CITY OF
CLOVERDALE

Sewer System Master Plan Update

Volume 1 Report
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EXECUTIVE SUMMARY

The purpose of the City of Cloverdale's Sewer Master Plan Update (Update) is to quantify and qualify Cloverdale's ability to transport, store, and treat the effluent wastewater generated by the City at current levels and into the future. Coastland Civil Engineering was retained by the City to perform this analysis and report findings to the City. This executive summary is a synopsis of the findings and recommendations of this Update.

The Update analysis used operational wastewater flow data from a six year period of 2002-2007 as the base data set for all calculations. In order to compare and contrast the base data with relevant historical data, the Update used the two year period of 2000-2001 as a comparative data set. This analysis was used to identify changes in wastewater flow patterns in the system from the prior Master Plan Update. The City of Cloverdale currently must transport, store, and treat an average of approximately 192 million gallons (MG) of wastewater each year compared to the 230 MG experienced in 2000-01. The 38 MG reduction from the comparative data set is due to City-wide active reduction in inflow and infiltration (I/I) of non-effluent waters from outside sources and an on-going reduction in domestic water usage. This reduction is even more significant given that there has been a growth in population from 7,333 residents in Jan 2002 to 8,577 in Jan 2008.

The wastewater sewer system has more than 30 miles of piping and one (1) wastewater treatment facility (WWTF). The average daily dry weather capacity of the WWTF is 1.0 million gallons per day (MGD) with a peak dry weather capacity of 2.20 MGD and peak wet weather capacity of 8.25 MGD. The flows experience over the analysis period were 0.41 MGD average dry weather, 1.40 MGD peak dry and 4.10 MGD peak wet weather compared to the 2000-01 values of 0.45 MGD average dry, 1.50 MGD peak dry, and 4.6 MGD peak wet. These results also support the finding that reductions in domestic water usage and I/I are working.

The current wastewater facilities, for both the piping network and at the WWTF, have demonstrated adequate capacity to handle the loads experienced in both the average day scenario and in the peak loading scenario year round. Under current loadings, capacity improvements do not appear to be necessary. Therefore, it is the recommendation of this report that the City continues to conduct routine system upkeep and replace aged system components where necessary, and to monitor all facets of the system in order to identify potential problems.

The Update has identified approximately 9.5 miles of pipes that are aged and in need of replacement. These stretches of aged pipe are likely a leading source of I/I. The Sewer Master Plan Update recommends a phased replacement of these lines. The total dollar value for each of 8 phases is $16.3 million. The Sewer Master Plan Update also recognizes the requirement as part of the City's current NPDES permit that the WWTF must be upgraded to an advance wastewater treatment facility (AWT) or provide a hydrogeology analysis and alternative wastewater disposal methods which still may result in the AWT upgrade. The City has contracted with HDR to provide the preliminary design for this upgrade. The estimated cost for the AWT and storage upgrade is $18.7 million and additional $1.6 to $6.0 million for the wastewater recycling program. No other significant system replacement or repairs were identified for the existing system.

The Update also addressed potential growth by the City in accordance with the adopted 2009 General Plan. Per the 2009 General Plan, the City plans to increase its population to a total of 12,000 residents and encourage complete build-out of all existing vacant commercial and industrial lands within the proposed Urban Growth Boundary. This planned growth will result in increased loadings on parts of the collection system and on the WWTF. The wastewater model prepared as part of this Update indicates that the current WWTF is sufficient to handle the average wet and dry weather flows associated with the increased loading; however, the WWTF capacity falls short of handling peak loading in both the wet and dry seasons at complete build-out. Additionally, several reaches of new piping networks would have to be constructed and several existing sewer pipe reaches would have to be upsized to deliver the increased wastewater loads to the WWTF.

Given the predicted loading, the WWTF would have a peak dry weather load of 3.00 MGD and a peak wet weather load of 8.47 MGD at General Plan build-out. Both of these loading scenarios are greater than the 2.25 MGD peak dry and 8.20 MGD peak wet design loads of the WWTF. Given the predicted loading, the WWTF would be operating at 93% of the peak dry weather capacity for a population of 10,000 residents and a total of 42% of complete commercial/industrial build-out. The Update therefore recommends that the City should continue to monitor loading levels as Cloverdale grows in accordance with the 2009 General Plan. When the population has reached approximately 10,000 residents the City should re-evaluate the wastewater flows into the WWTF and conduct another Sewer Master Plan Update to identify any changes in the loading criteria. An expansion to the WWTF capacity, if warranted, would be very costly to the City.

The associated upgrades to existing sewer mains to meet the demands of complete build-out are:

- Up-sizing North Cloverdale Blvd to 10-inch $1.17 million
- Up-sizing Northern Collector Main to 12-inch $7.84 million
- Up-sizing South Trunk Sewer Main to 30-inch $1.17 million
- Up-sizing the WWTF Main to 36-inch $0.40 million

The associated new piping networks to meet the demand of build-out are:

- North Cloverdale Blvd 8-inch SS Extension and Lift Station $1.99 million
- South Asti Rd Sewer Main Extension and Lift Stations $8.48 million
- Theresa Dr Hwy 101 8-inch SS Undercrossing $0.77 million

The conclusion of the Sewer Master Plan Update is that existing conditions do not warrant any upgrades to meet existing demands. If the City grows in accordance with the 2009 General Plan with the goal of a population of 12,000 residents then significant upgrades and new sewer networking will have to be constructed to meet the increased wastewater loading of the City at complete build-out. These conclusions and the supporting analysis are contained in the following Sewer Master Plan Update.

1. INTRODUCTION

The purpose of this Sewer System Master Plan Update (Update) is to evaluate the City of Cloverdale's (City) Sewer Network Collection System (Network) and Waste Water Treatment Facility (WWTF). This evaluation was made with regard to the Wastewater Treatment System's (System) current loading parameters and for the 2009 General Plan loading parameters. Further, the Update shall evaluate those results with regard to the Network and WWTF capacities, make recommendations for any System upgrades and/or improvements, and provide a cost analysis of any improvements or additions needed within the System to accommodate loading parameters. The previous Update was performed in 1998. This Update includes changes in the 2009 General Plan, System modifications, loading changes due to population and industrial/commercial growth since the last Update.

The primary emphasis of the Update is on the viability of the System. At current levels, the WWTF has excess treatment capacity. The 2009 General Plan population growth cap of 12,000 may cause a need for expansion of the WWTF if no significant additional progress can be made to the City's infrastructure to reduce inflow and infiltration (I/I.) If the City is able to make concerted efforts and reduce I/I, the existing WWTF may have sufficient capacity to accommodate the 2009 General Plan build-out of 12,000 people.

To analyze the System, a computerized hydraulic model (Model) of the overall System was prepared. The effluent sewer demands used in the analysis were calculated from modified domestic water usage data that was reduced to take into account irrigation and other outside water uses that do not generate effluent. The Model also included effluent flows experienced from other water sources such as groundwater and rainfall in the form of I/I. These wet weather effluent flows occur in areas of the system where leakage problems exist such as cracked or broken sewer lines and leaky manhole covers. The I/I factors generated were indicative of typical wet weather surface and groundwater flows into the System.

The Model assists in determining what reaches of the System are currently hydraulically inadequate. When General Plan build-out demands are added to the model, the results presented in this report specify which reaches of the Network and the WWTF will need to be upgraded to accommodate the proposed demands. Of note, the General Plan Land Use scenarios used in this report include the highest use (most intense level of development) for all vacant properties within the proposed Urban Growth Boundary. This scenario produces the highest potential effluent rates in the collection system. This was necessary to ensure that proposed sewer lines serving these areas were sized to be able to accommodate the effluent produced from the highest land use scenario.

This report identifies existing deficiencies and General Plan build-out upgrades necessary to support the General Plan build-out within the Urban Growth Boundary. Cost estimates have also been provided for deficiencies in the existing system, as well as for some of the main trunk line improvements needed to support build-out scenarios. The estimates will be used for future CIP projects and will figure into anticipated updates to the sewer user rate model and developer impact fees.

2. EXISTING SYSTEM ANALYSIS

The source data for the Cloverdale's Sewer Master Plan Update (Update) was obtained from the Cloverdale Wastewater Treatment Facility Monthly Self-Monitoring Reports supplied to the Regional Water Quality Control Board (RWQCB). The reports include data for every month from January 2000 through December 2007. The specific data groups used for this analysis were the average daily effluent flow in millions of gallons per day (MGD) and the maximum daily effluent flow per month in MGD. Analysis of the data was segregated into two data sets, base data set for the time period of 2002 through 2007 and a control data set for the time period 2000-2001.

The base and control data sets were assessed for data consistency and reliability. The factors that can affect data confidence are:

- Inconsistent data between independent sources (LOW)
- Multiple manipulations or recordation of data (LOW)
- Small data sets (LOW)
- Wide unanticipated variations in data sets (LOW)
- Consistent, well-monitored data retrieval (HIGH)
- Limited number of manipulations of data (HIGH)
- Large sample sets of data (HIGH)
- Consistent agreement with external validation source (HIGH)

The average daily flow data was a large consistent sample set, with a limited number of manipulations, and was in substantial agreement with rain flow data used in the analysis portion of this report; therefore, the data was assessed to be consistent and reliable. The average daily effluent flow data is tabulated in **Table 2.1**.

Table 2.1
City of Cloverdale
Daily Average WWTF Influent (MGD)

Month	2000	2001	2002	2003	2004	2005	2006	2007
January	0.82	0.65	1.10	1.10	0.85	1.00	1.01	0.34
February	1.64	1.20	0.60	0.66	1.20	0.69	0.69	0.74
March	0.92	0.89	0.67	0.67	0.56	0.86	1.24	0.45
April	0.65	0.51	0.54	0.85	0.39	0.64	1.17	0.36
May	0.56	0.44	0.47	0.70	0.33	0.61	0.44	0.31
June	0.47	0.41	0.43	0.44	0.29	0.43	0.36	0.28
July	0.44	0.39	0.46	0.37	0.29	0.34	0.29	0.25
August	0.40	0.37	0.38	0.36	0.27	0.30	0.28	0.25
September	0.39	0.38	0.38	0.34	0.28	0.29	0.26	0.24
October	0.41	0.36	0.36	0.26	0.30	0.32	0.26	0.26
November	0.43	0.65	0.44	0.30	0.35	0.34	0.29	0.27
December	0.45	1.40	1.50	1.00	0.74	1.02	0.43	0.35

The focus areas of the analysis on the existing Wastewater Treatment System's (System) are;

(1) To identify of what current average daily and peak weather flow rates are;
(2) To determine if the Wastewater Treatment Facility (WWTF) and the Sewer Network Collection System (Network) have the necessary capacity to accommodate the existing demands of the City of Cloverdale (City); and
(3) To identify any areas of the System that requires increased capacity to accommodate existing flows.

2.1 Wastewater Treatment Facility (WWTF)

The City owns and operates a municipal wastewater treatment facility and associated treated effluent disposal facilities. The WWTF's current National Pollution Discharge Elimination (NPDES) permit became effective on July 29, 2006 and will expire on June 29, 2011. The WWTF is a secondary wastewater treatment facility. The WWTF currently uses the following processes to treat the effluent flows:

- Influent flows from the collection system within the City flows into the WWTF headworks and passes through mechanical screens to remove solids from the waste stream. From the headworks, the wastewater flows into the first of two aeration ponds.
- The first aeration pond consists of extended aeration (Biolac) equipment including air infusion through bubble diffusers and baffles. The wastewater then flows into the second aeration pond which contains six mechanical surface floating aerators. Depending on the biological oxygen demand of the wastewater, aerators can be turned on or off to inject more or less oxygen into the wastewater in this pond. In combination, these ponds inject oxygen into the wastewater to aid in the biologic process of breaking down components of the wastewater.
- From the second aeration pond, water flows to a settling pond (also sometimes referred to as a polishing pond.) The settling pond allows the heavier suspended solids to settle and fall to the bottom of the pond.
- From the settling pond the wastewater is transmitted to a chlorine contact point, then pumped into a pipe that allows for adequate contact time for the chlorine react with the wastewater. From this pipe the treated wastewater is distributed into one of seven possible evaporation/percolation ponds

2.2 Sewer Network Collection System (Network)

The City has approximately 32.3 miles of sewer pipe. The Existing Base Map is shown on **Map 1,** which shows the relative location, directional flow and size of the existing Network. The age of the piping system varies from 80-years old to sections of pipe installed in 2008. The sewer pipes range in size from 6 to 27 inches in diameter. Pipe materials include clay and transite (pipes installed before 1970), concrete pipe (at the treatment plant), ductile iron (for all highway crossings or in areas that the cover above the line is less than 36 inches), and polyvinyl chloride pipe (PVC). Also, in the collection system there are approximately 850 manholes. Manholes are regularly inspected to remove any debris or other obstructions and to ensure that there are no clogs or leaks.

The City operates one lift station at Shahan Dr. and North Cloverdale Blvd serving about 50 homes. The lift station uses two (2) three horsepower pumps on a float system to move approximately 10,000 gallons of effluent per day under peak conditions. City staff indicates that the pump station is in need of an upgrade. The station was constructed in the 1970's and had a new control panel and new pumps installed in 2003; however, it is nearing the end of its useful life.

The City has historically had high inflow and infiltration (I/I) rates within the collection system. The City conducted extensive smoke testing and CCTV video inspection of over 60,000 feet of older sewer main in the older sections of the City in 1998. As a result of this study, repair locations and methods were identified. Of the repairs noted in the report, the biggest reduction in I/I flows has occurred from repair of several of the older and leaking manholes. Since 2000, over 45 manholes have been rehabilitated and coated with waterproofing material. It has been estimated that the repair to just the manholes has lead to a 40 million gallon per year reduction in I/I within the system. Besides the repair of manholes, many of the older sections of pipe have been replaced in the downtown area. Although significant reductions in I/I have been noted, there are a number of locations were repairs are still needed. Beginning in 2004, the City included capital replacement money as part of its rate structure. The revenue generated each year from rates has been able to fund a number of projects over the last several years. In addition, other I/I studies within other older parts of the City are proposed.

2.3 Effluent Flow Analysis

The analysis of the effluent flow is broken into two components the flow into the WWTF and the Network flow. The effluent flow into the WWTF is a function of all flows in the System; accordingly, it was used as the baseline data for the analysis. An industry standard analysis required that a comparison be made between wet weather and dry weather flow periods so that a determination can be made between effluent sewer flows generated by system users and flow generated from I/I.

2.3.1 WWTF Existing Flow Analysis

The industry standard of practice is to divide the year into a dry period (May through October) and a wet period (November through April) corresponding to standard historic dry and rainy seasons[1]. A comparison was made of average daily effluent flows into the WWTF for these periods. Data was divided into average daily flows over the entire year, average wet weather flows, average dry weather flows, resulting average I/I[2] flows, and total yearly flows[3]. These findings are shown in **Table 2.2**. The base data set for the analysis section of this Update were

[1] A comparison of industry standard rainy periods and Cloverdale's rain periods found that a general agreement exists. The industry standard practice is an over simplification of the actual rain periods by removing spikes and valleys for localized events; however this process allows the industry standard practice analysis to compare independent regional sewer systems on a state-wide or nation-wide level. **Figure 2.1** in this report provides a graphical illustration of comparison to actual monthly rainfall and the average effluent flows into the WWTF.

[2] Wet Weather Flow – Dry Weather Flow = I/I

[3] Total yearly flow was the summation of the average daily flow in a particular month times the number of days in that particular month summed over the entire year.

the years 2002 through 2007, as significant improvements to the system were made since the last Update. The years 2000 and 2001 were included as the control data set and there averages are shown in **Table 2.2** as a reference. The control data set was used to compare and contrast flow data between the pervious Update and the current Update. All data was derived from the Monthly Self-Monitoring Reports submitted to the Regional Water Quality Control Board (RWQCB.)

Table 2.2
City of Cloverdale
WWTF Loading Data Analysis (MGD)

	2000	2001	2002	2003	2004	2005	2006	2007	Base Data Average	Control Average
Average Daily Flow	0.62	0.63	0.61	0.59	0.48	0.57	0.56	0.34	**0.53**	**0.63**
Average Wet Weather Flow	0.81	0.88	0.82	0.77	0.68	0.76	0.81	0.41	**0.71**	**0.85**
Average Dry Weather Flow	0.45	0.39	0.41	0.41	0.29	0.38	0.32	0.27	**0.35**	**0.42**
Average I/I	0.37	0.49	0.40	0.36	0.39	0.38	0.49	0.15	**0.36**	**0.43**
Total Yearly Volume, MG	**228**	**232**	**224**	**215**	**176**	**208**	**204**	**124**	**192**	**230**

Table 2.3 illustrates the specific loading maximum loads for average dry weather and peak dry and wet weather. All of the experienced averages and peaks over the base loading period were significantly less than the WWTF capacities and show an improvement from the loading experienced in 2000-2001.

Table 2.3
City of Cloverdale
WWTF Capacity, Base Data Loading, and Comparative Data Loading

Loading	Design Capacity	Base Data Loading (2002-2007)	Comparative Data Loading (2000-2001)
Max Average Dry Weather Flow	1.00 MGD	0.41 MGD	0.45 MGD
Peak Dry Weather Flow	2.20 MGD	1.40 MGD	1.50 MGD
Peak Wet Weather Flow	8.25 MGD	4.10 MGD	4.60 MGD

2.3.2 System Dry Weather Effluent Flows

Dry weather base flows occur year round and consist of a combination of effluent sewer loading and a limited amount of infiltration due primarily to ground water seepage. Ideally, dry weather flows are driven entirely by the effluent added to the system by the City users. Accordingly, there is a relationship between the number of connections and effluent flow. The anticipated relationship is that as the number of connections increases, so does the total effluent dry weather

flow. In order to analyze this assumption, **Table 2.4** relates the number of connections to the dry weather flow rates.

Table 2.4
City of Cloverdale
Effluent Flow as a Function of Connections

Date	Number of Connections	Average Dry Weather Flows (MGD)	Flow Per Connection (GPCPD)
2002	2,608	0.41	158.5
2003	2,737	0.41	150.5
2004	2,891	0.29	101.5
2005	2,968	0.38	128.7
2006	2,993	0.32	105.9
2007	3,034	0.27	87.4

Although the number of connections in Cloverdale increased, by approximately 400 over the six-year period, the total effluent flow decreased which caused the effluent flow per connection to decrease by more than 70 gallons per connection per day (GPCPD). To explain why there was a drop in the average dry weather flows over the analysis period an understanding of the make-up of effluent flow is needed. Effluent flow is made-up of all discarded or bi-product fluids flowing into the sewer system. Showers, toilets, washing machines, dishwashers, and sinks are the primary sewer portals. The following are potential causes for the reduction in dry weather effluent flow.

- The improvements that have been made to the effluent collection systems that in turn reduce the total flow. Examples of these improvements are replacement of several older sewer mains and repair of a number of leaking manholes.
- The public awareness to water waste resulting in active water savings by the populous. This restriction of water flow reduces the total effluent flow.
- The drought conditions that are being experienced in the Russian River Watershed have resulted in the steady decline in total and monthly rainfall totals in Cloverdale over the past 2-3 years. The declining rainfall totals over the analysis period suggests that ground water levels in Cloverdale area are decreasing which in turn reduces the amount of infiltration during dry weather periods[4].
- For the most part, the increase in population/connections in Cloverdale has occurred in new construction; therefore, the added effluent population/connection loading has occurred in homes better equipped to reduce the effluent flow out of them, which would reduce the total effluent flow per GPCPD. Additionally, these new construction areas also have new sewer pipe networking which also reduces the amount of infiltration than are experienced in older piping networks.

[4] Although the standard industry practice is to call the period from May through October "dry weather", infiltration continues to impact the system when the ground water table is at or above the depth of the collection system pipes. The standard industry practice assumption is that during the dry weather period, inflows in the form of infiltration are significantly lower such that a difference can be made between typical "unavoidable" infiltration and excessive infiltration that occurs during the "wet weather" (where the level of ground water rises above the elevation of most of the collection system and enters into the collection system through cracks or damaged pipes.)

Each of these factors had an effect on the total dry weather effluent in the system. The per connection flow rate of 87.4 GPCPD would appear to be close to the base effluent rate which does not include any effect from infiltration, while the 158.5 GPCPD rate from 2002 was the maximum high point in the study period.

Table 2.5
City of Cloverdale
Percentage of Water Used

	2002	2003	2004	2005	2006	2007
Residential	86.29%	87.14%	87.59%	87.09%	86.09%	86.38%
Commercial/Professional	3.00%	2.86%	2.82%	2.94%	3.31%	3.71%
Restaurants/Motels/Hospitals	4.67%	4.60%	4.59%	4.27%	4.20%	4.11%
Light Industrials	2.18%	1.94%	1.72%	1.92%	1.55%	1.33%
Heavy Industrial	1.58%	1.18%	1.27%	1.21%	1.66%	1.65%
Civic	2.29%	2.28%	2.01%	2.57%	3.19%	2.81%

Table 2.5 illustrates the distribution of water demand by general land use categories. Residential water demand makes up about 87% of all water consumed in the City. The specific details of the relationship between effluent discharges by residential verses non-residential are unknown for the City because effluent flows are not monitored at the lateral connection. Typically, residential demand is on the order of 2 to 3 times greater than non-residential demand per acre as residential neighborhoods are more densely populated than industrial/commercial land uses.

Industrial/commercial effluent production differs from residential production in flow quantity and effluent strength. The relatively low number of high effluent production industries (such as the wine industry) in the City will have a limited effect on the system capacity due to the low overall percentage of total water consumption from these sources. However, the effluent strength can have a significant impact on the WWTF.

The City of Cloverdale's Industrial Wastewater Discharge Permit (IWWDP) process deals directly with monitoring and addressing potential problems associated with effluent flows from industrial sources. These problems typically include chemical pollutants, high pH and/or high suspended solids. Through the City's IWWDP process the City analyses the waste stream of proposed commercial and industrial users and if it is found that proposed users will contribute effluent with loading characteristics in excess of allowable limits, additional on-site processing is required as a condition of approval for the proposed facility.

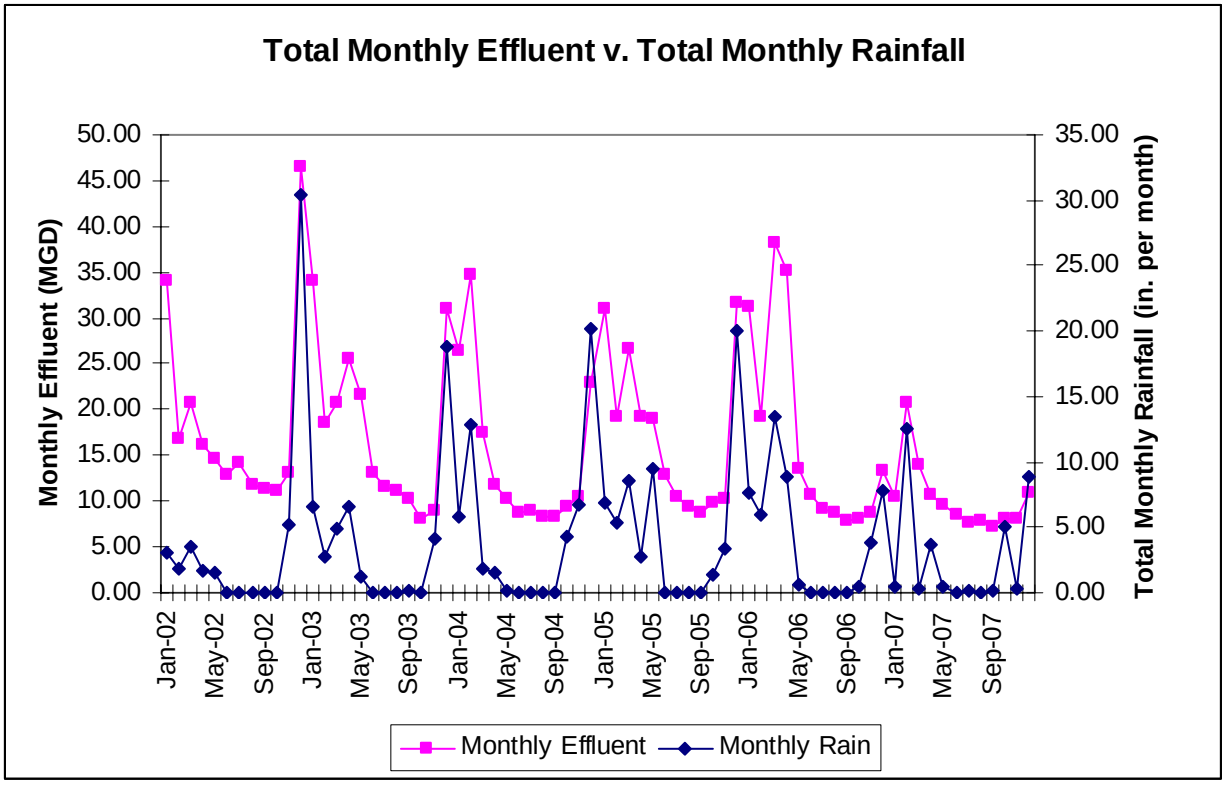
2.3.3 System Wet Weather Flows

Wet weather flows occur during the winter months. The only significant difference between wet weather flows and dry weather flows is the presence of I/I in the effluent steam. Inflow and infiltration is a concern to the sewer system because it produces additional flows of non-wastewater that take up both pipe and treatment plant capacity. Additionally, I/I increases treatment costs (the need to treat all water going through the treatment plant.) Inflow includes external surface water reaching the system through leaking manholes covers, storm water connections, open cleanouts, etc. Infiltration includes water seeping into the piping network

from subsurface ground water through leaking joints, cracked or broken sewer pipes and/or manholes.

As shown in **Table 2.2**, the average I/I experienced over the analysis period was 0.36 MGD, with a high in 2006 of 0.49 MGD. The volume of I/I has a direct relationship to the total rainfall in a given year. **Figure 2.1** shows the effluent flow and the rainfall totals for the base analysis period. The correlation between high effluent flow and rainfall is apparent.

Figure 2.1



Although Cloverdale has made headway in reducing I/I through sewer main replacements and manhole repairs, I/I continue to be a problem. The WWTF rated peak capacity for wet weather is 8.25 MGD. At no time during the study period did the capacity of the system approach this level of flow. However, with anticipated growth and high operation costs of the System, the City needs to continue to replace aging and leaking sewer mains and repairing manholes in an effort to further reduce I/I within the overall sewer collection system and to ensure that flows caused by the 2009 General Plan build-out can be adequately handled by the existing WWTF.

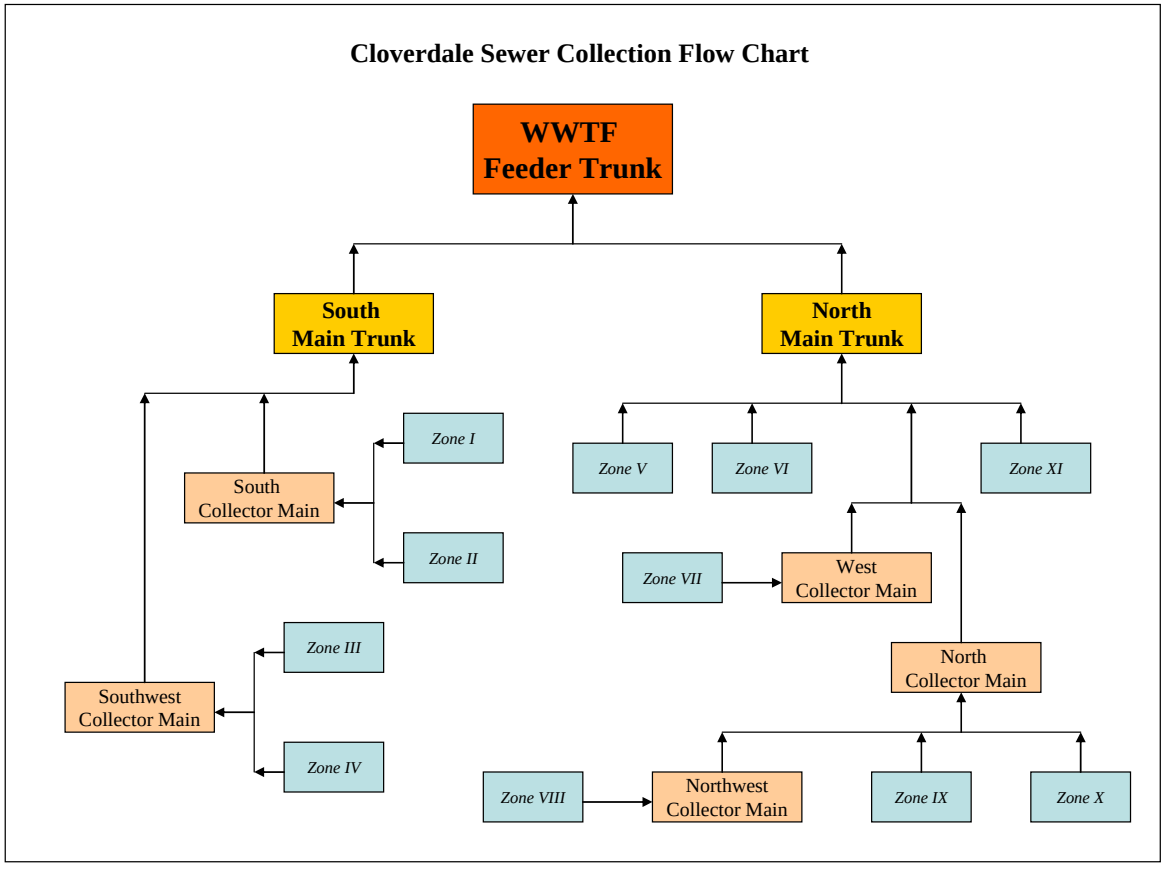
3. HYDRAULIC MODEL

3.1 General

To understand the flow characteristics of the City's sewer collection-piping network, a digital hydraulic model was developed. This model was developed in Microsoft Excel and Haestad SewerCAD. The hydraulic model was used to determine if there are inadequacies in the existing sewer system and to determine what level of upgrades to the system are needed to accommodate General Plan build-out. The model was also used to determine total flows from the General Plan Build-out scenario into the Wastewater Treatment Facility (WWTF) to compare with rated capacities.

For purposes of modeling, the sewer collection system was divided into eleven zones with five collection mains and two trunk mains flowing into the WWTF. The sewer network flow chart is shown in **Figure 3.1**. The Sewer Zone Map is attached as **Map 2,** which depicts these zones on the current Sewer Base Map.

Figure 3.1



The goals of the sewer model are to distribute the effluent flows through the Sewer Piping Network System (Network) in a way that best simulates actually loading in the City of Cloverdale (City). With this distribution, the pipe flow volume effects can be understood and evaluated. Further, once a working existing condition model is in-place the effects of potential changes to the system (e.g. increased growth within the Urban Growth Boundary to accommodate General Plan build-out) can be evaluated. To develop the hydraulic model three steps needed to be accomplished.

1. Background information for the sewer piping network system (e.g. pipe size, depth, slope and length) was collected for as much of the sewer system as could be obtained from city records;
2. Establish flow patterns for effluent into the system.
3. Evaluate inflow and infiltration (I/I) flows.

All of this information was compiled and input into an overall system hydraulic model. Once the hydraulic model was updated with this information, results for both the sewer-piping network and the WWTF flows were evaluated and checked against base flow data to ensure that the information being generated by the model was representative of the current sewer system.

3.2 Analysis of Water Demand vs. Effluent Flow

For the quantitative modeling purposes, the initial assumption made was that there is a direct relationship between domestic water consumed and the resulting effluent generation into the sewer system. The argument is that at all times during the year, effluent flow into the system is relatively constant such that the number of showers, loads of laundry, toilets flushes, etc. does not change appreciably. The effects of non-effluent generating water usage, such as irrigation and the effects of I/I added to the system vary seasonally and therefore their effects needed to be excluded, as much as possible, from the quantitative modeling process. Therefore, a relationship must be drawn that relates the normal water demand and the resulting effluent generated in the form of a conversion factor of water usage to effluent added.

One way to draw such a relationship is to compare dry weather effluent flows (limiting the amount of I/I) and wet weather water demand (limiting the amount of non-effluent water usage such as irrigation). Using modified water usage data obtained from the Cloverdale Water Master Plan Report[5] which included all applicable water connections[6] and effluent flow data a relationship between water usage and effluent flows was established. During the dry season (May through October) effluent flow rates are at their lowest. Conversely, water demands are at there lowest between November and April. **Table 3.1** below shows this relationship.

[5] Prepared by Coastland Civil Engineering, 2009

[6] Applicable connections included all water usage types identified in the Water Master Plan with the exception of all irrigation or fire fighting system water only connections and all connections without a sewer connection.

Table 3.1
City of Cloverdale
Relationship of Domestic Water Consumption to Effluent Sewer Flow

Year	Average Wet Weather Water Consumed (MGD)	Average Dry Weather Effluent Flow (MGD)	Avg. Dry Effluent / Ave Wet Consumed
2002	0.65	0.41	64.0%
2003	0.65	0.41	63.6%
2004	0.66	0.29	44.3%
2005	0.67	0.39	58.8%
2006	0.66	0.32	48.3%
2007	0.71	0.27	37.5%

As shown in **Table 3.1**, the ratio of average dry weather effluent flows to average wet weather water demand ranged from 64% in 2002 to 37.5% in 2007. Although water consumed appears to be relatively stable over the analysis period (ranging from 0.65 MGD to 0.71 MGD) the effluent flow fluctuated between 0.41 and 0.29 MGD over the same period. If a stable relationship had been discovered an average conversion value could have been used. However, because the conversion value was not stable further analysis was warranted.

Upon further analysis, it was relatively clear that the dry weather I/I flows were causing the conversion value to move unpredictably. It was determined then that a modification to the dry period that limited the I/I effect needed to be established.

The modification required was to identify the periods of least amount of rain and compare them with the corresponding dry weather period. **Table 3.2** shows that during the period from June through September Cloverdale experienced the least amount of rainfall in inches per month than at any other period during the year.

Exhibit 3.2
City of Cloverdale
Average Daily Effluent w/o I & I

Rainfall Totals (inches per month)

	2002	2003	2004	2005	2006	2007	Average
May	1.58	1.19	0.08	9.54	0.55	0.49	2.24
June	0.00	0.00	0.00	0.00	0.00	0.00	0.00
July	0.00	0.04	0.00	0.00	0.00	0.17	0.04
August	0.00	0.00	0.00	0.00	0.00	0.00	0.00
September	0.00	0.10	0.00	0.00	0.00	0.09	0.03
October	0.00	0.00	4.30	1.43	0.53	5.06	1.89

The monthly effluent flows for the same period are shown in the **Table 3.3**.

Table 3.3
City of Cloverdale
Average Monthly Effluent

Effluent Totals (million gallons per month)

Month	2002	2003	2004	2005	2006	2007	Average
May	14.57	21.70	10.23	18.91	13.60	9.60	14.77
June	12.90	13.20	8.70	12.90	10.80	8.50	11.17
July	14.26	11.47	8.99	10.54	9.10	7.60	10.33
August	11.78	11.16	8.37	9.30	8.80	7.80	9.54
September	11.40	10.20	8.40	8.70	7.90	7.30	8.98
October	11.16	8.06	9.30	9.92	8.10	8.00	9.09
		Average Monthly Effluent (Jun-Sep)					**10.0**
		Average Daily Effluent (Jun-Sep) MGD					**0.33**

The average wet weather water consumption was 0.66 MGD for the years 2002-2007. The average daily effluent flows for June through September were 0.33 MGD for the years 2002-2007. **Table 3.4** takes the average wet weather monthly water demand rate of 0.66 MGD and average monthly effluent flows and derives the water-to-effluent conversion factor of 50%.

Table 3.4
City of Cloverdale
Water-to-Effluent Conversion Factor

Average Wet Weather Water Consumed (MGD) 2002-2007	Average Dry Weather Effluent Flow (MGD) (July-October)	Avg. Dry Effluent / Avg Wet Consumed
0.66	0.33	**50%**

3.3 Effluent Flow Distribution Model

To understand the sewer pipe network, a SewerCAD sewer network model was developed based on the existing AutoCAD sewer pipe base mapping (**Map 1**). A manual inspection of existing as-built construction plans was able to provide sewer manhole depths and verify pipe sizes and slopes for approximately half of the city's collection system. In a few cases, as-built information was available for only part of a reach of the sewer piping network. In these cases newer piping networks were modeled and connected to older piping networks where as-built information was not available. Where the as-built information was not available, assumptions had to be made to estimate the depth and slope of the piping network so that the network was continuous. In order to make these assumptions topographical data was used from existing as-built plans and Google Earth which aligned the pipes to the relative elevation of the streets at an assumed and invert depth of 5-ft. These assumptions are shown in **Appendix 1a & 1b**.

The model type used was a semi-nodal[7] system analysis where all effluent sewer production is input in the model at manhole locations, or nodes (individual laterals were not modeled.) As addressed above, some of the construction documentation required to create a complete hydraulic model were just not available due to the age of construction. In those cases the predicted Network loading was placed at the nearest known node. The model therefore consisted of all sewer pipes that connected known nodes, which did not include end-of-line clean outs. The net length of sewer pipe modeled was approximately 23 miles of pipe.

The critical issue was determining the quantity of effluent from each connection. The water use demands identified in the Cloverdale Water Master Plan were used to differentiate the sewer production of the individual user. Each user's average water demand for the wet period of the 2007 was factored with the water-to-effluent flow factor and then applied to the closest down stream manhole connection point relative to the address of the user. The resulting model average dry weather flow was 0.36 MGD and the resulting average wet weather flow was 0.72 MGD. These model averages were with in 0.01 MGD of recorded averages over the base data period of 2002 through 2007.

3.4 Inflow and Infiltration Analysis

The quantity of effluent that reaches the sewer piping network from I/I varies over time and is a function of rainfall, surface runoff and ground water elevations. For the sewer hydraulic model, an average benchmark of I/I needed to be established. **Table 2.2** showed that the actual average I/I was 0.36 MGD for the period of 2002 through 2007, with a high of 0.49 MGD in 2006. An ongoing effort by the City has reduced the volume of inflow that reaches the sewer collection system. Accordingly, for modeling purposes it was assumed that a minimal amount of inflow existed and that the majority of I/I was due to infiltration into the collection system.

There are approximately 32.3 miles of sewer pipes within the City. If the average I/I over the analysis period is 0.36 MGD during the wet period, then the average I/I (in gallons per linear foot of pipe) is 2.11 gallons per linear foot per day. Due to the limited number of linear feet of Network pipes in the model (approximately 23 miles) the average I/I per linear foot of pipe is 3.06 GPD/lf.

3.5 Hydraulic Model Analysis and Output

Microsoft Excel was used to allocate and amass the volumes of flows for input into the hydraulic model program. A flow control spreadsheet allowed the values to be manipulated throughout each of the necessary sheets for average and peak volumes of effluent and I/I for both existing demand and for projected General Plan build-out. See Section 4 for capacity analysis.

The Excel spreadsheets were uploaded into the SewerCAD model for the analyses. Once in the SewerCAD model, the program processed the input flows and updated the SewerCAD flow network map. The map was then evaluated so that improvements to the system could be modeled for performance. Areas of concern, such as pipe sizing and pipe slope were evaluated

[7] Simi-Nodal is a system that places effluent flow quantities at nodal locations (manholes) and I/I flow per length of pipe.

and improvements were made in the model. The standard of practice and the benchmark used for maximum pipe flow criteria in this analysis is that the trunk mains should flow at no more than 50% of capacity and the rest of the pipe system should not flow more that 80% of capacity.

Additionally, new reaches of pipe were added into the model for the 2009 General Plan build-out areas. Flows for these new areas were established from land use data using effluent production based upon historic utility billing water use data or from industry standards (if the land use did not currently exist in the City.)

In the Appendix of this report, **Appendix 2a** through **2e**, show the man-hole and pipe output data from the existing system and the build-out system from SewerCAD. **Appendix 3a** and **3b** show the build-out loading used for the model. Each of the build-out connection points shown in **Appendix 3a** and **3b** are identified on **Map 3**, the Vacant Area Map.

4. CAPACITY ANALYSIS

The capacity analysis involved evaluating both the Wastewater Treatment Facility (WWTF) and the Sewer Collection Network System (Network) for the maximum peak day demand that each system can experience. Peak demands are extreme flow demands placed on the system for a relatively short period of time. The theoretical capacities of the Wastewater Treatment System (System) are the upper limit that the System could accommodate in a worst-case scenario. This analysis addresses what the expected peak demands of the system are for both the current system and the 2009 General Plan build-out condition and how these demands relate to the capacities of both the WWTF and the Network.

4.1 Existing System Capacity

The existing system capacity has not proven to be an issue with regards to either transportation or treatment of effluent flows for the City. The following analysis is broken into the WWTF Capacity and the Network Capacity. All capacities were evaluated based on historic effluent flow data evaluated in the previous sections of this report.

4.1.1 Current WWTF Capacity

The WWTF inflow capacities over the study period have not been met or surpassed. The rated capacities (based upon the design and current NPDES permit), historic maximum experienced loading and available capacity remaining for the WWTF are shown in **Table 4.1**.

Table 4.1
City of Cloverdale
WWTF Capacity and Historic Flows

Loading	Capacity	Maximum Historic Experienced Loading	Historic Maximum Loading Experience	Percentage of Available Capacity
Average Dry Weather Flow	1.00 MGD	0.41 MGD	Dry Period 2002 & 2003	41.0%
Peak Dry Weather Flow	2.20 MGD	1.40 MGD	May 2003 & May 2005	63.6%
Peak Wet Weather Flow	8.25 MGD	4.10 MGD	December 2003	50.0%

In order to calculate the maximum peak dry weather flow a peaking factor must be derived. A peaking factor takes the maximum flow experienced and divides that by the average flow. From the information in **Table 4.1** the peaking factor for dry weather flows can be calculated as follows:

Max Dry Weather Flow of 1.40 MGD / Average Dry Weather Flow of 0.36 MGD = 389%

To compare the findings from this study with industry standards, "Wastewater Engineering – Treatment and Reuse"[8] was used as a reference source. According to this reference, peaking

[8] "Wastewater Engineering – Treatment and Reuse", Fourth Edition, by Metcalf & Eddy, Inc, Revisions by George Tchobanoglous, Franklin L. Burton, H. David Stensel, McGraw Hill Publishing, 2003; Pg 202, Figure 3-13

factors for cities with a population of ~9,000 typically experience a peaking factor of 375 – 380%. The 389% peaking factor for dry weather flows experienced in Cloverdale is slightly higher than the published anticipated peaking factor for a total population of ~9,000 residents, but well within reason. By applying a 389% peak factor to the hydraulic model, the total anticipated dry weather WWTF flow is 1.41 MGD. This peak flow is approximately the same maximum peak of the base data period experienced in 2003 and 2005.

In order to determine the peaking factor for wet weather flow, the impact of I/I needs to be added to the peak dry weather flows. The inflow portion of I/I is a function of rainfall, while the infiltration is a function of ground water pressures on the various cracks and joints of the piping system. There is no way of knowing what the effluent flows are at during a peak wet weather scenario as all of the extra flow could be a result of I/I. Therefore, in order to calculate the effect of I/I the following equation needs to be used. First take the maximum experienced wet weather flow and removing the average dry weather flow. The remaining value would be maximum peak I/I. Then divide the maximum peak I/I from the average I/I and that yields the I/I maximum peaking factor.

Max Wet Weather Flow of 4.10 MGD – Average Dry Weather Flow of 0.36 MGD = 3.74 MGD

Max Peak I/I 3.74 MGD / Average I/I 0.36 MGD = I/I Peaking Factor 1,039%

Table 4.2 below tabulates the factors and anticipated loads of the existing system.

Table 4.2
City of Cloverdale
As-Built WWTF Influent Flow

Average					
	Water Usage to Effluent Factor	**Inflow Rate***	**I/I Peak**	**Flow Peak**	**AVERAGE DAILY FLOW (MGD)**
Current System Dry Weather Flows	50%	3.06	0%	100%	0.36
Current System Wet Weather Flows	50%	3.06	100%	100%	0.72
Peak					
	Water Usage to Effluent Factor	**Inflow Rate***	**I/I Peak**	**Flow Peak**	**PEAK DAILY FLOW (MGD)**
Current System Dry Weather Flows	50%	3.06	0%	389%	1.41
Current System Wet Weather Flows	50%	3.06	1039%	389%	5.16

* Inflow Rate is in gallons per linear feet of pipe

4.1.2 As-Built Sewer Pipe Network Capacity

Using the peaking factor calculated above, peak wet weather flows, totaling 5.16 MGD, were distributed into the SewerCAD model. The results were that at no point did any of the flows in any of the existing pipes exceed 100% of pipe capacity. A few sections of pipe were at levels that were above the desired level of the system. Those sections include:

- The 6-inch section of sewer pipe connecting Monaco Circle to Venezia Way was at 83% of capacity.
- The 18-inch reach of the southern trunk main adjacent to the WWTF was at 87% of capacity. Up-Sizing this reach of pipe to 24-inch sections would reduce the used capacity to 40%. This should be done at the time of the Plant upgrade.
- The 24-inch WWTF feeder pipe was at 95% of capacity. Up-Sizing this section of pipe to a 30-inch pipe would reduce the used capacity to 53%. This should be done at the time of the Plant upgrade.

However, it is the opinion of this Update, that although these reaches of the Network are greater than the desired levels, the loading anticipated by the sewer model does not warrant upgrading these facilities at this time if future upgrades to accommodate the 2009 General Plan build-out are under consideration.

4.2 Population Analysis

An analysis of the population of the City is critical to quantifying future wastewater demands of the City. **Table 4.3** shows annual population, growth and the mid-year population[9] [10]. The population growth over the life of the base data period is approximately 2% per year equating to a net increase of 1,200 new residents since 2002. The projected population at build-out (as stated in the City's 2009 General Plan) is 12,000 residents within 16 years. The average annual projected population growth needed to reach the complete build-out is approximately 170 new residents every year for the next 16 years.

Table 4.3
City of Cloverdale
Historic and Projected Population Table

Year	Population	Population Growth	Mid-Year Population
2002	7,333		7,208
2003	7,481	2.02%	7,407
2004	7,959	6.39%	7,720
2005	8,197	2.99%	8,078
2006	8,412	2.62%	8,305
2007	8,479	0.80%	8,446
2008	8,577	1.16%	8,528
2025	*12,000*	*39.91%*	

[9] The mid-year calculation is a linear interpolation between the prior year-end population and the following year-end population
[10] The source of population data was the Association of Bay Area Governments, and the U.S. Census Bureau

4.3 General Plan System Capacity

The 2009 General Plan sets forth the type and location of all planned development for the City by land use categories. Planned development includes residential, industrial and commercial lands. In order to quantify the impact and demand requirements that this development will have on the System, the Update must: identify what the wastewater requirements are for each land use type, propose a System which meets the needs of the 2009 General Plan build-out scenario, and quantify the additional demand loads that build-out will have on the WWTF and the Network. The proposed Land Use Development Map (**Map 3**) used in the 2009 General Plan identifies the areas where future development may occur.

4.3.1 Industrial/Commercial Build-out Wastewater Demand

The primary new areas of Industrial and Commercial development are anticipated to occur in the southern portion of the City, primarily along Asti Rd and Dutcher Creek Rd. Per the Land Uses identified in the General Plan update, these areas will encompass a wide array of uses including shopping, retail, a golf course, lumber industry, and wine/brewery facilities. Additionally, areas of infill throughout City are expected to develop. As shown in the Water Master Plan Update, each land use type has a water demand associated with it based on historical and analytical analysis. The build-out acreage and corresponding water demand and wastewater production are tabulated in **Table 4.4** below.

Table 4.4
City of Cloverdale
Industrial and Commercial Loading at Build-out

Land Use		Undeveloped Land Acreage	Water Demand (GPAPD)	Total Water Demand (GPD)	Water/ Effluent Factor	Average Effluent Produced (GPD)
Service Commercial	SC	11.32	500	5,660	50%	2,830
General Industrial	GI	143.63	1,100	157,997	50%	78,998
Business Park	BP	93.30	300	27,990	50%	13,995
General Commercial	GC	8.09	1,350	10,922	50%	5,461
Downtown Commercial	DTC	1.10	1,220	1,342	50%	671
Destination Commercial	DSC	103.57	1,200	124,280	50%	62,140
Mixed Use Commercial	MC	0.80	800	640	50%	320
Transportation Oriented Development	TOD	3.70	120	444	50%	222
		Total Average Effluent Produced by New Commercial/Industrial Development				**164,637**
		Peaking Factor				**389%**
		Peak Effluent Produced by New Commercial/Industrial Development				**640,438**

4.3.2 Residential Build-out Wastewater Demand

The 2009 General Plan states that the maximum population for the City shall be 12,000 residents. However, if maximum densities for the various residential land uses are used for all

current vacant land, the population at build-out would be more than 13,500 residents. Accordingly, for the analysis of the System build-out scenario, the effluent generation will be based on a population of 12,000. However, because residential land use densities can vary greatly throughout the City, the pipe sizing used in the Update assumes that maximum density development could happen in any vacant residential land use location. This was done to ensure that the collection system would be able to sustain up to the maximum density build-out in any of the areas to be developed.

Table 4.5 shows the, maximum build-out density for residential land uses. It should be noted that these demands are only indicative of the possible maximum density flows and not representative of the expected build-out flows, as those flows will be population dependent.

Table 4.5
City of Cloverdale
Maximum Build-out Density for Residential Land Uses

Land Use		Vacant Acreage	Residences Per Acre	Total Number of Residence	Water Demand per Residence* GPRPD	Total Water Demand GPD
Rural Residential	RR	91.00	1	91	331.8	30,194
Low Density Residential	LDR	140.50	2	281	331.8	93,236
Medium Density Residential	MDR	87.60	6	526	331.8	174,527
High Density Residential	HDR	8.60	12	103	331.8	34,175
Downtown Infill Area				500	331.8	165,900
Alexander Valley Area				170	331.8	56,406

** The per capita water demand per the Water Master Plan is 110.6 GPCPD, with an average of 3 residents per house*

Total Average Water Demand (Based on Maximum Density at Build-out)	554,438
Water/Effluent Factor	50%
Total Average Effluent Produced by New Residential Development	**277,219**
Peaking Factor	**389%**
Peak Effluent Produced by New Residential Development	**1,078,382**

Table 4.6 tabulates the expected residential flows into the WWTF. A maximum population of 12,000 was used to calculate flows into the WWTF.

Table 4.6
City of Cloverdale
Build-Out Residential Loading w/12,000 Population Max

Land Use		Vacant Acreage	Homes Per Acre	Total Number of Homes
Rural Residential	RR	91.00	1	91
Low Density Residential	LDR	140.50	2	281
Medium Density Residential	MDR	87.60	6	526
High Density Residential	HDR	8.60	12	103
Downtown Infill Area				500
Alexander Valley Area				170
Total New Homes				1,671
Total Number of New Residents*				**5,013**
Number of Existing Residents as of 1/1/08				8,577
Total Number of New Residents and Max Density Build-Out				13,590
2009 General Plan Population Goal				12,000
Percentage of Population under 12,000				**88.30%**

** The average of 3 residents per house*

Land Use		Adjusted Number of Homes**	Water Demand per Home*	Water Demand Per Home GPD
Rural Residential	RR	80	331.8	26,544
Low Density Residential	LDR	248	331.8	82,286
Medium Density Residential	MDR	464	331.8	153,955
High Density Residential	HDR	91	331.8	30,194
Downtown Infill Area		442	331.8	146,656
Alexander Valley Area		150	331.8	49,770

*** The Adjusted Number of Homes = Number of Homes * Percentage of Population under 12,000*

Total Average Effluent Added to the System	489,405
Water/Effluent Factor	50%
Total Average Effluent Added to the System	**244,703**
Peak Rate	**389%**
Peak Effluent Added to the System	**951,893**

4.3.3 Build-out I/I Loading

2009 General Plan build-out will require additional Network to the System. The additional Network will be affected by ground water infiltration. The build-out model accounts for the loading effect that this infiltration would have on the system in the wet weather flows. Loading from infiltration was estimated from two sources. The first source was the reaches of trunk sewer mains added to the System to get sewer services to a specific area not already serviced by the City. The second source was in the Network constructed within the new areas of development.

The first source includes the construction of approximately 10,500 linear feet of new trunk sewer main. The I/I added to the system for this newly installed pipe (using a rate of 3.06 gal/lf) is approximately 32,500 GPD. This estimate assumes that the newly installed reaches of pipe will have the same in flow rate as the existing system over time. The actual inflow rate may in fact be less due to better materials; however, as the level of inflow is not yet been determined, the existing inflow rate was used.

For the second source, because there is no idea of how the Network will be laid-out or how many miles of new pipe will be added to the system in areas of new development, a different way of accounting for I/I had to be used. **Table 4.7** shows how the average I/I per acre was arrived at for the second source of the collection system. The largest I/I experienced was divided by total used acreage to get an average I/I per acre then by applying the average I/I per acre to the vacant acreage results in a total average I/I due to the second source. However, because the maximum vacant acreage exceeds the total population if maximum density is used for those acreages the total I/I due to residential build-out must be scaled by the population limiting factor of 88%. The summation of the total peak I/I experienced due to build out is shown in **Table 4.7** below:

Table 4.7
City of Cloverdale
Per Acre I & I Calculation

Land Use Type		Total Acreage	Used Acreage	Vacant Acreage
Business Park	BP	153.7	60.6	93.3
Destination Commercial	DSC	336.2	59.5	103.6
Downtown Commercial	DTC	30.8	29.7	1.1
General Commercial	GC	27.7	19.6	8.1
Mixed Commercial	M	14.1	13.3	0.8
Service Commercial	SC	42.0	30.7	11.3
General Industry	GI	362.9	219.5	143.6
Transit Oriented Development	TOD	13.9	10.2	3.7
Public, Quasi-public, Institutional	P	290.7	290.7	0.0
Rural Residential	RR	757.3	701.4	91.0
Low Density Residential	LDR	816.6	726.0	140.5
Medium Density Residential	MDR	232.0	141.8	87.6
High Density Residential	HDR	84.8	75.5	8.6
Total		**3,162.7**	**2,378.5**	**693.2**

**CF Excluded from Acreage as land does not have sewer requirements*

Max Average Observed I & I	489,806
I/I Average Per Currently Developed Acre (gallons/acre)	**205.9**
Total Number of New Residents and Max Density Build-Out*	13,590
2009 General Plan Population Goal	12,000
Percentage of Population under 12,000	**88.30%**
Source 2a - Average I/I due to Build-Out of Internal Residential Collection Systems	67,483
Source 2a - Average I/I due to Max Build-Out of Internal Residential Collection Systems	59,588
Source 2a - Average I/I due to Build-Out of Internal Non-Residential Collection Systems	75,269
Source 1 - Average I/I due to new Trunk Sewer Mains	32,436
Total Average I & I due to Build-Out	**167,293**
Peak Rate	**1039%**
Peak Effluent Added to the System	**1,738,171**

* Per Table 4.6

4.3.4 Build-out Flows at WWTF

As shown in **Table 4.8** the build-out effluent average daily and peak wet weather flows are within the rated capacities of the WWTF. However, the build-out peak dry weather flows are 136% of the rated capacity of the WWTF.

Table 4.8
City of Cloverdale
Build-out Influent Flow into the WWTF

Average					
	Flow Factor	**Inflow Rate (gal/lf of pipe)**	**I/I Peak**	**Flow Peak**	**AVERAGE DAILY FLOW (MGD)**
Build-out Dry Weather Flows	50%	3.06		100%	0.77
Build-out Wet Flows	50%	3.06	100%	100%	1.27
Peak					
	Flow Factor	**Inflow Rate (gal/lf of pipe)**	**I/I Peak**	**Flow Peak**	**AVERAGE PEAK FLOW (MGD)**
Build-out Dry Flows	50%	3.06		389%	3.00
Build-out Wet Flows	50%	3.06	1039%	389%	8.16

These peak flows are based on maximum build-out over the next 16 years. The loads identified in **Table 4.8** are based upon the flows over the past 5 years; however, the flow characteristics can change. Reductions in total water consumed, low water demand development, non-maximum density industrial/commercial development, and continued I/I reduction projects can reduce the total effluent produced City-wide so that the capacity threshold of the WWTF may not be surpassed in the peak flow scenarios. Given the current loading criterion, the WWTF would be operating at 93% of the peak dry weather capacity for a population of 10,000 residents and a total of 42% of complete commercial/industrial build-out. The Update therefore recommends that the City should continue to monitor loading levels as Cloverdale begins to expand to meet the 2009 General Plan. When the population has reached approximately 10,000 residents the City should re-evaluate the wastewater flows into the WWTF and conduct another Sewer Master Plan Update to identify any changes in the loading criteria. An expansion to the WWTF, if warranted, would be very costly to the City.

4.3.5 Build-out Sewer Collection Network System Capacity

The Network model identified several areas that will require either new piping network to support the build-out demands or up-sizing of existing sewer piping to accommodate greater flows while maintaining a design criteria of 80% full capacity for sewer pipes and 50% full capacity for trunk mains. **Table 4.9** shows which reaches of pipes will need to be upsized and **Table 4.10** shows what new reaches of pipes will need to be added to the existing sewer-piping network.

Table 4.9
City of Cloverdale
Existing Sewer Collection System Needing to be Up-Sized to Accommodate Growth

Reach	Length (ft)	Existing Pipe Size (inch)	Up-Sized Pipe Size (inch)	Avg % of Flow w/Existing Pipe Sizing	Avg % of Flow w Pipe Up-Sizing
North Cloverdale Blvd from North St. to 415 N. Cloverdale Blvd	1,463	6	10	170%	43%
Fourth St./North Main St./East St Collector from 415 N. Cloverdale Blvd to Lake St	2,346	6	12	116%	22%
South Trunk Main from Junction of S and SW Collection to WWTF Trunk Main	1,354	18	30	130%	33%
WWTF Trunk Main	200	24	36	160%	54%

Table 4.10
City of Cloverdale
New Sewer Collection System Needed to Accommodate Growth

Reach	Length (ft)	New Pipe Size (inch)
North Cloverdale Blvd from North St. to McCray Rd +1 Lift Station	3,010	8
Asti Rd from Santana Blvd to South of Theresa Dr +2 Lift Stations	8,952	12 & 8
Theresa Dr from Asti Rd to Dutcher Creek Rd	708	8

The North Cloverdale Blvd and Fourth Street/North Main St./East St. collector up-sizing and the Network extension along North Cloverdale Blvd are necessary to accommodate primarily residential flows from the developments to the north, as well as new services to existing residences and business along this reach. The WWTF Trunk Main and South Trunk Main up-sizing and sewer piping extension along the Asti Rd and Theresa Dr are necessary primarily to accommodate both residential and industrial/commercial development along the Highway 101 corridor. These improvements are discussed in more detail in Section 5.4.

5. SYSTEM IMPROVEMENTS

The 2009 General Plan outlines the planned growth for the City of Cloverdale (City) for the next 16 years. The 2009 General Plan plans for the potential growth in the population of City from the current population of ~8,500 residents to a maximum population of 12,000 residents by 2025. The 2009 General Plan shows the addition of approximately 693 acres of commercial/industrial development to the City. In order to accommodate this growth, the City will have to expand the City's Wastewater Collection Network (Network) to those areas. Note that this Update only considers the main truck and collector improvements necessary to accommodate those areas. The collection system within any given development would need to be designed and constructed with that development.

5.1 Existing Network Replacement/Improvements

The current Network performs well in moving effluent flows from the Network connections to the Wastewater Treatment Facility (WWTF); however, the system does require upkeep and replacement/improvement to aged parts of the Network. The Sewer Master Plan Update (Update) has identified several areas where the Network pipes in the ground are aged and in need of replacement based on the age and material of the pipe in the ground and from the experience of the Wastewater Treatment Plant Operators who inspect the system. These pipes are a major source of inflow and infiltration (I/I) into the Wastewater Collection System (System). The aged sewer pipes requiring improvements are located in the following streets (the exact reaches of streets are contained in the Cost Estimate portion of the Update):

Grace Ct.
Heidi Ln.
Kay Ct.
Shahan Dr.
Champlain Ave.
Charles St.
Fourth St.
Haehl St.
Hardister Dr.
Jefferson St
Kerry Ln.
North St.
School St.
Silva St.
Washington St.
Butler Ct.
Foster Ct.
Josephine Dr.
North Foothill Dr.
First St.
Franklin St.
Los Colinas Dr.
Second St.
Main St.
Stameroff Ct.
Third St.
Triplett Dr.
University Dr.
Vista View Dr.
Evergreen Ln.
Lake St.
Live Oak Ln.
Allen Ave.
Alter St.
Blair St.
Brookside Dr.
Caldwell St.
Clark Ave.
Debmar Ln.
Dina St.
E Cherry Creek Rd.
Elm St.
Hillview Dr.
Mayor Way
Rosewood Dr.
Tarman Dr.
Bandiera Way
Burgundy Ct.
Chablis Way
Cherry Creek Rd.
Foothill Blvd.
Roan Ct.
Rose Ct.
Vine Dr.

5.2 Existing Network Upgrades

The Network and WWTF adequately serves the existing needs of the City. At current effluent levels, some non-mandatory piping system upgrades could be performed to address concerns outlined in the previous section of this report. These include:

- The 18-inch reach of the southern trunk main adjacent to the WWTF is currently at 87% of capacity. Up-sizing this reach of pipe to 24-inch sections would reduce the used capacity to 40% under current conditions; however, 2009 General Plan build-out will require this portion of main to be replaced with a 30-inch.
- The 24-inch WWTF feeder main is at 95% of capacity. Up-sizing this feeder pipe to a 30-inch main would reduce the used capacity to 53%; however, 2009 General Plan build-out will require this portion of main to be replaced with a 36-inch.

5.3 2009 General Plan Build-out Improvements

Future development in the City is comprised primarily of residential and industrial/commercial. Residential development is made up of single-family homes, multi-family apartment and condominium complexes. Industrial/commercial development varies by land use types and encompasses a wide array of different wastewater production rates. Included in the proposed industrial/commercial development array are winery/brewery facilities, retail facilities, lumber industry storage and production facilities, hotel/motel facilities, and a golf course, among others.

5.3.1 WWTF Upgrade to AWT

Specific to the City, Advanced Treated Wastewater for discharge to the Russian River is defined in Article IV.A.1 of the City's NPDES Permit (NPDES No. CA0022977). The numerical limitations for advanced wastewater treatment are tabulated in **Table 5.1**. The City has retained HDR to perform a preliminary study to modify the WWTF to AWT. At the time of this writing the HDR study has not been completed. Consequently, the following discussion of the WWTF improvements is preliminary. Once completed, the HDR study should be referred to for further information.

The AWT upgrade would involve three related elements: advance wastewater treatment, wastewater storage, and a recycled water distribution program. The advance wastewater treatment design typically includes, a conventional activated sludge wastewater treatment plant, followed by tertiary filtration and chlorine or ultra violet light (UV) disinfection, in combination with local pretreatment limits and/or commercial and industrial pretreatment program are capable of achieving the limitations shown in **Table 5.1**.

Table 5.1
City of Cloverdale
Numerical Limitations for Advanced Wastewater Treatment

Parameter	Units	Effluent Limitations			
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Min / Max
Biological Oxygen Demand (5 day @ 20°C)	mg/L	10	15	--	--
Total Suspended Solids	mg/L	10	15	--	--
pH	Su	--	--	--	6.5 to 8.5
Turbidity	NTU	2	--	5	--
Coliform (Total)	MPN/100 mL	--	2.2	23	240
Chlorine (Total)	mg/L	--	--	--	< 0.1
Cyanide	µg/L	4.3	--	8.5	--
Copper	µg/L	A		A	
Carbon Tetrachloride	µg/L	0.25	--	0.50	--
Mercury	µg/L	0.050	--	0.100	--
Dichlorobromomethane	µg/L	0.56	--	1.1	--

The wastewater storage improvements are a direct result of North Coast Regional Water Control Boards (NCRWCB) concerns over treated wastewater potentially reaching the Russian River during the period of restricted discharge. In addressing these concerns HDR is looking into a storage system that will allow the City to store wastewater in this period without percolation into the soil. Treated waters from the WWTF will be stored during the restricted discharge period in ponds which do not percolate into the soil. These treated flows will then be moved from the ponds into a recycled water distribution network and used for irrigation. During the period of permitted discharge the current system of percolation ponds with an option for direct discharge may be used in accordance with the restrictions of the NCRWCB.

5.4 Build-Out Network Improvements

Based on the land use shown in the 2009 General Plan, up-sizing and extension of the existing Network will need to occur to support development. Primarily, Network extensions will need to be constructed to support major developments both at the north and south of the Urban Growth Boundary. Improvements needed include the following (as identified in **Tables 4.9** and **4.10**):

- Approximately 1,730 linear feet of 8-inch sewer main will need to be installed from North Street northerly to the top of the grade on North Cloverdale Boulevard. This portion of the system will be a gravity system. From this point, approximately 1,280 linear feet of 6-inch non-gravity force main will need to be installed to support the area zoned for residential development adjacent to McCray Road. A pump station will need to be installed in close proximity to the proposed development. The pump station should be capable of pumping 0.527 MGD peak wet flows to overcome the approximate 95-feet of elevation difference between the area zoned for residential and the top of the grade of North Cloverdale Blvd. Additionally, all lift stations should be above ground where ever

practical. Additional sewer mains will need to be constructed to support development in this area; however the location collection system will be the responsibility of the developers in this area.

- For the area at the southern portion of the City, approximately 6,400 linear feet of 12-inch and 1,400 linear feet of 8-inch gravity sewer main and 1,100 linear feet of 6-inch sewer force mains will need to be constructed in Asti Road to serve the areas zoned for development. In addition, two pump stations will be required at various locations along Asti Rd. will be needed to lift effluent at two low spots along this route. Subsequently, a line will need to be extended at Theresa Drive and will pass under the Highway 101 to connect the Dutcher Creek Road and Theresa Drive areas. This will require just over 700 linear feet of sewer main to be constructed. The main will pass through the Caltrans right-of-way either at Theresa Dr or be bored and jacked under the freeway at another location. The total added load that the Asti Rd collection system will transmit will be 0.274 MGD during peak wet flow periods.

In addition to the new sewer mains detailed above, up-sizing of portions of the existing Network will have to be done to accommodate anticipated growth shown in the 2009 General Plan. The following three primary reaches of the sewer collection system will need to be up-sized:

- North Cloverdale Blvd - from North Street to approximately 415 N Cloverdale Boulevard (1465 lf), the 6-inch existing sewer main will need to be upsized to a 10-inch main. This main will have to be connected to the existing sewer main in East Fourth Street.
- The existing sewer mains in East Fourth Street. (between North Cloverdale Boulevard and Main Street), in Main Street (from East Fourth Street to East Second Street), in East Second Street (from Main Street to East Street) and in East Street (from East Second Street to Lake Street) will ultimately need to be upsized to 10 and 12-inch mains. The total amount of Up-Sizing associated with these streets is approximately 1,460 linear feet of 10-inch main and approximately 2,350 linear feet of 12-inch main.
- A portion of the existing 18-inch trunk main serving the southern portion of the City will eventually need to be upsized from an 18-inch main to a 30-inch main to accommodate new development per the General Plan Update in the southern portion of the City. Up-Sizing will need to occur from the junction point of the existing 15-inch sewer main and the 18-inch sewer main (from the Santana Drive area) close to Porterfield Creek on the east side of Highway 101. This section of Up-Sizing involves approximately 1,350 linear feet of sewer main.
- A 200 linear foot section of the existing 24-inch sewer line just upstream from the headworks at the WWTF will eventually need to be upsized to a 36-inch main from the junction point of the existing 27-inch and 18-inch mains to the headworks.

6. IMPROVEMENT COSTS ANALYSIS

The cost analyses for the required upgrades and new sewer collection systems needed to support the build-out per the 2009 General Plan are shown in the following sections. The cost estimates include portions of the Wastewater Collection Network System (Network) that are considered the trunk mains within the City of Cloverdale (City).

6.1 Cost Estimate WWTF Upgrade Description

Conceptual level cost estimates were developed based on the 0.5 MGD (Phase 1) and 1.0 MGD (Phase 2) WWTF capacities and a cursory review of recent projects with similar facilities and improvements. A summary of the estimate of probable construction and capital cost is presented in **Table 6.1**. The basis for the cost estimates is the ENR Construction Cost Index for the San Francisco Bay Area for June 2008, which is 5244.

Table 6.1a
City of Cloverdale
Waste Water Treatment Facility Advanced Treatment Upgrade

Item Number	Description	Phase 1	Phase 2	Total
1	Biolac Type Extended Aeration System	$730,000	$630,000	$1,360,000
2	Secondary Clarifiers	$840,000	$680,000	$1,520,000
3	Tertiary Filtration	$1,250,000	$1,100,000	$2,350,000
4	UV Disinfection	$160,000	$570,000	$730,000
5	Site Piping	$420,000	$210,000	$630,000
6	Pumping Station	$370,000	$210,000	$580,000
7	Ancillary Improvements	$470,000	$310,000	$780,000
8	Miscellaneous Improvements	$750,000	$350,000	$1,100,000
	Phase Construction Subtotal	$4,990,000	$4,060,000	
	Construction Subtotal			**$9,050,000**
	Contingency (30%)	$1,497,000	$1,218,000	$2,715,000
	Construction Total	**$6,487,000**	**$5,278,000**	**$11,765,000**
	Administration & Legal (10%)	$499,000	$406,000	$905,000
	Design PS&E (15%)	$748,500	$609,000	$1,357,500
	Environmental (20%)	$998,000	$812,000	$1,810,000
	Construction Management (15%)	$748,500	$609,000	$1,357,500
	Total ATP Upgrade Cost	**$9,481,000**	**$7,714,000**	**$17,195,000**

Table 6.1b
City of Cloverdale
Waste Water Treatment Facility Wastewater Storage Upgrade

Item Number	Description	Phase 1	Phase 2	Total
1	Liner	$152,000	$87,000	$239,000
2	Storage Basin	$350,000	$200,000	$550,000
	Phase Construction Subtotal	$502,000	$287,000	
	Construction Subtotal			**$789,000**
	Contingency (30%)	$150,600	$86,100	$236,700
	Construction Total	**$652,600**	**$373,100**	**$1,025,700**
	Administration & Legal (10%)	$50,200	$28,700	$78,900
	Design PS&E (15%)	$75,300	$43,050	$118,350
	Environmental (20%)	$100,400	$57,400	$157,800
	Construction Management (15%)	$75,300	$43,050	$118,350
	Total Wastewater Storage Cost	**$953,800**	**$545,300**	**$1,499,100**
	Total Project Cost	**$10,434,800**	**$8,259,300**	**$18,694,100**

In addition to the improvements for AWT and storage an additional cost will be required for a distribution system of recycled water. This cost ranges from $1.5 million to $6.0 million for this distribution system depending upon the availability of irrigation sites and other factors.

6.2 Aged Network Phased Replacement

The Sewer Master Plan Update (Update) has identified several areas where the Network pipes in the ground are aged and in need of replacement. These pipes are probably a major source of inflow and infiltration (I/I) into the Wastewater Collection System (System). The following sections outline the different phases as identified by the Wastewater Treatment System Operators (Operator). The total estimated cost of all eight phases is $16.3 million. Prior to any actual "in-the-ground" projects are undertaken each project should be CCTV video inspected and smoke tested to identify problem areas (the inspection cost were included in the cost estimates).

6.2.1 Aged Network Replacement Phase 1

The following estimate is for replacement of aged sewer mains east of the pump station at Shahan Drive. The majority of the upgrades entail replacing 6" asbestos concrete mains with 8" PVC mains that conform to current City Standards. These streets are Grace Court, Heidi Lane, Kay Court, and Shahan Drive. This project is for ongoing maintenance and upgrade to the aging system and are not needed for capacity or General Plan Build-Out.

Table 6.2.1

Phase 1 - Shahan Dr., Heidi Ln, Kay Ct, Grace Ct, Block Dr, Oak Ln, N. Cloverdale Blvd.

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Video Tape Existing Mains	4,290	LF	$3	$10,725
2	Video Tape Analysis	1	LS	$1,609	$1,609
3	Traffic Control System	1	LS	$20,000	$20,000
4	Erosion Control / BMP	1	LS	$5,000	$5,000
5	Remove and Replace Misc Facilities	1	LS	$5,000	$5,000
6	Bypass Pumping	1	LS	$32,175	$32,175
7	Remove Existing Cleanout	7	EA	$400	$2,800
8	Construct Cleanout	7	EA	$850	$5,950
9	48" Sanitary Sewer Manhole (Elevations Less than 8')	21	EA	$5,300	$111,300
10	Remove 48" Sanitary Sewer Manhole	21	EA	$1,350	$28,350
11	Surcharge for Disposal of Asbestos Pipe	4,290	LF	$5	$21,450
12	8" PVC Sewer Main	4,290	LF	$69	$296,010
13	Trench Bracing and Shoring - Sewer	1	LS	$12,750	$12,750
14	Trench Dam	2	EA	$750	$1,500
15	Remove Concrete Pavement (Roadway + Laterals)	14,470	S.F.	$5	$72,350
16	Asphalt Concrete Surface (0.3' Thick & 36" Wide)+ 82 laterals (0.3' thick & 12" wide)	326	Tons	$105	$34,185
17	CL 2 AB (12" thick & 24" wide + 82 laterals 12" wide 12" thick)	377	CY	$30	$11,311
18	Sewer Main Line Reconnect	1	EA	$1,500	$1,500
19	Construct New 4" Lateral Connection	64	EA	$1,820	$116,480
20	Pavement Markings	1	LS	$5,000	$5,000
21	Pump Station Upgrades	1	LS	$125,000	$125,000
22	Allowance for Hazardous Material	1	LS	$15,000	$15,000
23	Mobilization	1	LS	$46,156	$46,156
				Construction Subtotal	$969,267
				Contingency (20%)	$193,853
				Construction Total	**$1,163,120**
				Administration & Legal (10%)	$96,927
				Design PS&E (15%)	$145,390
				Right of Way	$10,000
				Environmental (5%)	$48,463
				Construction Management (15%)	$145,390
				Total Project Cost	**$1,609,291**

6.2.2 Aged Network Replacement Phase 2

The following estimate is for replacement of aged sewer mains in older areas west of Cloverdale Blvd. The majority of the replacement entails replacing 6” asbestos concrete mains with 8” PVC mains that conform to current City Standards along the following streets: Champlain Ave., Charles St., Fourth St., Haehl St., Hardister Dr., Jefferson St (north of Fourth St.), Kerry Ln.,

North St. (west of Venezia Way), School St. (west of N. Cloverdale Boulevard and west of Silva St), and Silva St., Washington St. (between School St. and Fourth St.). Additionally, the 10" mains between Hardister Dr. and along Butler Ct. connecting to the sewer main on Jefferson St. have been identified by the Operators as damaged and in need of repair. This project is for ongoing maintenance and upgrade to the aging system and are not needed for capacity or General Plan Buildout.

Table 6.2.2

Phase 2 - Jefferson St, North St, Champlain Ave, School St, Washington St, Haehl St, Charles St, Kerry Ln, Fourth St, Hardister Dr, Butler Ct

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Video Tape Existing Mains	10,340	LF	$3	$25,850
2	Video Tape Analysis	1	LS	$3,878	$3,878
3	Traffic Control System	1	LS	$20,000	$20,000
4	Erosion Control / BMP	1	LS	$5,000	$5,000
5	Remove and Replace Misc Facilities	1	LS	$5,000	$5,000
6	Bypass Pumping	1	LS	$77,550	$77,550
7	Remove Existing Cleanout	9	EA	$400	$3,600
8	Construct Cleanout	9	EA	$850	$7,650
9	48" Sanitary Sewer Manhole (Elevations Less than 8')	36	EA	$5,300	$190,800
10	Remove 48" Sanitary Sewer Manhole	36	EA	$1,350	$48,600
11	Surcharge for Surface Restoration	1	LS	$15,000	$15,000
12	Surcharge for Disposal of Asbestos Pipe	10,340	LF	$5	$51,700
13	8" PVC Sewer Main	9,740	LF	$69	$672,060
14	10" PVC Sewer Main	600	LF	$97	$58,200
15	Trench Bracing and Shoring - Sewer	1	LS	$31,000	$31,000
16	Remove Concrete Pavement (Roadway + Laterals)	31,895	S.F.	$5	$159,475
17	Asphalt Concrete Surface	718	Tons	$105	$75,352
18	CL 2 AB	99	CY	$30	$2,974
19	Sewer Main Line Reconnect	11	EA	$1,500	$16,500
20	Construct New 4" Lateral Connection	107	EA	$1,820	$194,740
21	Pavement Markings	1	LS	$5,000	$5,000
22	Allowance for Hazardous Material	1	LS	$20,000	$20,000
23	Mobilization	1	LS	$83,010	$83,010
				Construction Subtotal	$1,743,211
				Contingency (20%)	$348,642
				Construction Total	**$2,091,854**
				Administration & Legal (10%)	$174,321
				Design PS&E (15%)	$261,482
				Right of Way	$10,000
				Environmental (5%)	$87,161
				Construction Management (15%)	$261,482
				Total Project Cost	**$2,886,299**

6.2.3 Aged Network Replacement Phase 3

The following estimate is for replacement of aged sewer mains in older areas along Josephine Dr. The majority of the upgrades entail replacing 6" asbestos concrete mains with 8" PVC mains that conform to current City Standards along the following streets: Foster Ct., Josephine Dr., and North Foothill Dr. (between School St. and the proposed alignment of West Fourth St.). This

project is for ongoing maintenance and upgrade to the aging system and are not needed for capacity or General Plan Buildout.

Table 6.2.3
City of Cloverdale
Phase 3 - Josephine Dr, N. Foothill Dr, Foster Ct,

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Video Tape Existing Mains	3,370	LF	$3	$8,425
2	Video Tape Analysis	1	LS	$1,264	$1,264
3	Traffic Control System	1	LS	$15,000	$15,000
4	Erosion Control / BMP	1	LS	$5,000	$5,000
5	Remove and Replace Misc Facilities	1	LS	$2,500	$2,500
6	Bypass Pumping	1	LS	$25,275	$25,275
7	Remove Existing Cleanout	5	EA	$400	$2,000
8	Construct Cleanout	5	EA	$850	$4,250
9	48" Sanitary Sewer Manhole (Elevations Less than 8')	13	EA	$5,300	$68,900
10	Remove 48" Sanitary Sewer Manhole	13	EA	$1,350	$17,550
11	Surcharge for Disposal of Asbestos Pipe	3,370	LF	$5	$16,850
12	8" PVC Sewer Main	3,370	LF	$69	$232,530
13	Trench Bracing and Shoring - Sewer	1	LS	$10,100	$10,100
14	Remove Concrete Pavement (Roadway + Laterals)	12,135	S.F.	$5	$60,675
15	Asphalt Concrete Surface	273	Tons	$105	$28,669
16	CL 2 AB	325	CY	$30	$9,739
17	Sewer Main Line Reconnect	2	EA	$1,500	$3,000
18	Construct New 4" Lateral Connection	81	EA	$1,820	$147,420
19	Pavement Markings	1	LS	$5,000	$5,000
20	Allowance for Hazardous Material	1	LS	$5,000	$5,000
21	Mobilization	1	LS	$32,973	$32,973
				Construction Subtotal	$692,431
				Contingency (20%)	$138,486
				Construction Total	**$830,917**
				Administration & Legal (10%)	$69,243
				Design PS&E (15%)	$103,865
				Right of Way	$10,000
				Environmental (5%)	$34,622
				Construction Management (15%)	$103,865
				Total Project Cost	**$1,152,511**

6.2.4 Aged Network Replacement Phase 4

The following estimate is for replacement of aged sewer mains in older areas near the City Park and near the Citrus Fair Grounds. The majority of the upgrades entail replacing 6” asbestos concrete mains with 8” PVC mains that conform to current City Standards along the following streets: First St., Franklin St. (between Second St. and Los Colinas Dr.), Los Colinas Dr., and

Second St., (along the northern boundary of the Citrus Fair grounds). Additionally, the 10" mains in Washington St. south of First St. and the 10" main along the northern boundary of the Citrus Fair grounds have been identified by the Operators as damaged and in need of repair. This project is for ongoing maintenance and upgrade to the aging system and are not needed for capacity or General Plan Buildout.

Table 6.2.4

Phase 4 - First St, Second St, City Park, Franklin St, Las Colinas Dr., Washington Dr, Citrus Fair Grounds

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Video Tape Existing Mains	6,745	LF	$3	$16,863
2	Video Tape Analysis	1	LS	$2,529	$2,529
3	Traffic Control System	1	LS	$20,000	$20,000
4	Erosion Control / BMP	1	LS	$5,000	$5,000
5	Remove and Replace Misc Facilities	1	LS	$5,000	$5,000
6	Bypass Pumping	1	LS	$50,600	$50,600
7	Remove Existing Cleanout	5	EA	$400	$2,000
8	Construct Cleanout	5	EA	$850	$4,250
9	48" SS Manhole (Elevations Less than 8')	23	EA	$5,300	$121,900
10	Remove 48" Sanitary Sewer Manhole	23	EA	$1,350	$31,050
11	Surcharge for Surface Restoration	1	LS	$15,000	$15,000
12	Surcharge for Disposal of Asbestos Pipe	6,745	LF	$5	$33,725
13	8" PVC Sewer Main	5,550	LF	$69	$382,950
14	10" PVC Sewer Main	1,195	LF	$97	$115,915
15	Trench Bracing and Shoring - Sewer	1	LS	$20,235	$20,235
16	Remove Concrete Pavement (Roadway + Laterals)	18,500	S.F.	$5	$92,500
17	Asphalt Concrete Surface	416	Tons	$105	$43,706
18	CL 2 AB	568	CY	$30	$17,044
19	Sewer Main Line Reconnect	6	EA	$1,500	$9,000
20	Construct New 4" Lateral Connection	74	EA	$1,820	$134,680
21	Pavement Markings	1	LS	$5,000	$5,000
22	Allowance for Hazardous Material	1	LS	$15,000	$15,000
23	Mobilization	1	LS	$56,228	$56,228
				Construction Subtotal	$1,180,783
				Contingency (20%)	$236,157
				Construction Total	**$1,416,940**
				Administration & Legal (10%)	$118,078
				Design PS&E (15%)	$177,118
				Right of Way	$10,000
				Environmental (5%)	$59,039
				Construction Management (15%)	$177,118
				Total Project Cost	**$1,958,293**

6.2.5 Aged Network Replacement Phase 5

The following estimate is for replacement of aged sewer mains in older areas near University St. and along Cloverdale Creek. The majority of the upgrades entail replacing 6" asbestos concrete mains with 8" PVC mains that conform to current City Standards along the following streets: Fourth St., Main St. (between Third and Fourth St.), Stameroff Ct., Third St., Triplett Dr.,

University Dr., and Vista View Dr. This project is for ongoing maintenance and upgrade to the aging system and are not needed for capacity or General Plan Buildout.

Table 6.2.5
Phase 5 - University, East Fourth, Vista View Dr, Triplett Dr

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Video Tape Existing Mains	6,160	LF	$3	$15,400
2	Video Tape Analysis	1	LS	$2,310	$2,310
3	Traffic Control System	1	LS	$20,000	$20,000
4	Erosion Control / BMP	1	LS	$5,000	$5,000
5	Remove and Replace Misc Facilities	1	LS	$5,000	$5,000
6	Bypass Pumping	1	LS	$46,200	$46,200
7	Remove Existing Cleanout	5	EA	$400	$2,000
8	Construct Cleanout	5	EA	$850	$4,250
9	48" Sanitary Sewer Manhole (Elevations Less than 8')	37	EA	$5,300	$196,100
10	Remove 48" Sanitary Sewer Manhole	37	EA	$1,350	$49,950
11	Surcharge for Surface Restoration	1	LS	$15,000	$15,000
12	Surcharge for Disposal of Asbestos Pipe	6,160	LF	$5	$30,800
13	8" PVC Sewer Main	5,740	LF	$69	$396,060
14	8" DIP Sewer Main (Under Cloverdale Creek)	420	LF	$95	$39,900
15	Bore & Jack Steel Casing (Under Cloverdale Creek)	420	LF	$400	$168,000
16	Trench Bracing and Shoring - Sewer	1	LS	$18,480	$18,480
17	Trench Dam	10	EA	$750	$7,500
18	Remove Concrete Pavement (Roadway + Laterals)	20,380	S.F.	$5	$101,900
19	Asphalt Concrete Surface	459	Tons	$105	$48,148
20	CL 2 AB (12" thick & 24" wide + 76 laterals 12" wide 12" thick)	527	CY	$30	$15,800
21	Sewer Main Line Reconnect	7	EA	$1,500	$10,500
22	Construct New 4" Lateral Connection	76	EA	$1,820	$138,320
23	Pavement Markings	1	LS	$5,000	$5,000
24	Allowance for Hazardous Material	1	LS	$15,000	$15,000
25	Mobilization	1	LS	$66,945	$66,945
				Construction Subtotal	$1,405,853
				Contingency (20%)	$281,171
				Construction Total	**$1,687,024**
				Administration & Legal (10%)	$140,585
				Design PS&E (15%)	$210,878
				Right of Way	$10,000
				Environmental (5%)	$70,293
				Construction Management (15%)	$210,878
				Total Project Cost	**$2,329,658**

6.2.6 Aged Network Replacement Phase 6

The following estimate is for replacement of aged sewer mains in Lake St. east of Asti Rd. The majority of the upgrades entail replacing 6” asbestos concrete mains with 8” PVC mains that conform to current City Standards along the following streets: Evergreen Ln., Lake St., and Live

Oak Ln. This project is for ongoing maintenance and upgrade to the aging system and are not needed for capacity or General Plan Buildout.

Table 6.2.6
Phase 6 - Lake Street (East of Asti) Sewer Main Up-Sizing Project

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Video Tape Existing Mains	1,240	LF	$3	$3,100
2	Video Tape Analysis	1	LS	$465	$465
3	Traffic Control System	1	LS	$2,500	$2,500
4	Erosion Control / BMP	1	LS	$1,500	$1,500
5	Remove and Replace Misc Facilities	1	LS	$2,500	$2,500
6	Bypass Pumping	2	LS	$9,300	$18,600
7	Remove Existing Cleanout	2	EA	$400	$800
8	Construct Cleanout	2	EA	$850	$1,700
9	48" Sanitary Sewer Manhole (Elevations Less than 8')	6	EA	$5,300	$31,800
10	Remove 48" Sanitary Sewer Manhole	6	EA	$1,350	$8,100
11	Surcharge for Disposal of Asbestos Pipe	1,240	LF	$5	$6,200
12	8" PVC Sewer Main	1,240	LF	$69	$85,560
13	Trench Bracing and Shoring - Sewer	1	LS	$10,000	$10,000
14	Trench Dam	1	EA	$750	$750
15	Remove Concrete Pavement (Roadway + Laterals)	4,070	S.F.	$5	$20,350
16	Asphalt Concrete Surface (0.3' Thick & 36" Wide)+ 14 laterals (0.3' thick & 12" wide)	92	Tons	$105	$9,615
17	CL 2 AB (12" thick & 24" wide + 14 laterals 12" wide 12" thick)	105	CY	$30	$3,144
18	Sewer Main Line Reconnect	1	EA	$1,500	$1,500
19	Construct New 4" Lateral Connection	14	EA	$1,820	$25,480
20	Pavement Markings	1	LS	$5,000	$5,000
21	Allowance for Hazardous Material	1	LS	$5,000	$5,000
22	Mobilization	1	LS	$12,005	$12,005
				Construction Subtotal	$252,105
				Contingency (20%)	$50,421
				Construction Total	**$302,526**
				Administration & Legal (10%)	$25,210
				Design PS&E (15%)	$37,816
				Right of Way	$10,000
				Environmental (5%)	$12,605
				Construction Management (15%)	$37,816
				Total Project Cost	**$425,973**

6.2.7 Aged Network Replacement Phase 7

The following estimate is for replacement of aged sewer mains in the Tarman Subdivision area. The majority of the upgrades entail replacing 6" asbestos concrete mains with 8" PVC mains that conform to current City Standards along the following streets: Allen Ave., Alter St., Blair St., Brookside Dr., Caldwell St., Clark Ave., Debmar Ln., Dina St., E. Cherry Creek Rd., Elm St., Hillview Dr., Mayor Way, Rosewood Dr., and Tarman Dr. This project is for ongoing maintenance and upgrade to the aging system and are not needed for capacity or General Plan Buildout.

Table 6.2.7
Phase 7 - Tarman Subdivision Sewer Main Up-Sizing Project

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Video Tape Existing Mains	12,590	LF	$3	$31,475
2	Video Tape Analysis	1	LS	$4,721	$4,721
3	Traffic Control System	1	LS	$20,000	$20,000
4	Erosion Control / BMP	1	LS	$10,000	$10,000
5	Remove and Replace Misc Facilities	1	LS	$5,000	$5,000
6	Bypass Pumping	1	LS	$94,425	$94,425
7	Remove Existing Cleanout	10	EA	$400	$4,000
8	Construct Cleanout	10	EA	$850	$8,500
9	48" Sanitary Sewer Manhole (Elevations Less than 8')	48	EA	$5,300	$254,400
10	Remove 48" Sanitary Sewer Manhole	48	EA	$1,350	$64,800
11	Surcharge for Surface Restoration	1	LS	$15,000	$15,000
12	Surcharge for Disposal of Asbestos Pipe	12,590	LF	$5	$62,950
13	8" PVC Sewer Main	12,590	LF	$69	$868,710
14	Trench Bracing and Shoring - Sewer	1	LS	$37,800	$37,800
15	Remove Concrete Pavement (Roadway + Laterals)	44,770	S.F.	$5	$223,850
16	Asphalt Concrete Surface	1,007	Tons	$105	$105,769
17	CL 2 AB (12" thick & 24" wide + 280 laterals 12" wide 12" thick)	1,192	CY	$30	$35,756
18	Sewer Main Line Reconnect	11	EA	$1,500	$16,500
19	Construct New 4" Lateral Connection	280	EA	$1,820	$509,600
20	Pavement Markings	1	LS	$5,000	$5,000
21	Allowance for Hazardous Material	1	LS	$25,000	$25,000
22	Mobilization	1	LS	$118,353	$118,353
				Construction Subtotal	$2,485,413
				Contingency (20%)	$497,083
				Construction Total	**$2,982,495**
				Administration & Legal (10%)	$248,541
				Design PS&E (15%)	$372,812
				Right of Way	$10,000
				Environmental (5%)	$124,271
				Construction Management (15%)	$372,812
				Total Project Cost	**$4,110,931**

6.2.8 Aged Network Replacement Phase 8

The following estimate is for replacement of aged sewer mains in older areas near Foothill Blvd. between Cherry Creek Rd. and Porterfield Creek Dr. The majority of the upgrades entail replacing 6" asbestos concrete mains with 8" PVC mains that conform to current City Standards along the following streets: Bandiera Way, Burgundy Ct., Chablis Way, Cherry Creek Rd., Foothill Blvd., Roan Ct., Rose Ct., and Vine Dr. Additionally, the existing 8" main north of Cherry Creek along the private property has been identified by the Operators as damaged and in need of repair. This project is for ongoing maintenance and upgrade to the aging system and are not needed for capacity or General Plan Buildout.

Table 6.2.8

Phase 8 - Cherry Creek Road, Foothill Blvd, Roan CT, Chablis Way, Vine Dr, Bandiera Way, Rose CT, and Burgundy CT)

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Video Tape Existing Mains	5,710	LF	$3	$14,275
2	Video Tape Analysis (15% of Video Tape Existing Mains)	1	LS	$2,141	$2,141
3	Traffic Control System	1	LS	$20,000	$20,000
4	Erosion Control / BMP	1	LS	$5,000	$5,000
5	Remove and Replace Misc Facilities	1	LS	$5,000	$5,000
6	Bypass Pumping	1	LS	$42,825	$42,825
7	Remove Existing Cleanout	8	EA	$400	$3,200
8	Construct Cleanout	8	EA	$850	$6,800
9	48" Sanitary Sewer Manhole (Elevations Less than 8')	17	EA	$5,300	$90,100
10	Remove 48" Sanitary Sewer Manhole	17	EA	$1,350	$22,950
11	Surcharge for Surface Restoration	1	LS	$15,000	$15,000
12	Surcharge for Disposal of Asbestos Pipe	5,710	LF	$5	$28,550
13	8" PVC Sewer Main	5,710	LF	$69	$393,990
14	Trench Bracing and Shoring - Sewer	1	LS	$17,150	$17,150
15	Remove Concrete Pavement (Roadway + Laterals)	19,805	S.F.	$5	$99,025
16	Asphalt Concrete Surface	446	Tons	$105	$46,789
17	CL 2 AB	522	CY	$30	$15,661
18	Sewer Main Line Reconnect	2	EA	$1,500	$3,000
19	Construct New 4" Lateral Connection	107	EA	$1,820	$194,740
20	Pavement Markings	1	LS	$5,000	$5,000
21	Allowance for Hazardous Material	1	LS	$15,000	$15,000
22	Mobilization	1	LS	$51,489	$51,489
				Construction Subtotal	$1,081,269
				Contingency (20%)	$216,254
				Construction Total	**$1,297,523**
				Administration & Legal (10%)	$108,127
				Design PS&E (15%)	$162,190
				Right of Way	$10,000
				Environmental (5%)	$54,063
				Construction Management (15%)	$162,190
				Total Project Cost	**$1,794,095**

6.3 North Cloverdale Blvd 10" Sewer Main Project

The North Cloverdale Blvd up-sizing project will provide additional capacity to the existing sewer collection system to support growth per the General Plan Update shown in the northern portion of the Sphere of Influence. Construction of this project includes replacement of the existing 6-inch main with a new 10-inch main on North Cloverdale Boulevard between North St and East Fourth Street. The preliminary cost estimate is shown in **Table 6.3**.

Table 6.3
City of Cloverdale
North Cloverdale Blvd 10" Sewer Main Project

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Traffic Control System	1	LS	$15,000	$15,000
2	Remove and Replace Misc Facilities	1	LS	$5,000	$5,000
3	10" PVC Sewer Main	1,465	LF	$155	$227,075
4	10" DIP Sewer Main (assumed 2.5%)	37	LF	$165	$6,043
5	Remove Sanitary Sewer Manholes	8	EA	$1,500	$12,000
6	48" Sanitary Sewer Manhole (Elevations Less than 8')	8	EA	$6,500	$52,000
7	Trench Bracing and Shoring - Sewer	1	LS	$15,000	$15,000
8	Sewer Bypass Pumping	1	LS	$10,000	$10,000
9	Soil Disposal	1	LS	$30,000	$30,000
10	Trench Dam	6	EA	$750	$4,500
11	Remove Concrete Pavement (Roadway + Laterals)	5,708	S.F.	$5	$28,538
12	Asphalt Concrete Surface (3" Thick & 36" Wide)+ 35 laterals (3" thick & 18" wide)	107	Tons	$105	$11,237
13	Asphalt Concrete Base (2" Thick & 36" Wide)+ 35 laterals (2" thick & 18" wide)	71	Tons	$105	$7,493
14	CL 2 AB (12" thick & 24" wide + 35 laterals 12" wide 12" thick)	141	CY	$30	$4,228
15	Remove and Replace Sewer Lateral (assumed length 25 ft)	35	EA	$3,000	$105,000
16	Sewer Main Line Reconnect	5	EA	$1,500	$7,500
17	Pavement Markings	1	LS	$7,500	$7,500
18	Thermoplastic Traffic Stripe, Crosswalk	4	EA	$275	$1,100
19	Allowance for Hazardous Material	1	LS	$125,000	$125,000
20	Mobilization	1	LS	$33,711	$33,711
				Construction Subtotal	$707,923
				Contingency (20%)	$141,585
				Construction Total	**$849,508**

Administration & Legal (10%)	$70,792
Design PS&E (15%)	$106,188
Right of Way	$0
Environmental (5%)	$35,396
Construction Management (15%)	$106,188
Total Project Cost	**$1,168,073**

6.4 E. Fourth, N. Main, E. Second and East St. Sewer Main Up-Sizing Project

This project will provide additional capacity to the sewer collection system in the downtown area to support anticipated increases in effluent flows produced by the areas in the northern portion of the Sphere of Influence. The preliminary cost estimate is shown in **Table 6.4**.

Table 6.4
City of Cloverdale
East Fourth, North Main, East Second and East Street Sewer Main Up-Sizing Project

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Traffic Control System	1	LS	$15,000	$15,000
2	Remove and Replace Misc Facilities	1	LS	$5,000	$5,000
3	12" PVC Sewer Main	2,346	LF	$200	$469,200
4	12" DIP Sewer Main (assumed 2.5%)	59	LF	$215	$12,610
5	Remove Sanitary Sewer Manholes	11	EA	$1,500	$16,500
6	48" Sanitary Sewer Manhole (Elevations Less than 8')	9	EA	$6,500	$58,500
7	60" Sanitary Sewer Manhole (Elevations Greater than 8')	2	EA	$10,000	$20,000
8	Trench Bracing and Shoring - Sewer	1	LS	$15,000	$15,000
9	Sewer Bypass Pumping	1	LS	$10,000	$10,000
10	Soil Disposal	1	LS	$30,000	$30,000
11	Trench Dam	6	EA	$750	$4,500
12	Replace PCC Valley Gutter	5	EA	$500	$2,500
13	Remove Concrete Pavement (Roadway + Laterals)	10,311	S.F.	$5	$51,555
14	Asphalt Concrete Surface (3" Thick & 36" Wide)+ 56 laterals (3" thick & 18" wide)	193	Tons	$105	$20,300
15	Asphalt Concrete Base (2" Thick & 36" Wide)+ 56 laterals (2" thick & 18" wide)	129	Tons	$105	$13,536
16	CL 2 AB (12" thick & 30" wide + 56 laterals 12" wide 12" thick)	269	CY	$30	$8,072
17	Remove and Replace Sewer Lateral (assumed length 25 ft)	56	EA	$3,000	$168,000
18	Sewer Main Line Reconnect	7	EA	$1,500	$10,500
19	Pavement Markings	1	LS	$7,500	$7,500
20	Thermoplastic Traffic Stripe, Crosswalk	3	EA	$275	$825
21	Allowance for Hazardous Material	1	LS	$125,000	$125,000
22	Mobilization	1	LS	$53,205	$53,205
			Construction Subtotal		$1,117,303

Contingency (20%)	$223,461
Construction Total	**$1,340,763**

Administration & Legal (10%)	$111,730
Design PS&E (15%)	$167,595
Right of Way	$0
Environmental (5%)	$55,865
Construction Management (15%)	$167,595
Total Project Cost	**$1,843,549**

6.5 South Trunk Sewer Main Up-Sizing Project

This project will provide additional capacity to the sewer collection system to provide service to the areas in the southern portion of the Sphere of Influence. Construction of this project will replace a portion of the existing 18-inch sewer main with 30-inch pipe. The cost analysis is shown in **Table 6.5**.

Table 6.5
City of Cloverdale
South Trunk Sewer Main Up-Sizing Project

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Traffic Control System	1	LS	$5,000	$5,000
2	Remove and Replace Misc Facilities	1	LS	$5,000	$5,000
3	30" DIP Sewer Main	1,354	LF	$275	$372,350
4	60" Sanitary Sewer Manhole (Elevations Greater than 8'/ pipe larger than 18" Dia.)	3	EA	$10,000	$30,000
5	Concrete Pier Pipe Supports	20	EA	$2,500	$50,000
6	Trench Bracing and Shoring - Sewer	1	LS	$5,000	$5,000
7	Sewer Bypass Pumping	1	LS	$15,000	$15,000
8	Soil Disposal	1	LS	$30,000	$30,000
9	Trench Dam	6	EA	$750	$4,500
10	Remove Concrete Pavement (80' of Roadway)	400	S.F.	$5	$2,000
11	Asphalt Concrete Surface (3" Thick & 60" Wide)	8	Tons	$105	$788
12	Asphalt Concrete Base (2" Thick & 60" Wide)	5	Tons	$105	$525
13	CL 2 AB (12" thick & 48" wide)	201	CY	$30	$6,018
14	Sewer Main Line Reconnect	2	EA	$1,500	$3,000
15	Pavement Markings	1	LS	$1,000	$1,000
16	Allowance for Hazardous Material	1	LS	$125,000	$125,000
17	Mobilization	1	LS	$32,759	$32,759
				Construction Subtotal	$687,939

Contingency (20%)	$137,588
Construction Total	**$825,527**

Administration & Legal (10%)	$68,794
Design PS&E (15%)	$103,191
Right of Way	$30,000
Environmental (5%)	$34,397
Construction Management (15%)	$103,191
Total Project Cost	**$1,165,100**

6.6 Wastewater Treatment Facility Main Up-Sizing Project

This project will provide the additional capacity to portions of the trunk main just upstream of the headworks at the WWTF to accommodate proposed growth as shown in the General Plan Update. The preliminary cost estimate for this project is shown in **Table 6.6**.

Table 6.6
City of Cloverdale
Preliminary Engineer's Estimate
Waste Water Treatment Facility Main Up-Sizing Project

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Traffic Control System	1	LS	$5,000	$5,000
2	Remove and Replace Misc Facilities	1	LS	$5,000	$5,000
3	36" DIP Sewer Main	293	LF	$360	$105,480
4	Custom Sanitary Sewer Manhole (Pipe Larger than 30" Dia.)	1	EA	$15,000	$15,000
5	Concrete Pier Pipe Supports	4	EA	$2,500	$10,000
6	Trench Bracing and Shoring - Sewer	1	LS	$5,000	$5,000
7	Sewer Bypass Pumping	1	LS	$40,000	$40,000
8	Soil Disposal	1	LS	$7,500	$7,500
9	Trench Dam	1	EA	$750	$750
10	Remove Concrete Pavement (35' of Roadway)	210	S.F.	$5	$1,050
11	Asphalt Concrete Surface (3" Thick & 72" Wide)	4	Tons	$105	$413
12	Asphalt Concrete Base (2" Thick & 72" Wide)	3	Tons	$105	$276
13	CL 2 AB (12" thick & 60" wide)	54	CY	$30	$1,628
14	Sewer Main Line Reconnect	2	EA	$1,500	$3,000
15	Pavement Markings	1	LS	$500	$500
16	Allowance for Hazardous Material	1	LS	$25,000	$25,000
17	Mobilization	1	LS	$11,280	$11,280
			Construction Subtotal		$236,877

Contingency (20%)	$47,375
Construction Total	**$284,252**

Administration & Legal (10%)	$23,688
Design PS&E (15%)	$35,532
Right of Way	$10,000
Environmental (5%)	$11,844
Construction Management (15%)	$35,532
Total Project Cost	**$400,847**

6.7 North Cloverdale Boulevard 8-inch Sewer Main Extension Project

This project will provide service to the proposed development on the north end of the Sphere of Influence to the City's existing collection system. A new 8-inch sewer main, a 6-inch force main and a pump station will need to be constructed to accommodate this area. This project should be constructed after or concurrently with the competition of the North Cloverdale Boulevard 10" Sewer Main Project. The preliminary cost estimate for this project is shown in **Table 6.7**.

Table 6.7
City of Cloverdale
North Cloverdale Boulevard 8-inch Sewer Main Extension Project

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Traffic Control System	1	LS	$15,000	$15,000
2	Remove and Replace Misc Facilities	1	LS	$5,000	$5,000
3	6" Force Main	1,200	LF	$75	$90,000
4	8" PVC Sewer Main	1,730	LF	$85	$147,050
5	8" DIP Sewer Main (assumed 2.5%)	43	LF	$95	$4,109
6	48" Sanitary Sewer Manhole (Elevations Less than 8')	2	EA	$6,500	$13,000
7	60" Sanitary Sewer Manhole (Elevations Greater than 8')	3	EA	$10,000	$30,000
8	Trench Bracing and Shoring - Sewer	1	LS	$15,000	$15,000
9	Soil Disposal	1	LS	$30,000	$30,000
10	Trench Dam	12	EA	$750	$9,000
11	Remove Concrete Pavement (Roadway)	8,903	S.F.	$5	$44,513
12	Asphalt Concrete Surface (3" Thick & 36" Wide)+ 3 laterals (3" thick & 18" wide)	167	Tons	$105	$17,527
13	Asphalt Concrete Base (2" Thick & 36" Wide)+ 3 laterals (2" thick & 18" wide)	111	Tons	$105	$11,687
14	CL 2 AB (12" thick & 24" wide + 3 laterals 12" wide 12" thick)	220	CY	$30	$6,594
15	Sewer Main Line Reconnect	1	EA	$1,500	$1,500
16	Remove and Replace Sewer Lateral (assumed length 25 ft)	3	EA	$3,000	$9,000
17	Pavement Markings	1	LS	$7,500	$7,500
18	Lift Station	1	LS	$550,000	$550,000
19	Allowance for Hazardous Material	1	LS	$125,000	$125,000
20	Mobilization	1	LS	$56,574	$56,574
				Construction Subtotal	$1,188,053
				Contingency (20%)	$237,611
				Construction Total	**$1,425,664**
				Administration & Legal (10%)	$118,805
				Design PS&E (15%)	$178,208
				Right of Way	$30,000
				Environmental (5%)	$59,403
				Construction Management (15%)	$178,208
				Total Project Cost	**$1,990,288**

6.8 South Asti Sewer Main Extension Project

This project will provide service to the proposed future development in the southern portion of the Sphere of Influence. Construction of this project will include 6-inch force main, 8-inch and 12-inch pipe and will add two new pump stations to provide service for the proposed development along Asti Rd. The preliminary cost estimate is shown below in **Table 6.8**.

Table 6.8
City of Cloverdale
South Asti Sewer Main Extension Project

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Clearing and Grubbing	1	LS	$4,352	$4,352
2	Construction Area Signs	1	LS	$45,337	$45,337
3	Erosion Control	1	LS	$10,881	$10,881
4	Traffic Control	1	LS	$36,270	$36,270
5	Roadway Excavation	4,127	CY	$30	$123,800
6	Disposal of Contaminated Soil Material	1,376	CY	$100	$137,556
7	Full Road Reconstruction (w/Bike Lane)	2,994	LF	$175	$523,950
8	Full Road Reconstruction	2,176	LF	$170	$369,950
9	8" SS Line	1,416	LF	$85	$120,360
10	12" SS Line	6,418	LF	$200	$1,283,600
11	48" Sewer Manholes	8	EA	$6,500	$52,000
12	60" Sewer Manholes	15	EA	$10,000	$150,000
13	SS Clean Outs	3	EA	$1,500	$4,500
14	6" Force Main Pipe	1,207	LF	$80	$96,560
15	Bore & Jack Steel Casing	700	LF	$750	$525,000
16	Pump Station 1	1	LS	$500,000	$500,000
17	Pump Station 2	1	LS	$650,000	$650,000
18	Allowance for Hazardous Material	1	LS	250,000.00	250,000.00
19	Mobilization	1	LS	$244,206	$244,206
			Construction Subtotal		$5,128,322

Contingency (20%)	$1,025,664
Construction Total	**$6,153,986**

Administration & Legal (10%)	$512,832
Design PS&E (15%)	$769,248
Right of Way	$15,000
Environmental (5%)	$256,416
Construction Management (15%)	$769,248
Total Project Cost	**$8,476,731**

6.9 Theresa Drive 8-inch Sewer Main Extension Project

This project will extend the service to provide for the Dutcher Creek Road/Teresa Drive area. The new line will extend under the Highway 101 and connect the Dutcher Creek Rd and Theresa Drive to the proposed sewer main in Asti Road. This project should be done in conjunction with or after the completion of the Asti Rd Extension. The preliminary cost estimate for this project is shown in **Table 6.7**.

Table 6.9
City of Cloverdale
Theresa Drive 8-inch Sewer Main Extension Project

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Traffic Control System	1	LS	$15,000	$15,000
2	Remove and Replace Misc Facilities	1	LS	$15,000	$15,000
3	8" PVC Sewer Main	426	LF	$85	$36,210
4	8" DIP Sewer Main	300	LF	$95	$28,500
5	48" Sanitary Sewer Manhole (Elevations Less than 8')	3	EA	$6,000	$18,000
6	Trench Bracing and Shoring – Sewer	1	LS	$15,000	$15,000
7	Bore & Jack Steel Casing (under Freeway)	295	LF	$750	$221,250
8	Soil Disposal	1	LS	$30,000	$30,000
9	Trench Dam	4	EA	$750	$3,000
10	Remove Concrete Pavement (Roadway)	1,278	S.F.	$5	$6,390
11	Asphalt Concrete Surface (3" Thick & 36" Wide)	24	Tons	$105	$2,516
12	Asphalt Concrete Base (2" Thick & 36" Wide)	16	Tons	$105	$1,678
13	CL 2 AB (12" thick & 24" wide)	32	CY	$50	$1,578
14	Sewer Main Line Reconnect	1	EA	$1,500	$1,500
15	Pavement Markings	1	LS	$5,000	$5,000
16	Allowance for Hazardous Material	1	LS	$25,000	$25,000
17	Mobilization	1	LS	$21,281	$21,281
			Construction Subtotal		$446,903

Contingency (20%)	$89,381
Construction Total	**$536,283**

Administration & Legal (10%)	$44,690
Design PS&E (15%)	$67,035
Right of Way	$30,000
Environmental (5%)	$22,345
Construction Management (15%)	$67,035
Total Project Cost	**$767,389**

7. CONCLUSION

The purpose of the City of Cloverdale's (City) Sewer Master Plan Update (Update) is to quantify and qualify City's ability to transport, store, and treat the effluent wastewater generated by the City currently and into the future. Coastland Civil Engineers was contracted by the City to perform this analysis and report to the City the findings. The findings of this update can be organized into four parts; analysis of the current system capacity with regard to historical performance, analysis of current and future system loading, recommendations for system improvements, upgrades, and modifications given current loading patterns, and recommendations for system improvements, upgrades and modifications to meet 2009 General Plan build-out.

The first part of the update was the analysis of the current Wastewater Treatment System (System) capacities. The data analyzed used operational wastewater flow data from a six year period of 2002-2007 as the base data set and used a two year period of 2000-2001 as a comparative data set to compare and contrast the operational data set to identify changes in wastewater flow patterns as a result to changes in the system from the prior Master Plan Update. The results of this analysis found that the City of Cloverdale currently must transport, store, and treat and average of approximately 192 million gallons (MG) of wastewater each year. This was a net average reduction of 38 MG of wastewater experienced over the 2000-01 period. This reduction was also experienced in the average dry weather period, and the peak wet and dry weather period loadings at the WWTF. The maximum experience values were 0.41 MGD average dry weather flow; 1.40 MGD peak dry weather and 4.10 MGD peak wet weather flows. The comparative 2000-01 maximums were 0.45 MGD average dry, 1.50 MGD peak dry, and 4.6 MGD peak wet. These results illustrate that the on going efforts in the reductions in I/I and domestic water usage are working; moreover, given a growth in population of 7,333 residents in Jan 2002 to 8,577 in Jan 2008 continued efforts to reduce I/I and domestic water will continue to net benefits into the future.

The second part of the update outlined the analysis procedures used, provided supplementary calculations to support, and the results of the current and future wastewater loading model in order to understand how the wastewater system works and the anticipated loading scenarios given the 2009 General Plan build-out growth anticipated. The model was developed from data amassed over the 2002-2007 study period using wastewater flow information, water usage values, and planning and construction documentation in order to build a working model of the sewer system in Cloverdale. The model supported the findings the previous part of the report that the loading experienced from effluent flow was with in the capacity of the existing system. Further, the model developed the potential build-out loading that is anticipated given the current loading criterion.

The third part of the update expanded on the second part by making recommendations for changes to the system as a result from the current loading conditions. The current wastewater treatment facilities, both in the piping network and at the wastewater treatment plant, have demonstrated the adequate capacity to handle the loads experienced in both the average day scenario and in the peak loading scenario year round. Therefore, it is the recommendation of this report that the City continues to conduct routine system upkeep and aged system replacement

where necessary, and to monitor all facets of the system in order to identify potential problems. The update also identified where aged system replacement was warranted.

The Update has identified approximately 9.5 miles of pipes that are aged and in need of replacement. These stretches of aged pipe are a leading source of inflow and infiltration (I/I) of external water sources which limit the capacity of the wastewater system. The Sewer Master Plan Update recommends a phased replacement of these lines. The total dollar value for all of 8 phases is $16.3 million. The Update has also identified the requirement that the wastewater treatment plant must upgrade the wastewater treatment process to an advance wastewater treatment (AWT) or provide a hydrogeology analysis and alternative wastewater disposal methods which still may result in the AWT upgrade. The estimated cost for the AWT improvement including AWT, treated water storage and a recycled water distribution network is between $20 million and $25 million. No other significant system replacement or repairs were identified for the existing system.

The four part of the update addressed potential growth by the City in accordance with the draft General Plan. Per the current draft General Plan, the City plans to increase its population to a total of 12,000 residents and encourage complete build-out of all existing vacant commercial and industrial lands within the proposed Urban Growth Boundary. The wastewater model indicates that the current wastewater treatment plant is sufficient to handle the average wet and dry weather flows associated with the increased loading; however, the plant capacity falls short of handling peak loading in both the wet and dry seasons at complete build-out. Additionally, several reaches of new piping networks would have to be constructed and several existing sewer pipe reaches would have to be upsized to deliver the increased wastewater loads to the treatment plant.

Given the current plant capacities the treatment plant would have a peak dry weather load of 3.00 MGD and a peak wet weather load of 8.47 MGD. Both of these loading scenarios are greater than the 2.25 MGD peak dry and 8.20 MGD peak wet design loads of the plant. The sewer master plan has identified, given the current loading criterion that the wastewater treatment plant would be operating at 93% of the peak dry weather capacity for a population of 10,000 residents and 42% of complete build-out. The Sewer Master Plan recommends that the City should be to continue to monitor loading levels as Cloverdale begins to expand to meet the 2009 General plan. At the point when the population has reached approximately 10,000 residents the City should re-evaluate the wastewater flows into the treatment plant and conduct another Sewer Master Plan Update to identify changes in the loading criterion and recalculate whether an expansion to the treatment plant is warranted as the cost of such an improvement would be very costly to the City.

From the 2009 General Plan there are two significant areas of build-out development contained by the proposed Urban Growth Boundary. Those areas are the north and south ends of Cloverdale near Highway 101. The Northern Cloverdale Expansion Area would require new sewer main along N. Cloverdale Blvd and upgraded sewer facilities in N. Cloverdale Blvd and through the Northern Collector Main. The Southern Cloverdale Expansion Area would require new sewer main along Asti Rd and a sewer under-crossing of Highway 101 at Theresa Dr to support the annexation of the lands to the west. Further, the South Trunk Sewer and WWTF

Feeder Sewer Main will need to be upsized. The associated upgrades to existing sewer mains to meet the demands of complete build-out are:

- Up-sizing the sewer main in North Cloverdale Blvd to a 10-inch sewer main. The approximate cost of this phase of the Northern Cloverdale Expansion would require upgrades of $1.17 million. This upgrade would be in conjunction with;
- The up-sizing of the Northern Collector Main to a 12-inch sewer main which runs from North Cloverdale Blvd down at E. Fourth St to N Main St. to E Second St. to N East St to Lake St. The approximate cost for this phase of the project is $7.84 million
- To support the Southern Cloverdale Expansion the first phase would require the South Trunk Sewer Main to be upsized to a 30-inch sewer main. The cost of this upsizing would be $1.17 million. This upgrade would be in conjunction with;
- The second phase is the up-sizing the WWTF Main to 36-inch sewer main at a cost of $0.40 million

The associated new piping networks to meet the demand of build-out are:

- The placement of a new 8-inch sewer main from Shahan Dr. along N Cloverdale Blvd to the top of the hill and connect that to a 6-inch force main that brings effluent flows from a pump station at McCray Rd. The cost of the sewer main extension, force main and lift station is $1.99 million.
- The South Asti Rd Sewer Main Extension requires two phases the first phase includes approximately 6000 lf of 12-inch lines and 1200 lf of 8-inch sewer lines two reaches of 6-inch force mains and two lift stations to connect the lumber yard past the Asti Rd exit of Highway 101 and Santana Blvd along Asti Rd. The estimated cost for this expansion is $8.48 million. In conjunction:
- The connection of Theresa Dr to the South Asti Rd Sewer Main Extension would require crossing beneath Highway 101 at Theresa Dr with an 8-inch sewer main. This phase of the Southern Cloverdale Expansion would cost $0.77 million.

In conclusion, the Sewer Master Plan Update analyzed and quantified all existing wastewater treatment facilities for current and future requirements of the City and included them in this update. It is the conclusion of is update that the existing conditions do not warrant significant upgrades to meet existing demands. If the City adopts the 2009 General Plan with the goal of a population of 12,000 residents then significant upgrades and new sewer networking are going to have to be constructed to meet the increased wastewater loading of the City at complete build-out.