460,000	$460,000
DIVISION 31 - EARTHWORK				
Excavation	550	CY	$30	$16,500
Backfill	390	CY	$12	$4,680
Baserock	330	CY	$26	$8,580
DIVISION 46 - WATER AND WASTEWATER EQUIPMENT				
Mechanical Plant Equipment	1	LS	$505,000	$505,000
Installation (Including Electrical, I&C, and Site Piping)	35%			$176,750
Subtotal				**$1,172,000**
Contingency	20%			$234,400
Engineering, Legal, Easement/Permit Acquisition, Bidding, Construction Inspection and Administration	20%			$281,000
Total				**$1,687,000**

COST ESTIMATE OF PUMP STATION AT PROPERTY TO WAL-MART LIFT STATION				
ITEM	**QUANTITY**	**UNIT**	**UNIT PRICE**	**EXTENSION**
DIVISION 40 - PROCESS INTEGRATION				
6" Sewer Forcemain	5,500	LF	$60	$330,000
Air Release Valve and Vault	3	EA	$8,200	$24,600
Highway Bore and Casing	200	LF	$400	$80,000
DIVISION 46 - WATER AND WASTEWATER EQUIPMENT				
Pump Station and Valve Vault	1	LS	$330,000	$300,000
Installation	20%			$60,000
Subtotal				**$795,000**
Electrical/I&C	5%			$39,750
Site Work	5%			$39,750
Contingency	20%			$174,900
Engineering, Legal, Easement/Permit Acquisition, Bidding, Construction Inspection and Administration	20%			$209,880
Total				**$1,259,000**

COST ESTIMATE OF GRAVITY INTERCEPTOR TO THE SOUTH				
ITEM	**QUANTITY**	**UNIT**	**UNIT PRICE**	**EXTENSION**
DIVISION 40 - PROCESS INTEGRATION				
10" PVC - Gravity	450	LF	$50	$22,500
15" PVC - Gravity	620	LF	$65	$40,300
18" PVC - Gravity	2,500	LF	$100	$250,000
21" PVC - Gravity	5,300	LF	$125	$662,500
24" PVC - Gravity	3,130	LF	$150	$469,500
30" PVC - Gravity	1,200	LF	$180	$216,000
36" PVC - Gravity	2,500	LF	$225	$562,500
4' Dia. Std. Manhole	16	EA	$3,000	$48,000
5' Dia. Std. Manhole	10	EA	$3,800	$38,000
6' Dia. Std. Manhole	8	EA	$4,700	$37,600
Rock Excavation	5,600	EA	$75	$420,000
Tie into Existing South LS	1	LS	$5,000	$5,000
Sewer Forcemain	7,100	LF	$65	$461,500
Storage at LS	1	LS	$60,000	$60,000
DIVISION 46 - WATER AND WASTEWATER EQUIPMENT				
Pump Station and Valve Vault	1	LS	$465,000	$465,000
Installation	20%			$93,000
Subtotal				**$3,851,000**
Electrical/I&C	5%			$192,550
Site Work	5%			$192,550
Contingency	20%			$847,220
Engineering, Legal, Easement/Permit Acquisition, Bidding, Construction Inspection and Administration	20%			$1,016,664
Total				**$6,100,000**