TECHNICAL SUPPORT DOCUMENT: BACTERIA TOTAL MAXIMUM DAILY LOADS FOR THE CLEAR CREEK WATERSHED, HOUSTON, TEXAS (1101, 1101B, 1101D, 1102, 1102A, 1102B, 1102C, 1102D, 1102E)

Prepared for:

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

TCEQ

Prepared by:

University of Houston

and

PARSONS

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ACRONYMS AND ABBREVIATIONS

ASAE	American Society of Agricultural Engineers
COH	City of Houston
C-CAP	Coastal Change Analysis Program
CAFO	concentrated animal feeding operation
CFR	Code of Federal Regulations
cfs	cubic feet per second
counts	colony forming unit
CN	curve number
dL	deciliter
DMR	discharge monitoring report
E. coli	Escherichia coli
EMC	event mean concentration
FDC	flow duration curve
GCHD	Galveston County Health District
GIS	geographic information system
GPS	global positioning system
HCFCD	Harris County Flood Control District
HCOEM	Harris County Office of Emergency Management
H-GAC	Houston-Galveston Area Council
LA	load allocation
LDC	load duration curve
mL	milliliter
MOS	margin of safety
MS4	municipal separate storm sewer system
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NRCS	National Resources Conservation Service
OSSF	on-site sewage facility
RMSE	root mean square error
SSO	sanitary sewer overflow
SWQS	surface water quality standards
SWQMIS	Surface Water Quality Information System
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TCOON	Texas Coastal Ocean Observation Network
TMDL	Total Maximum Daily Loads

TPDES	Texas Pollution Discharge Elimination System
TSARP	Tropical Storm Allison Recovery Project
TWDB	Texas Water Development Board
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WLA	waste load allocation
WQM	water quality monitoring
WQS	water quality standard
WWTF	wastewater treatment facility

CHAPTER 1
INTRODUCTION

1.1 Watershed Description

The Clear Creek Watershed encompasses approximately 180 square miles of land located just southeast of the City of Houston, Texas. The Clear Creek Watershed is part of the San Jacinto-Brazos Coastal Basin. Clear Creek flows into Clear Lake (Segment 2425) which, in turn, feeds into Upper Galveston Bay (Segment 2421). Approximately 40 percent of the watershed lies within Brazoria County, 35 percent lies within Harris County, 20 percent is within Galveston County, and 5 percent of the watershed lies within Fort Bend County. These counties are part of the Northern Humid Gulf Coastal Prairies ecoregion. The eastern and central portions of the watershed are primarily urban and residential, with some commercial and industrial uses. The western and southern parts of the watershed include rural and agricultural land uses which continue to transition over time from cultivated and woody land to developed land.

Clear Creek and its tributaries have both freshwater segments and tidally influenced mixed segments. The Texas Commission on Environmental Quality (TCEQ) classified Clear Creek as two separate waterbodies, Clear Creek Tidal, Segment 1101 and Clear Creek above Tidal, Segment 1102. Unclassified waterbodies that are tributaries to Clear Creek Tidal (Segment 1101) include Robinson Bayou (Segment 1101D), which is tidally influenced, and Chigger Creek (Segment 1101B), which is not. The tidal influence within Clear Creek creates a median high tide level of 2.0 feet and an average annual peak tide of 3.3 feet above mean sea level (USACE 1985). Unclassified waterbodies that are tributaries to Clear Creek above Tidal (Segment 1102) include Cowart Creek (Segment 1102A), Mary's Creek (Segment 1102B), Hickory Slough (Segment 1102C), Turkey Creek (Segment 1102D), and Mud Gully (Segment 1102E). All the tributaries to Clear Creek above Tidal are freshwater streams.

Subwatershed List

This report focuses on the following waterbodies that TCEQ placed in Category 5 [303(d) list] of the 2002 and 2006 Integrated Report for nonsupport of contact recreation use:

- Clear Creek Tidal, Segment 1101
- Chigger Creek, Segment 1101B
- Robinson Bayou, Segment 1101D
- Clear Creek above Tidal, Segment 1102
- Cowart Creek, Segment 1102A
- Mary's Creek, Segment 1102B
- Hickory Slough, Segment 1102C
- Turkey Creek, Segment 1102D
- Mud Gully, Segment 1102E

The climate of the region is subtropical humid, with very hot and humid summers and mild winters (USACE 1985). The average maximum daytime temperature is 34 degrees Celsius

(93 degrees Fahrenheit) while the temperature averages between 4 and 16 degrees Celsius (39 to 61 degrees Fahrenheit) during the winter. Summer rainfall is dominated by sub-tropical convection, winter rainfall by frontal storms, and fall and spring months by combinations of these two (Burian 2005). The floodplain encompasses about 10 percent of the drainage area of the watershed, approximately 12,800 acres (20 square miles) (Dunbar 1998).

Table 1-1, derived from the 2000 U.S. Census, demonstrates that the counties in which these watersheds are located are very densely populated (U.S. Census Bureau 2000). For comparison purposes, the population in 2005 from the Office of the State Demographer was included to show the population growth per county.

Table 1-1 County Population and Density

County Name	2000 U.S. Census	2000 Population Density (per square mile)	Texas State Demographic Projections 2005[a]	2005 Population Density (per square mile)
Harris	3,400,578	1,967	3,590,782	2,077
Galveston	250,158	629	256,615	645
Brazoria	241,767	174	252,367	182
Fort Bend	354,452	405	368,999	422

[a] *Office of the State Demographer, October 2006*

Figure 1-1 is a location map showing these Texas waterbodies and their contributing watersheds. The delineation of each subwatershed is derived from 2005 geographic information system (GIS) data files created for the Tropical Storm Allison Recovery Project (TSARP) provided by Harris County Flood Control District (HCFCD). Using the TSARP GIS file produces watershed delineations that are slightly different than the historic delineations based on TCEQ GIS files associated with classified segments (Segments 1101 and 1102). The importance of the watershed delineations based on the TSARP subwatershed delineations and their influence on the calculation method used for establishing total maximum daily loads (TMDL), will be discussed in more detail in Section 2.4 of this report. These waterbodies and their surrounding watersheds are hereinafter referred to as the Study Area.

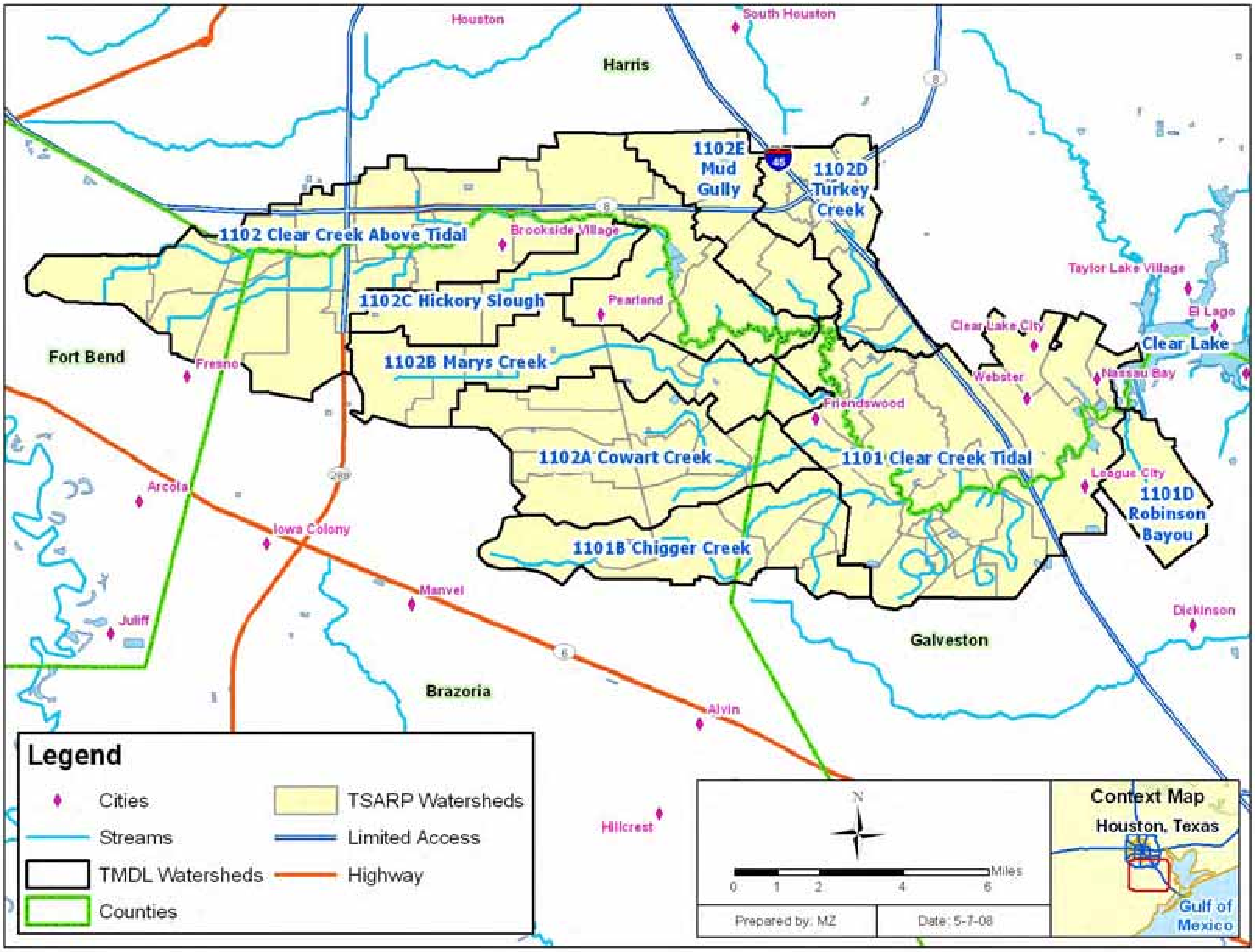


Figure 1-1 Location Map for Clear Creek Watershed

The six largest cities within the Clear Creek Watershed are expected to increase in population by an average of 49.4 percent from 2000 to 2020, according to the Texas Water Development Board (TWDB) (Montgomery Watson America, Inc. 2000). Table 1-2 lists TWDB population growth estimates for these six cities from 2000 to 2020.

Table 1-2 Clear Creek Watershed Population Increases by City, 2000 to 2020

City	2000 Census Population	2010 Population	2020 Population	Growth Rate (2000-2020)
Brookside Village	1,960	2,282	2,618	34%
Friendswood	29,037	32,353	35,216	21%
League City	45,444	53,546	60,539	33%
Nassau Bay *	4,170	Unknown	Unknown	0%
Pearland	37,640	66,049	83,462	122%
Webster	9,083	13,076	16,946	87%

Source:http//www.twdb.state.tx.us/data/data.asp (Jan 2008).
Projections last updated 04/17/2006.
** Possible error since projected populations are all the same.*

1.2 Summary of Existing Data

The following subsections summarize existing data relevant to soil, land use, and precipitation throughout the watershed as well as the chemical and physical characteristics of the waterbodies using ambient water quality, stream flow, tide, and conductivity data.

1.2.1 Soil

The geology of the Clear Creek Watershed comprises unconsolidated clay, clay shale, and poorly cemented sand that extend several miles in depth (TCEQ 2005). The soil has a low water-bearing capacity, high moisture content, low permeability, and a high shrink-swell potential. As can be observed in Figure 1-2, the soil types that dominate the watershed are TX276 and TX163, as defined by the Natural Resources Conservation Service (NRCS). Other soil types within the boundaries include TX100, TX162, TX248, and TX346. Table 1-3 describes the attributes and compositions of each of these soil types. The land surface slopes at a slight percent change of only about 0.03 percent toward the southeast (USACE 1985). The highest elevations within the watershed reach 75 feet above mean sea level. Near the mouth of Clear Creek where the flow discharges into Clear Lake, the land elevation decreases to mean sea level (USACE 1985).

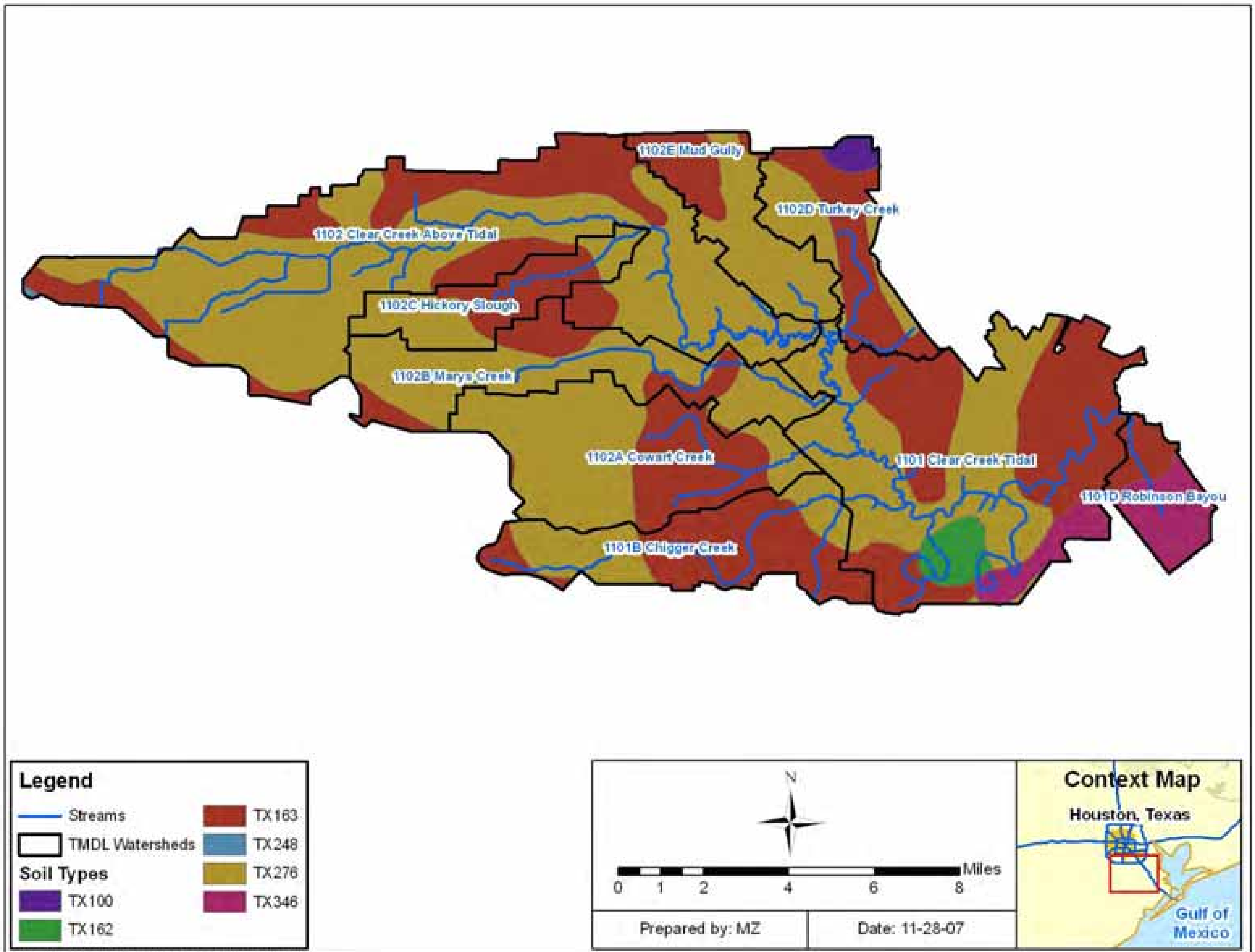


Figure 1-2 Clear Creek Region Soil Types

Table 1-3 Characteristics of Soil Types within the Clear Creek Watershed

NRCS Soil Type	Surface Texture	Hydro-logic Soil Group	Soil Drainage Class	Total % Coarse Sand	Total % Medium Sand	Total % Fine Sand	Total % Sand	Total % Silt	Total % Clay	Avg. Sediment Diameter (in.)	Weighted Avg Water Capacity
TX100	Loam	D	Poorly Drained	2%	3%	31%	36%	52%	11%	0.0069	0.16
TX162	Fine Sandy Loam	D	Somewhat Poorly Drained	1%	5%	24%	30%	50%	20%	0.0065	0.16
TX163	Fine Sandy Loam	D	Somewhat Poorly Drained	1%	6%	19%	27%	49%	24%	0.0066	0.17
TX248	Fine Sandy Loam	D	Somewhat Poorly Drained	1%	1%	43%	45%	43%	11%	0.0061	0.16
TX276	Clay	D	Somewhat Poorly Drained	1%	7%	7%	15%	47%	38%	0.0057	0.17
TX346	Silt Loam	D	Somewhat Poorly Drained	1%	3%	15%	19%	56%	24%	0.005	0.17

All information derived from STATSGO data
Weighted Avg Water capacity is in units of (inches of water/inch of soil)

1.2.2 Land Use

Table 1-4 summarizes the acreages and the corresponding percentages of the land use categories for the contributing watershed associated with each subwatershed in the Clear Creek Watershed. The land use/land cover data were retrieved from the National Oceanic and Atmospheric Administration's (NOAA) Coastal Services Center. The specific land use/land cover data files were derived from the Coastal Change Analysis Program (C-CAP), Texas 2005 Land Cover Data (NOAA 2007). The land use categories are displayed in Figure 1-3. The total acreage of each watershed in Table 1-4 corresponds to the watersheds delineated in Figure 1-3. The primary land use category in all watersheds within the Study Area is developed land (between 39% and 82%). The second most prominent land use category is pasture/hay land which ranges between 5 percent and 28 percent. Open water and bare/transitional land account for less than 2 percent of each of the waterbodies within the Clear Creek Watershed. The Clear Creek Tidal, Robinson Bayou, Mary's Creek/North Fork Mary's Creek, Hickory Slough, Turkey Creek, and Mud Gully watersheds are primarily urban with 51 percent to 82 percent developed land. Chigger Creek, Clear Creek above Tidal, and Cowart Creek are less urbanized with 39 percent to 49 percent developed land. The western and southern parts of the watershed include rural and agricultural land use which continues to transition over time from cultivated and woody land to developed land. The Study Area has seven incorporated cities within its watershed. Twelve independent utility districts and seven drainage districts are active within the watershed.

Table 1-4 Aggregated Land Use Summaries by Segment

Aggregated Landuse Category	Segment Name and ID								
	Clear Creek Tidal	Chigger Creek	Robinson Bayou	Clear Creek above Tidal	Cowart Creek	Marys Creek	Hickory Slough	Turkey Creek	Mud Gully
Segment ID	1101	1101B	1101D	1102	1102A	1102B	1102C	1102D	1102E
Percent Developed	58	39	51	41	49	79	54	57	82
Percent Cultivated Land	0.6	10.3	0.0	5.5	3.2	0.0	0.0	0.0	0.0
Percent Pasture/Hay	12.1	22.3	12.1	24.5	27.7	7.9	22.7	15.7	5.0
Percent Grassland/Herbaceous	3.8	6.1	7.0	4.5	5.9	3.3	6.1	6.4	2.1
Percent Woody Land	14	15	15	12	11	7.2	12	9.1	6.1
Percent Open Water	1.9	0.9	0.7	1.5	0.4	0.6	2.2	0.3	1.5
Percent Wetland	8.4	6.5	14	11	3.3	1.4	2.8	12	3.5
Percent Bare/Transitional	0.9	0.0	0.9	0.3	0.1	0.1	0.3	0.3	0.3
Acres of Developed	14,726	3,696	1,760	13,123	6,024	8,243	2,674	3,664	4,906
Cultivated Land	141	985	1	1752	397	0	0	1	1
Pasture/Hay	3072	2127	422	7851	3428	822	1122	1015	300
Grassland/Herbaceous	954	584	244	1431	733	344	300	412	128
Acres of Woody Land	3,669	1,434	571	3,991	1,331	746	580	589	365
Acres of Open Water	480	85	26	467	54	64	111	20	88
Acres of Wetland	2,137	622	479	3,394	414	149	137	760	213
Acres of Bare/Transitional	223	3	30	83	9	8	14	17	15
Total Acres	25,402	9,535	3,478	32,094	12,390	10,375	4,937	6,478	6,016
Watershed Area (sq. miles)	39.7	14.9	5.4	57.8	19.4	16.2	7.7	10.1	9.4

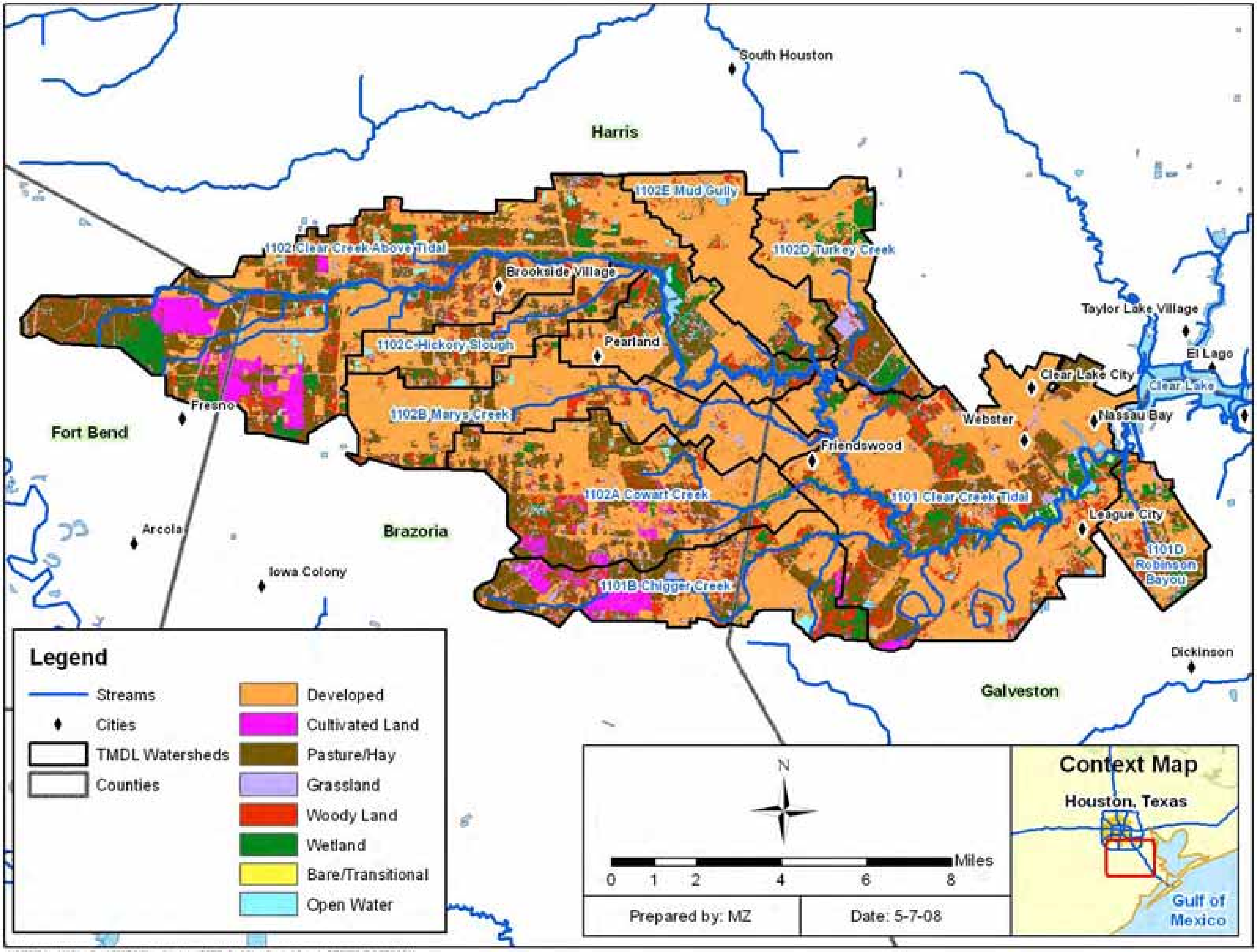


Figure 1-3 Land Use Map

1.2.3 Precipitation

The region has high levels of humidity and receives annual precipitation typically ranging between 50 and 60 inches per year. Fifteen rain gages are located within the watershed and are maintained by the Harris County Office of Emergency Management (HCOEM 2007). Rain gages 3480 and 4220 recorded erroneous data and were left out of these analyses to preserve the accuracy of the rainfall data. The cumulative rainfall recorded at the remaining 13 gages for each of the years 1999 through 2004 is tabulated in Table 1-5. Based on the 1999 to 2004 data, the watershed average is around 57.1 inches.

Table 1-5 Annual Totals at Rainfall Gages in Clear Creek Watershed

Gage number	Year						Average
	1999	2000	2001	2002	2003	2004	
Gage 105	N/A	46.9	78.1	68.7	53	55.6	60.5
Gage 110	30.9	52	77	81.3	59.4	58.7	59.9
Gage 115	N/A	48.6	56.4	70.6	N/A	62.7	59.6
Gage 120	35.7	35.1	74.7	77.9	52.5	64.2	56.7
Gage 125	N/A	36.3	72.6	78	53	64	60.8
Gage 130	N/A	45.3	80.4	75	55.3	67.1	64.6
Gage 135	N/A	N/A	N/A	79.9	42.6	59.9	60.8
Gage 140	34.9	46.2	69.3	68	47	59	54.1
Gage 150	35.6	49.9	77.4	62.1	37	59.4	53.5
Gage 160	32.8	45.7	64.5	74.9	48.7	59.4	54.3
Gage 170	31.4	38.5	60.9	61.6	54.3	57.7	50.7
Gage 180	47.1	23.6	80.5	69.5	48.9	57.3	54.5
Gage 190	48.2	42	65.9	58.8	46.7	55.1	52.8
Average rainfall across watershed (inches)							***57.1***

Annual average precipitation data were also compiled for the time period 1970 to 2000 based on the national data set from PRISM Group (PRISM Group 2006) summarized in Table 1-6. The PRISM data indicate a slightly lower average annual precipitation for the Clear Creek Watershed than the rainfall gages of the Harris County Office of Emergency Management, due to the high rainfall recorded during 2001 and 2002. The annual average precipitation values for each subwatershed derived from PRISM in this portion of Texas range between 51.77 and 54.52 inches and average 53.01 inches. The precipitation data from this longer period of record will be used to support the flow calculations in the load duration curves. Figure 1-4 illustrates the historical annual precipitation ranges for the watershed, as obtained from PRISM Group.

Table 1-6 PRISM Annual Average Precipitation, 1970-2000

Segment Name	Segment ID	Average Annual (Inches)
Clear Creek Tidal	1101	54.04
Chigger Creek	1101B	53.11
Robinson Bayou	1101D	54.52
Clear Creek above Tidal	1102	51.77
Cowart Creek	1102A	52.70
Mary’s Creek	1102B	52.37
Hickory Slough	1102C	52.22
Turkey Creek	1102D	53.33
Mud Gully	1102E	53.02

Source: PRISM Group 2006

1.2.4 Ambient Water Quality

A considerable amount of ambient water quality data are available to support water quality assessment and development of TMDLs for segments in the Clear Creek Watershed. Much of the indicator bacteria data from Clear Creek and its tributaries have been collected by the Galveston County Health District and TCEQ Region 12. Additional water quality data collection has been performed by the City of Houston Health and Human Services Department, City of Houston Department of Public Works and Engineering, the City of Pearland, and the Environmental Institute of Houston. These organizations worked in collaboration with the TCEQ, the Houston-Galveston Area Council (H-GAC), and the City of Houston (COH) to collect and analyze the data. Furthermore, as part of this project, additional indicator bacteria data were collected at various water quality monitoring (WQM) stations throughout the Clear Creek Watershed by the University of Houston and Parsons in 2006.

For some of the stations throughout the watershed, data for all three indicator bacteria, fecal coliform, *Escherichia coli (E. coli.)* and Enterococci were collected. Table 1-7 summarizes the number of samples collected and submitted to the TCEQ between 1970 and 2006 from various state and local entities.

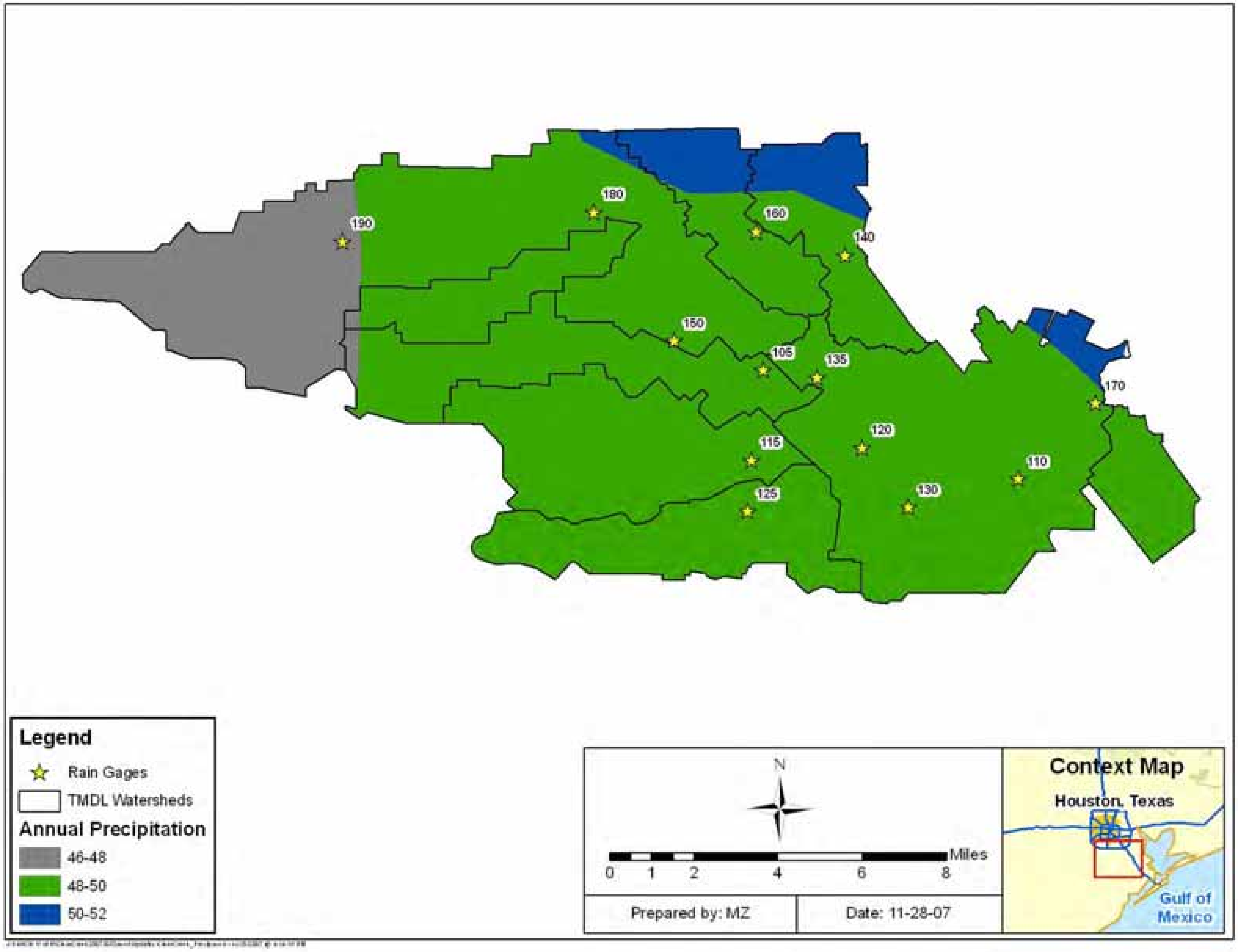


Figure 1-4 Precipitation Map

Table 1-7 Number of Indicator Samples Collected by Agencies in Clear Creek Watershed

Indicator	Agencies that Conducted Sampling						
	TCEQ Regional Office	Galveston County Health	Houston Health and Human Services	COH Dept. of Public Works and Eng.	City of Pearland	Environmental Institute of Houston	Univ. of Houston & Parsons[a]
Fecal Coliform	1130	972	137	21	75	0	NA
E. coli	24	1256	0	0	75	6	260
Enterococci	42	587	0	0	0	7	138
Total	1204	2815	137	21	150	13	398

[a] *Data collected during intensive surveys conducted in summer of 2006 (April 24-August 18).*
NA: not applicable

While Table 1-7 demonstrates that the majority of the historical water quality data over this 36-year period is for fecal coliform, a number of changes have occurred in the past 10-years that warrant refinements in how indicator bacteria data are used to support water quality assessments and TMDL development in Texas. Some key factors that influence which indicator bacteria to use for water quality assessment and TMDL development and the period of record to use include:

- changes in land use and locations of Texas Pollution Discharge Elimination System (TPDES)-permitted facilities;
- changing the indicator bacteria in the 2000 TCEQ surface water quality standards (SWQS) from fecal coliform to *E. coli* for fresh water, and Enterococci for marine waters;
- refinements in the TCEQ surface water quality monitoring procedures; and
- changes in the TCEQ guidance, *Assessing and Reporting Surface Water Quality in Texas.*

As a result of these evolving factors in the water quality management arena associated with the protection and maintenance of contact recreation use, the historical data set used to support the TMDLs in this report have been narrowed, wherever possible, to utilize only *E. coli* and Enterococci data from January 1990 through December 2006. In situations where there are an insufficient number of samples for *E. coli* or Enterococci to conduct adequate data analyses, fecal coliform data were utilized.

Table 1-8 summarizes the indicator bacteria data set for select TCEQ WQM stations in the Clear Creek Watershed for the period of record 1990-2006. This data set was derived from the TCEQ Surface Water Quality Information System (SWQMIS) database and includes results from the sampling events conducted under this project in 2006. The complete ambient water quality data set for bacteria used to prepare Table 1-8 is provided in Appendix A. Table 1-8 presents the number of indicator bacteria samples, as well as the geometric mean of the concentrations for each indicator, and the number and percentage of single sample exceedances of the Texas SWQS. As previously stated, the majority of the historical water quality data are for fecal coliform, and very few Enterococci data have been collected. A more in-depth discussion of the analysis of this data set is provided in Subsections 2.3 and 2.4. The locations of these WQM stations are displayed in Figure 1-5.

Table 1-8 Historical Water Quality Data for TCEQ Stations from 1990 to 2006

Segment	Station ID	Indicator Bacteria	Geometric Mean Criterion (counts/dL)	Geometric Mean Concentration (counts/ dL)	Single Sample Criterion (counts/ dL)	Number of Samples	Number of Samples Exceeding Single Sample Criterion	% of Samples Exceeding
Clear Creek Tidal								
1101	11446	FC	200	282	400	41	18	44%
		EC	126	24	394	5	0	0%
		ENT	35	50	89	45	13	29%
	11447	FC	200	290	400	51	19	37%
		EC	126	39	394	7	0	0%
		ENT	35	56	89	3	1	33%
	11448	FC	200	451	400	88	33	38%
		EC	126	128	394	11	2	18%
		ENT	35	974	89	19	19	100%
	15458	FC	200	332	400	47	20	43%
		EC	126	108	394	4	1	25%
		ENT	35	15	89	3	0	0%
	16572	FC	200	130	400	29	6	21%
		EC	126	193	394	2	1	50%
		ENT	35	19	89	20	5	25%
	16573	FC	200	84	400	29	4	14%
		EC	126	3229	394	1	1	100%
		ENT	35	24	89	8	0	0%
	16575	FC	200	235	400	40	13	33%
		EC	126	21	394	5	0	0%
		ENT	35	49	89	5	3	60%
	16576	FC	200	253	400	40	13	33%
		EC	126	33	394	11	0	0%
		ENT	35	314	89	30	6	77%
	16577	FC	200	222	400	40	10	25%
		EC	126	56	394	12	1	8%
		ENT	35	490	89	1	1	100%
Chigger Creek								
1101B	16472	FC	200	319	400	41	15	37%
		EC	126	90	394	28	18	18%
	16493	FC	200	824	400	38	23	61%
		EC	126	260	394	41	14	34%
	17072	FC	200	193	400	14	5	36%
		EC	126	173	394	22	7	32%
	17078	FC	200	160	400	8	3	38%
		EC	126	85	394	9	3	33%
Robinson Bayou								
1101D	16475	FC	200	824	400	40	27	68%
		EC	126	267	394	10	5	50%
		ENT	35	158	89	27	17	63%

Segment	Station ID	Indicator Bacteria	Geometric Mean Criterion (counts/dL)	Geometric Mean Concentration (counts/ dL)	Single Sample Criterion (counts/ dL)	Number of Samples	Number of Samples Exceeding Single Sample Criterion	% of Samples Exceeding
1101D	16486	FC	200	3061	400	32	26	81%
		EC	126	165	394	11	47	36%
		ENT	35	1191	89	15	14	93%
Clear Creek above Tidal								
1102	11449	FC	200	461	400	39	18	46%
		EC	126	51	394	20	1	5%
	11450	FC	200	833	400	53	31	58%
		EC	126	358	394	52	22	42%
		ENT	35	92	89	11	6	55%
	11451	FC	200	458	400	31	15	48%
		EC	126	146	394	27	9	33%
	11452	FC	200	381	400	63	27	43%
		EC	126	170	394	57	18	32%
	14229	FC	200	435	400	56	30	54%
		EC	126	161	394	27	10	37%
	17073	FC	200	185	400	25	9	36%
		EC	126	75	394	18	4	22%
	17074	FC	200	348	400	29	13	45%
		EC	126	75	394	36	7	19%
	17076	FC	200	368	400	30	10	33%
		EC	126	189	394	25	5	20%
	17077	FC	200	210	400	30	8	27%
		EC	126	79	394	25	4	16%
	17079	FC	200	117	400	22	2	9%
		EC	126	99	394	38	6	16%
Cowart Creek								
1102A	11425	FC	200	628	400	17	9	53%
		EC	126	314	394	29	13	45%
	11426	FC	200	354	400	13	4	31%
		EC	126	259	394	13	5	38%
	16477	FC	200	520	400	40	19	48%
		EC	126	102	394	11	3	27%
	16478	FC	200	777	400	23	14	61%
		EC	126	56	394	11	2	9%
Mary's Creek								
1102B	16473	FC	200	711	400	40	22	55%
		EC	126	231	394	41	10	24%
	17917	FC	200	119	400	14	1	7%
		EC	126	85	394	23	2	9%
	17918	FC	200	46	400	14	1	7%
		EC	126	51	394	24	2	8%
Hickory Slough								
1102C	17068	FC	200	267	400	31	11	35%
		EC	126	159	394	45	13	29%
Turkey Creek								
1102D	17069	FC	200	2196	400	15	11	73%

Segment	Station ID	Indicator Bacteria	Geometric Mean Criterion (counts/dL)	Geometric Mean Concentration (counts/ dL)	Single Sample Criterion (counts/ dL)	Number of Samples	Number of Samples Exceeding Single Sample Criterion	% of Samples Exceeding
		EC	126	97	394	10	3	30%
Mud Gully								
1102E	17070	FC	200	1340	400	20	17	85%
		EC	126	54	394	11	2	18%
	17071	FC	200	743	400	12	6	50%
		EC	126	48	394	12	1	8%

EC: E. coli, FC: Fecal Coliform; ENT: Enterococci
Highlighted stations are tidally influenced. Load duration curve analysis cannot be applied to WQM stations that are tidally influenced; therefore, these stations will be part of the TMDL analysis associated with Clear Creek Tidal, Segment 1101.

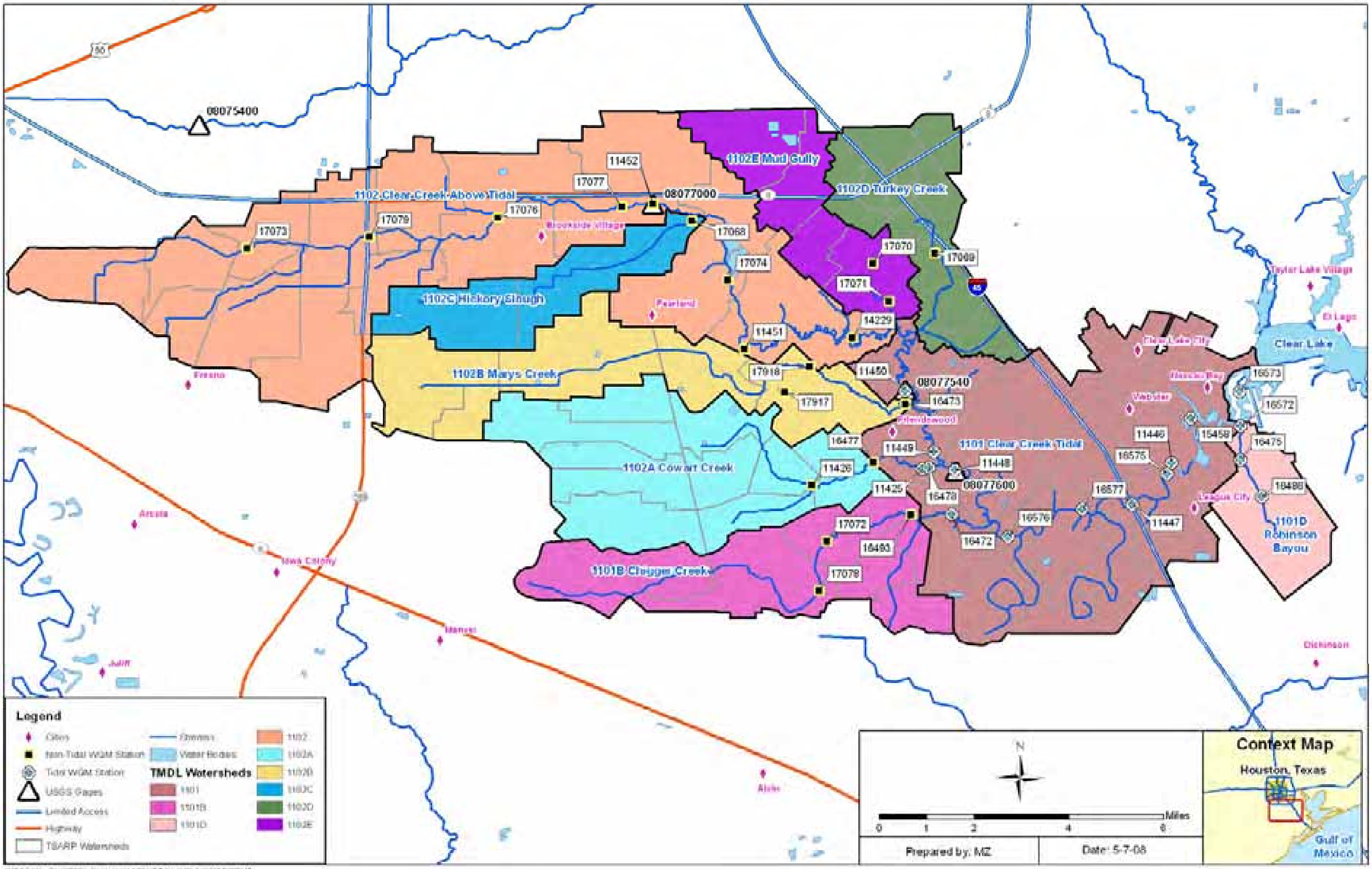


Figure 1-5 WQM Station Locations

1.2.5 Stream Flow Data

Stream flow data is key information when conducting water quality assessments such as TMDLs. The U.S. Geological Survey (USGS) has operated flow gages at three locations along Clear Creek to measure flow and elevations. The period of record and type of data collected at these gages are listed from upstream to downstream in Table 1-9. The locations of these gage stations are shown on Figure 1-6. The limited historical flow data available from these stations are summarized as flow exceedance percentiles in Appendix B.

Table 1-9 USGS Gages in the Clear Creek Watershed

USGS Gage Number	Name	Period of Record	Data Type
08077000	Clear Ck nr Pearland, TX	8/1/1944 - 9/4/1994	Discharge (cfs)
08077540	Clear Ck at Friendswood, TX	10/18/1994- 4/26/1997	Peak Stream flow (cfs)
08077600	Clear Ck nr Friendswood, TX	8/27/1997 - present	Elevation (ft)[a]

[a] *tidal gage*

The most downstream USGS station on Clear Creek, 8077600, is currently the only active gage in the watershed; however, because it is on a tidally influenced reach, it records water surface elevation but not stream flow. This lack of current, long-term flow data for Clear Creek above Tidal and its tributaries does presents complications when attempting to conduct estimates of pollutant fate and transport. However, flow projections can be estimated for the freshwater streams in the Clear Creek Watershed using long-term flow records from USGS gage stations in surrounding watersheds. Consequently, it was necessary to expand the data compilation and analysis of flow data to USGS gage stations from watersheds nearby in the Houston metropolitan area. As such, other USGS gages just north of the Clear Creek Watershed in Harris County were analyzed in search of flow data for a continuous period of record from 1996 through 2006. Using the most recent 10-year period of record was considered the most ideal data set since it would reflect current hydrologic conditions, meteorological characteristics, and a 10-year period was considered sufficient to account for seasonal variability. Furthermore, the time period of 1996 through 2006 was chosen as the 10-year period since instream bacteria samples and discharge monitoring reports (DMR) for wastewater treatment facilities were available for the same time period as well.

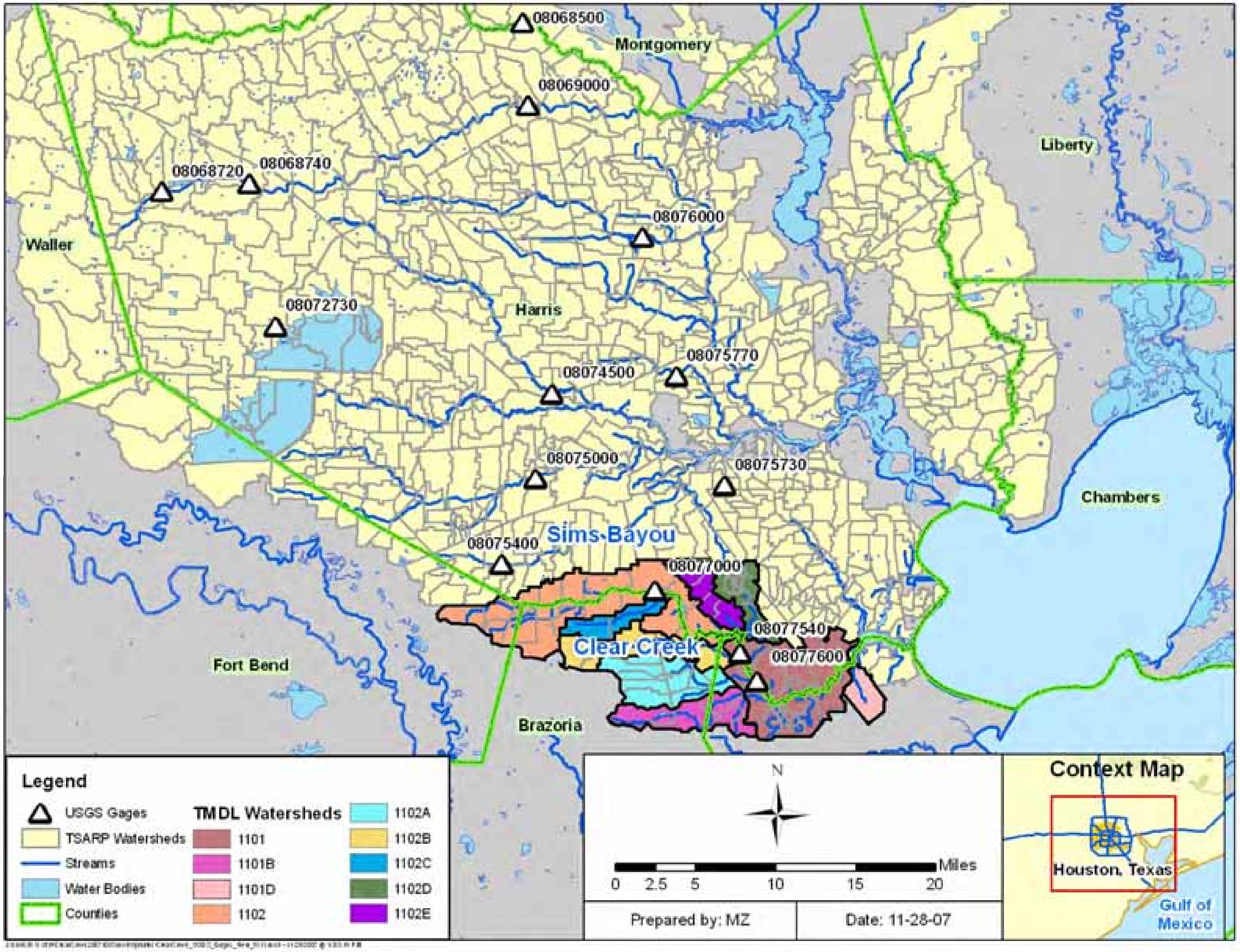


Figure 1-6 USGS Gage Stations Used for Compilation of Long-Term Flow Records

Eleven USGS gages outside the Clear Creek Watershed were determined to have a continuous period of record from 1996 to 2006. In addition to identifying gage stations with suitable flow data, other watershed drainage characteristics were compiled for the total drainage area of each USGS gage station. Nearby watersheds with similar precipitation patterns, drainage areas, and NRCS curve numbers are expected to produce similar area-normalized natural stream flows, though wastewater discharges will tend to alter low stream flows. The curve number (CN) reflects the efficiency of surface runoff from the land surface based on land use and soil properties. Table 1-10 summarizes the drainage area, curve number, annual precipitation, and mean flow calculated for each of the 11 USGS gage stations. The locations of these 11 stations are also displayed in Figure 1-6. The historical flow data available from these stations are summarized as flow exceedance percentiles in Appendix B. Because of its proximity and general similar characteristics, USGS station 080875400 in Sims Bayou was selected as for predicting streamflows in the Clear Creek Watershed.

Table 1-10 USGS Gages in Harris County with a Continuous Period of Record from 1996 to 2006

Gage Number	Name	Drainage Area (sq. miles)	CN	Annual Average Precipitation (in.)	Mean Flow (cfs)	Number of Continuous Data Points
08068500	Spring Creek near Spring, TX	406.9	56.4	47.7	338.7	3926
08068720	Cypress Creek at Katy-Hockley Rd near Hockley, TX	110.0	71.6	45.1	55.5	3926
08068740	Cypress Creek at House-Hahl Rd near Cypress, TX	127.8	70.8	45.4	87.2	3926
08069000	Cypress Creek near Westfield, TX	282.1	72.0	46.9	246.1	3926
08072730	Bear Creek near Barker, TX	23.9	78.7	46.9	30.5	3926
08074500	Whiteoak Bayou at Houston, TX	86.0	87.1	50.0	152.8	3926
08075000	Brays Bayou at Houston, TX	94.3	88.7	49.9	203.9	3926
08075730	Vince Bayou at Pasadena, TX	7.6	89.2	53.1	17.0	3926
08075770	Hunting Bayou at IH 610, Houston, TX	15.9	89.2	50.8	28.8	3926
08076000	Greens Bayou near Houston, TX	69.3	82.2	49.9	110.2	3926
08075400	Sims Bayou at Hiram Clarke St, Houston, TX	20.7	83.2	50.3	35.6	3652

Instantaneous flow was measured at 28 locations in the tidal and non-tidal segments of Clear Creek during intensive surveys, instream sampling and storm sampling conducted during summer 2006. Historical flow data measured at the same time as bacteria samples were being collected were also compiled from the TCEQ SWQMIS database to assist with characterizing stream flows. Table 1-11 lists the stations where instantaneous flow measurements were collected. The complete set of instantaneous flow data is provided in Appendix B.

Table 1-11 Historical Number of Flow Measurements in the Study Area

Segment	Station	Number of Flow Measurements	
		2006 Intensive Survey and In-Stream Sampling	1996 – 2006 SWQMIS database
1101	11448	10	
	16576	10	1
	16575		1
	16611	16	
	16985	11	
	18818	16	
1101B	16472	17	
	17072		5
	16493	17	1
1101D	16475	16	
	16486	17	
1102	11449	7	
	11450	17	3
	11451		2
	11452	17	23
	11453	17	
	17074	7	1
	17076		1
	17079	11	1
1102A	11425	12	5
	16678	18	
1102B	16473	16	6
	16803	12	
	17915	17	
1102C	17068	19	1
1102D	F1	23	
	17069		1
1102E	17071		1

1.2.6 Tide Data

Tide data were compiled to support the assessment and modeling of bacteria loading in Clear Creek Tidal (Segment 1101) and Robinson Bayou (Segment 1101D). There are two water level elevation gages in the tidal portion of Clear Creek. The Texas Coastal Ocean Observation Network (TCOON) operates station 502 at Clear Lake and the USGS operates USGS gage 08077600 at Clear Creek near Friendswood. One hour gage data for the period of 1/01/2000 – 12/31/2006 were downloaded from TCOON for station 502 at Clear Lake (http://lighthouse.tamucc.edu/overview/502). During the simulation period, the minimum, maximum, median and average tide elevation were 0.331, 0.728, 0.004, and 0.008 ft, respectively. Tide data are provided in electronic format in Appendix C.

1.2.7 Conductivity Data

Specific conductance data were used to assist in calibrating the tidal prism model that was used for analyzing the tidal segments in Clear Creek. These data were gathered from TCEQ's SWQMIS database with dates ranging from 1970 through 2007 and from three intensive field surveys that were conducted in 2006. Statistical summaries of specific conductance data are shown in Table 1-12. As expected, these summaries show higher values for specific conductance in Clear Creek Tidal (Segment 1101) and Robinson Bayou (Segment 1101D). These data also demonstrate that tidal influence extends farther upstream on Clear Creek above Tidal than the TCEQ historic tidal boundary between Clear Creek Tidal and Clear Creek above Tidal. The data used to create Table 1-12 can be found in Appendix D.

1.3 Bacteria Concentrations: Correlation with Rainfall Runoff and Trend Analysis

Runoff can transport large concentrations of bacteria to surface water bodies through several pathways. Runoff from urban regions has been identified by the U.S. Environmental Protection Agency (USEPA) as "the leading cause of impairment of the nation's surface waters" (USEPA 1983). In addition, as a result of inflow and infiltration, rainfall increases the potential for storm sewer overflows and biosolids releases from WWTFs.

Based on historical data, correlations between bacteria concentrations and precipitation were investigated for each sampling event at select monitoring stations within the Clear Creek Watershed. In this data analysis exercise, a partial historical data set (1970 through 2005) of TCEQ stations was used in an attempt to establish stronger statistical correlations. Data results collected by the University of Houston or other agencies during 2006 are not included in this data set. The geometric means of indicator bacteria concentrations on the day of a rainfall event and subsequent days at each of the monitoring stations are included in Tables 1-13 and 1-14. Throughout the watershed, relatively high fecal bacteria concentrations are observed for samples collected on the day of a rainfall event. These tend to increase sharply through the day following a rainfall event, and then decline over the next two to three days. After the third to fourth day following a rainfall event, the concentrations appear to return to a significantly lower baseline level, although the strong variation common for bacteria indicator levels in surface water is still seen.

Table 1-12 Summary of Conductivity Data from 1970 to 2007

Segment	Station ID	Description	Specific Conductivity: Field Statistics (µS/cm)							
			Start Date	End Date	n	Min	Max	Mean	Std. Dev.	Median
1101	11446	Clear Creek Tidal at SH 3	3/13/74	10/10/07	461	203	40800	10143	8687	7730
	11447	Clear Creek Tidal at IH 45	3/11/76	8/12/03	119	247	29200	7614	7597	4000
	11448	Clear Creek Tidal at FM528	6/9/70	8/18/06	237	100	43294	2548	4977	1220
	15458	Clear Creek at Egret Bay Blvd	4/19/99	5/16/03	58	268	26000	10837	6852	11405
	16572	Clear Creek Tidal at Robinsons Bay	1/11/99	2/12/07	57	271	26500	10715	7758	9920
	16573	Clear Creek Tidal at confluence with Clear Lake	1/11/99	5/16/03	41	325	28300	11299	8124	9100
	16575	Clear Creek Tidal at Walter Hall	1/8/99	8/2/05	44	200	22800	4930	5877	2020
	16576	Clear Creek Tidal at Brookdal	1/6/99	2/4/07	86	212	23400	2751	4565	791
	16577	Clear Creek Tidal at Challenger Park	1/6/99	8/2/05	57	154	11100	2059	2618	1320
1101B	16472	Chigger Creek at Oak Drive	1/6/99	8/18/06	59	189	1880	844	409	737
	16493	Chigger Creek at FM528 Bridge	1/6/99	2/4/07	75	180	1970	950	392	997
1101D	16475	Robins Bayou at FM270	1/8/99	2/5/07	90	27	40316	9523	9563	6650
	16486	Robinsons Bayou at Webster	1/8/99	8/17/06	61	140	43696	1276	5526	554
1102	11449	Clear Ck at Friendswood Link	3/1/76	8/20/03	103	100	12000	1165	1361	90
	11450	Clear Creek at FM 2351	3/13/74	10/10/07	237	9	2300	886	390	880
	14229	Clear Creek at Dixie Farm Road	5/7/99	2/26/07	58	159	3070	1005	623	916
1102A	11425	Cowart Creek at FM 518	3/7/83	2/4/07	41	268	4690	1355	871	1110
	16477	Cowart Creek at Sunset Drive	1/6/99	8/20/03	41	213	3780	1465	881	1480
	16478	Cowart Creek Near Arbre Lane	10/12/99	8/20/03	35	168	2610	1126	633	1100
1102B	16473	Mary's Creek at Mary's Crossing	1/6/99	2/4/07	77	187	1450	714	268	711
1102D	F1	Turkey Creek at Beamer Rd	4/24/06	8/18/06	16	203	1009	649	195	692
1102E	17071	Mud Gully at Dixie Farm Road	2/7/00	8/23/05	25	229	881	1694	184	760

µS/cm = microsiemens per centimeter
n = number of measurements

Table 1-13 Rainy Day Tables for *E. coli*

	Samples Collected on the Day of Event		Samples Collected the Day After Event		Samples Collected 2nd Day After Event		Samples Collected 3rd Day After Event		Samples Collected 4th Day After Event		Samples Collected 5th Day After Event		Samples Collected 6th Day After Event		Samples Collected 7th Day After Event		Samples Collected 8+ Days After Event	
	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)
		0		1		2		3		4		5		6		7		8
14229	15	1618	10	5810	4	303	4	542	3	180	1	616	3	183	3	1210	8	209
16473	15	842	8	6674	4	525	4	418	4	174	1	135	3	397	4	200	6	532
16477	14	1954	10	8814	3	510	3	67	3	463	2	283	3	160	4	163	4	362
17068	4	7510	3	1093	4	604	4	86	0	N/A	0	N/A	2	401	0	N/A	9	229
17069	6	13195	1	882	1	5	2	312	1	246	3	1247	1	230	0	N/A	6	986
17071	5	1093	3	1677	0	N/A	2	323	3	171	2	167	2	163	0	N/A	5	801

Geo Conc = Geometric Mean; dL = deciliters; N=Number of samples

Table 1-14 Rainy Day Tables for Enterococci

	Samples Collected on the Day of Event		Samples Collected the Day After Event		Samples Collected 2nd Day After Event		Samples Collected 3rd Day After Event		Samples Collected 4th Day After Event		Samples Collected 5th Day After Event		Samples Collected 6th Day After Event		Samples Collected 7th Day After Event		Samples Collected 8+ Days After Event	
	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)	N	Geo Conc (#/dL)
16472	7	1229	7	4707	3	121	3	260	0	N/A	0	N/A	0	N/A	2	12	4	362
16475	7	5837	3	1049	5	267	0	N/A	3	16	1	152	2	39	2	41	7	54
16572	7	195	1	9280	1	32	3	44	1	4	3	6	0	N/A	0	N/A	5	26

Geo Conc = Geometric Mean; dL = Deciliters; N = Number of samples

The correlation between fecal bacteria concentration and days since last rainfall presented in the tables above indicates the strongest trend occurred from one day following a rain event to four days after a rain event. For this period of time, the average indicator concentrations decreased at a rate of 1,160 bacteria per deciliter of ambient water per day with a confidence of over 99.99 percent and an R squared value of 0.48. Over this period of time an increase of 626 bacteria per dL of ambient water per day was observed. This trend has a confidence level of slightly under 90 percent and an R squared value of 0.20. The bacteria concentrations were not found to exhibit any significant trends after the fourth day past a rainfall event. The geometric mean values for bacteria concentrations at a select group of WQM monitoring stations are shown in Figures 1-7 and 1-8 to provide a visualization of the trends. The WQM stations displayed in Figures 1-7 and 1-8 represent the downstream most stations on each water body.

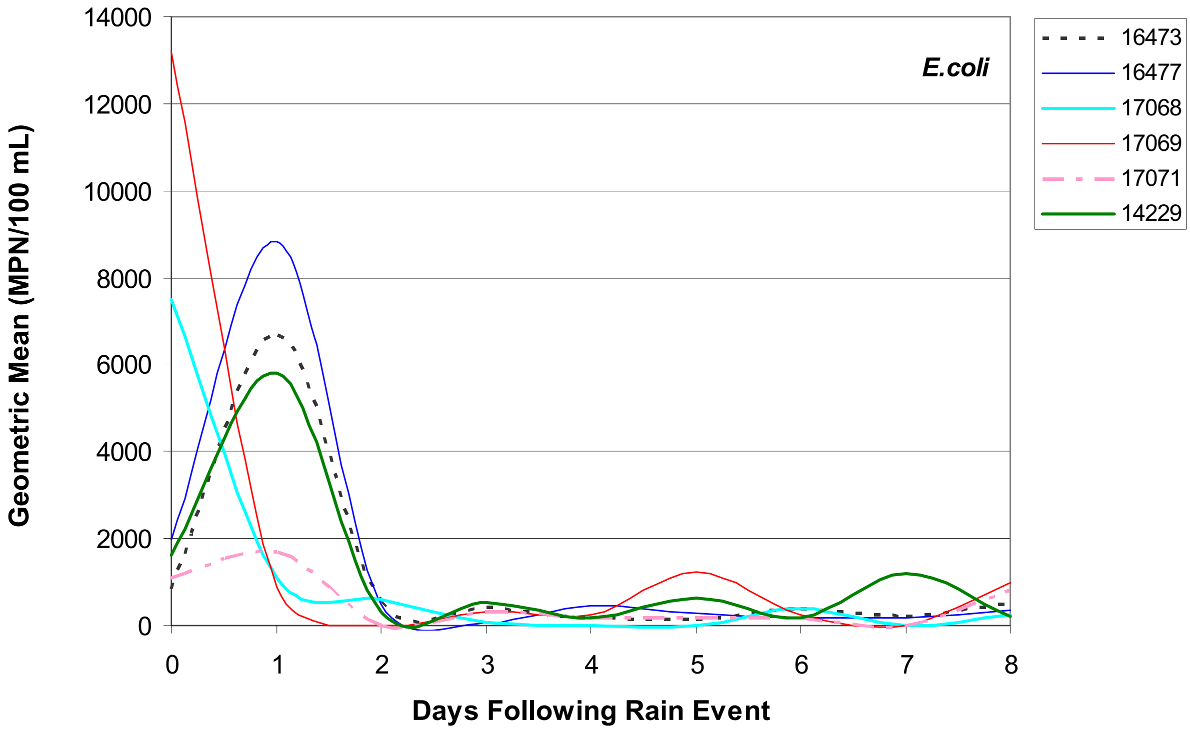


Figure 1-7 Effects of Rainfall on *E. coli* Concentrations in Clear Creek above Tidal and Tributaries

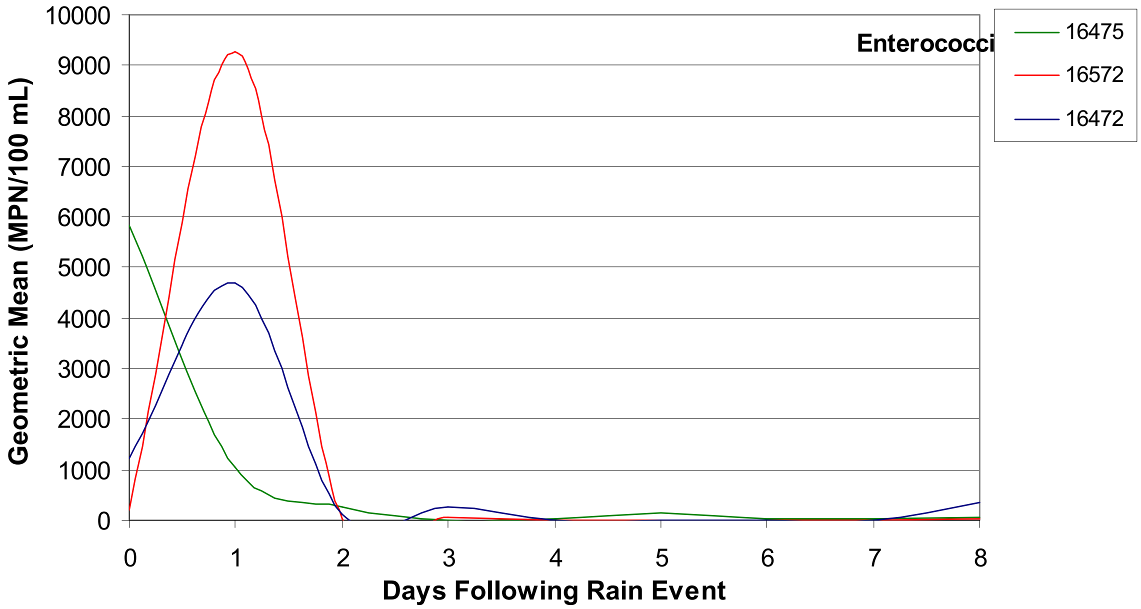


Figure 1-8 Effects of Rainfall on Enterococci Concentrations in Robinson Bayou, Clear Creek Tidal, and Chigger Creek

1.4 Clear Creek Seasonality

Seasonal differences in indicator bacteria concentrations were assessed by comparing historical bacteria concentrations collected in the warmer months versus those collected during the cooler months. The monthly average temperatures for Houston obtained from NOAA (Table 1-15) and the following criteria were used to divide the data sets into warmer (24 – 32°C) and cooler months (12 – 18°C). Based on these temperature ranges, November, December, January, and February were cooler months, and May, June, July, August, and September were warmer months.

Table 1-15 Average Monthly Temperatures for Houston Hobby AP, TX (1971-2000)

Month	Daily Max (°C)	Daily Min (°C)	Daily Mean (°C)	Classification
Jan	17.4	7.3	12.4	Cool
Feb	19.5	9	14.3	Cool
Mar	23.1	12.7	17.9	
Apr	26.3	15.9	21.1	
May	29.9	20.1	25	Warm
Jun	32.8	23.1	27.9	Warm
Jul	34.2	24.1	29.2	Warm
Aug	34.1	24.1	29.1	Warm
Sep	31.8	22	26.9	Warm
Oct	27.8	16.8	22.3	
Nov	22.5	11.9	17.2	Cool
Dec	18.6	8.2	13.4	Cool

Note: Temperature values from NOAA (degrees Fahrenheit) have been converted to degrees Celsius.
http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl

A t-test was conducted on log transformed data between the warmer months and cooler months for stations with 6 or more samples. Geometric means were also calculated for the warmer and cooler months. Table 1-16 shows that 13 out of 18 stations (72%) fecal coliform exhibited higher geometric means for colder months than for warmer months. Fecal coliform levels were significantly higher (p-value<0.05) during cool months at three of the 18 stations, perhaps due to increased survival times of fecal bacteria at cooler temperatures. However, overall there was no statistically significant seasonal difference.

Table 1-16 Seasonal Differences for Fecal Coliform Concentrations

Segment	Station ID	Warm Months		Cold Months		*p*-value
		n	Geomean	n	Geomean	
1102	17074	12	337	10	364	0.94
1102A	16477	22	454	10	608	0.69
1102B	16473	22	627	10	723	0.82
1101	16577	22	114	10	602	0.02
1101B	16472	23	218	10	541	0.21
1102	17077	11	99	11	328	0.13
1102	17076	11	433	11	279	0.52
1102	17068	12	286	11	264	0.93
1102	11453	16	449	14	708	0.42
1102	14229	29	390	14	514	0.62
1101	15458	23	161	16	977	0.001
1102	11451	21	1220	18	278	0.07
1102	11449	38	535	24	608	0.82
1101	11447	45	232	27	465	0.21
1102	11450	63	970	41	712	0.48
1101	11446	59	131	42	484	0.002
1101	11448	68	580	46	429	0.49
1102	11452	75	512	55	733	0.26

n = number of samples
Highlighted rows correspond to stations for which the warm and cold datasets are significantly different at a 95% confidence interval.
p-value is based on a t-test conducted at each station using single sample concentrations.
All concentrations are in counts/dL.

For *E. coli*, Table 1-17 shows that 56 percent of the stations (5 out of 9) exhibited higher geometric mean concentrations for the colder months than the warmer months. Similar to fecal coliform, only one out of 9 stations showed statistically significant differences in concentrations between the warmer and cooler periods.

Table 1-17 Seasonal Differences for *E. coli* Concentrations

Segment	Station ID	Warm Months		Cold Months		*p*-value
		n	Geomean	n	Geomean	
1102	17076	10	321	9	126	0.14
1102	17077	10	45	9	147	0.17
1102	17079	10	149	9	56	0.21
1102B	16803	10	75	6	69	0.93
1102	14229	12	85	9	671	0.01
1102	11451	12	118	9	225	0.44
1102	17074	13	115	9	100	0.89
1102	11450	17	174	8	986	0.19
1102	11452	20	94	13	1324	0.004

n = number of samples
Highlighted rows correspond to stations for which the warm and cold datasets are significantly different at a 95% confidence interval.
p-value is based on a t-test conducted at each station using single sample concentrations.
All concentrations are in counts/dL.

For Enterococci, a majority of the stations either did not have any data or had inadequate data to conduct an analysis. Only one station (11446) had more than 6 samples. For that station, the geometric mean of the samples for colder months was 224 counts/dL (11 samples), while the geometric mean for the warmer months was 28 counts/dL (21 samples).

CHAPTER 2
PROBLEM IDENTIFICATION AND WATER QUALITY TARGET

2.1 Pollutant of Concern: Characteristics of Bacterial Indicators

The contact recreation use is assigned to almost every designated water body in the State of Texas, although full support of the contact recreation use is not a guarantee that the water is completely safe of disease-causing organisms. The evolution of the contact recreation criteria currently used by Texas began with criteria first published in 1968 based on general studies done on lakes in the Midwest and New York using fecal coliform bacteria as an indicator of the potential presence of fecal contamination (USEPA 1986). The USEPA-recommended criteria for recreational waters in 1976 included a geometric mean criterion: no more than 200 counts/dL based on five samples collected over a 30-day period; and an instantaneous criterion: no more than 10 percent of the individual grab samples could exceed 400 counts/dL (USEPA 1986). Shortly thereafter, these recommended criteria were adopted by the State of Texas in its SWQSs. These criteria, and the studies on which they were based, were heavily criticized by the USEPA in 1986 (USEPA 1986) following an extensive program of epidemiology testing. During that decade, USEPA studies found that fecal coliform was not a good predictor of the risk of disease and recommended new tests and criteria. The USEPA recommended new criteria for swimming areas, using *E. coli* and Enterococci as new fecal indicator organisms, and incorporating the idea of varying criteria with the level of swimming use.

In Texas, three indicator bacteria are analyzed in water samples collected to determine support of the contact recreation use: fecal coliform and *E. coli* in freshwater and fecal coliform and Enterococci in marine waters. *E. coli* and Enterococci bacteria are measured to determine the relative risk of contact recreation, depending on whether the water body is fresh or marine. The presence of these bacteria indicates that associated pathogens from the fecal waste of warm-blooded species (human or animal) may be reaching a body of water. The standard associated with contact recreation use is designed to ensure that water is safe for swimming, wading by children or other water sports that involve direct contact with the water, especially with the possibility of ingesting it. High concentrations of certain bacteria in water indicate there may be an increased risk of becoming ill from recreational activities.

Texas water quality standards (WQS) for contact recreation allow exemptions for waterbodies where elevated bacteria concentrations frequently occur due to sources of pollution that cannot be reasonably controlled by the existing regulations, or where recreation is considered unsafe for other reasons, such as barge or ship traffic (*e.g.,* Houston Ship Channel), unrelated to water quality. This exemption and reclassification to less strict “noncontact recreation” standards has been applied to only a few waterbodies in Texas.

2.2 TCEQ Water Quality Standards for Contact Recreation

The TCEQ is responsible for administering provisions of the constitution and laws of the State of Texas to promote judicious use of and protection of the quality of waters in the state. Included in this responsibility is the continuous monitoring and assessment of water quality to evaluate compliance with SWQSs established within Texas Water Code, §26.023 and Title 30

Texas Administrative Code (TAC), §§307.1-307.10. Texas SWQS, 30 TAC 307.4, specify the designated uses and general criteria for all surface waters in the state.

This report focuses on the waterbodies within the Clear Creek Watershed that are on the federal Clean Water Act §303(d) list because they do not support contact recreation use. Table 2-1 summarizes the designated uses and the applicable bacteria indicators used to assess the contact recreation use of each waterbody addressed in this report. Table 2-1 also identifies the year each waterbody was placed on the Texas' Clean Water Act §303(d) List for nonsupport of contact recreation use, the stream length in miles, and other designated uses for each waterbody. The TMDLs in this report only address the contact recreation use. TMDLs are a necessary step in the process to restore contact recreation use for each waterbody.

Table 2-1 Synopsis of Texas Integrated Report for Waterbodies in the Clear Creek Watershed

Segment ID	Segment Name	Indicator Bacteria	Designated Use*				Year Placed on 303(d) List	Stream Length (miles)
			CR	AL	GU	F		
1101	Clear Creek Tidal	ENT (or FC)	NS	S	S	S	1996	12
1101B	Chigger Creek	*E. coli* (or FC)	NS	S		S	2002	9.8
1101D	Robinson Bayou	ENT (or FC)	NS				2006	1.4
1102	Clear Creek above Tidal	*E. coli* (or FC)	NS	S	S	S	1996	30
1102A	Cowart Creek	*E. coli* (or FC)	NS	S		S	2002	6.4
1102B	Mary's Creek/North Fork Mary's Creek	*E. coli* (or FC)	NS	S		S	2002	10.9
1102C	Hickory Slough	*E. coli* (or FC)	NS	S	S	S	2006	10.4
1102D	Turkey Creek	*E. coli* (or FC)	NS	S	S	S	2006	3.0
1102E	Mud Gully	*E. coli* (or FC)	NS	S	S	S	2006	2.7

CR: Contact recreation; AL: Aquatic Life; GU: General Use; F: Fish Consumption; NS: Nonsupport, ENT: Enterococci, FC: fecal coliform
NS = Non Support; S = Support

The excerpts below from Chapter 307, Texas SWQS (TCEQ 2000) stipulate how water quality data were assessed to determine support of contact recreation use as well as how the water quality targets are defined for each bacterial indicator.

§307.7. Site-specific Uses and Criteria.

(a) Uses and numerical criteria are established on a site-specific basis in Appendices A, D, and E of §307.10 of this title (relating to Appendices A - E). Site-specific uses and numerical criteria may also be applied to unclassified waters in accordance with §307.4(h) of this title (relating to General Criteria) and §307.5(c) of this title (relating to Antidegradation). Site-specific criteria apply specifically to substances attributed to waste discharges or the activities of man. Site-specific criteria do not apply to those instances in which surface waters exceed criteria due to natural phenomena. The application of site-specific uses and criteria is described in §307.8 of this title (relating to the Application of Standards) and §307.9 of this title (relating to the Determination of Standards Attainment).

(b) Appropriate uses and criteria for site-specific standards are defined as follows.

(1) Recreation. Recreational use consists of two categories - contact recreation waters and noncontact recreation waters. Classified segments are designated for contact recreation unless elevated concentrations of indicator bacteria frequently occur due to sources of pollution which cannot be reasonably controlled by existing regulations or contact recreation is considered unsafe for other reasons such as ship or barge traffic. In a classified segment where contact recreation is considered unsafe for reasons unrelated to water quality, a designated use of noncontact recreation may be assigned criteria normally associated with contact recreation. A designation of contact recreation is not a guarantee that the water so designated is completely free of disease-causing organisms. Indicator bacteria, although not generally pathogenic, are indicative of potential contamination by feces of warm blooded animals. The criteria for contact recreation are based on these indicator bacteria, rather than direct measurements of pathogens. Criteria are expressed as the number of "colony forming units" of bacteria per 100 milliliters (mL) of water. Even where the concentration of indicator bacteria is less than the criteria for contact recreation, there is still some risk of contracting waterborne diseases. Additional guidelines on minimum data requirements and procedures for evaluating standards attainment are specified in the latest approved version of the TNRCC Guidance for Screening and Assessing Texas Surface and Finished Drinking Water Quality Data.

(A) Freshwater

(i) Contact recreation. The geometric mean of E. coli should not exceed 126 per 100 mL. In addition, single samples of E. coli should not exceed 394 per 100 mL. Contact recreation applies to all bodies of freshwater except where specifically designated otherwise in §307.10 of this title (relating to Appendices A - E).

(ii) Noncontact recreation. The geometric mean of E. coli should not exceed 605 per 100 mL.

(B) Saltwater

(i) Contact recreation. The geometric mean of Enterococci should not exceed 35 per 100 mL. In addition, single samples of Enterococci should not exceed 89 per 100 mL. Contact recreation applies to all bodies of saltwater, except where specifically designated otherwise in §307.10 of this title.

(ii) Noncontact recreation. The geometric mean of Enterococci should not exceed 168 per 100 mL.

(C) Fecal coliform bacteria. Fecal coliform bacteria can be used as an alternative instream indicator of recreational suitability until sufficient data are available for E coli or Enterococci. For segments designated as oyster waters in §307.10 of this title, fecal coliform can continue to be used as an indicator of recreational suitability because fecal coliform is used as the indicator for suitability of oyster water use as described in paragraph (3)(B) of this subsection. Fecal coliform can also continue to be used as a surrogate indicator in effluent limits for wastewater discharges. Fecal coliform criteria are the same for both freshwater and saltwater, as follows.

(i) Contact recreation. The geometric mean of fecal coliform should not exceed 200 per 100 mL. In addition, single samples of fecal coliform should not exceed 400 per 100 mL.

(ii) Noncontact recreation. Fecal coliform shall not exceed 2,000 per 100 mL as a geometric mean. In addition, single samples of fecal coliform should not exceed 4,000 per 100 mL.

(D) Swimming advisory programs. For areas where local jurisdictions or private property owners voluntarily provide public notice or closure based on water quality, the use of any single sample or short-term indicators of recreational suitability are selected at the discretion of the local managers of aquatic recreation. Guidance for single-sample bacterial indicators is available in the USEPA document entitled Ambient Water Quality Criteria for Bacteria - 1986. Other short-term indicators to assess water quality suitability for recreation -- such as measures of streamflow, turbidity, or rainfall -- may also be appropriate.

§307.10. Appendices A - E.

The indicator bacteria for recreation for freshwater is E. coli and for saltwater is Enterococci. Fecal coliform can still be used as an alternative indicator during the transition to the new indicator bacteria, as specified in §307.7 (b). The appropriate bacterial criteria and fecal coliform alternative are listed in the appendix under the Indicator Bacteria column. E. coli criteria of 126 colonies per 100 mL of water are applied as specified in §307.7(b)(1)(A)(i) and (ii) for contact recreation (relating to Site-specific Uses and Criteria). The criteria of 605 colonies per 100 mL of water are applied as specified in §307.7(b)(1)(A)(iii) for noncontact recreation. Enterococci criteria of 35 colonies per 100 mL are applied as specified in §307.7(b)(1)(B)(i) and (ii) for contact recreation, and 168 colonies per 100 mL for noncontact recreation. The indicator bacteria for suitability for oyster waters is fecal coliform. The fecal coliform criteria for oyster waters is 14 colonies per 100 mL as specified in §307.7(b)(3)(B).

As an alternative, fecal coliform criteria of 200 per 100 mL are applied as specified in §307.7(b)(1)(C)(i) and (ii). Fecal coliform criteria of 2,000 per 100 mL are applied as specified in §307.7(b)(1)(C)(iii).

As stipulated in Draft 2006 *Guidance for Assessing and Reporting Surface Water Quality in Texas* (TCEQ 2007), utilization of the geometric mean to determine compliance for any of the bacterial indicators depends on the collection of at least 10 samples over the most recent 10-year period.

Draft 2006 *Guidance for Assessing and Reporting Surface Water Quality in Texas* (TCEQ 2007)*:*

Ten samples will also be required for listing and delisting water bodies for which the assessment method is based on an average. Larger sample sizes increase the state's confidence that impairments are not missed. Although we will use more than 10 samples, if available, it is not reasonable at this time to require more than 10 samples for a minimum data set, given the monitoring resources and currently available data.

The 2006 assessment period of record for the last five years is December 1, 1999 through November 30, 2004. Samples from these five years are evaluated when available, if necessary, the most recent samples collected in the preceding five years (December 1, *1994 through November 30, 1999) can also be included to meet the requirements for minimum sample number.*

2.3 Problem Identification

Pursuant to §303(d) of the federal Clean Water Act, states must establish TMDLs for pollutants contributing to violations of WQSs. Table 2-2 identifies the waterbodies requiring TMDLs identified in Category 5 of the 2006 Texas Water Quality Inventory and §303(d) List (TCEQ 2006). The two classified segments, Clear Creek Tidal (Segment 1101) and Clear Creek above Tidal (Segment 1102), were originally placed on the Texas §303(d) list in 1996. Between 1996 and 2006, as the TCEQ WQSs and water quality assessment method were modified and additional water quality data were collected throughout the Clear Creek Watershed, unclassified tributaries of the two classified segments were added to the §303(d) list. Table 2-2 lists the TCEQ WQM stations from which ambient water quality data were summarized to support the decision to place these waterbodies on the TCEQ 303(d) list. The locations of these WQM stations are displayed in Figure 2-1 and on this map each station is designated as a tidal or non-tidal station. Water quality data from 1996 through 2000 were used for the 2002 assessment. For the 2006 assessment, the data from December 1, 1999 through November 30, 2004 were used in the assessment of nonsupport for contact recreation use.

Table 2-2 Water Quality Monitoring Stations Used for 2002 and 2006 303(d) Listing Decision

Segment	Water Body	Description of Assessment Unit Not Supporting Contact Recreation Use	Monitoring Station IDs	Assessment Year
1101	Clear Creek Tidal	Upstream of FM 528 to I 45	11448, 16576, 16577, 11447	2002
		I 45 to SH 3	11446, 16575	
		Downstream SH3 to confluence with Clear Lake	15458, 16572, 16573	
1101B	Chigger Creek	From headwaters to FM 528	16493	2002
		From FM 528 to the confluence with Clear Creek	16472	
1102	Clear Creek above Tidal	Upper segment boundary to SH 35	17073, 17076, 17077, 11452	2002
		SH 35 to FM 1959 (Dixie Farm Rd.	17074, 11451, 14229	
		FM 1959 to upstream of FM 528	11450, 11449	
1102A	Cowart Creek	Entire water body	16477	2002
1102B	Mary's Creek	Entire water body	16473	2002
1101	Clear Creek Tidal	Upper segment boundary to Chigger Creek confluence	11448	2006
		Chigger Creek confluence to I 45	16576, 16577, 11447	
		I 45 to confluence with Cow Creek	15458, 11446, 16575	

Segment	Water Body	Description of Assessment Unit Not Supporting Contact Recreation Use	Monitoring Station IDs	Assessment Year
		Cow Bayou confluence to confluence with Clear Lake	16572, 16573	
1101B	Chigger Creek	From headwaters to FM 528	17078, 17072, 16493	2006
		From FM528 to confluence with Clear Creek Tidal	16472	
1101D	Robinson Bayou	From headwaters to Abilene St	16486	2006
		From Abilene St to confluence with Clear Lake	16475	
1102	Clear Creek above Tidal	Upper segment boundary (Rouen Rd) to SH 288	17073, 17079	2006
		SH 288 to confluence with Hickory Slough	11452, 17077, 17076	
		Confluence with Hickory Slough to confluence with Turkey Creek	14229, 17074, 11451	
		Confluence with Turkey Creek to Mary's Creek confluence	11450	
		Mary's Creek confluence to lower segment boundary	11449	
1102A	Cowart Creek	Sunset Drive to SH 35	16477, 11426	2006
		Confluence with Clear Creek to Sunset Dr.	16478, 11425	
1102B	Mary's Creek	Entire water body	17917, 17918	2006
1102C	Hickory Slough	Entire water body	17068	2006
1102D	Turkey Creek	Entire water body	17069	2006
1102E	Mud Gully	Entire water body	17070, 17071	2006

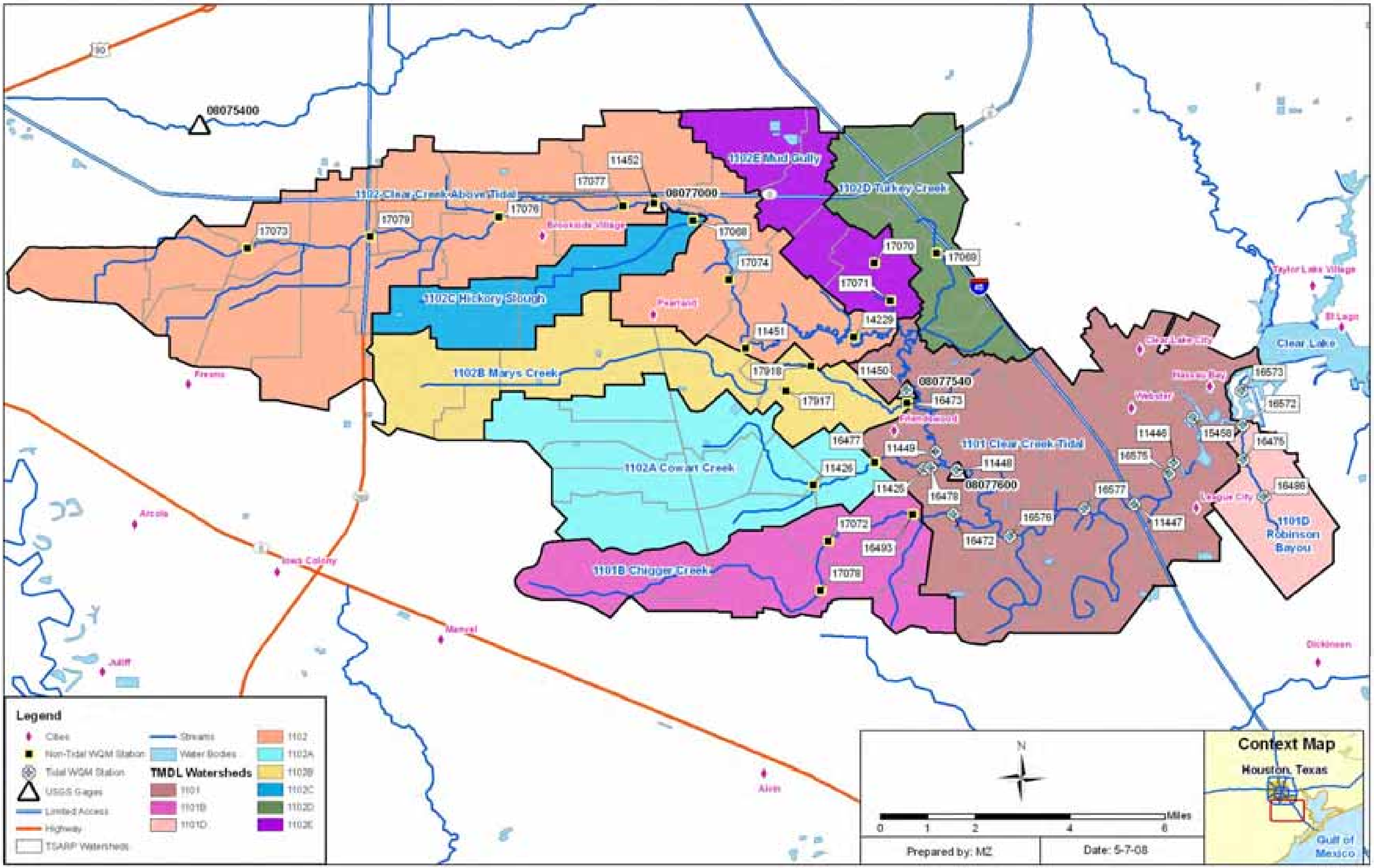


Figure 2-1 TCEQ WQM Stations in the Clear Creek Watershed

Table 2-3 summarizes the ambient water quality data for the TCEQ WQM stations on each impaired waterbody. From these data results, key inferences can be made regarding the temporal and spatial extent of the contact recreation use impairment.

Table 2-3 Water Quality Data for TCEQ Stations from 1990 to 2006

Segment	Station ID	Indicator Bacteria	Geometric Mean Criterion (counts/ dL)	Geometric Mean Concentration (counts/ dL)	Single Sample Criterion (counts/ dL)	Number of Samples	Number of Samples Exceeding Single Sample Criterion	% of Samples Exceeding
Clear Creek Tidal								
1101	11446	FC	200	282	400	41	18	44%
		EC	126	24	394	5	0	0%
		ENT	35	50	89	45	13	29%
	11447	FC	200	290	400	51	19	37%
		EC	126	39	394	7	0	0%
		ENT	35	56	89	3	1	33%
	11448	FC	200	451	400	88	33	38%
		EC	126	128	394	11	2	18%
		ENT	35	974	89	19	19	100%
	15458	FC	200	332	400	47	20	43%
		EC	126	108	394	4	1	25%
		ENT	35	15	89	3	0	0%
	16572	FC	200	130	400	29	6	21%
		EC	126	193	394	2	1	50%
		ENT	35	19	89	20	5	25%
	16573	FC	200	84	400	29	4	14%
		EC	126	3229	394	1	1	100%
		ENT	35	24	89	8	0	0%
	16575	FC	200	235	400	40	13	33%
		EC	126	21	394	5	0	0%
		ENT	35	49	89	5	3	60%
	16576	FC	200	253	400	40	13	33%
		EC	126	33	394	11	0	0%
		ENT	35	314	89	30	23	77%
	16577	FC	200	222	400	40	10	25%
		EC	126	56	394	12	1	8%
		ENT	35	490	89	1	1	100%
Chigger Creek								
1101B	16472	FC	200	319	400	41	15	37%
		EC	126	90	394	28	5	18%
	16493	FC	200	824	400	38	23	61%
		EC	126	260	394	41	14	34%
	17072	FC	200	193	400	14	5	36%
		EC	126	173	394	22	7	32%
	17078	FC	200	160	400	8	3	38%
		EC	126	85	394	9	3	33%

Segment	Station ID	Indicator Bacteria	Geometric Mean Criterion (counts/ dL)	Geometric Mean Concentration (counts/ dL)	Single Sample Criterion (counts/ dL)	Number of Samples	Number of Samples Exceeding Single Sample Criterion	% of Samples Exceeding
Robinson Bayou								
1101D	16475	FC	200	824	400	40	27	68%
		EC	126	267	394	10	5	50%
		ENT	35	158	89	27	17	63%
	16486	FC	200	3061	400	32	26	81%
		EC	126	165	394	11	4	36%
		ENT	35	1191	89	15	14	93%
Clear Creek above Tidal								
1102	11449	FC	200	461	400	39	18	46%
		EC	126	51	394	20	1	5%
	11450	FC	200	833	400	53	31	58%
		EC	126	358	394	52	22	42%
		ENT	35	92	89	11	6	55%
	11451	FC	200	458	400	31	15	48%
		EC	126	146	394	27	9	33%
	11452	FC	200	381	400	63	27	43%
		EC	126	170	394	57	18	32%
	14229	FC	200	435	400	56	30	54%
		EC	126	161	394	27	10	37%
	17073	FC	200	185	400	25	9	36%
		EC	126	75	394	18	4	22%
	17074	FC	200	348	400	29	13	45%
		EC	126	75	394	36	7	19%
	17076	FC	200	368	400	30	10	33%
		EC	126	189	394	25	5	20%
	17077	FC	200	210	400	30	8	27%
		EC	126	79	394	25	4	16%
	17079	FC	200	117	400	22	2	9%
		EC	126	99	394	38	6	16%
Cowart Creek								
1102A	11425	FC	200	628	400	17	9	53%
		EC	126	314	394	29	13	45%
	11426	FC	200	354	400	13	4	31%
		EC	126	259	394	13	5	38%
	16477	FC	200	520	400	40	19	48%
		EC	126	102	394	11	3	27%
	16478	FC	200	777	400	23	14	61%
		EC	126	56	394	11	2	9%
Mary's Creek								
1102B	16473	FC	200	711	400	40	22	55%
		EC	126	231	394	41	10	24%
	17917	FC	200	119	400	14	1	7%
		EC	126	85	394	23	2	9%

Segment	Station ID	Indicator Bacteria	Geometric Mean Criterion (counts/ dL)	Geometric Mean Concentration (counts/ dL)	Single Sample Criterion (counts/ dL)	Number of Samples	Number of Samples Exceeding Single Sample Criterion	% of Samples Exceeding
	17918	FC	200	46	400	14	1	7%
		EC	126	51	394	24	2	8%
Hickory Slough								
1102C	17068	FC	200	267	400	31	11	35%
		EC	126	159	394	45	13	29%
Turkey Creek								
1102D	17069	FC	200	2196	400	15	11	73%
		EC	126	97	394	10	3	30%
Mud Gully								
1102E	17070	FC	200	1340	400	20	17	85%
		EC	126	54	394	11	2	18%
	17071	FC	200	743	400	12	6	50%
		EC	126	48	394	12	1	8%

EC: E. coli, FC: Fecal Coliform; ENT: Enterococci
Highlight indicates downstream WQM station selected for TMDL development and indicator bacteria selected as water quality target.

Clear Creek Tidal (Segment 1101): At seven of the nine WQM stations, 25 percent or more of the samples exceed the Enterococci criterion established for this waterbody, and at six of the nine WQM stations the geometric mean criterion for Enterococci is exceeded, which indicates conditions of widespread and persistent elevated levels of bacteria resulting in nonsupport of contact recreation use. However, it should be noted that of these seven stations, five (11447, 15458, 16573, 16575, and 16577) have less than 10 samples.

Chigger Creek (Segment 1101B): At all four WQM stations, more than 25 percent of the samples exceed the single sample criterion established for *E. coli* and fecal coliform in this waterbody. The geometric mean criterion for *E. coli* was exceeded at WQM stations 16493 and 17072. This indicates conditions of persistent elevated levels of bacteria resulting in nonsupport of contact recreation use. One of these four WQM stations (17078) does have a small (<10) sample set.

Robinson Bayou (Segment 1101D): Seventeen of the 27 samples (63%) collected at the WQM station 16475 and fourteen of the fifteen samples (93%) collected at WQM station 16486 used to assess this waterbody exceed the Enterococci criterion established for this waterbody. The geometric mean criterion for Enterococci was also exceeded at both WQM stations. This data set indicates widespread and persistent elevated levels of bacteria resulting in nonsupport of contact recreation use.

Clear Creek above Tidal (Segment 1102): At nine of the 10 WQM stations, more than 25 percent of the samples exceed the single sample criterion established for either *E. coli* or fecal coliform, or both, in this waterbody. At five of the ten WQM stations the geometric mean criterion for *E. coli* was also exceeded. This indicates conditions of widespread and persistent elevated levels of bacteria resulting in nonsupport of contact recreation use.

Cowart Creek (Segment 1102A): At all four WQM stations, more than 25 percent of the samples exceed the single sample criterion established for either *E. coli* or fecal coliform, or both, in this waterbody. At two of the four WQM stations the geometric mean criterion for *E. coli* was also exceeded. This data analysis indicates conditions of widespread and persistent elevated levels of bacteria resulting in nonsupport of contact recreation use.

Mary's Creek (Segment 1102B): Of the three WQM stations, only the downstream most station exceeds the single sample criterion established for fecal coliform in this waterbody. Fifty-five percent of the samples exceed the fecal coliform criterion, and 24 percent of the samples exceed the *E. coli* criterion. However, the geometric mean for both criterions is exceeded. This may indicate conditions of localized but persistent elevated levels of bacteria resulting in nonsupport of contact recreation use only in the downstream portion of the segment. An additional factor that complicates characterization of the impairment of contact recreation at this WQM station is the fact that this station is tidally influenced.

Hickory Slough (Segment 1102C): At WQM station 17068, the single sample criterion and the geometric mean criterion for both *E. coli* and fecal coliform are exceeded. The geometric mean of *E. coli* at WQM station 17068 is 159 counts/dL. Given the small size of this watershed, it is presumed that this station adequately represents conditions of persistent elevated levels of bacteria resulting in nonsupport of contact recreation use.

Turkey Creek (Segment 1102D): At station 17069, both *E. coli* and fecal coliform exceeded the single sample criterion (73% and 30%, respectively). The geometric mean of fecal coliform at this station is 2,196 counts/100mL which significantly exceeds the water quality criterion. These data indicate high concentrations of fecal coliform are present in the Turkey Creek watershed.

Mud Gully (Segment 1102E): At station 17070, fecal coliform exceeded the single sample criterion 85 percent of the time and at station 17071, fecal coliform exceeded the single sample criterion 50 percent of the time. At both WQM stations the geometric mean criterion for fecal coliform was also exceeded. Based on samples of the *E. coli* indicator, the contact recreation use is met at the two sampling locations in the segment. However, because there are a limited number of *E. coli* samples, fecal coliform data were used to determine the TMDL to protect the contact recreation use. The fecal coliform data indicate conditions of persistent elevated levels of indicator bacteria resulting in nonsupport of contact recreation use.

2.4 Rationale for Selection of Water Quality Monitoring Stations Targeted for TMDL Development

As previously stated, a separate TMDL calculation is required for each water body listed in Table 2-1 above. Selecting the most downstream WQM station on each 303(d) listed water body as the location for establishing a TMDL is the most logical approach since TMDLs are most effective when established at the watershed scale. However, utilizing the most downstream WQM station on freshwater streams in the Clear Creek Watershed for TMDL development was not practical in all cases because a variety of factors indicated that WQM stations close to Clear Creek Tidal (Segment 1101) were tidally influenced. Recognizing that the load duration curve (LDC) approach would be used on the freshwater streams in the Clear Creek Watershed, it was acknowledged that the WQM stations selected for TMDL development were required to be free flowing and not under any tidal influence. A variety of characteristics and sources of information were evaluated to determine which downstream WQM stations on Chigger Creek, Cowart Creek, Mary's Creek, and Clear Creek above Tidal were tidally influenced.

Information that was evaluated included channel bottom elevations from TSARP HEC-RAS models for Clear Creek above Tidal, instantaneous flow measurements collected in 2006 that demonstrate tidal flux, and best professional judgment from TCEQ Region 12 staff on stations that typically demonstrate tidal influence. Table 2-4 provides a qualitative summary of the information used to select the appropriate WQM station for TMDL development in Chigger Creek, Cowart Creek, Mary's Creek, and Clear Creek above Tidal. WQM stations on Hickory Slough, Mud Gully, and Turkey Creek were not evaluated since these freshwater streams are not tidally influenced.

Table 2-4 Criteria for Evaluating Tidal Influence on Select WQM Stations

Segment	WQM Station	Bottom Elevation based on TSARP HEC-RAS < MSL	Instantaneous Flow Measurements < 0 cfs	Tidal Influence based on TCEQ Region 12 Field Experience	Mean Value Conductivity > 1000uS/cm	Appropriate for Application of LDC Method
Chigger Creek						
1101B	16472	NA	Yes	Yes	No	No
	16493	NA	No	No	No	Yes
Clear Creek above Tidal						
1102	11449	Yes	Yes	Yes	Yes	No
	11450	Yes	No	Yes	No	No
	14229	No	NA	No	Yes	Yes
Cowart Creek						
1102A	16478	NA	NA	No	Yes	No
	11425	NA	Yes	Yes	Yes	No
	16477	NA	NA	No	Yes	Yes
Mary's Creek						
1102B	16473	NA	No	NA	No	Yes

MSL = Mean Sea Level
NA = Not available
For the purposes of this report, the freshwater stations that are actually tidally influenced will be associated with Clear Creek Tidal, Segment 1101, under the tidal modeling approach.

Based on this qualitative summary, TCEQ may re-evaluate the tidal boundary between Clear Creek above Tidal (1102) and Clear Creek Tidal (1101). Historically, the upper boundary of Clear Creek Tidal (1101) has been defined by the TCEQ SWQS and this upper boundary is displayed in Figure 2-2. However, based on the well defined channel bottom elevations from the TSARP HEC-RAS model, it is clear that the upper boundary of the tidal influence on the mainstem of Clear Creek in fact extends approximately 7 miles farther upstream than the historic TCEQ tidal boundary, which is also displayed in Figure 2-2. Land subsidence may be responsible for this expansion of the tidal zone. This information may be used by the TCEQ to refine the tidal boundaries in the upcoming Triennial Standards Revision process.

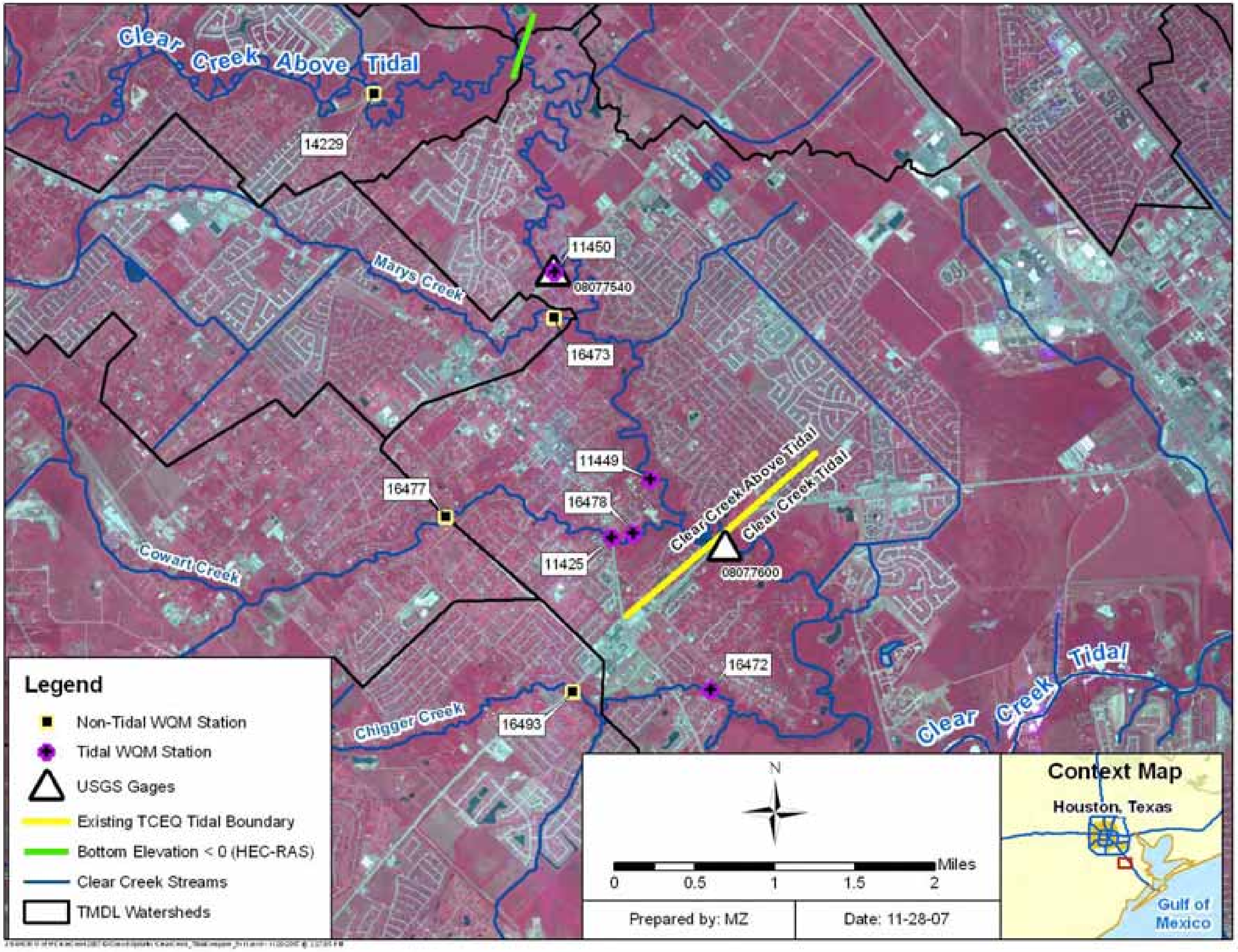


Figure 2-2 Historic and Recommended Tidal Boundary for Clear Creek Mainstem

2.5 Water Quality Targets for Contact Recreation

The Code of Federal Regulations (40 CFR §130.7(c)(1)) states that, "TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numerical water quality standards." The Texas SWQSs (TCEQ 2000) provide numeric and narrative criteria to evaluate attainment of designated uses. The basis for water quality targets for all TMDLs developed in this report will be the numeric criteria for bacterial indicators from the 2000 Texas SWQSs as described in Subsection 2.2 above. *E. coli* is the preferred indicator bacteria for assessing contact recreation use in freshwater, and Enterococci is the preferred indicator bacteria is saltwater.

Several studies have been performed by the USEPA that show a stronger link between the concentrations of *E. coli* and Enterococci and the concentrations of fecal pathogens than the previous standard, fecal coliform. The USEPA studies found that in freshwater streams, *E. coli* concentrations were the strongest predictor of illness following contact recreation. The TCEQ adopted the limit of 394 per dL for single samples of *E. coli* and a geometric mean limit of 126 per dL for waterbodies that have been designated for contact recreation use. Within tidal streams and saltwater bodies, however, the USEPA determined that Enterococci concentrations were the strongest predictor of illness. The TCEQ adopted a limit of 89 per dL for Enterococci in any single sample, and a limit of 35 per dL for the geomean of all samples at any location for Enterococci concentrations within a tidal stream designated for contact recreation uses (TCEQ 2000). During the process of switching to the new standards, the USEPA recommended that fecal coliform concentrations (400 per dL in any single sample and 200 per dL for the geomean of all samples) be used until at least 10 data points have been collected for either of the two new standards that will be used for each segment.

The water quality target for the TMDLs for freshwater segments is to maintain concentrations below the geometric mean criterion of 126 counts per dL for *E. coli* or if necessary 200 counts per dL for fecal coliform. The water quality target for the TMDLs for tidal (saltwater) segments is to achieve concentrations of Enterococci below the geometric mean criterion of 35 counts per dL. The tidal segments are Clear Creek Tidal and Robinson Bayou. Maintaining the geometric mean criterion for each indicator bacteria is expected to be protective of the single sample criterion also and therefore will ultimately result in the attainment of the contact recreation use. TMDLs will be based on a percent reduction goal required to meet the geometric mean criterion.

Table 2-5 identifies the specific WQM stations where TMDLs will be set in this report. Table 2-5 also presents the specific data sets of indicator bacteria (1999-2006) used for TMDL development. In most cases, *E. coli* and Enterococci measurements do not exist prior to 2000. For this project *E. coli* data were used for data analysis and modeling to support TMDL development for Clear Creek above Tidal, Chigger Creek, Cowart Creek, Mary's Creek/North Fork Mary's Creek, and Hickory Slough. Fecal coliform data were used for data analysis and modeling to support TMDL development for Turkey Creek, and Mud Gully. For data analysis and modeling to support TMDLs for Clear Creek Tidal and Robinson Bayou, fecal coliform, *E. coli*, and Enterococci data were used. Figure 2-3 displays the locations of each of these stations.

Table 2-5 Summary of Indicator Bacteria Samples for Clear Creek Watershed TMDLs (1999-2006)

Segment	Station ID	Indicator Bacteria	Geometric Mean Criterion (counts/dL)	Geometric Mean Concentration (counts/dL)	Single Sample Criterion (counts/dL)	Number of Samples	Number of Samples Exceeding Single Sample Criterion	% of Samples Exceeding
Clear Creek Tidal								
1101	**16572** Clear Creek Tidal at the Mouth of Robinson Bayou, approx. 100 ft from the sign for Preserve Lakeside Luxury Subdivision	FC	200	130	400	29	6	21%
		EC	126	193	394	2	1	50%
		ENT	35	19	89	20	5	25%
Chigger Creek								
1101B	**16493** Chigger Creek at FM528 Bridge in Friendswood	FC	200	824	400	38	23	61%
		EC	126	260	394	41	14	34%
Robinson Bayou								
1101D	**16475** Robinsons Bayou at FM270 in League City	FC	200	824	400	40	27	68%
		EC	126	267	394	10	5	10%
		ENT	35	158	89	27	17	63%
Clear Creek above Tidal								
1102	**14229** Clear Creek at Dixie Farm Road (FM 1959) near Friendswood	FC	200	435	400	56	30	54%
		EC	126	161	394	27	10	37%
Cowart Creek								
1102A	**16477** Cowart Creek at Sunset Drive in Friendswood	FC	200	520	400	40	19	48%
		EC	126	102	394	11	3	27%
Mary's Creek								
1102B	**16473** Mary’s Creek at Mary's Crossing in North Friendswood	FC	200	711	400	40	22	55%
		EC	126	231	394	41	10	24%

Segment	Station ID	Indicator Bacteria	Geometric Mean Criterion (counts/dL)	Geometric Mean Concentration (counts/dL)	Single Sample Criterion (counts/dL)	Number of Samples	Number of Samples Exceeding Single Sample Criterion	% of Samples Exceeding
Hickory Slough								
1102C	**17068** Hickory Slough at Robinson Drive in Pearland	FC	200	267	400	31	11	35%
		EC	126	159	394	45	13	29%
Turkey Creek								
1102D	**17069** Turkey Creek at Dixie Farm Road in Friendswood	FC	200	2196	400	15	11	73%
		EC	126	97	394	10	3	30%
Mud Gully								
1102E	**17071** Mud Gully at Dixie Farm Road, SW of IH45 in Friendswood	FC	200	743	400	12	6	50%
		EC	126	48	394	12	1	8%

Highlighted indicator bacteria are used for TMDL calculations
EC: E. coli; FC: Fecal coliform; ENT: Enterococci

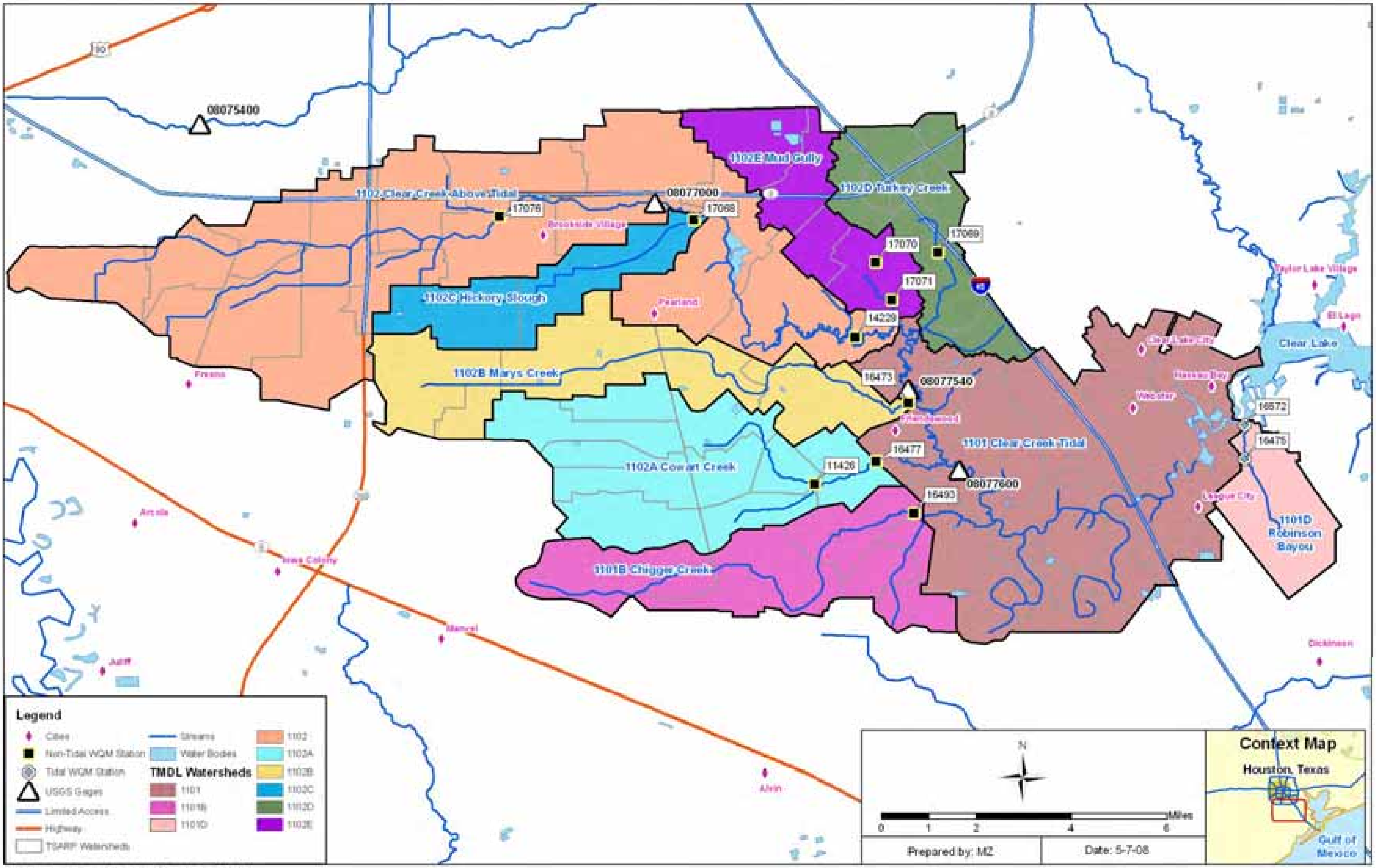


Figure 2-3 Clear Creek TMDL Watersheds

The water quality target for each waterbody will incorporate an explicit 5 percent margin of safety (MOS). For example, if fecal coliform is utilized to establish the TMDL, then the water quality target would be 380 counts/dL, 5 percent lower than the single sample water quality criterion (400/dL) and the geometric mean water quality target would be 190 counts/dL, 5 percent lower than the criterion value (200/dL). For *E. coli,* the single sample water quality target would be 374 counts/dL, 5 percent lower than the criterion value (394/dL), and the geometric mean water quality target would be 120 counts/dL, 5 percent lower than the criterion value (126/dL).

For non-tidal segments, each water quality target will be used to determine the allowable bacteria load that is derived by using the actual or estimated flow record multiplied by the instream criteria minus a 5 percent MOS. For tidal segments, a mass-balance model will be used to determine the maximum amount of loading discharged to the water bodies that result in meeting the geometric mean criteria throughout the length of the segment.

CHAPTER 3
POLLUTANT SOURCE ASSESSMENT

To support TMDL development, a pollutant source assessment attempts to characterize known and suspected sources of pollutant loading to impaired waterbodies. Pollutant sources within a watershed are categorized and quantified to the extent that information is available. Fecal bacteria such as *E. coli* and Enterococcus originate in the intestines of warm-blooded species (human and animal), and sources of bacteria may be point (permitted) or nonpoint (non-permitted) in nature.

Point sources are permitted through the National Pollution Discharge Elimination System (NPDES) program. Some storm water runoff may be permitted through NPDES as municipal separate storm sewer systems (MS4). Other non-permitted sources of storm water runoff that typically cannot be identified as entering a waterbody through a discrete conveyance at a single location are often referred to as nonpoint sources. For example, non-permitted sources include land activities that contribute bacteria to surface water as a result of rainfall runoff or on-site sewage system facilities. For the TMDLs in this report, all sources of pollutant loading not regulated by a NPDES-permit are considered nonpoint sources. The following discussion describes what is known regarding permitted and non-permitted sources of bacteria in the impaired watersheds.

3.1 Point Sources: NPDES/TPDES-Permitted Sources

Under 40 CFR, §122.2, a point source is described as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Under the Texas Water Code TCEQ has adopted rules and procedures to issue permits to control the quantity and quality of discharges into or adjacent to waters of the state through the TPDES program. NPDES/TPDES-permitted facilities classified as point sources that may contribute bacteria loading to surface waters include:

- TPDES municipal wastewater treatment facilities (WWTF);
- TPDES industrial WWTF;
- TPDES municipal no-discharge WWTF;
- TPDES regulated storm water (municipal separate storm sewer systems); and
- TPDES Concentrated Animal Feeding Operation (CAFO).

Continuous point source discharges such as WWTFs, could result in discharge of elevated concentrations of fecal bacteria if the disinfection unit is not properly maintained, is of poor design, or if flow rates exceed the disinfection capacity. Some industrial WWTF may contain fecal bacteria in their effluent. While no-discharge facilities do not discharge wastewater directly to a waterbody, it is possible that collection systems associated with these types of facilities may be a source of bacteria loading to surface waters. Permitted storm water runoff from TPDES regulated discharge areas called municipal separate storm sewer systems can also contain high fecal bacteria concentrations. CAFOs are recognized by USEPA as significant sources of pollution, and may have the potential to cause serious impacts to water quality if not properly managed.

All watersheds in the Study Area, including Clear Creek Tidal (1101), Chigger Creek (1101B), Robinson Bayou (1101D), Clear Creek above Tidal (1102), Cowart Creek (1102A), Mary's Creek (1102B), Hickory Slough (1102C), Turkey Creek (1102D), and Mud Gully (1102E), have NPDES/TPDES-permitted sources. A significant portion of the Study Area (approximately 64%) is regulated under the TPDES storm water discharge permit jointly held by Harris County, HCFCD, City of Houston, and Texas Department of Transportation. There are no NPDES-permitted CAFOs within the Study Area.

3.1.1 Permitted Sources: Continuous Point Source Discharges

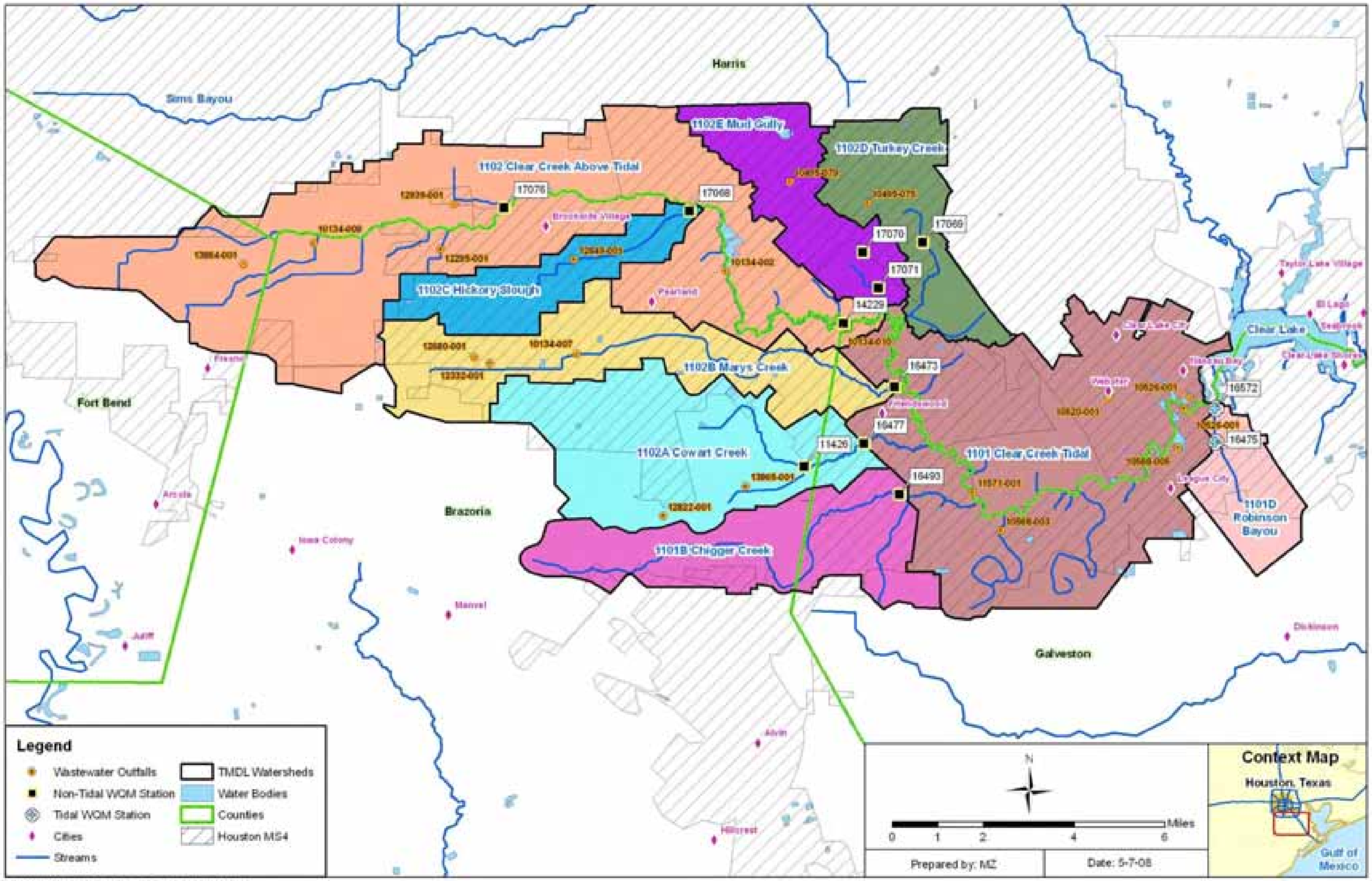
The locations of the TPDES-permitted facilities that continuously discharge wastewater to surface waters addressed in these TMDLs are listed in Table 3-1 and displayed in Figure 3-1. There are 21 permitted outfalls for WWTFs in the Study Area and Table 3-1 lists both the NPDES number as well as the TPDES permit number. There are no WWTFs located in Chigger Creek or Robinson Bayou watersheds.

Not all TPDES-permitted facilities that discharge treated wastewater are required to monitor for fecal bacteria. In addition, while current instream water quality criteria are based on *E. coli* and Enterococci bacteria, permit limits are based on levels of fecal coliform, another measure of fecal bacteria of which *E. coli* is often the major constituent. Therefore, data on bacteria loads from WWTF outfalls is only available for some of the TPDES permitted dischargers in the Clear Creek Watershed. Table 3-2 lists the eight TPDES WWTFs that monitor their discharge for fecal coliform. DMRs were used to determine the number of fecal coliform analyses that were performed for the eight TPDES WWTFs. The 90th percentile of the monthly average load and the maximum monthly average loads are provided to estimate fecal coliform loads from these eight TPDES WWTPs. The data used to generate Table 3-2 are provided in Appendix E. Table 3-3 lists the number of reported monthly exceedances of the geometric mean concentration of 200 counts/dL, and the number of reported daily exceedances of the single sample standard of 400 counts/dL. As shown in Table 3-3, only two permitted facilities exceeded fecal coliform permit limits during the monitoring time frame. Both of the permits are held by the City of Pearland.

Table 3-1 TPDES-Permitted Facilities in the Study Area

TPDES Number	Outfall	NPDES NUMBER	Facility Type	Facility Name	DTYPE	County	Permitted Flow (MGD)	Segment	Receiving Water
10520-001	001	TX0024589	Sewerage Systems	City of Webster	W	Harris	3.30	1101	Clear Creek Tidal
10526-001	001	TX0023833	Sewerage Systems	City of Nassau Bay	W	Harris	1.33*	1101	Clear Creek Tidal
10526-001	002	TX0023833	Sewerage Systems	City of Nassau Bay	W	Harris	1.33*	1101	Clear Creek Tidal
10568-003	001	TX0071447	Sewerage Systems	City of League City	D	Galveston	0.66	1101	Clear Creek Tidal
10568-005	001	TX0085618	Sewerage Systems	City of League City	W	Galveston	12.0	1101	Clear Creek Tidal
11571-001	001	TX0069728	Sewerage Systems	Gulf Coast Waste Disposal Authority	W	Harris	9.25	1101	Clear Creek Tidal
10134-002	001	TX0032735	Sewerage Systems	City of Pearland	W	Brazoria	4.5	1102	Clear Creek above Tidal
10134-008	001	TX0117501	Sewerage Systems	City of Pearland	W	Brazoria	2.00	1102	Clear Creek above Tidal
10134-010	001	TX0032743	Sewerage Systems	City of Pearland	W	Brazoria	2.50	1102	Clear Creek above Tidal
10134-010	002	TX0032743	Sewerage Systems	City of Pearland	W	Brazoria	2.00	1102	Clear Creek above Tidal
12295-001	001	TX0085383	Sewerage Systems	City of Pearland	D	Brazoria	0.95	1102	Clear Creek above Tidal
12939-001	001	TX0095842	Sewerage Systems	Harris County WCID 89	D	Harris	0.95	1102	Clear Creek above Tidal
13864-001	001	TX0119750	Sewerage Systems	Fresno Manufacturing LLC	D	Fort Bend	0.0084	1102	Clear Creek above Tidal
12822-001	001	TX0094226	Sewerage Systems	Walker Water Works Inc.	D	Brazoria	0.035	1102A	Cowart Creek
13865-001	001	TX0117447	Operator of Residential Mobile Home	Forestaire Estates	D	Brazoria	0.049	1102A	Cowart Creek
10134-007	001	TX0116581	Sewerage Systems	City of Pearland	W	Brazoria	4.0	1102B	Mary's Creek
12332-001	001	TX0086118	Sewerage Systems	Brazoria County Mud No. 1	W	Brazoria	2.4	1102B	Mary's Creek
12680-001	001	TX0092614	Operator of Residential Mobile Home	H & R Realty Investments LLC	D	Brazoria	0.012	1102B	Mary's Creek
12849-001	001	TX0094463	Operator of Residential Mobile Home	CMH Parks Inc.	D	Brazoria	0.075	1102C	Hickory Slough
10495-075	001	TX0063070	Sewerage Systems	City of Houston	W	Harris	6.14	1102D	Turkey Creek
10495-079	001	TX0035009	Sewerage Systems	City of Houston	W	Harris	5.33	1102E	Mud Gully

Source: TCEQ, August 2007
MGD - Millions of Gallons per Day
TYPE
C = Cooling Water
D = Domestic <1 MGD
S = storm water
W = domestic >=1 MGD or industrial process water, including water treatment plant discharge
** The total flow from both outfalls combined cannot exceed 1.33 MGD.*



Source: The jurisdictional boundary of the Houston MS4 permit is derived from Urbanized Area Map Results for Texas *which can be found at the USEPA website* http://cfpub.epa.gov/npdes/stormwater/urbanmapresult.cfm?state=TX.

Figure 3-1 TPDES-Permitted Facilities in the Clear Creek Watershed

Table 3-2 DMR Data for Permitted Wastewater Discharges (December 1999-September 2007)

TPDES Number	NPDES Number	Facility Name	Segment	Stream Name	Dates Monitored		# of Records	Monthly Average Flow (MGD)	Permitted Flow (MGD)	FC Load (counts/day)	
					Start	End				90 Percentile Monthly Average	Maximum Monthly Average
11571-001	TX0069728	Gulf Coast Waste Disposal Authority	1101	Clear Creek Tidal	05/31/00	04/30/05	89	5.34	9.25	5.58E+09	2.63E+10
10568-003	TX0071447	City of League City	1101	Clear Creek Tidal	09/30/01	09/30/01	1	0.38	0.66	NA	2.18E+08
10568-005	TX0085618	City of League City	1101	Clear Creek Tidal	03/31/04	03/31/05	23	6.17	7.5	6.32E+09	1.11E+10
12332-001	TX0086118	Brazoria County Mud No. 1	1102B	Mary's Creek	12/31/99	03/31/00	2	0.63	2.4	2.14E+08	2.35E+08
12822-001	TX0094226	Walker Water Works, Inc.	1102A	Cowart Creek	03/31/00	06/30/00	2	0.01	0.035	6.82E+07	7.34E+07
12849-001	TX0094463	CMH Parks Inc	1102C	Hickory Slough	12/31/99	12/31/99	1	0.04	0.075	NA	1.32E+06
10134-007	TX0116581	City of Pearland	1102B	Mary's Creek	02/29/00	05/31/05	86	1.27	2.0	1.52E+10	2.16E+11
10134-008	TX0117501	City of Pearland	1102	Clear Creek above Tidal	08/31/03	05/31/05	50	0.28	2.0	5.33E+08	2.96E+09

Source: TCEQ, September 2007
Notes: FC = Fecal Coliform, NA = Not Applicable, MGD = Millions of Gallons per Day, counts = Colony Forming Unit

Table 3-3 Fecal Coliform Exceedance Data for Permitted Wastewater Discharges (December 1999-September 2007)

Facility Name	TPDES Number	NPDES Number	Number of Records	Number of MCMX Exceedances	Number of MCAV Exceedances	Percentage of MCMX Exceedances	Percentage of MCAV Exceedances
Gulf Coast Waste Disposal Authority	11571-001	TX0069728	89	0	0	0%	0%
City of League City	10568-003	TX0071447	1	0	0	0%	0%
City of League City	10568-005	TX0085618	23	0	0	0%	0%
Brazoria County Mud No. 1	12332-001	TX0086118	2	0	0	0%	0%
Walker Water Works, Inc.	12822-001	TX0094226	2	0	0	0%	0%
CMH Parks Inc	12849-001	TX0094463	1	0	0	0%	0%
City of Pearland	10134-007	TX0116581	86	15	13	17%	15%
City of Pearland	10134-008	TX0117501	50	3	2	6%	4%

Source: TCEQ, November 2007
Notes: MCMX = Measurement: Concentration Maximum, MCAV = Measurement: Concentration Average

3.1.2 Permitted Sources: NPDES No-Discharge Facilities and Sanitary Sewer Overflows

There are no No-Discharge Facilities located within the Study Area.

Sanitary sewer overflows (SSO) are permit violations that must be addressed by the responsible TPDES permittee. SSOs most often result from blockages in the sewer collection pipes caused by tree roots, grease and other debris. The TCEQ maintains a database of SSO data collected from wastewater operators in the Clear Creek Watershed. TCEQ Region 12-Houston provided two database queries for SSO data – one is collected by the City of Houston and the other is compiled from the remainder of the wastewater dischargers in the Clear Creek Watershed (Rice 2005). These data are included in Appendix F and summarized in Table 3-4. As can be seen from Table 3-4, there have been approximately 630 sanitary sewer overflows reported in the Clear Creek Watershed between January 2000 and July 2005. The reported SSOs averaged 11,118 gallons per event. The locations and magnitudes of the all reported SSOs are displayed in Figure 3-2. The WWTF service area boundaries are also shown in Figure 3-2.

Table 3-4 Sanitary Sewer Overflow (SSO) Summary

Facility Name	NPDES Permit No.	Facility ID	Number of Occurrences	Date Range		Amount (Gallons)	
				From	To	Min	Max
City of Pearland	*N/A*[1]	10134-001	8	06/28/2003	06/15/2004	1500	3,150
City of Pearland	TX0032735	10134-002	182	04/03/2000	07/15/2005	200	181,500
City of Pearland	*N/A*[1]	10134-003	48	09/15/2000	12/13/2001	200	68,100
City of Pearland	TX0116581	10134-007	25	10/05/2000	07/18/2005	100	63,000
City of Pearland	TX0032743	10134-010	86	05/17/2002	07/25/2005	200	180,000
Sagemont	TX0063070	10495-075	77	01/21/2000	08/24/2004	7	147,050
Sagemeadow UD	TX0035009	10495-079	85	01/07/2000	07/19/2005	5	25,240
City of Nassau Bay	TX0023833	10526-001	4	06/09/2001	06/28/2004	200	500
City of League City	TX0085618	10568-005	40	08/14/2000	05/10/2005	50	480,000
City of Webster	TX0024589	10520-001	1	11/24/2002	11/24/2002	N/A	N/A
Pilchers Property	*N/A*[1]	11572-001	1	03/13/2002	03/13/2002	20000	20,000
Gulf Coast Waste Disposal Authority[2]	TX0069728	11571-001	52	11/15/2000	07/22/2005	30	450,000
Brazoria Co Mud 5	TX0085383	12295-001	3	01/07/2001	04/12/2003	30	200
Brazoria Co Mud 2	TX0086118	12332-001	16	10/31/2000	09/18/2004	75	18,000
Brazoria Co Mud 19	TX0119911[1]	14135-001	3	12/10/2001	12/30/2002	2000	20,000

[1] *Inactive Facility*
[2] *Facility name change provided by TCEQ, November 2007. Facility name listed in Appendix F is Blackhawk/Friendswood*

An effort was made to correlate SSOs with instream bacteria concentrations. Figure 3-3 displays six SSOs and bacteria concentrations found at downstream water quality monitoring stations. These bacteria concentrations were measured within one to two days of the SSO incident. This data shows that SSOs contribute to the elevated bacteria levels in streams.

For example, a 54-foot sewer line managed by the City of League City WWTF (10568-005) collapsed on April 4, 2001. The next day, water quality samples were collected downstream of this collapse at TCEQ monitoring stations 11446 and 16575 approximately 2.0 miles and 1.8 miles from the collapsed line. These stations were found to have fecal coliform concentrations of 2,400 counts and 9,000 counts, respectively. This indicates that the 480,000 gallons of overflow directly impacted the in-stream water quality with exceedances ranging from six to 22.5 times greater than the water quality criterion for fecal coliform.

3.1.3 Permitted Sources: TPDES Regulated Storm Water

In 1990, the USEPA developed rules establishing Phase I of the NPDES Storm Water Program, designed to prevent harmful nonpoint sources of pollutants from being washed by storm water runoff into municipal separate storm sewer systems and then discharged into local waterbodies (USEPA 2005). Phase I of the program required medium and large permitted dischargers (those generally serving populations of 100,000 or greater) to implement a storm water management program as a means to control polluted discharges. Approved storm water management programs for medium and large permitted discharges are required to address a variety of water quality-related issues, including roadway runoff management, municipal-owned operations, and hazardous waste treatment.

Phase II of the rule extends coverage of the NPDES Storm Water program to certain small MS4s. Small MS4s are defined as any MS4 that is not a medium or large MS4 covered by Phase I of the NPDES Storm Water Program. Phase II requires operators of regulated small MS4s to obtain NPDES permits and develop a storm water management program. Programs are designed to reduce discharges of pollutants to the "maximum extent practicable," protect water quality, and satisfy appropriate water quality requirements of the CWA. Small MS4 storm water programs must address the following minimum control measures:

- Public Education and Outreach;
- Public Participation/Involvement;
- Illicit Discharge Detection and Elimination;
- Construction Site Runoff Control;
- Post- Construction Runoff Control; and
- Pollution Prevention/Good Housekeeping.

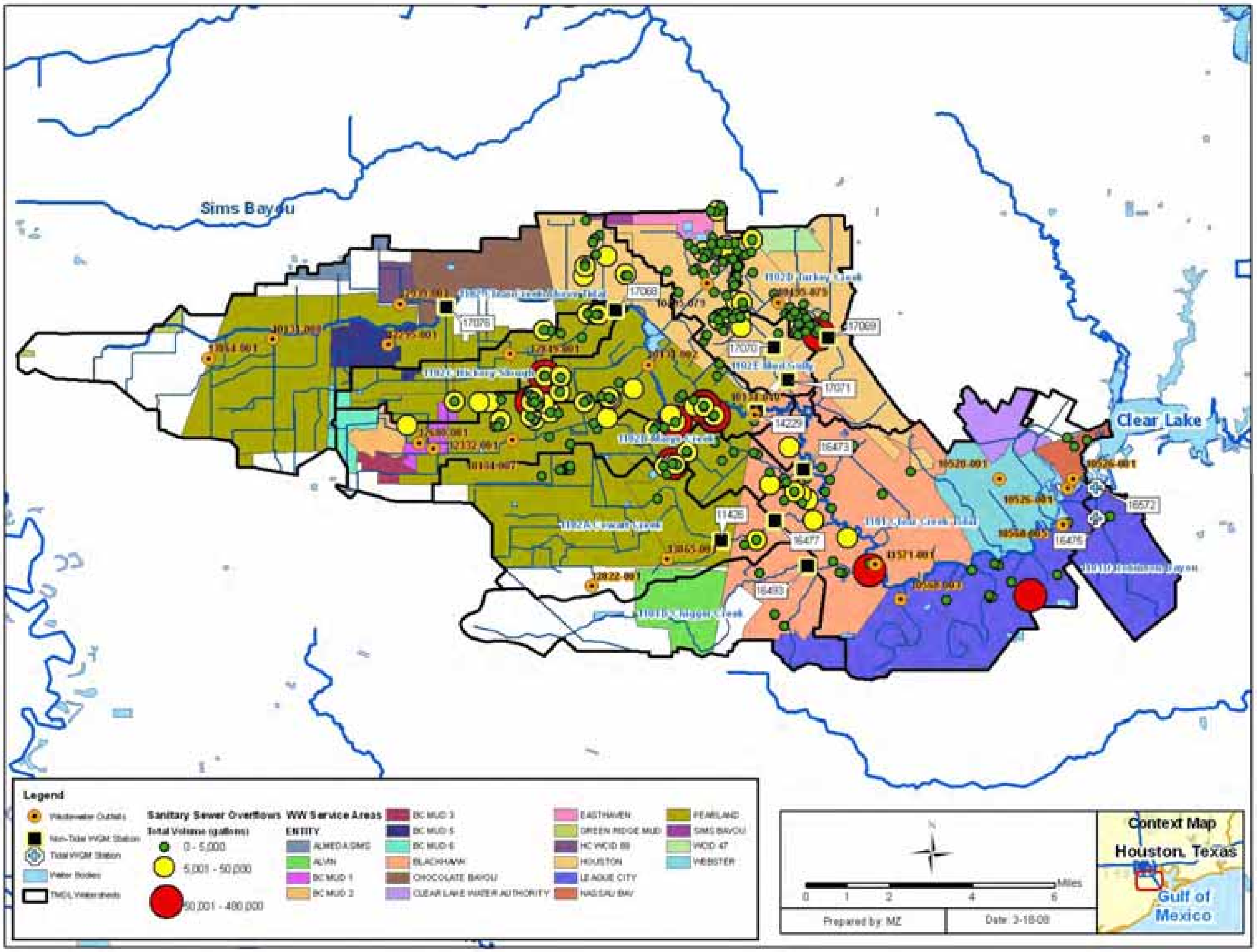


Figure 3-2 Sanitary Sewer Overflow Locations

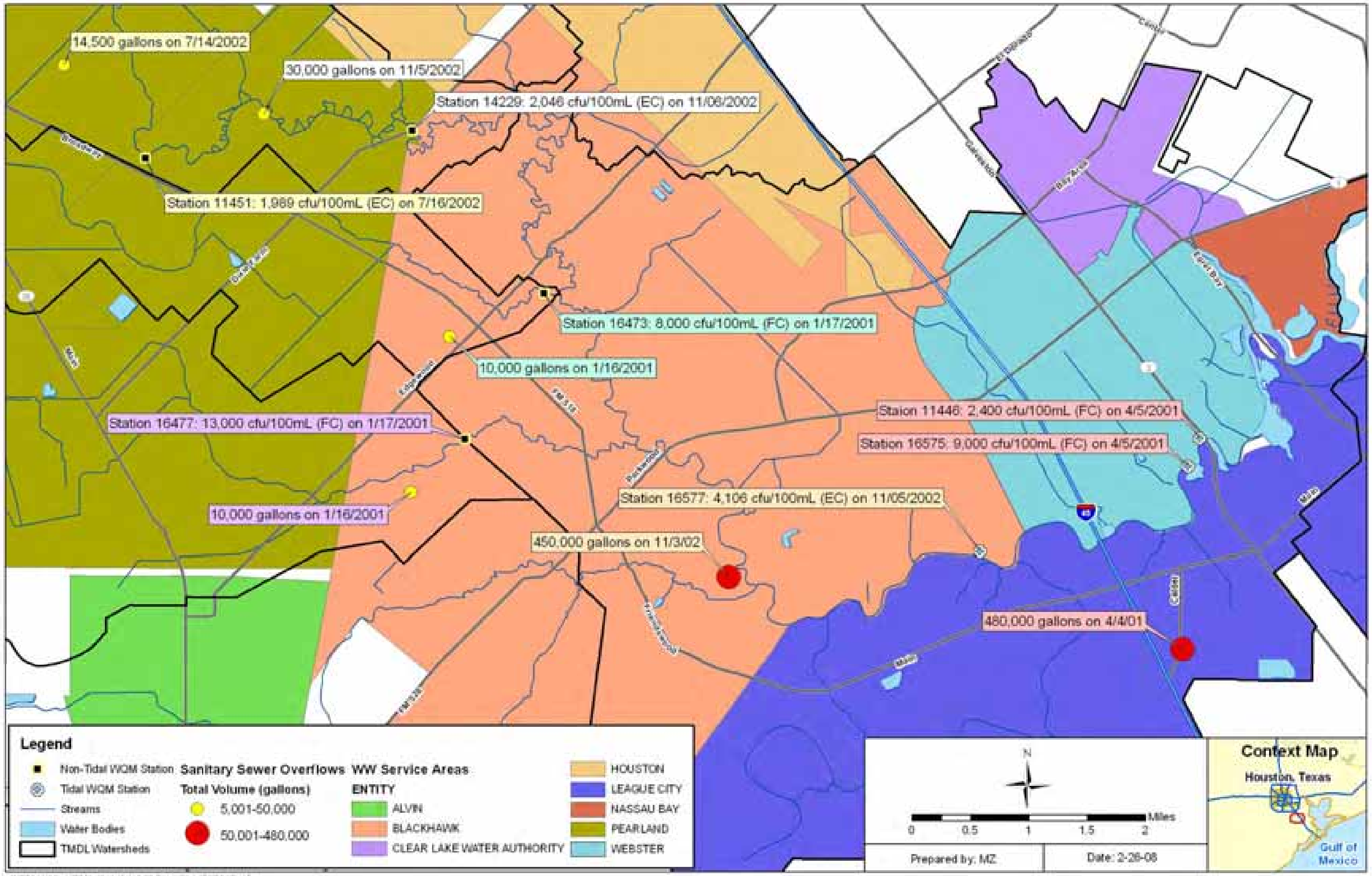


Figure 3-3 Sanitary Sewer Overflows and Bacteria Correlation

When evaluating pollutant loads originating from storm water runoff, a critical distinction must be made between storm water originating from an area under an NPDES/TPDES regulated discharge permit and storm water originating from areas not under an NPDES/TPDES regulated discharge permit. To characterize pollutant loads from storm water runoff, it is necessary to segregate storm water into two categories: 1) permitted storm water, which is storm water originating from an NPDES/TPDES-permitted Phase 1 or Phase 2 urbanized area; and 2) non-permitted storm water, which is storm water originating from any area outside an NPDES/TPDES-permitted Phase 1 or Phase 2 urbanized area. Considerable portions of each watershed in the Study Area are covered under the City of Houston/Harris County MS4 permit (TPDES Permit No. WQ0004685000). The jurisdictional boundary of the Houston MS4 permit is derived from *Urbanized Area Map Results for Texas* which is based on the 2000 U.S. Census and can be found at the USEPA website http://cfpub.epa.gov/npdes/stormwater/urbanmapresult.cfm?state=TX Figure 3-1 displays the portion of the watershed that contributes bacteria loads to the receiving waters from areas of permitted and non-permitted storm water.

Under the City of Houston/Harris County permitted discharge permit, Harris County, HCFCD, City of Houston, and Texas Department of Transportation are designated as co-permittees. These agencies do not have any monitoring points located on water bodies that drain into the Clear Creek Watershed (Martin 2005). Therefore, there are no monitoring data available to characterize bacteria concentrations or loads from regulated storm water discharged to receiving waters in the Clear Creek Watershed. Table 3-5 lists the percentage of area within each watershed covered under the Houston MS4 permit.

Table 3-5 Percentage of Permitted Storm Water in each Watershed

Segment	Receiving Stream	TPDES Number	Total Area (acres)	Area under MS4 Permit (Acres)	Percent of Watershed under MS4 Jurisdiction
1101	Clear Creek Tidal	WQ0004685000	24,347	19,271	94%
1101B	Chigger Creek	WQ0004685000	9,526	4,127	43%
1101D	Robinson Bayou	WQ0004685000	3,481	2,476	66%
1102	Clear Creek above Tidal	WQ0004685000	33,084	15,367	69%
1102A	Cowart Creek	WQ0004685000	12,380	6,476	52%
1102B	Marys Creek	WQ0004685000	10,375	9,317	90%
1102C	Hickory Slough	WQ0004685000	4,936	4,740	96%
1102D	Turkey Creek	WQ0004685000	6,482	4,829	100%
1102E	Mud Gully	WQ0004685000	6,009	4,968	100%

Storm water runoff sampling was conducted in May and July 2006 to estimate the potential magnitude of loading from storm water in the Study Area. Samples were collected at the mouths of the tributaries in response to significant rainfall in the project area. Significant rainfall events were defined as those that produced discharge of storm water runoff into the study segments. Sampling was initiated as soon as possible on the rising limb of the hydrograph. Samples were collected during two storm events at nine locations as shown in Figure 3-4. Three to four samples were collected at each site over a 2-day period during each event. The sites were spatially distributed and located at tributaries that may discharge significant loads of bacteria to Clear Creek Tidal (Segment 1101) and Clear Creek above Tidal (Segment 1102). The tributaries include Ditch #11 DD2, Hickory Slough, Turkey Creek, Mary's Creek, Cowart Creek, Chigger Creek, Magnolia Creek, Unnamed tributary, and Robinson Bayou (listed from upstream to downstream).

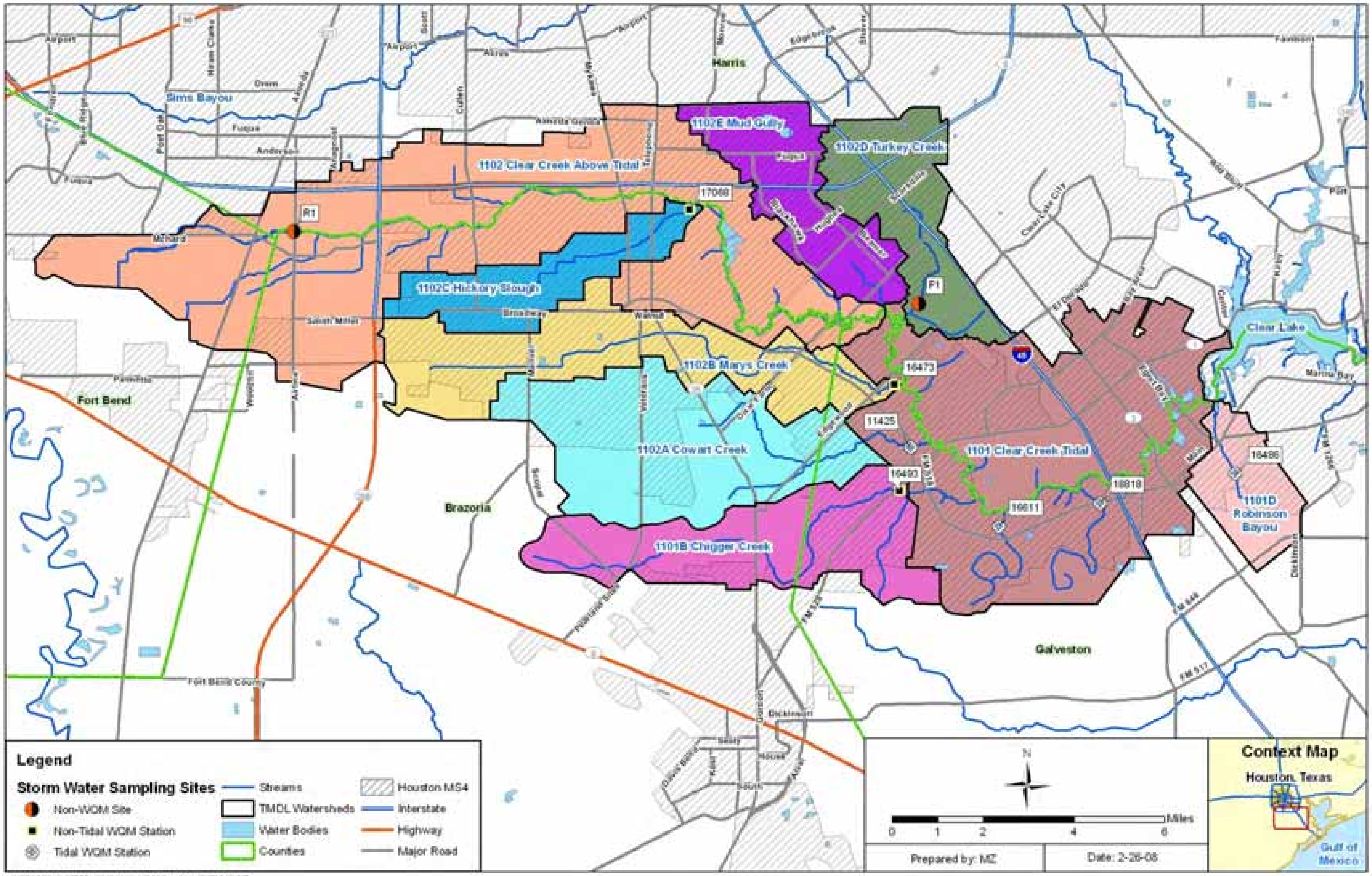


Figure 3-4 Storm Water Sampling Sites - Samples Collected in 2006

Detailed data from storm water sampling are presented in Appendix G. These data were used to estimate storm water loads discharged from the tributaries to Clear Creek Tidal (Segment 1101) and Clear Creek above Tidal (Segment 1102). Table 3-6 summarizes the geometric mean of the bacteria loads at each location. The largest *E. coli* loads during both events were contributed by Mary's Creek: 9.95E+12/day and 9.80E+12/day, respectively. Turkey Creek and Cowart Creek also contributed relatively significant *E. coli* loads during both storm events. During the second event, the loads discharged were much larger at all stations except Hickory Slough, which had a larger load during the first event. The lowest *E. coli* load (3.05E+07/day) during both storm events was discharged from Ditch #11 DD2. Of the tributaries that are tidally influenced, where Enterococci bacteria were measured instead of *E. coli*, Magnolia Creek contributed the highest Enterococci load during both storm events: 2.27E+12/day and 3.44E+13/day, respectively. An unnamed tributary contributed the lowest Enterococci load (3.67E+11/day and 5.69E+10/day) of the other tidal sites tested during both storm events. The Enterococci loads at Magnolia Creek and Robinson Bayou were higher during the second storm event than the first, while those at the unnamed tributary were higher during the first than the second. The total bacteria load discharged during the second storm event was one order of magnitude higher than the first storm. This is due to the larger rainfall volume that accumulated during the second storm event.

Table 3-6 Bacteria Loading from Storm Water

WQM Station ID	Tributaries	1st Storm Sampling		2nd Storm Sampling	
		Geomean of *E. coli* Load (#/day)	Geomean of Enterococci Load (#/day)	Geomean of *E. coli* Load (#/day)	Geomean of Enterococci Load (#/day)
R1	DITCH # 11 DD2	3.05E+07		5.07E+11	
17068	Hickory Slough	1.48E+12		9.34E+11	
F1	Turkey Creek	9.01E+12		9.56E+13	
16473	Mary's Creek	9.95E+12		9.80E+13	
11425	Cowart Creek	1.80E+12		1.28E+13	
16493	Chigger Creek	2.13E+10		2.14E+13	
16611	Magnolia Creek		2.27E+12		3.44E+13
18818	Unnamed Tributary		3.67E+11		5.69E+10
16486	Robinson Bayou		9.07E+11		3.80E+12
Total		**2.23E+13**	**3.54E+12**	**2.29E+14**	**3.82E+13**

Notes:
1. Yellow Color indicates Maximum Load, and Light Green indicates Minimal Load.
2. Sites are listed from upstream to downstream

3.1.4 Evaluation of Pipe Outfall Reconnaissance

This section describes potential bacteria loadings from pipe outfalls located throughout the Clear Creek Watershed during dry weather conditions. Included in this section are summaries of two field investigations of pipe discharges conducted along Clear Creek above Tidal (Segment 1102) and Clear Creek Tidal (Segment 1101) and some of their tributaries. Using the results of these two field reconnaissance studies, inferences are made regarding contributions of bacteria loading from pipe outfalls during dry weather conditions for the Clear Creek subwatersheds.

Bacteria loads from storm water can enter the streams from permitted outfalls and illicit discharges under both dry and wet weather conditions. This section details general findings on water that was observed discharging from pipes during dry weather events. Occasional overflows from sanitary sewer lift stations or surcharged manholes may also contribute dry weather bacteria loadings to Clear Creek. There may also be seasonal and possibly even diurnal variation in flows and bacteria levels from pipes during dry weather conditions.

Galveston County Health District Pipe Investigation

The Galveston County Health District (GCHD 2001) conducted a study in 2000 of the storm sewer discharges into Clear Creek and its tributaries. The data collection and analysis were performed in collaboration with the H-GAC with funding from the Clean Rivers Program. The objectives of this study were to locate all the storm water outfalls, sample the dry weather flows for indicator bacteria, investigate any contaminated discharges, and locate and eliminate cross connections between the sanitary and storm sewer systems in the region. The GCHD study found that 385 of 1,140 storm water outfalls in the region had dry weather discharges and that 22 percent of these (83 outfalls) had contaminated flows. Contaminated flows were defined as flows that had fecal coliform concentrations greater than 1,000 counts/dL. During the study, the GCHD eliminated 12 of these illicit discharges by working with the responsible parties to determine solutions. During the course of the investigation, upon observation at a second visit, the GCHD found that 18 of the original 83 contaminated sources were either no longer discharging or fecal concentrations had dropped below 1,000 counts/dL. In addition, 22 of the sources could not be identified through the investigation process and, therefore, may remain sources of contamination. Due to the time constraints of their project, 31 of the GCHD pipes were not investigated (GCHD 2001).

During the research performed for the GCHD study, two separate phases of sampling were carried out to determine the water quality of each outfall within the watershed and the effect that the outfalls had on the water quality of the impaired segments. The GCHD sampled every source of discharge into Clear Creek and its tributaries it was able to locate. Because no comprehensive outfall maps existed at the time of the study, the field personnel walked the entire length of Clear Creek and its tributaries and identified each of the discharge outfall locations. A sample was obtained at each outfall that had flow and was tested in the GCHD lab facilities for fecal coliform concentrations. During the latter portion of the study, the samples were also tested for Enterococci and *E. coli*. The illicit discharge data for fecal coliform concentrations obtained by the GCHD are provided in Table 3-7.

Table 3-7 Fecal Coliform Concentrations from GCHD Discharge Study

Segment	Stream Name	Number of Fecal Coliform Samples	Fecal Coliform Geometric Mean (counts/100ml)
1101	Clear Creek Tidal	27	179.8
1101B	Chigger Creek	31	230
1102	Clear Creek above Tidal	38	409.7
1102A	Cowart Creek	11	481
1102B	Mary's Creek	97	376.5
1102C	Hickory Slough	74	273
1102D	Turkey Creek	23	103.7
1102E	Mud Gully	37	290.5

1. Orange indicates fecal coliform concentration from 200 to 400 counts/100ml.
2. Red indicates fecal coliform concentration greater than 400 counts/100ml.

TCEQ 2005-2006 Pipe Investigation

In 2005 and 2006, additional reconnaissance of pipe outfalls discharging directly into Clear Creek and its tributaries was conducted by Parsons/UH for the TCEQ. The creek banks were canvassed by walking, kayaking, or using a motorboat to identify pipes with an outfall directly into Clear Creek or its tributaries. The primary goals of this task were to document the location, diameter, global positioning system (GPS) coordinates, and drainage classification (flowing or not flowing) of all pipes that enter the water bodies of Clear Creek. Sampling of bacteria levels of observed discharges was not one of the tasks of this reconnaissance project.

This pipe reconnaissance identified a total of 440 pipes positioned to discharge into Clear Creek and its tributaries. Of these 440 pipes, 98 were observed as having visible flow. Figure 3-5 depicts the Clear Creek Watershed and the pipe outfall locations identified in the 2005 and 2006 pipe reconnaissance. This figure differentiates between pipes observed as not flowing and those that were flowing and the location of TCEQ-permitted outfalls.

Figures 3-6 to 3-9 are photographs of typical pipes, with and without dry weather flow, observed during the pipe reconnaissance.

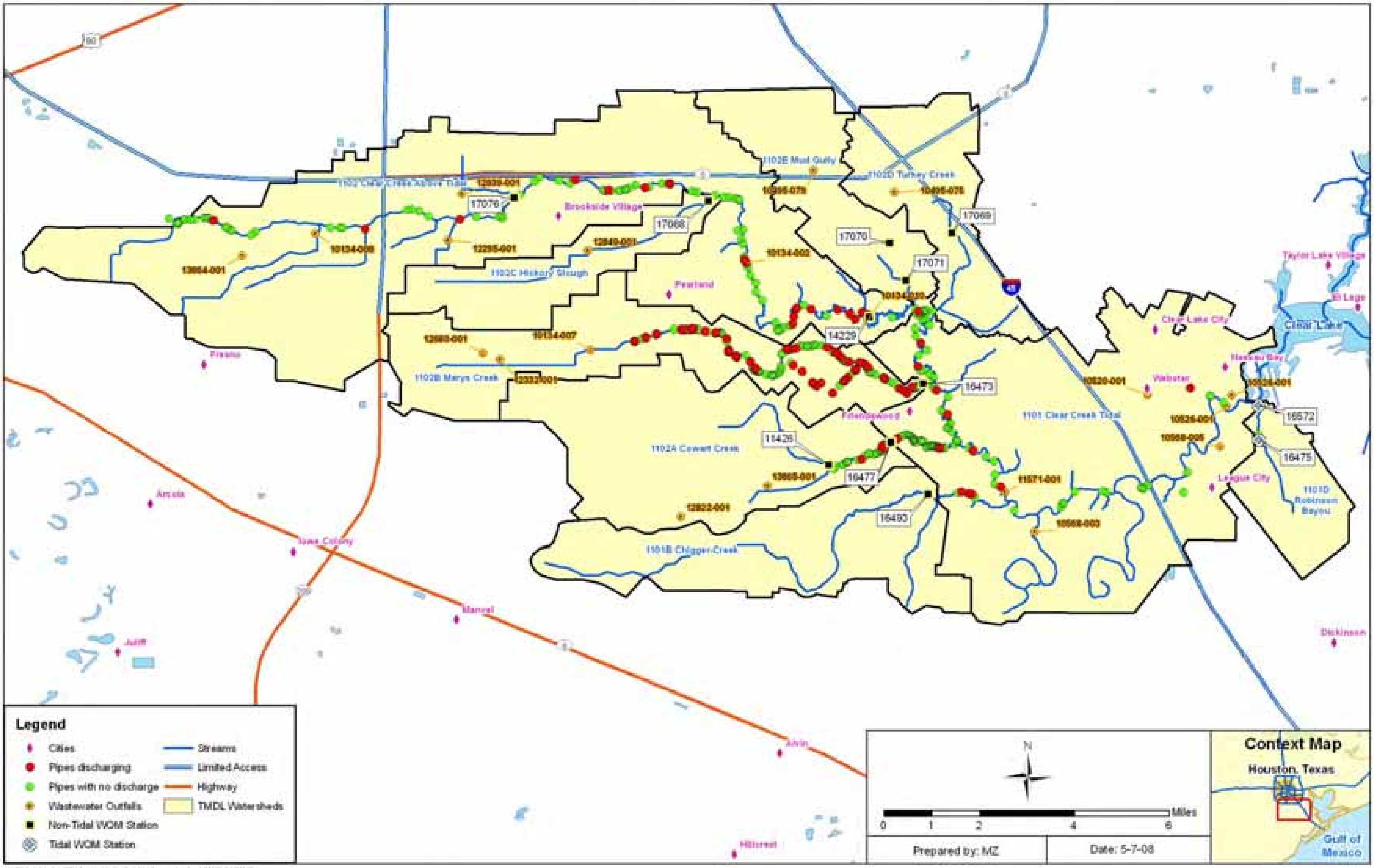


Figure 3-5 2005-2006 Pipe Reconnaissance

Figure 3-6 Typical Pipe, Clear Creek Tidal Area

Figure 3-7 Typical Pipe, Mary's Creek

Figure 3-8 Typical Pipe, Mary's Creek

Figure 3-9 Typical Pipe, Mary's Creek

During the field survey, parts of the region often received the typical scattered showers that frequently develop in the Houston/Galveston area. This may have created situations where daily rainfall amounts at specific pipe locations might have varied significantly from rainfall totals at the meteorological station utilized for measuring rainfall data. Also, localized heavy rains may have occurred in an area prior to the field crew arriving, creating flows in some storm sewer pipes that might have resulted in a pipe being documented as having dry weather flow.

Estimating Bacteria Loads to Clear Creek from Flowing Pipes during Dry Weather

Inferences can be made to demonstrate the general magnitude of bacteria loadings from pipes flowing under dry weather conditions by combining data from the GCHD Study (GCHD 2001) and the University of Houston and Parsons reconnaissance (University of Houston 2006).

The bacteria loading was estimated using the fecal coliform results from the GCHD study. Only fecal coliform results were utilized in this assessment because an insufficient number of Enterococci and *E. coli* samples were collected during the GCHD study. Approximate flow values for the pipes discharging during dry weather conditions were assembled from the Parsons' reconnaissance effort.

Table 3-8 shows a general ranking of bacteria loadings from pipe outfalls in the Clear Creek subwatersheds. This ranking of bacteria loadings combines two separate study efforts. Approximate water flow values were derived during pipe reconnaissance performed by Parsons in the summers of 2005 and 2006. These were calculated using the individual pipe flows observed during reconnaissance and were summed by subwatershed. The order of magnitude ranking of fecal coliform bacteria concentrations for dry weather pipe flows is presented in the far right column on Table 3-8. These rankings were based on the fecal coliform results presented in the legend of Table 3-7, which are: Low = less than 200 counts/dL, Medium = 200 to 400 counts/dL, and High = greater than 400 counts/dL. The high and medium fecal coliform geometric mean values observed in many of the watersheds of Clear Creek indicate that flow from pipes during dry weather can contribute significant bacteria loading to Clear Creek. Despite having few Enterococci and *E. coli* data from the GCHD investigation, results of these limited data also indicated high geometric mean values for several watersheds when ranking based on the WQSs for those indicators.

Table 3-8 Pipe Outfall Order of Magnitude Bacteria Loadings, Dry Weather Pipe Flows

Segment	Stream Name	Ranking of Dry Weather Pipe Flow Value	Ranking of Dry Weather Bacteria Concentrations From Pipe Outfalls
1101	Clear Creek Tidal	Medium	Low
1101B	Chigger Creek	Low	Medium
1102	Clear Creek above Tidal	High	High
1102A	Cowart Creek	Low	High
1102B	Mary's Creek	High	Medium
1102C	Hickory Slough	ND	ND
1102D	Turkey Creek	ND	Low
1102E	Mud Gully	ND	Medium
1101D	Robinsons Bayou	Low	ND

ND = No data available

3.1.5 Concentrated Animal Feeding Operations

There are no CAFOs located within the Study Area.

3.2 Non-permitted Sources: Storm Water, On-site Sewage Facilities, and Direct Deposition

Non-permitted sources (nonpoint sources) include those sources that cannot be identified as entering the waterbody at a specific location. Bacteria originate from rural, suburban, and urban areas. The following section describes possible major nonpermitted sources contributing fecal coliform loading within the Study Area.

Nonpoint sources of bacteria can emanate from wildlife, various agricultural activities, and domesticated animals, land application fields, urban runoff, failing on-site sewage facilities (OSSF), and domestic pets. Bacteria associated with urban runoff can emanate from humans, wildlife, livestock, and domestic pets. Based on the ability of warm-blooded animals to harbor and shed human pathogens, the current USEPA policy establishes the position that it is inappropriate to conclude that livestock and wildlife sources present no risk to human health from waterborne pathogens. Consequently, states and authorized tribes should not use broad exemptions from the bacteriological criteria for waters designated for primary contact recreation based on the presumption that high levels of bacteria resulting from non-human fecal contamination present no risk to human health (USEPA 2002). Water quality data collected from streams draining urban communities often show existing concentrations of fecal coliform bacteria at levels greater than a state's instantaneous standards. A study under USEPA's National Urban Runoff Project indicated that the average fecal coliform concentration from 14 watersheds in different areas within the United States was approximately 15,000 /dL in storm water runoff (USEPA 1983). Non-permitted storm water can be a significant source of fecal bacteria.

3.2.1 Wildlife and Unmanaged Animal Contributions

Fecal coliform and Enterococci bacteria are common inhabitants of the intestines of all warm-blooded animals, including wildlife such as mammals and birds. In developing bacteria TMDLs, it is important to identify the potential for bacteria contributions from wildlife by watershed. Wildlife is naturally attracted to riparian corridors of streams and rivers. With direct access to the stream channel, the direct deposition of wildlife waste can be a concentrated source of bacteria loading to a waterbody. Fecal coliform and Enterococci bacteria from wildlife is also deposited onto land surfaces, where it may be washed into nearby streams by rainfall runoff. Typical of coastal watersheds, there is a significant population of avian species that frequent the watershed and the riparian corridors, in particular. However, currently there are insufficient data available to estimate populations and spatial distribution of wildlife and avian species by watershed. Consequently, it is difficult to assess the magnitude of bacteria contributions from wildlife species as a general category.

3.2.2 Non-Permitted Agricultural Activities and Domesticated Animals

There are a number of non-permitted agricultural activities that can also be sources of fecal bacteria loading. Agricultural activities of greatest concern are typically those associated with livestock operations (Drapcho and Hubbs 2002). The following are examples of livestock activities that can contribute to bacteria sources:

- Processed livestock manure is often applied to fields as fertilizer, and can contribute to fecal bacteria loading to waterbodies if washed into streams by runoff.
- Livestock grazing in pastures deposit manure containing fecal bacteria onto land surfaces. These bacteria may be washed into waterbodies by runoff.
- Livestock often have direct access to waterbodies and can provide a concentrated source of fecal bacteria loading directly into streams.

Table 3-9 provides estimated numbers of selected livestock by watershed based on the 2002 USDA county agricultural census data (USDA 2002). The county-level estimated livestock populations were distributed among watersheds based on GIS calculations of pasture land per watershed, based on the Texas 2005 C-CAP Land Cover Data (NOAA 2007). If watersheds were located in multiple counties, then the agricultural numbers were calculated separately by county and then summed for the entire watershed. Because the watersheds are generally much smaller than the counties, and livestock are not evenly distributed across counties or constant with time, these are rough estimates only. Cattle are the most abundant species of livestock in the Study Area, and often have direct access to the waterbodies or their tributaries.

The Texas AgriLife Extension Service was contacted in January 2007 to get feedback from local experts on whether the livestock numbers from the 2002 USDA Census of Agriculture reflect current livestock numbers in the Clear Creek watershed. County Extension Agents in Galveston, Harris and Brazoria Counties stated that overall the numbers of livestock animals have decreased since 2002 as grazing land continues to be developed. All stated that no manure application is occurring in the Study Area. It was also indicated that broilers (chickens) may have increased because of the increase in youth livestock programs such as Future Farmers of America and 4-H (Cranfill 2008). Livestock numbers and their contributions to bacteria loadings, in the Clear Creek watershed are expected to decrease over time as more land is converted from grazing to developed, urban uses.

Table 3-9 Livestock and Manure Estimates by Watershed

Segment	Stream Name	Cattle & Calves-all	Dairy Cows	Horses & Ponies	Sheep & Lambs	Hogs & Pigs	Ducks & Geese	Chickens & Turkeys
1101	Clear Creek Tidal	46	0	5	1	0	1	9
1101B	Chigger Creek	115	0	9	1	1	2	9
1102	Clear Creek above Tidal	37	0	2	0	1	0	62
1102A	Cowart Creek	8	0	1	0	0	0	1
1102B	Mary's Creek	595	0	34	5	19	5	771
1102C	Hickory Slough	583	0	29	6	22	3	971
1102D	Turkey Creek	802	9	93	14	9	21	163
1102E	Mud Gully	193	2	22	3	2	5	39
1101D	Robinson Bayou	306	0	25	1	3	7	24

According to a livestock study conducted by the American Society of Agricultural Engineers (ASAE), the daily fecal coliform production rates by livestock species were estimated as follows (ASAE 1999):

- Beef cattle release approximately 1.04E+11 per animal per day;
- Dairy cattle release approximately 1.01E+11 per animal per day
- Swine release approximately 1.08E+10 per animal per day
- Chickens release approximately 1.36E+08 per animal per day
- Sheep release approximately 1.20E+10 per animal per day
- Horses release approximately 4.20E+08 per animal per day;
- Turkey release approximately 9.30E+07 per animal per day
- Ducks release approximately 2.43E+09 per animal per day
- Geese release approximately 4.90E+10 per animal per day

Using the estimated livestock populations and the fecal coliform production rates from ASAE, an estimate of fecal coliform production from each group of livestock was calculated in Table 3-10 for each watershed of the Study Area. It should be noted that only a fraction of these fecal coliform loading estimates are expected to reach the receiving water, either washed into streams by runoff or by direct deposition from wading animals. Cattle appear to represent the most likely livestock source of fecal bacteria.

Table 3-10 Fecal Coliform Production Estimates for Selected Livestock ($x10^9$ /day)

Segment	Stream Name	Cattle & Calves-all	Dairy Cows	Horses & Ponies	Sheep & Lambs	Hogs & Pigs	Ducks & Geese	Chickens & Turkeys	Total
1101	Clear Creek Tidal	4,746	46	2	9	5	14	1	4,823
1101B	Chigger Creek	11,987	0	4	7	10	39	1	12,048
1102	Clear Creek above Tidal	3,858	0	1	4	15	9	8	3,895
1102A	Cowart Creek	868	0	0	1	1	3	0	872
1102B	Mary's Creek	61,913	0	14	61	202	156	105	62,452
1102C	Hickory Slough	60,623	0	12	68	242	140	132	61,217
1102D	Turkey Creek	83,367	915	39	169	97	246	22	84,856
1102E	Mud Gully	20,090	221	9	41	23	59	5	20,449
1101D	Robinson Bayou	31,836	0	10	18	28	103	3	31,998

3.2.3 Failing On-site Sewage Facilities

On-site sewage facilities (OSSFs) can be a source of bacteria loading to streams and rivers. Bacteria loading from failing OSSFs can be transported to streams in a variety of ways, including runoff from surface ponding or through groundwater. Fecal coliform-contaminated groundwater can also be discharged to creeks through springs and seeps.

Over time, most OSSFs operating at full capacity will fail. OSSF failures are proportional to the adequacy of a state's minimum design criteria (Hall 2002). The 1995 American Housing Survey conducted by the U.S. Census Bureau estimates that, nationwide, 10 percent of occupied homes with OSSFs experience malfunctions during the year (U.S. Census Bureau 1995). A statewide study conducted by Reed, Stowe & Yanke, LLC (2001) reported that approximately 12 percent of the OSSFs in Harris County, which is part of Region 4, were chronically malfunctioning. Most studies estimate that the minimum lot size necessary to ensure against contamination is roughly one-half to one acre (Hall 2002). Some studies, however, found that lot sizes in this range or even larger could still cause contamination of ground or surface water (University of Florida 1987). It is estimated that areas with more than 40 OSSFs per square mile (6.25 septic systems per 100 acres) can be considered to have potential contamination problems (Canter and Knox 1985).

Only permitted OSSF systems are recorded by authorized county or city agents; therefore, it is difficult to estimate the exact number of OSSFs in use in the Study Area. Table 3-11 lists the OSSF totals based on the 1990 U.S. Census and the number of OSSF permits obtained by authorized county or city agents between 1992 -2007. Permits are obtained to install or replace systems. However, some permits are obtained when an older failing system needs repair (H-GAC 2005). It is assumed that there are more OSSFs in each city or county listed in Table 3-11 which were installed prior to 1992. Because the Clear Creek Watershed covers only portions of each of the four counties listed in Table 3-11, specific steps were taken to estimate the proportion of OSSFs that exist within the Clear Creek Watershed.

Table 3-11 Numbers of Permits Issued by Authorized County or City Agent

Year	City of Brookside Village	Brazoria	Fort Bend	Galveston	Harris	City of Pearland
1990 Census Totals	NA	25,772	9,721	12,733	44,120	NA
1992	6	177	113	134	243	
1993	16	499	252	319	651	1
1994	14	398	343	361	881	
1995	10	660	347	321	1,035	
1996	10	811	304	344	1,327	
1997	11	570	343	360	1,393	
1998	5	713	504	446	1,301	
1999		712	594	456	1,606	
2000		701	544	401	1,422	
2001		655	444	432	1,388	
2002		755	495	461	1,397	
2003		788	538	506	1,424	
2004		724	501	568	1,174	
2005		720	550	511	1,080	
2006		668	555	425	1,039	
2007*		112	281	224	498	
Total	**72**	**35,435**	**16,429**	**19,002**	**61,979**	**1**

Note: Data obtained from TCEQ On-Site Activity Reporting System
** data available up to (8/8/2007)*
NA: Not Available

To estimate the potential magnitude of fecal bacteria loading from OSSFs, the number of OSSFs was estimated for each watershed. The estimate of OSSFs was derived by using data from the 1990 U.S. Census (U.S. Census Bureau 2000) and a GIS shapefile obtained from H-GAC showing all areas where wastewater service currently exists. Figure 3-10 displays unsewered areas that did not fall under the wastewater service areas. OSSFs were calculated using spatial GIS queries for areas not covered by wastewater service areas. OSSFs were assigned proportionally based on the percentage of the area falling outside a wastewater service area within each watershed. Finally, the OSSFs for each unsewered area were then totaled by TMDL watershed. This approach gives an estimate of OSSFs in the watershed. Table 3-12 shows the estimated number of OSSFs calculated using this GIS method.

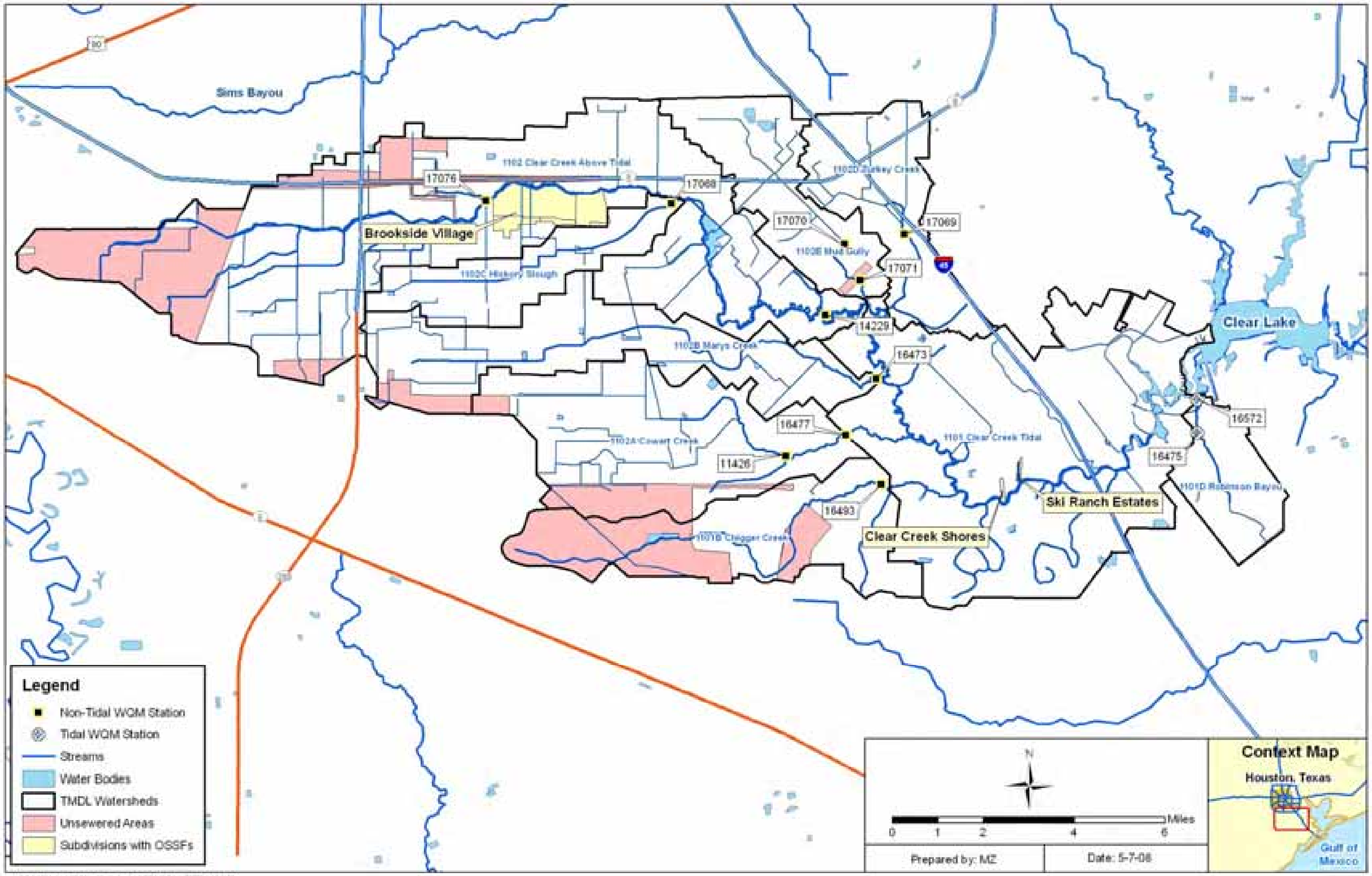


Figure 3-10 Unsewered Areas and Subdivisions with OSSF

Harris County provided additional OSSF data for select portions of the Study Area. The subdivisions of Clear Creek Shores, Ski Ranch Estates and Joseph A Dickinson Survey were listed as OSSF areas. There are 54 exiting structures in these subdivisions, 33 have permits for OSSFs, the remaining 21 are suspected to be failing. These estimates were also included in Table 3-12. It was suggested that these older systems are believed to discharge sewage directly into the drainage canals leading to Clear Creek. Figure 3-10 points out subdivisions that have been identified as having OSSFs, including the City of Brookside Village and the subdivisions of Clear Creek Shores, Ski Ranch Estates and Joseph A Dickinson Survey (not shown in Figure 3-10).

For the purpose of estimating fecal coliform loading in watersheds, the OSSF failure rate of 12 percent from the Reed, Stowe & Yanke, LLC (2001) report for Texas Region 4 was used. Using this 12 percent failure rate, calculations were made to characterize fecal coliform loads in each watershed.

Fecal coliform loads were estimated using the following equation (USEPA 2001):

$$\#\frac{counts}{day} = \left(\#\,Failing\_systems\right) \times \left(\frac{10^6\,counts}{100ml}\right) \times \left(\frac{70gal}{personday}\right) \times \left(\#\frac{person}{household}\right) \times \left(3785.2\frac{ml}{gal}\right)$$

The average of number of people per household was calculated to be 2.78 for counties in the Study Area (U.S. Census Bureau 2000). Approximately 70 gallons of wastewater were estimated to be produced on average per person per day (Metcalf and Eddy 1991). The fecal coliform concentration in septic tank effluent was estimated to be 10^6 per dL of effluent based on reported concentrations from a number of published reports (Metcalf and Eddy 1991; Canter and Knox 1985; Cogger and Carlile 1984). Using this information, the estimated load from failing septic systems within the watersheds was summarized below in Table 3-12. Based on this data, it was determined that the estimated fecal coliform loading from OSSFs in the Study Area were found to be negligible.

Table 3-12 Estimated Number of OSSFs per Watershed and Fecal Coliform Load

Segment	Stream Name	OSSF Estimate using 1990 Census method	OSSF data from Harris County and OARS	# of Failing OSSFs	Estimated Loads from OSSFs (x 10^9 counts/day)
1101	Clear Creek Tidal	9	54	21*	155
1101B	Chigger Creek	37		4	33
1102	Clear Creek above Tidal	420	72	59	435
1102A	Cowart Creek	22		3	19
1102B	Mary's Creek	12		1	11
1102C	Hickory Slough	1		0	1
1102D	Turkey Creek	0		0	0
1102E	Mud Gully	23		3	20
1101D	Robinson Bayou	0		0	0

OARS = Online Assessment Reporting System
** Twenty-one OSSFs are suspected to be failing from Clear Creek Shores, Ski Ranch Estates and Joseph A Dickinson Survey.*

3.2.4 Domestic Pets

Fecal matter from dogs and cats is transported to streams by runoff from urban and suburban areas and can be a potential source of bacteria loading. On average nationally, there are 0.58 dogs per household and 0.66 cats per household (American Veterinary Medical Association 2004). Using the U.S. Census data at the block level (U.S. Census Bureau 2000), dog and cat populations can be estimated for each watershed. Table 3-13 summarizes the estimated number of dogs and cats for the watersheds of the Study Area.

Table 3-13 Estimated Numbers of Pets

Segment	Stream Name	Dogs	Cats
1101	Clear Creek Tidal	23,359	26,581
1101B	Chigger Creek	4,900	5,576
1102	Clear Creek above Tidal	16,860	19,186
1102A	Cowart Creek	6,254	7,116
1102B	Mary's Creek	12,493	14,216
1102C	Hickory Slough	5,798	6,597
1102D	Turkey Creek	11,947	13,595
1102E	Mud Gully	12,893	14,672
1101D	Robinson Bayou	4,799	5,461

Table 3-14 provides an estimate of the fecal coliform load from pets. These estimates are based on estimated fecal coliform production rates of $5.4x10^8$ per day for cats and $3.3x10^9$ per day for dogs (Schueler 2000). Only a small portion of these loads is expected to reach waterbodies, through wash-off of land surfaces and conveyance in runoff.

Table 3-14 Estimated Fecal Coliform Daily Production by Pets (x 10^9)

Segment	Stream Name	Dogs	Cats	Total (counts/day)
1101	Clear Creek Tidal	77,085	14,354	91,438
1101B	Chigger Creek	16,170	3,011	19,181
1102	Clear Creek above Tidal	55,638	10,360	65,998
1102A	Cowart Creek	20,638	3,843	24,481
1102B	Mary's Creek	41,227	7,677	48,904
1102C	Hickory Slough	19,133	3,562	22,696
1102D	Turkey Creek	39,425	7,341	46,766
1102E	Mud Gully	42,547	7,923	50,470
1101D	Robinson Bayou	15,837	2,949	18,786

3.3 Bacteria Re-growth and Die-off

Bacteria are living organisms that grow and die. Certain enteric bacteria can regrow in organic materials if appropriate conditions prevail (*e.g.,* warm temperature). It is shown in the general literature that fecal organisms can regrow from improperly treated effluent during their transport in pipe networks, and they can regrow in organic rich materials such as compost and sludges. While the die-off of indicator bacteria has been demonstrated in natural water systems due to the presence of sunlight and predators, the potential for their regrowth is less well understood. Both processes (regrowth and die-off) are in-stream processes and are not considered in the bacteria source loading estimates of each water body.

CHAPTER 4
TECHNICAL APPROACH AND METHODS

The objective of a TMDL is to estimate allowable pollutant loads and to allocate these loads to the known pollutant sources in the watershed so appropriate control measures can be implemented and the standard for contact recreation achieved. A TMDL is expressed as the sum of three elements as described in the following mathematical equation:

$$TMDL = \Sigma\ WLA + \Sigma\ LA + MOS$$

The wasteload allocation (WLA) is the portion of the TMDL allocated to existing and future permitted (point) sources. The load allocation (LA) is the portion of the TMDL allocated to non-permitted (nonpoint) sources, including natural background sources. The MOS is intended to ensure that standard for contact recreation will be met. Thus, the allowable pollutant load that can be allocated to point and nonpoint sources can then be defined as the TMDL minus the MOS.

40 CFR, §130.2(1), states that TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measures. For fecal coliform, *E. coli*, or Enterococci bacteria, TMDLs are expressed as numbers per day, where possible, or as a percent reduction goal, and represent the maximum one day load the stream can assimilate while still attaining the standard for contact recreation. For the Clear Creek Watershed, to quantify allowable pollutant loads, percent reduction goals to achieve standard for contact recreation, and specific TMDL allocations for point and nonpoint sources, two different methods are used: 1) the load duration curve method for non-tidal streams and 2) a mass balance method using a tidal prism for tidal steams. These two different technical approaches are described in this Section.

4.1 Using Load Duration Curves to Develop TMDLs

The TMDL calculations for freshwater streams presented in this report are derived from LDCs. LDCs facilitate rapid development of TMDLs, and as a TMDL development tool, are effective at identifying whether impairments are associated with point or nonpoint sources. The technical approach for using LDCs for TMDL development includes the four following steps described in Subsections 4.2 through 4.4 below:

- preparing flow duration curves (FDC) for gaged and ungaged WQM stations;
- estimating existing bacteria loading in the receiving water using ambient water quality data;
- using LDCs to identify the critical condition that will dictate loading reductions necessary to attain the contact recreation standard; and
- interpreting LDCs to derive TMDL elements – WLA, LA, MOS, and percent reduction goal.

Historically, in developing WLAs for pollutants from point sources, it was customary to designate a critical low flow condition (*e.g.,* 7Q2) at which the maximum permissible loading was calculated. As water quality management efforts expanded in scope to quantitatively address nonpoint sources of pollution and types of pollutants, it became clear that this single critical low flow condition was inadequate to ensure adequate water quality across a range of flow conditions. Use of the LDC obviates the need to determine a design storm or selected flow recurrence interval with which to characterize the appropriate flow level for the assessment of critical conditions. For waterbodies impacted by both point and nonpoint sources, the "nonpoint source critical condition" would typically occur during high flows, when rainfall runoff would contribute the bulk of the pollutant load, while the "point source critical condition" would typically occur during low flows, when WWTF effluents would dominate the base flow of the impaired water.

LDCs display the maximum allowable load over the complete range of flow conditions by a line using the calculation of flow multiplied by the water quality criterion. Using LDCs, a TMDL can be expressed as a continuous function of flow, equal to the line, or as a discrete value derived from a specific flow condition.

4.2 Development of Flow Duration Curves

Flow duration curves serve as the foundation of LDCs and are graphical representations of the flow characteristics of a stream at a given site. FDCs utilize the historical hydrologic record from stream gages to forecast future recurrence frequencies. While many WQM stations throughout Texas do not have long term flow data, there are various methods that can be used to estimate flow frequencies at ungaged stations or gaged stations missing flow data. The most basic method to estimate flows at an ungaged site involves 1) identifying an upstream or downstream flow gage; 2) calculating the contributing drainage areas of the ungaged sites and the flow gage; and 3) calculating daily flows at the ungaged site by using the flow from an acceptable nearby gaged site multiplied by the drainage area ratio. In developing the FDC presented in this report, a more complex approach was used that also considers watershed differences in rainfall, land use, WWTF discharges, and the hydrologic properties of soil that govern runoff and retention. More than one upstream flow gage may also be considered. A more detailed explanation of the methods for estimating flow at ungaged WQM stations is provided in Appendix H.

Flow duration curves are a type of cumulative distribution function. The flow duration curve represents the fraction of flow observations that exceed a given flow at the site of interest. The observed flow values are first ranked from highest to lowest then, for each observation, the percentage of observations exceeding that flow is calculated. The flow value is read from the y-axis, which is typically on a logarithmic scale since the high flows would otherwise overwhelm the low flows. The flow exceedance frequency is read from the x-axis, which is numbered from 0 to 100 percent, and may or may not be logarithmic. The lowest measured flow occurs at an exceedance frequency of 100 percent indicating that flow has equaled or exceeded this value 100 percent of the time, while the highest measured flow is found at an exceedance frequency of 0 percent. The median flow occurs at a flow exceedance frequency of 50 percent.

While the number of observations required to develop a flow duration curve is not rigorously specified, a flow duration curve is usually based on more than 5-years of observations, and encompasses inter-annual and seasonal variation. Ideally, the drought of record and flood of record are included in the observations. For this purpose, the long-term flow gaging stations operated by the USGS are utilized. As previously mentioned in Section 1.2.5, the lack of current, long-term flow data from within the Study Area necessitated that flows be estimated for Clear Creek above Tidal, Chigger Creek, Cowart Creek, Mary's Creek, Hickory Slough, Turkey Creek, and Mud Gully. Therefore, USGS gage station 08075400 (Sims Bayou at Hiram Clarke Street, Houston, Texas), which is located outside the watershed, was chosen to conduct flow projections to establish estimated flows for each of these freshwater segments. The period of record for flow data used from this station was 1996 through 2006.

A typical semi-log flow duration curve exhibits a sigmoidal shape, bending upward near a flow exceedance frequency value of 0 percent and downward at a frequency near 100 percent, often with a relatively constant slope in between. For sites that on occasion exhibit no flow, the curve will intersect the abscissa at a frequency less than 100 percent. As the number of observations at a site increases, the line of the FDC tends to appear smoother. However, at extreme low and high flow values, flow duration curves may exhibit a "stair step" effect due to the USGS flow data rounding conventions near the limits of quantitation.

Figures 4-1 through 4-7 present the FDC developed for the downstream WQM station used for calculating the TMDLs of each 303(d) listed freshwater stream using the flow projection method outlined above and further described in Appendix H. The flow exceedance percentiles for each WQM station described below and presented in Figures 4-1 through 4-7 are provided in Appendix I.

Figure 4-1 represents the FDC for Chigger Creek, segment 1101B at WQM station 16493. There are no permitted WWTF discharges on Chigger Creek so there are no additions to the naturalized flow.

Figure 4-2 represents the FDC for Clear Creek above Tidal segment 1102 at WQM station 14229. Because WWTF discharges occur in Clear Creek above Tidal, average monthly WWTF flows obtained from DMRs were added to the projected naturalized flows. DMR data was not available for two of the WWTFs (TX0032743 and TX0119750) located in the watershed. To compensate for the lack of flow data for these two dischargers, one-half of the facility design flow was added to the projected naturalized flows.

Figure 4-3 represents the FDC for Cowart Creek segment 1102A at WQM station 16477. Because WWTF discharges occur in Cowart Creek, average monthly WWTF flows obtained from DMRs were added to the projected naturalized flows.

Figure 4-4 represents the FDC for Mary's Creek segment 1102B at WQM station 16473. Because WWTF discharges occur in Mary's Creek, average monthly WWTF flows obtained from DMRs were added to the projected naturalized flows.

Figure 4-5 represents the FDC for Hickory Slough segment 1102C at WQM station 17068. Because WWTF discharges occur in Hickory Slough, average monthly WWTF flows obtained from DMRs were added to the projected naturalized flows.

Figure 4-6 represents the FDC for Turkey Creek, segment 1102D at WQM station 17069. Because WWTF discharges occur in Turkey Creek, average monthly WWTF flows obtained from DMRs were added to the naturalized projected flows.

Figure 4-7 represents the FDC for Mud Gully, segment 1102E at WQM station 17071. Because WWTF discharges occur in Mud Gully, average monthly WWTF flows obtained from DMRs were added to the projected naturalized flows.

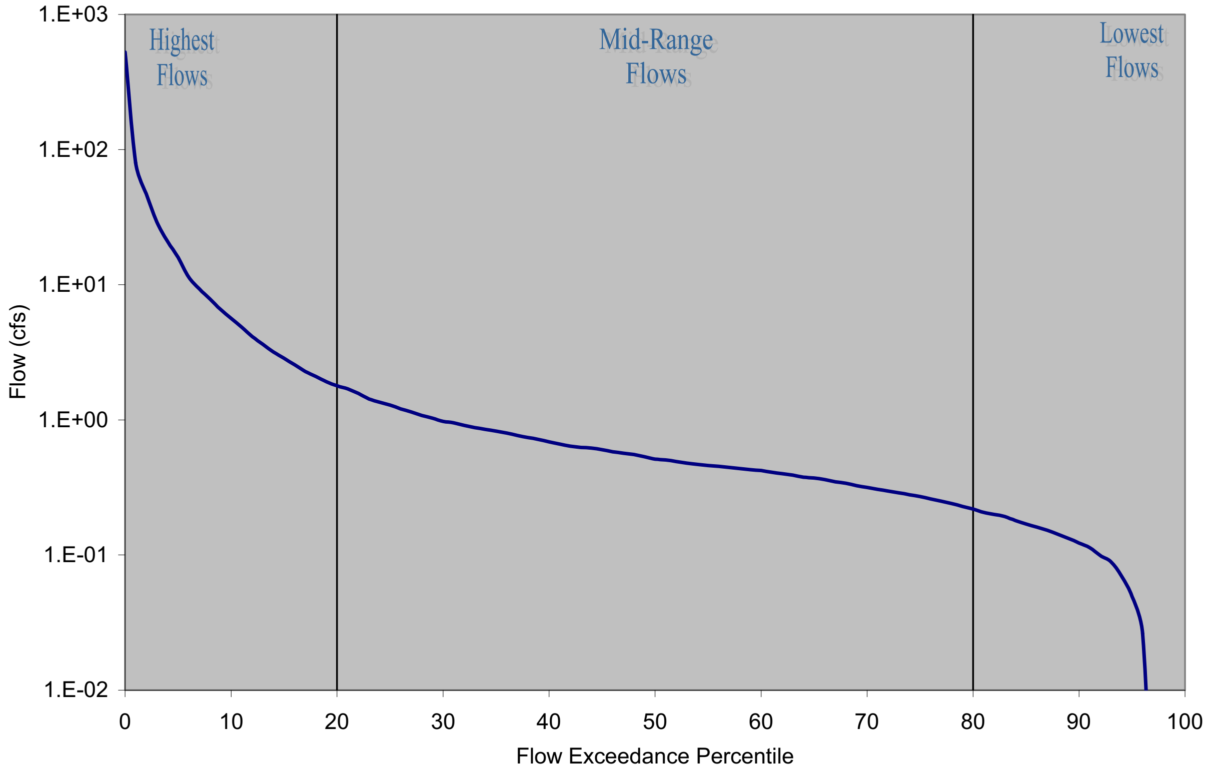


Figure 4-1 Flow Duration Curve for Chigger Creek (1101B)

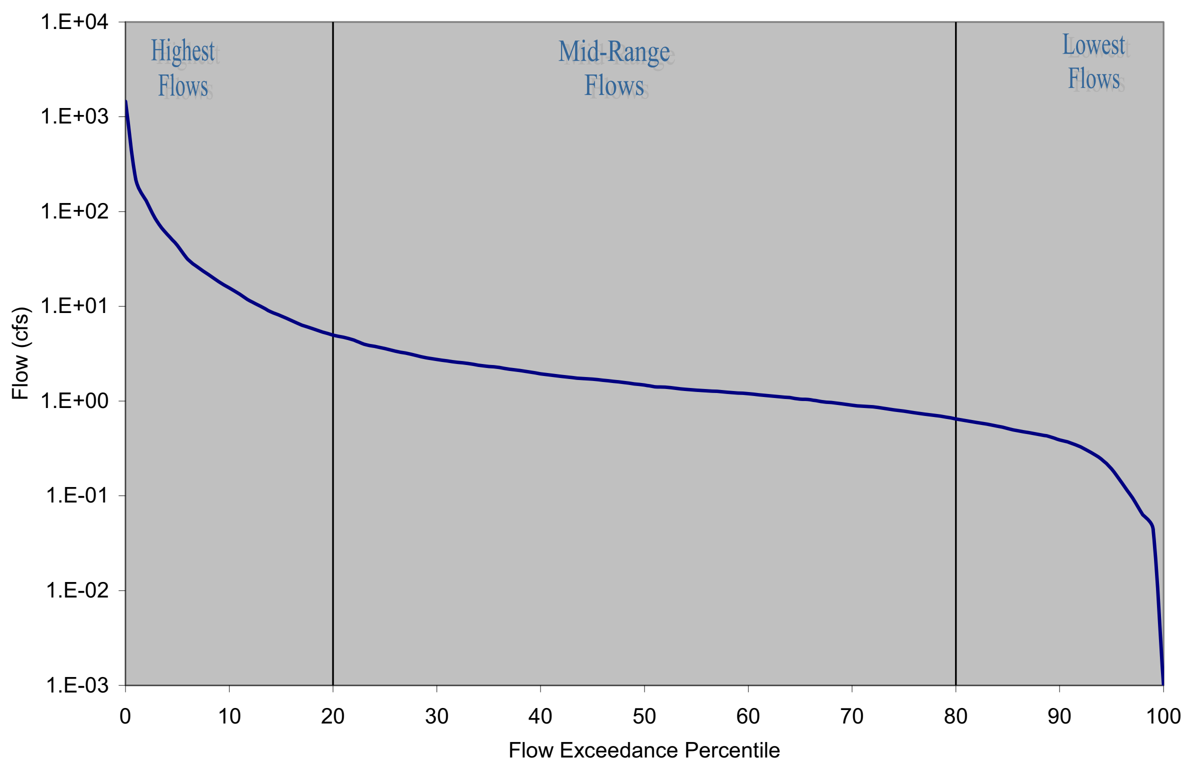


Figure 4-2 Flow Duration Curve for Clear Creek above Tidal (1102)

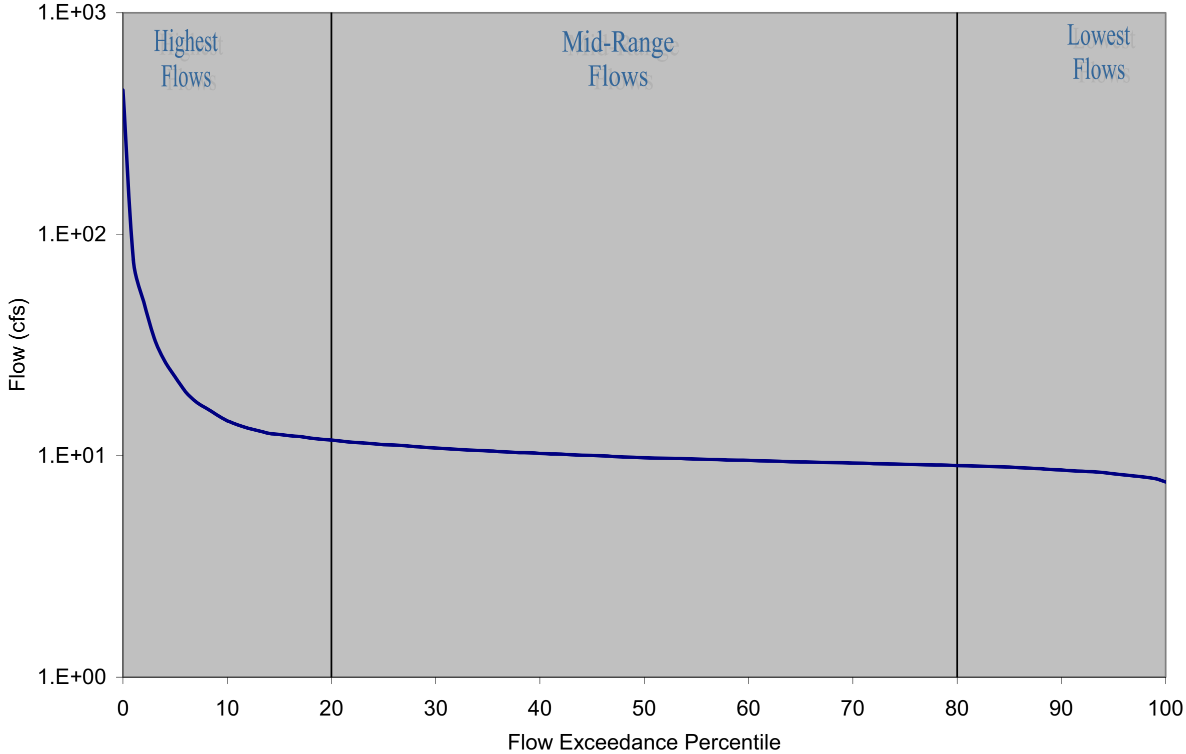


Figure 4-3 Flow Duration Curve for Cowart Creek (1102A)

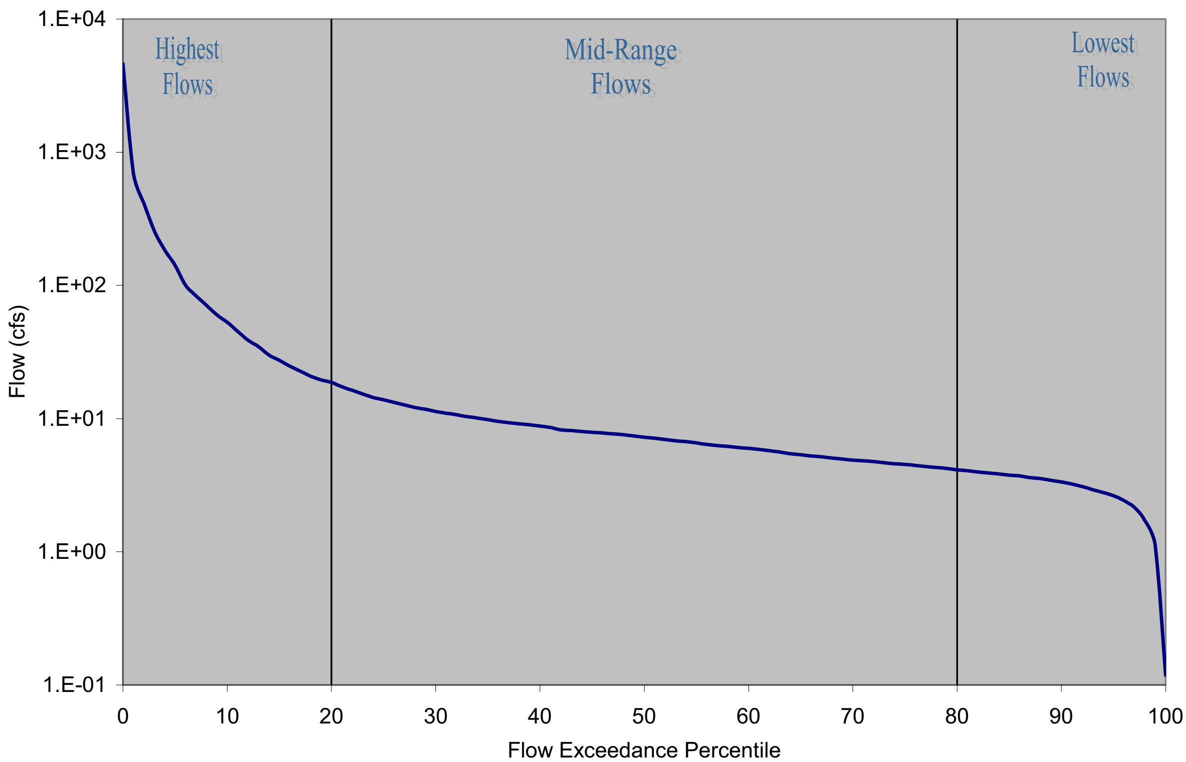


Figure 4-4 Flow Duration Curve for Mary's Creek (1102B)

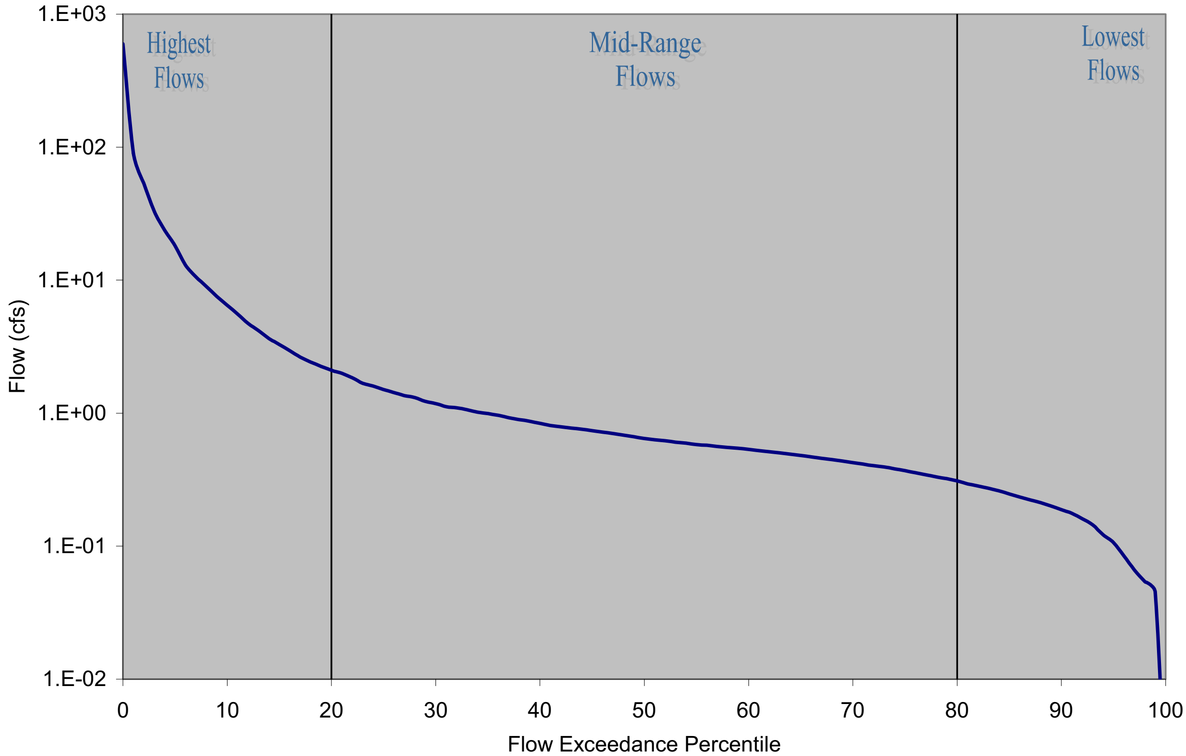


Figure 4-5 Flow Duration Curve for Hickory Slough (1102C)

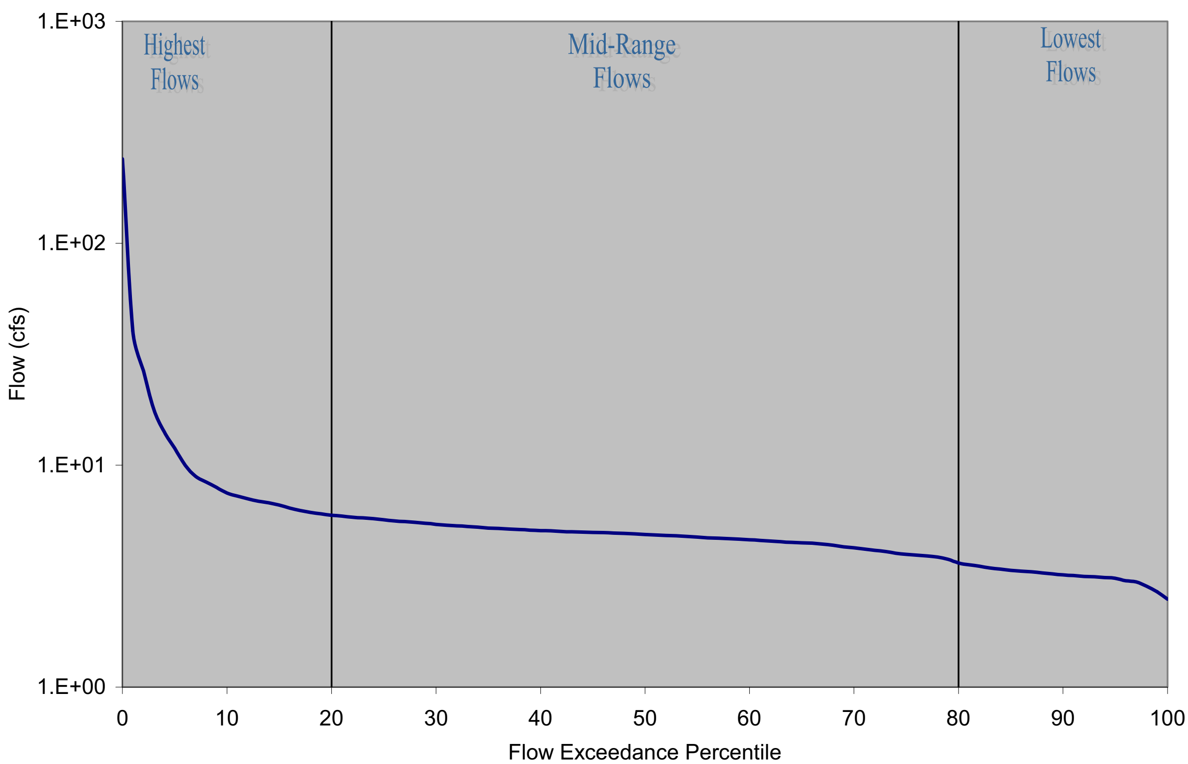


Figure 4-6 Flow Duration Curve for Turkey Creek (1102D)

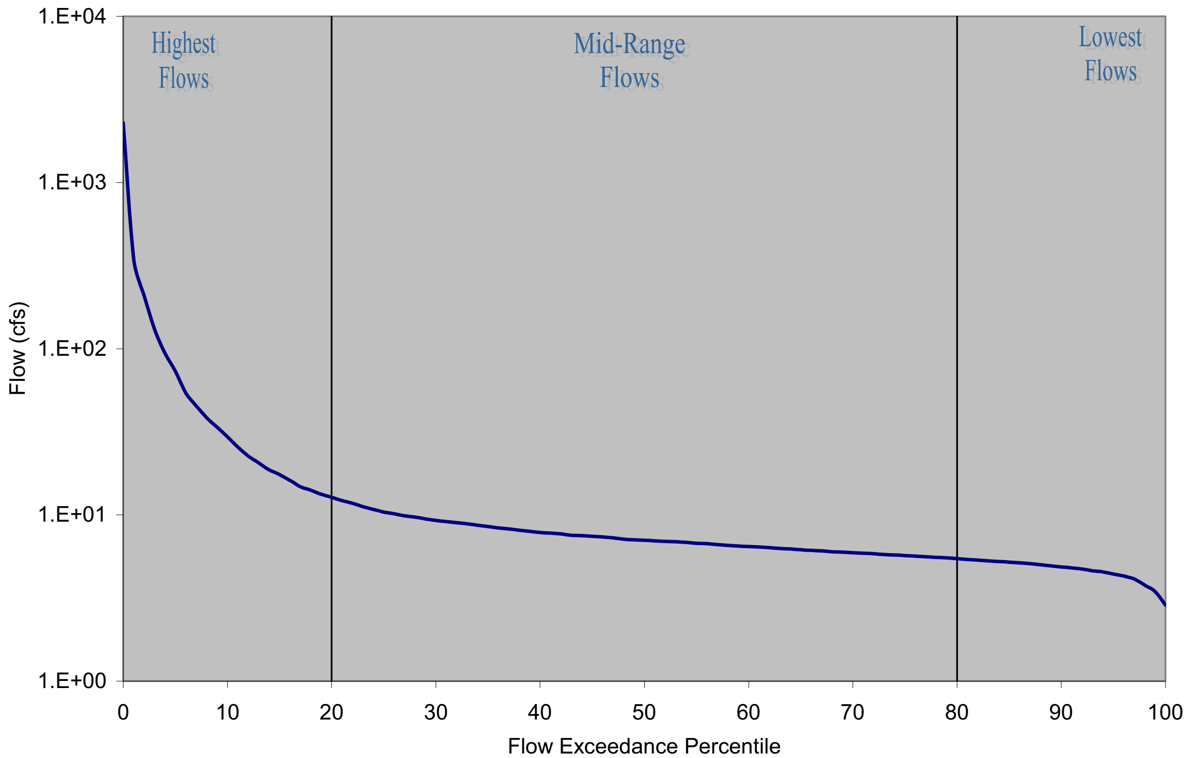


Figure 4-7 Flow Duration Curve for Mud Gully (1102E)

FDCs can be subdivided into hydrologic condition classes to facilitate the diagnostic and analytical uses of flow and LDCs. The hydrologic classification scheme utilized in this application is described as follows:

Table 4-1 Hydrologic Classification Scheme

Flow Exceedance Percentile	Hydrologic Condition Class
0-20	Highest flows
20-80	Mid-range flows
80-100	Lowest flows

Some instantaneous flow measurements were available from various agencies. These were not combined with the daily average flows or used in calculating flow percentiles, but were matched to bacteria grab measurements collected at the same site and time. When available, these instantaneous flow measurements were used in lieu of the daily average flow to calculate instantaneous bacteria loads.

4.3 Estimating Current Point and Nonpoint Loading and Identifying Critical Conditions from Load Duration Curves

Another key step in the use of LDCs for TMDL development is the estimation of existing bacteria loading from point and nonpoint sources and the display of this loading in relation to the TMDL. In Texas, WWTFs that discharge treated sanitary wastewater must meet the criteria for indicator bacteria at the point of discharge. However, for TMDL analysis it is necessary to understand the relative contribution of WWTFs to the overall pollutant load and its general compliance with required effluent limits. The monthly bacteria load for continuous point source dischargers is estimated by multiplying the monthly average flow rates by the monthly geometric mean bacteria concentration, with a volumetric conversion factor. Where available, data necessary for this calculation were extracted from each point source's discharge monitoring reports from 1996 through 2006. The current pollutant loading from each permitted point source discharge is calculated using the equation below and these calculations are provided in Appendix E.

*Point Source Loading = monthly average flow rates (mgd) * geometric mean of corresponding fecal coliform concentration * unit conversion factor*

Where:

unit conversion factor = 37,854,120 dL/million gallons (mg)

It is difficult to estimate current nonpoint loading due to lack of specific water quality and flow information that would assist in estimating the relative proportion of non-specific sources within the watershed. Therefore, existing instream loads were used as a conservative surrogate for nonpoint loading. Existing instream loads were calculated using measured bacteria concentrations from WQM stations multiplied by the flow rate (estimated or instantaneous) under various flow conditions.

4.4 Development of Bacteria TMDLs for Freshwater Streams Using Load Duration Curves

The final step in the TMDL calculation process involves a group of additional computations derived from the preparation of LDCs. These computations are necessary to derive a percent reduction goal (one method of presenting how much bacteria loading must be reduced to meet the water quality criterion in an impaired watershed).

Step 1: Generate Bacteria LDCs. LDCs are similar in appearance to flow duration curves; however, the ordinate is expressed in terms of a bacteria load in counts/day. The curve represents the instantaneous water quality criterion for fecal coliform (400 counts/dL) or *E. coli* (394 counts/dL), expressed in terms of a load through multiplication by the continuum of flows historically observed at this site. Using the single sample water quality criterion to generate the LDC is necessary to display the allowable pollutant load in relation to the existing loads which are represented by existing ambient water quality samples. The basic steps to generating an LDC involve:

- obtaining daily flow data for the WQM station of interest from the USGS;
- sorting the flow data and calculating flow exceedance percentiles for the time period and season of interest;
- obtaining the water quality data;
- matching the water quality observations with the flow data from the same date;

- display a curve on a plot that represents the allowable load multiply the actual or estimated flow by the SWQS for each respective indicator;
- multiplying the flow by the water quality parameter concentration to calculate daily loads; then
- plotting the flow exceedance percentiles and daily load observations in a load duration plot.

The culmination of these steps is expressed in the following formula, which is displayed on the LDC as the TMDL curve:

*TMDL (counts/day) = criterion * flow (cfs) * unit conversion factor*

Where: criterion = 400 counts /dL (Fecal coliform); or 394 counts/dL (E. coli) and

*unit conversion factor = 24,465,755 dL/ft3 * seconds/day*

The flow exceedance frequency (x-value of each point) is obtained by looking up the historical exceedance frequency of the measured or estimated flow; in other words, the percent of historical observations that equal or exceed the measured or estimated flow. Historical observations of bacteria concentration are paired with flow data and are plotted on the LDC. The indicator bacteria load (or the y-value of each point) is calculated by multiplying the indicator bacteria concentration (counts/dL) by the instantaneous flow (cubic feet per second [cfs]) at the same site and time, with appropriate volumetric and time unit conversions. Indicator bacteria loads representing exceedance of water quality criterion fall above the water quality criterion line.

Figure 4-8 provides a schematic representation of where permitted and non-permitted sources of pollution occur throughout the entire hydrograph for a typical stream. This figure shows that runoff typically contributes pollutant loads during high flow to mid-ranged flow conditions. However, flows do not always correspond directly to runoff events. For instance, high flows may occur in dry weather and runoff influence may be observed with low or moderate flows.

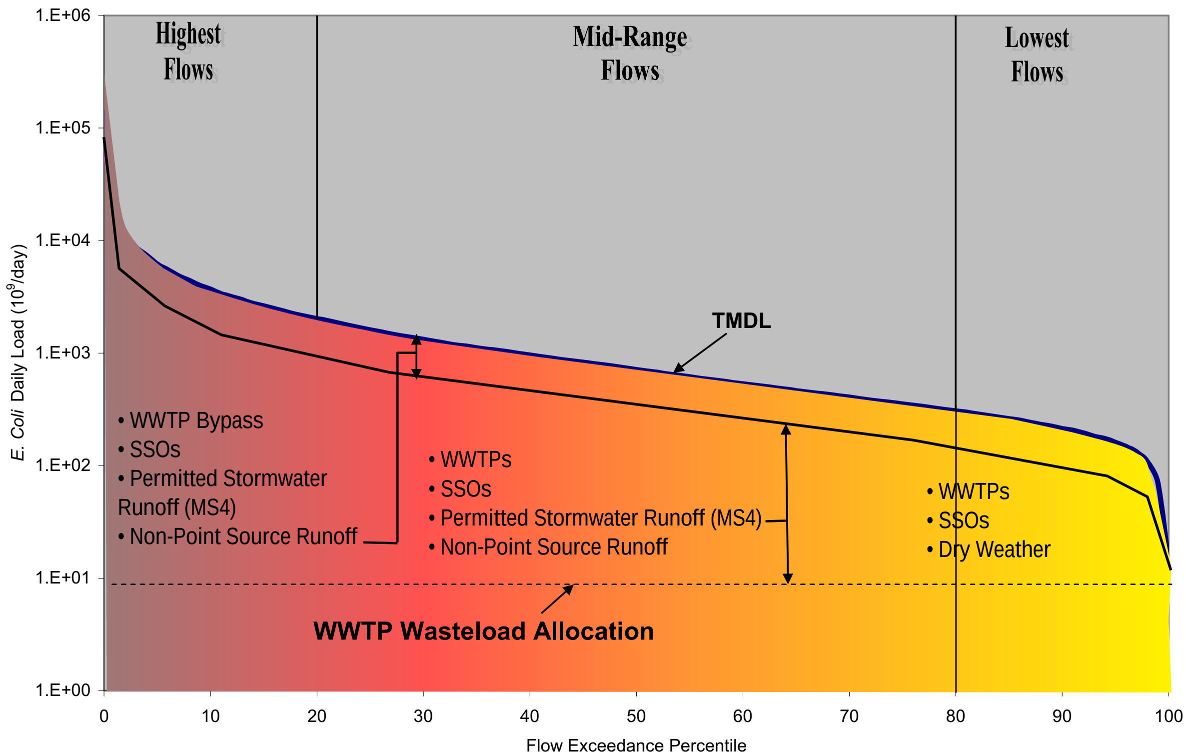


Figure 4-8 LDC Schematic Diagram – Interpreting Sources and Loads

To determine if a bacteria sample was influenced by runoff, rainfall data from the rain gage closest to a WQM station were evaluated. The potential maximum retention after runoff begins (S) was calculated to determine how much rainfall would be needed to produce runoff for each watershed. S is calculated using the formula below:

$$S = \frac{1000}{CN} - 10$$

Where: S = potential maximum retention after runoff begins (inches)

CN =average curve number for the watershed

Three day rainfall totals were then calculated for each rain gage. This data was matched to the date which the bacteria sample was collected. A bacteria sample was then considered a wet weather sample if the three day rainfall total was greater than or equal to S. These bacteria samples were then plotted in the LDCs using a different symbol from those samples that were not considered wet weather influenced.

Step 2: Develop LDCs with MOS. The MOS may be defined explicitly or implicitly. An LDC depicting slightly lower estimates than the TMDL is typically developed to incorporate an MOS into the TMDL calculations. A typical explicit approach would reserve some fraction of the TMDL (*e.g.,* 5%) as the MOS. In an implicit MOS approach, conservative assumptions used in developing the TMDL are relied upon to provide an MOS to assure that standard for contact recreation is attained.

For the TMDLs for freshwater streams in this report, an explicit MOS of 5 percent of the TMDL value (5% of the instantaneous water quality criterion) has been selected to slightly reduce assimilative capacity in the watershed. The MOS at any given percent flow exceedance, therefore, is defined as the difference in loading between the TMDL and the TMDL with MOS.

Step 3: Calculate WLA. As previously stated, the pollutant load allocation for permitted (point) sources is defined by the WLA. A point source can be either a wastewater (continuous) or storm water permitted discharge. Storm water point sources are typically associated with urban and industrialized areas, and recent USEPA guidance includes NPDES-permitted storm water discharges as point source discharges and, therefore, part of the WLA.

The LDC approach recognizes that the assimilative capacity of a waterbody depends on the flow, and that maximum allowable loading will vary with flow condition. TMDLs can be expressed in terms of maximum allowable concentrations, or as different maximum loads allowable under different flow conditions, rather than single maximum load values. This concentration-based approach meets the requirements of 40 CFR, 130.2(i) for expressing TMDLs "in terms of mass per time, toxicity, or other appropriate measures" and is consistent with USEPA's Protocol for Developing Pathogen TMDLs (USEPA 2001).

WLA for WWTF. WLAs may be set to zero for watersheds with no existing or planned continuous permitted point sources. For watersheds with permitted point sources, WLAs may be derived from TPDES permit limits. A WLA may be calculated for each active TPDES wastewater discharger using a mass balance approach as shown in the equation below. The permitted average flow rate used for each point source discharge and the water quality criterion concentration are used to estimate the WLA for each wastewater facility. Through TPDES permits WLAs for WWTFs are constant across all flow conditions and ensure that WQS will be attained (USEPA 2007). All WLA values for each TPDES wastewater discharger are then summed to represent the total WLA for the watershed.

*WLA = criterion * flow * unit conversion factor (#/day)*

Where: criterion = 200/dL (Fecal coliform); 126/dL (E. coli); or 33/dL (Enterococci)

flow (mgd) = permitted flow

unit conversion factor = 37,854,120-dL/ mgd

WLA for NPDES/TPDES MS4s. Given the lack of data and the complexity of quantifying bacteria concentrations or loads associated with wet weather events, calculating the WLA for permitted storm water (MS4) discharges must be derived in a manner similar to that used for all other non-permitted nonpoint sources. In other words it must be derived from the overall LA or the area under the TMDL curve and above the WLA established for WWTFs. Rather than one discrete value, which is practical for WWTF discharges, the WLA calculations for permitted storm water discharges must be expressed as different maximum loads allowable under different flow conditions. Therefore, the percentage of a watershed that is under MS4 jurisdiction is used to estimate the load that should be allocated as the permitted storm water load. For example, the area of the City of Houston/Harris County permitted MS4 discharge in the project area is estimated to be 14,753 acres, 46 percent of the Clear Creek above Tidal (Segment 1102) watershed. Therefore, 46 percent of the LA calculated at any flow condition will be designated as the WLA the City of Houston/Harris County permitted storm water discharge. The WLA for MS4s can be expressed as a value for each flow exceedance frequency.

Step 4: Calculate LA. LAs for non-permitted sources (nonpoint sources) can be calculated under different flow conditions as the water quality target load minus the sum of WLA for WWTFs (if any) and permitted storm water (or MS4). The LA is represented by the area under the LDC but above the WLA. The LA at any particular flow exceedance is calculated as shown in the equation below.

$$LA = TMDL - MOS - \Sigma WLA_{WWTF} - \Sigma WLA_{MS4}$$

Where:

LA = allowable load from non-permitted sources
TMDL= total allowable load
ΣWLA_{WWTF} = sum of all WWTF loads
ΣWLA_{MS4} = sum of all MS4 loads
MOS = margin of safety

Step 5: Estimate WLA Load Reduction. The WLA load reduction for TPDES-permitted WWTFs was not calculated since it was assumed that continuous dischargers are adequately regulated under existing permits and, therefore, no WLA reduction would be required. However, for permitted storm water the load reduction will be the same as the percent reduction goal established for the LA (nonpoint sources).

Step 6: Estimate LA Load Reduction. A percent reduction goal is derived for each WQM station on each segment for the geometric mean criterion. After existing loading estimates are computed for the applicable indicator bacteria (fecal coliform or *E. coli*), nonpoint load reduction estimates for each sampling location are calculated by using the difference between estimated existing loading and the allowable load expressed by the LDC (TMDL-MOS). Existing loads were determined by using the median flow (10^{th}, $50^{th,}$ and 90^{th} flow exceedance percentile) of each of the three flow regimes multiplied by the geometric mean concentration of the historical bacteria data. For example, for the 0-20_{th} percentile flow range, the flow corresponding to the 10_{th} percentile was used. The geometric mean of the indicator bacteria samples within the 0-20^{th} flow percentile range was then multiplied by the 10^{th} flow exceedance percentile to determine the existing load. Overall, percent reduction goals were also calculated for the most-downstream station of each segment. The highest reduction determined for each segment is then applied as the percent reduction goal. In this case, all indicator bacteria data from flow exceedance percentiles of 0 through 100 were used to calculate the geometric mean and the percent reduction goal was derived using the formula of:

$$\text{Percent Reduction Goal} = \frac{\text{Geometric Mean of Indicator Bacteria Data} - \text{Water Quality Target} \times 100}{\text{Geometric Mean of Indicator Bacteria Data}}$$

4.5 Development of Bacteria TMDLs for Tidal Streams Using a Mass Balance Approach

4.5.1 Modeling Approach

A time-variable tidal prism modeling approach with a moderate level of spatial resolution was used to simulate the bacterial indicator loads and establish TMDLs for the tidal segments of the Clear Creek Watershed. The tidal prism is the volume of water gained in a tidal stream between low and high tide levels. Load calculations were developed for a series of reaches within Clear Creek Tidal and Robinson Bayou, as well as the portions of the major tributaries discharging to Clear Creek Tidal that periodically are influenced by tidal fluctuations. The model incorporates the three primary mechanisms through which Enterococci loadings and water enter the impaired systems: i) rain-induced freshwater inputs via tributaries or direct runoff, ii) direct point source discharges, and iii) tidally influenced loadings, which are introduced during the diurnal tidal fluctuations that occur in the system. The model assumes that Enterococci are removed with the net estuarine flow from the system and via net decay. A generalized schematic of the source and sink terms for the tidally influenced impaired waterbodies (1101, 1101D) is presented in Figure 4-9.

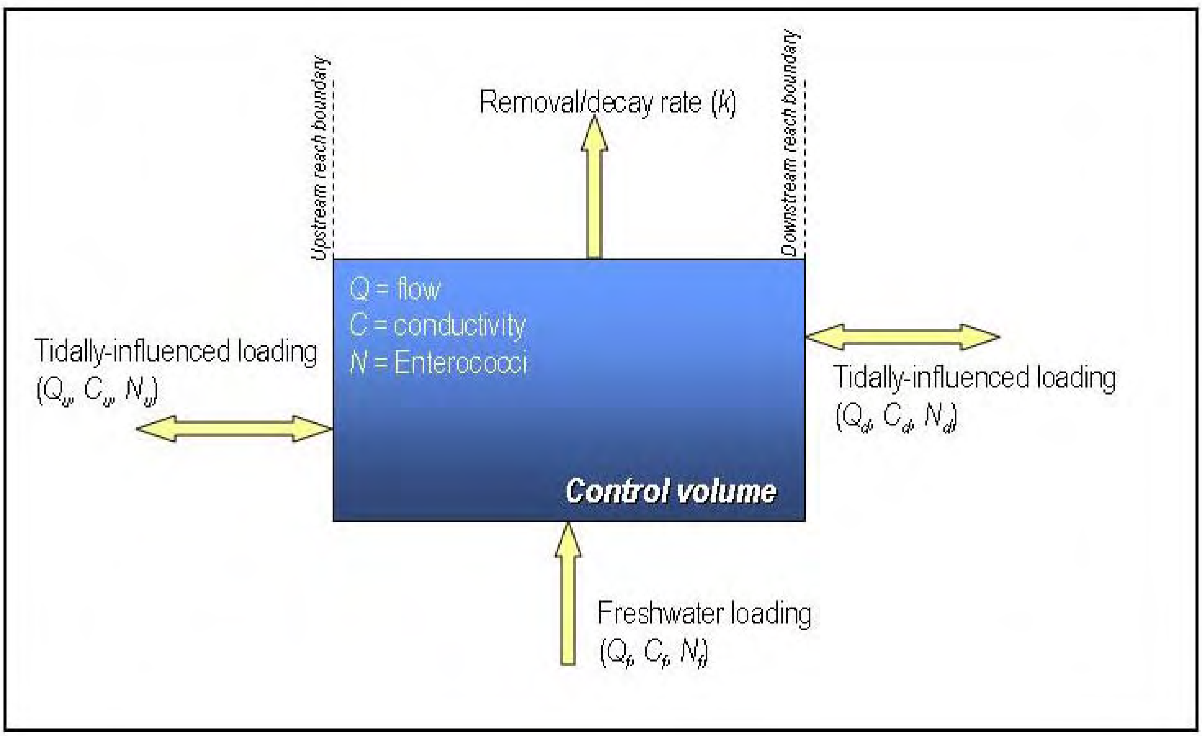


Figure 4-9 Conceptual Model for Sources and Sinks of Enterococci

The mass balance of water for a given reach at a given time step can be written as follows:

$$\frac{dV}{dt} = Q_u + Q_f - Q_d \quad (1)$$

Where: Q_u = volume of water crossing the upstream boundary of the reach [m^3/hr]

Q_d = volume of mixed water crossing the downstream boundary of the reach [m^3/hr]

Q_f = volume of freshwater inflow (runoff, tributaries, and WWTFs) discharging along the reach [m^3/hr],

dV/dt = change in volume of the reach with time [m^3/hr]

The following paragraphs summarize the steps that were followed to complete the tidal prism model.

Step 1: Define Reaches. Clear Creek Tidal, Segment 1101, was divided into eleven reaches (Figure 4-10). The tidal prism model includes reaches for Robinson Bayou, a tidal tributary of Clear Creek Tidal, and portions of freshwater tributaries Cowart Creek, Chigger Creek, and Magnolia Creek. A small downstream reach of Clear Creek above Tidal (Reaches A and B) is also incorporated into the tidal prism model because it is tidally influenced. An effort was made to ensure that model reaches were of similar size.

Data from TSARP models were used to calculate cross-sectional areas for the boundaries of each main stem reach. Cross-sectional areas for small tributaries were estimated using LiDAR (Light Detection and Ranging) 2-foot contour elevation data collected in 2001 provided by TSARP. These data are provided in electronic format in Appendix J.

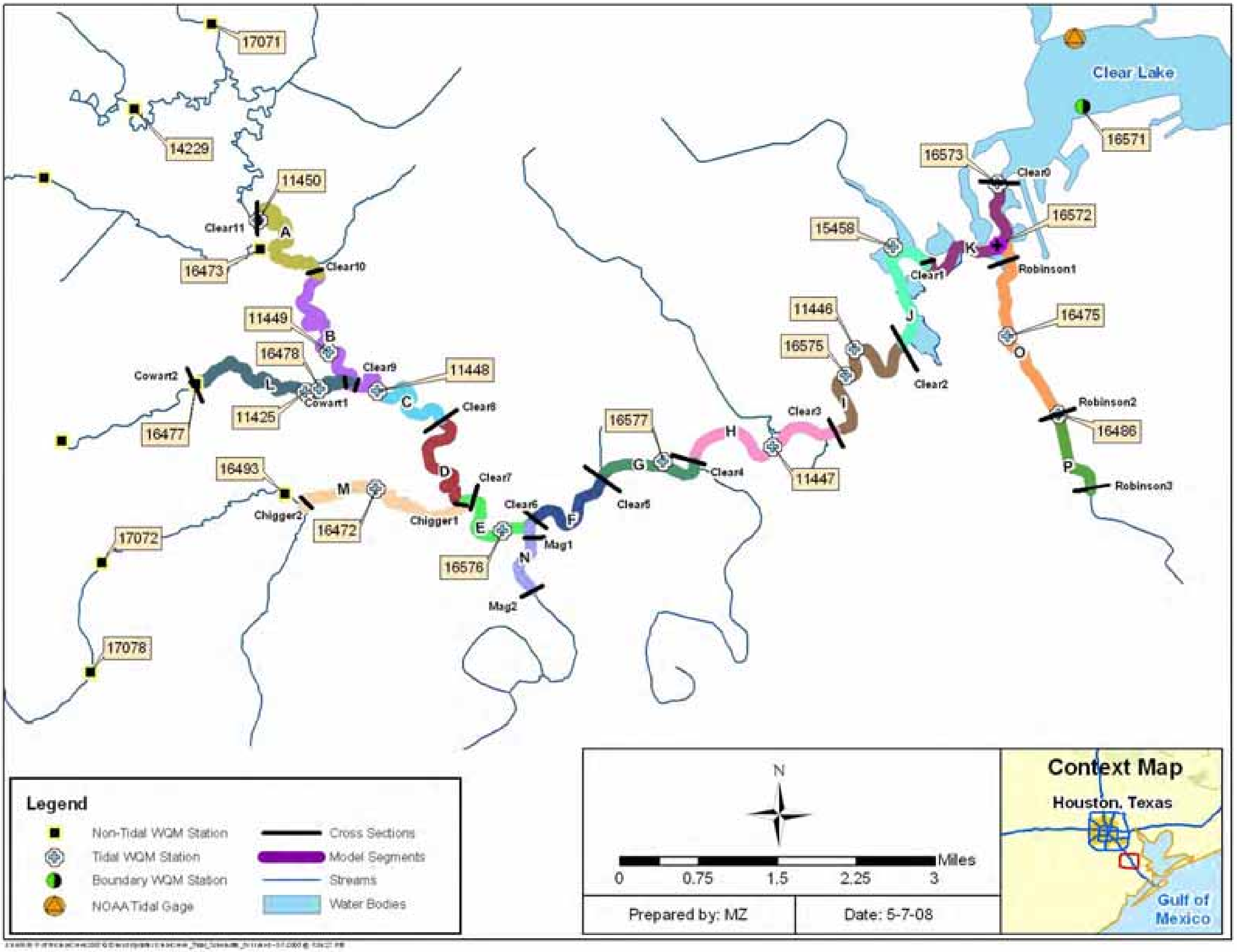


Figure 4-10 Schematic of Clear Creek Tidal Reaches

Step 2: Establishing Tributary Inflows and Loads

The model requires time series for inflow and bacterial indicator loads from the freshwater tributaries (the model headwaters) discharging to the tidal portions. The methods for estimating these headwater boundary flows and Enterococci loads are summarized in this step.

Inflows from Non-Tidal Tributaries to Tidal Model Reaches

Estimated daily inflows from non-tidal (freshwater) tributary streams to the tidal model reaches were derived from the drainage area ratio method described in Appendix H. These daily inflows were then disaggregated to hourly time series for the modeled period (2000 through 2006), and provided in Appendix K in electronic format.

Enterococci Loads from Upstream Freshwater Segments

Indicator bacteria concentrations measured at the most downstream WQM stations on non-tidal tributaries, including Mary's Creek (16473) Chigger Creek (16493), Cowart Creek (16477), and Clear Creek above Tidal (14299) were used to estimate Enterococci loads to the tidal prism model. For most of the WQM stations on these tributaries, only *E. coli* or fecal coliform data were available. Therefore, Enterococci concentrations were estimated from *E. coli* or fecal coliform data using Enterococci/*E. coli* (ENT/EC) or Enterococci/fecal coliform (ENT/FC) conversion ratios, based on data collected by the City of Houston and H-GAC for their Alternate Indicator Study (Running 2007). The median ENT/EC and ENT/FC ratios were 0.34 and 0.27, respectively. For dates with no historical water quality data available, the geometric mean of the observed values of each respective station was used. For Magnolia Creek, Robinson Bayou and Tributary One, the load time series were developed using the geometric means of the data collected during the 2006 Intensive Surveys (stations 16611, 16486, and 18818, respectively) for low flows (defined as flows lower than the 60^{th} percentile), while the geometric means of the storm water data collected for the same locations were used for high flows. For Tributaries A through E for which no bacterial indicator data were available, the overall geometric means of the intensive surveys and the storm water sampling were used for low and high flows, respectively. Tributary load input datasets for Enterococci are included in electronic format in Appendix L and summarized in Table 4-2.

Table 4-2 Summary of Tributary Inflows and Loads to the Tidal Prism Model

Interface	Average Flow (m^3/day)	Average Flow (cfs)	Average Enterococci Load (counts/day)
Clear Creek above Tidal (Reach A-K)	7.49E+04	3.06E+01	6.49E+10
Cowart Creek (Reach L)	2.67E+04	1.09E+01	2.17E+10
Chigger Creek (Reach M)	9.61E+03	3.93E+00	1.04E+10
Magnolia Creek (Reach N)	1.01E+04	4.11E+00	2.19E+12
Robinson Bayou (Reach P)	3.74E+02	1.53E-01	2.67E+10
Mary's Creek (Reach A)	9.19E+04	3.76E+01	1.33E+11
Tributary A (Reach A)	2.83E+03	1.16E+00	4.28E+11
Tributary B (Reach G)	1.52E+02	6.21E-02	2.19E+10
Tributary One (Reach G)	1.61E+04	6.58E+00	2.31E+12
Tributary C (Reach H)	4.14E+03	1.69E+00	6.27E+11
Tributary D (Reach H)	4.26E+03	1.74E+00	6.46E+11
Tributary E (Reach J)	3.70E+04	1.51E+01	5.60E+12

Step 3: Estimating Direct (non-tributary) Point and Nonpoint Source InFlows and Loading to the System.

The key variables required for estimating loading into Clear Creek Tidal and Robinson Bayou are direct runoff to the tidal streams modeled, WWTF discharges to the various reaches, and indicator bacteria concentrations in runoff and WWTF effluents. The methods for estimating these tidal prism inputs are summarized below.

Permitted Sources: Continuous Point Source Dischargers (WWTFs)

Six TPDES-permitted WWTFs that continuously discharge wastewater are located in the Clear Creek Tidal Watershed. To be consistent with estimating bacterial indicator loads under the LDC method, average monthly flows from DMRs were again used to estimate fecal coliform loads from discrete point sources as inputs to the tidal prism model. Loads were calculated using maximum monthly geometric mean data for fecal coliform when available from TCEQ, then converted to estimates to Enterococci loads before using the 0.27 ENT/FC ratio). *E. coli* data collected from a select group of WWTFs by Harris County in November 2007 were also used if no other data was available to characterize the bacteria concentrations in wastewater effluent. A summary of these data are shown in Table 4-3.

Table 4-3 Summary of Existing WWTF Loads in Model

Model Reach	TPDES Permit Number	Flow (average self reported) m^3/day	Flow (average self reported) MGD	Enterococci Concentration (counts/dL)	Enterococci Load (counts/day)
D	11571-001	20,222	5.343	28[a]	5.66E+09
I	10520-001	5,169	1.366	0.5[b]	2.58E+07
J	10526-001	2,303	0.608	1[b]	2.30E+07
J	10568-005	23,356	6.170	13[a]	3.04E+09
K	10526-001	2,618	0.692	1[b]	2.62E+07
N	10568-003	1,450	0.383	4[a]	5.80E+07

[a] *Maximum value of monthly self-reported fecal coliform geomeans times 0.27 (ENT/FC ratio)*
[b] *Maximum E. coli data from Harris County, 2007 times 0.34 (ENT/EC ratio)*

Permitted and Non-permitted Storm Water Runoff

Storm water runoff loads discharging directly to the model reaches were input to the model for the days on which a rain event occurred (as indicated by the closest HCOEM gage to each segment). Drainage areas were estimated using TSARP subwatersheds displayed in Figure 4-11. Daily Enterococci runoff loads were calculated using land cover information from the C-CAP Texas 2005 Land Cover Data, and the amounts of rainfall recorded for the simulation period.

The amount of runoff for each drainage area was calculated using the NRCS runoff curve number method (NRCS 1986). The NRCS runoff equation is:

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S} \qquad (2)$$

where Q = runoff (in);

P = rainfall (in);

S = potential maximum retention after runoff begins (in); and

I_a = initial abstraction (in).

Initial abstraction refers to all the losses before runoff begins and includes water intercepted by vegetation, infiltration, evaporation, and water retained in surface depressions. This parameter is highly variable but is correlated to land cover and soil type (NRCS 1986). The NRCS (1986) estimates I_a to be equal to:

$$I_a = 0.2S \qquad (3)$$

thus,

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)} \qquad (4)$$

Finally, S is related to the curve number (CN) by:

$$S = \frac{1000}{CN} - 10 \qquad (5)$$

CN values range from 0 to 100 and are based on land cover and soil group. For this runoff calculation, all subwatersheds were assumed to be in soil group D (silt and clay) that generally has low infiltration rates. Land coverage data developed by C-CAP were aggregated from 22 categories into the six land cover categories listed in Table 4-4. The classification system and their corresponding runoff curve numbers are included in Table 4-4.

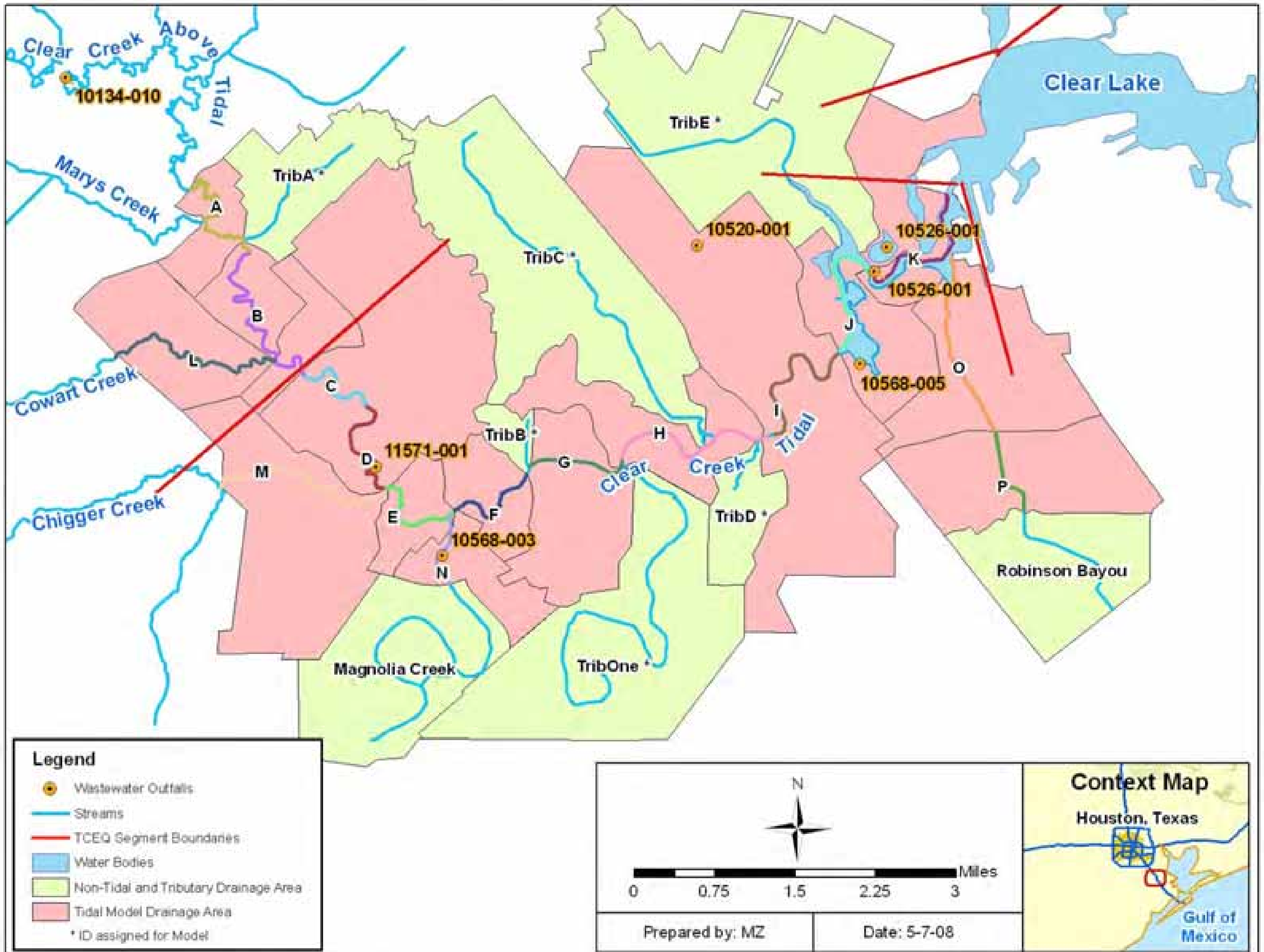


Figure 4-11 Drainage Areas for the Tidal Prism Model Reaches

Event mean concentrations (EMC) for Enterococci were estimated based on fecal coliform EMCs obtained from the Storm Water Management Joint Task Force in 2002. The ENT/FC ratio (0.27) was applied to obtain Enterococci EMCs for different land cover categories. The Enterococci concentrations used for the tidal prism model are included in Table 4-4.

Table 4-4 Runoff Curve Numbers for the Clear Creek Watershed

Land Cover Description	CN	Enterococci EMCs (cfu/dL)
Developed	92[a]	18,000
Cultivated Land	84[b]	700
Grassland/Herbaceous	80[b]	700
Pasture/Hay	80[b]	700
Woodland	77[c]	400
Open Water	0	0
Wetlands	0	0
Transitional/Bare	89[d]	12,000

[a] *Obtained from C-CAP Medium-Intensity Developed*
[b] *Obtained from "Urban Hydrology for Small Watersheds." Natural Resources Conservation Service, Technical Release 55, June 1986. Cultivated agricultural land, small grain, contoured. (Good)*
[c] *Obtained from "Urban Hydrology for Small Watersheds." Natural Resources Conservation Service, Technical Release 55, June 1986. Pasture, grassland, or range- continuous forage for grazing. (Good)*
[c] *Obtained from C-CAP Mixed Forest*
[d] *Obtained from "Urban Hydrology for Small Watersheds." Natural Resources Conservation Service, Technical Release 55, June 1986. Open space (lawns, parks, golf courses, cemeteries, etc.) Poor condition (grass cover < 50%)*

Average storm water runoff loads from the contributing subwatershed of each reach are summarized in Table 4-5. The total average daily load from runoff into Clear Creek Tidal (including the tidal portions of the major tributaries) was estimated to be 1.11 $x10^{13}$ /day, the total for Robinson Bayou was estimated to be 8.71 $x10^{11}$ /day. Runoff flow and Enterococci load calculations are provided in electronic format in Appendix M.

Table 4-5 Storm Water Runoff Loads to the Tidal Prism Model

Reach	Average Flow (m^3/day)	Average Flow (cfs)	Average Enterococci Load (counts/day)
A	1,930	0.79	2.70E+11
B	4,840	1.98	7.75E+11
C	8,320	3.4	1.21E+12
D	7,680	3.14	1.12E+12
E	1,690	0.689	1.69E+11
F	1,850	0.755	1.46E+11
G	6,300	2.58	9.16E+11
H	4,180	1.71	3.57E+11
I	20,400	8.34	2.64E+12
J	6,510	2.66	1.05E+12
K	475	0.194	5.91E+10
L	5,620	2.3	8.87E+11

Reach	Average Flow (m^3/day)	Average Flow (cfs)	Average Enterococci Load (counts/day)
M	9,330	3.81	9.94E+11
N	3,360	1.37	5.39E+11
O	259	0.106	2.77E+10
P	5,750	2.35	8.43E+11

Note: Variable daily loads were input into the model. The loads presented here are the averages over the simulation period (01/01/2000 to 09/30/2006).

Step 4: Estimate Tidal Flows. Tidal flows for each reach were computed as the tidal exchange over the course of one hour, and were estimated as the difference in volume between two consecutive time steps (Equation 1). To calculate volumes, one hour gage data for the simulation period of 1/01/2000 – 09/30/2006 were downloaded from the Texas Coastal Ocean Observation Network Station 502 at Clear Lake (http://lighthouse.tamucc.edu/overview/502). After adjusting cross-sectional areas to reflect tidal elevation, the hourly volumes for each reach were calculated as the average of the cross-sectional areas at the downstream and upstream reach boundaries times the length of the reach.

Step 5: Verify Flow Balance Using Conductivity. An important step to estimating freshwater loading is to construct a conductivity balance of the system to ensure that the model is correctly estimating freshwater inflows and tidal exchange. Electrical conductivity measures the salt content (salinity) of water, and the major salts are considered a conservative (non-reactive) tracer. To accomplish this, conductivity data from TCEQ stations and from the NOAA gage were used as a conservative tracer to determine the flow balance of each reach. The conductivity balance calculation for each reach is represented as:

$$C_t V_t = C_{t-1} V_{t-1} + \sum C_{in} V_{in} - \sum C_{out} V_{out} + C_f V_f \qquad (6)$$

Where: V_t = volume of reach at time step t [m^3]

V_{t-1} = volume of reach at time step t-1 [m^3]

V_f = freshwater volume [m^3]

V_{in}, V_{out} = tidally influenced volumes for time step t [m^3]

C_t = conductivity in the reach [µS/cm]

C_f = conductivity in the freshwater inputs [µS/cm]

C_{in}, C_{out} = conductivity of the tidally influenced flows [µS/cm]

The average conductivity values for the existing water quality monitoring stations were used to define the initial conductivity levels in the model reaches. Because a long-term conductivity record was not available at the downstream boundary (*i.e.*, Clear Lake), long-term conductivity records for the NOAA gage at Eagle Point (Station 8771013) were multiplied by the ratio of average salinities for the Clear Lake and Eagle Point NOAA gages to estimate salinities at the downstream boundary. Conductivity in freshwater (runoff, tributaries and effluent) was assumed equal to 1,000 µS/cm. Tidally influenced volumes were calculated using Equation 1 and freshwater volumes as described earlier. Using the above information Equation 6 was solved for the conductivity in the reach (C_t). The computed conductivity levels were then compared to existing measurements within the impaired waterbody to corroborate that the flows are accurately represented throughout the system. Figure 4-12 presents a comparison of observed and modeled average conductivity concentrations along Clear Creek Tidal.

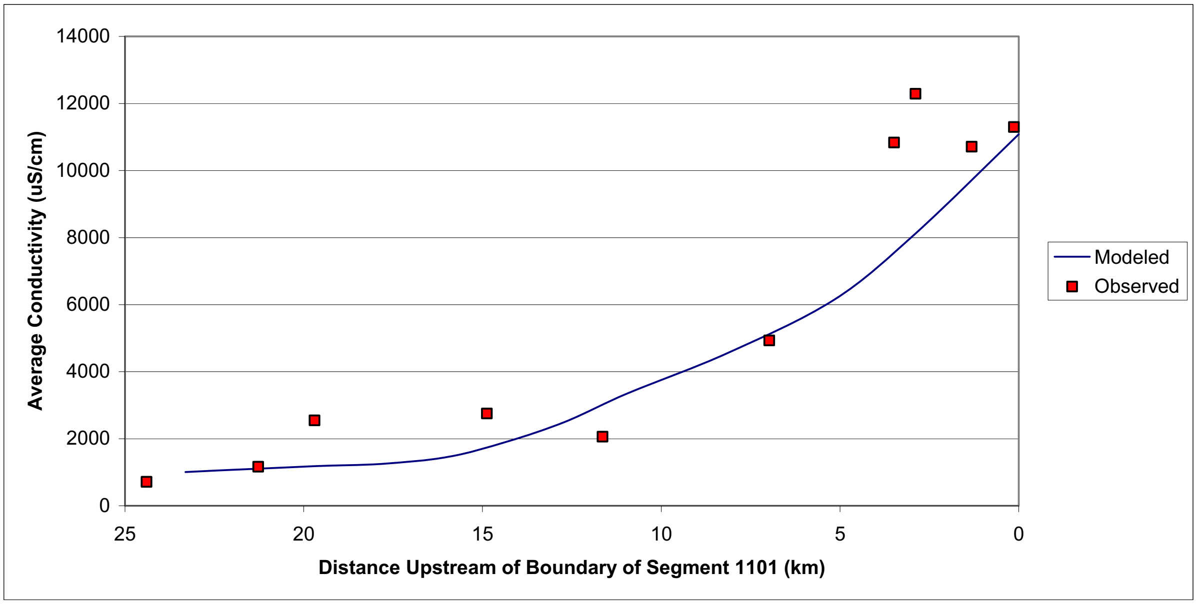


Figure 4-12 Longitudinal Profile of Average Conductivity

Step 6: Perform Mass Balance on Enterococci Levels. Upon validation of the flow balance, a mass-balance on Enterococci for each reach can be computed as follows:

$$N_t V_t = N_{t-1} V_{t-1} + \sum N_{in} V_{in} - \sum N_{out} V_{out} + N_f V_f - k N_{t-1} V_{t-1} \qquad (7)$$

Where: N_t = Enterococci level in the reach [counts/dL]

N_f = Enterococci level in the freshwater flow [counts/dL]

N_{in}, N_{out} = Enterococci level in tidally influenced flow [counts/dL]

k = Enterococci first-order decay rate [hr^{-1}]

The average Enterococci concentrations measured at each of the water quality monitoring stations along Clear Creek Tidal and Robinson Bayou were used to define the initial conditions in each model reach. The geometric mean of Enterococci concentrations measured in Clear Lake station 16571 (12 counts/dL) was used to set the downstream boundary concentration of Enterococci. Enterococci levels in runoff, tributaries and WWTFs were estimated as described in Steps 2 and 3.

The model was calibrated by varying the decay rate by reach and adjusting this decay rate within the bounds of reported rates until the model accurately reproduced the temporal and spatial distribution of observed Enterococci within the system. Sinton, *et al*. (1994) and Davies-Colley, *et al*. (1998) reported decay rates between 0.12 and 40 day^{-1}, Anderson, *et al*. (2005) reported rates between 0.73 and 2.1 day^{-1}, and Kay, *et al*. (2005) measured decay rates between 2.2 and 8.5 day^{-1}. Final decay rates applied to the model ranged from 0.7 to 3.6 day^{-1}, which are within the ranges reported in the literature. The decay rates were not varied temporally because insufficient data were available to estimate the seasonal variation in decay rates. The calibrated spreadsheet model is included in Appendix N in electronic format.

Figure 4-13 presents a comparison of measured and modeled Enterococci concentrations along the main stem of Clear Creek. As can be seen, the model reasonably predicts the spatial distribution of Enterococci along the creek. For the tidal prism model, indicator bacteria data (including fecal coliform and *E. coli*), from 2000 through 2006 for a given station were used to compare to modeled values. Fecal coliform and *E. coli* data were converted to Enterococci concentrations using calculated ENT/FC and ENT/EC ratios (0.27 and 0.34, respectively) as previously described.

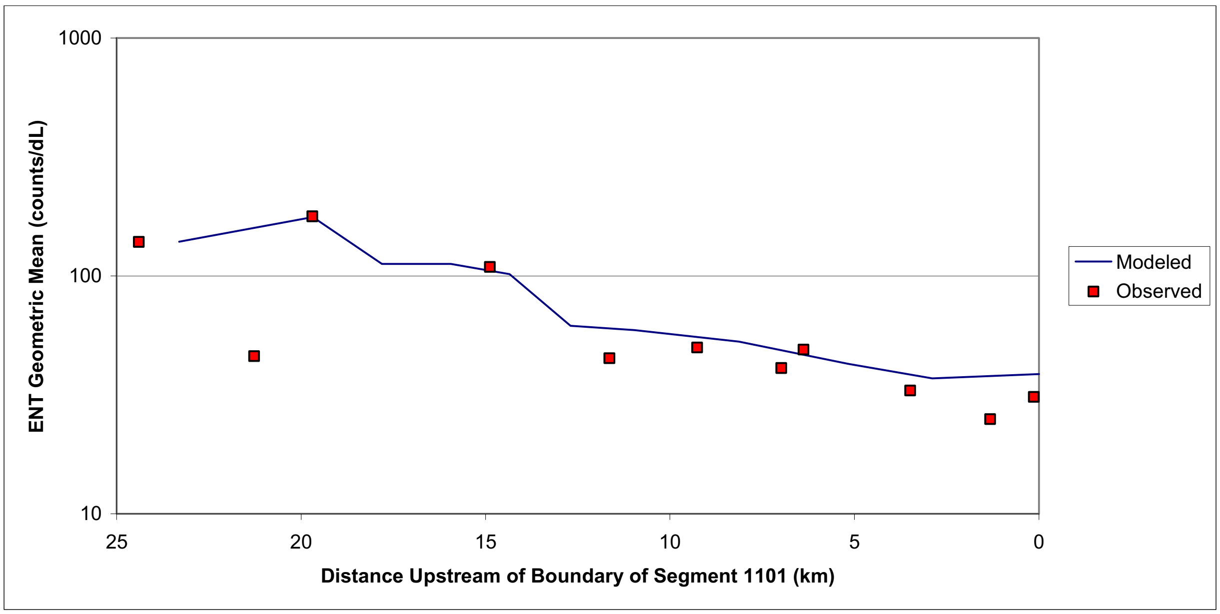


Figure 4-13 Longitudinal Profile of Enterococci Concentrations

Figures 4-14 through 4-17 show time series of Enterococci concentrations for a number of water quality monitoring stations in the main stem of Clear Creek Tidal. Figures 4-18 through 4-21 show Enterococci time series for the major tributaries. As indicated by the figures, the model reasonably represents the temporal distribution of Enterococci concentrations for the various WQS.

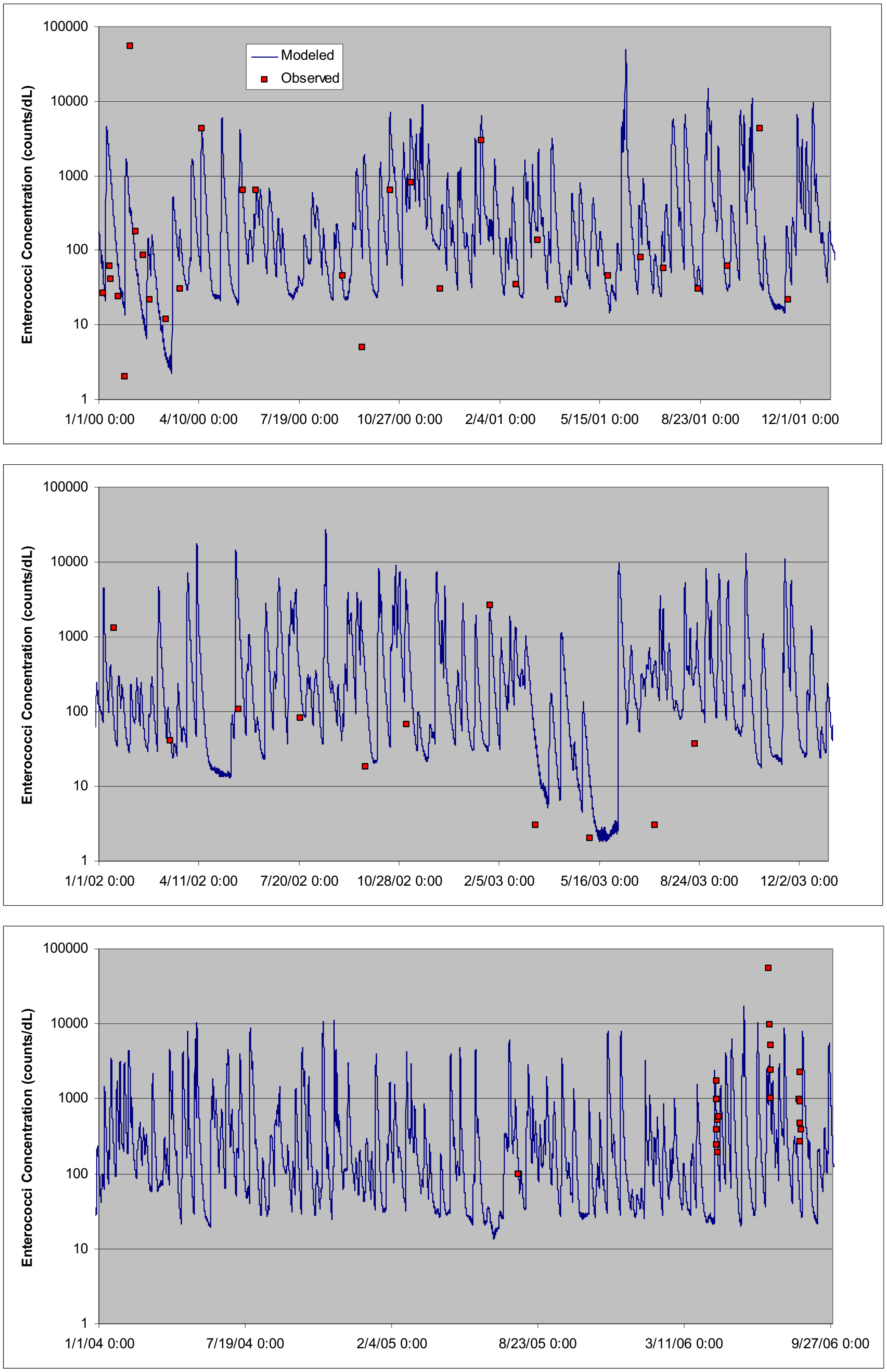


Figure 4-14 Enterococci Levels at Station 11448 (Reach B), Clear Creek Tidal

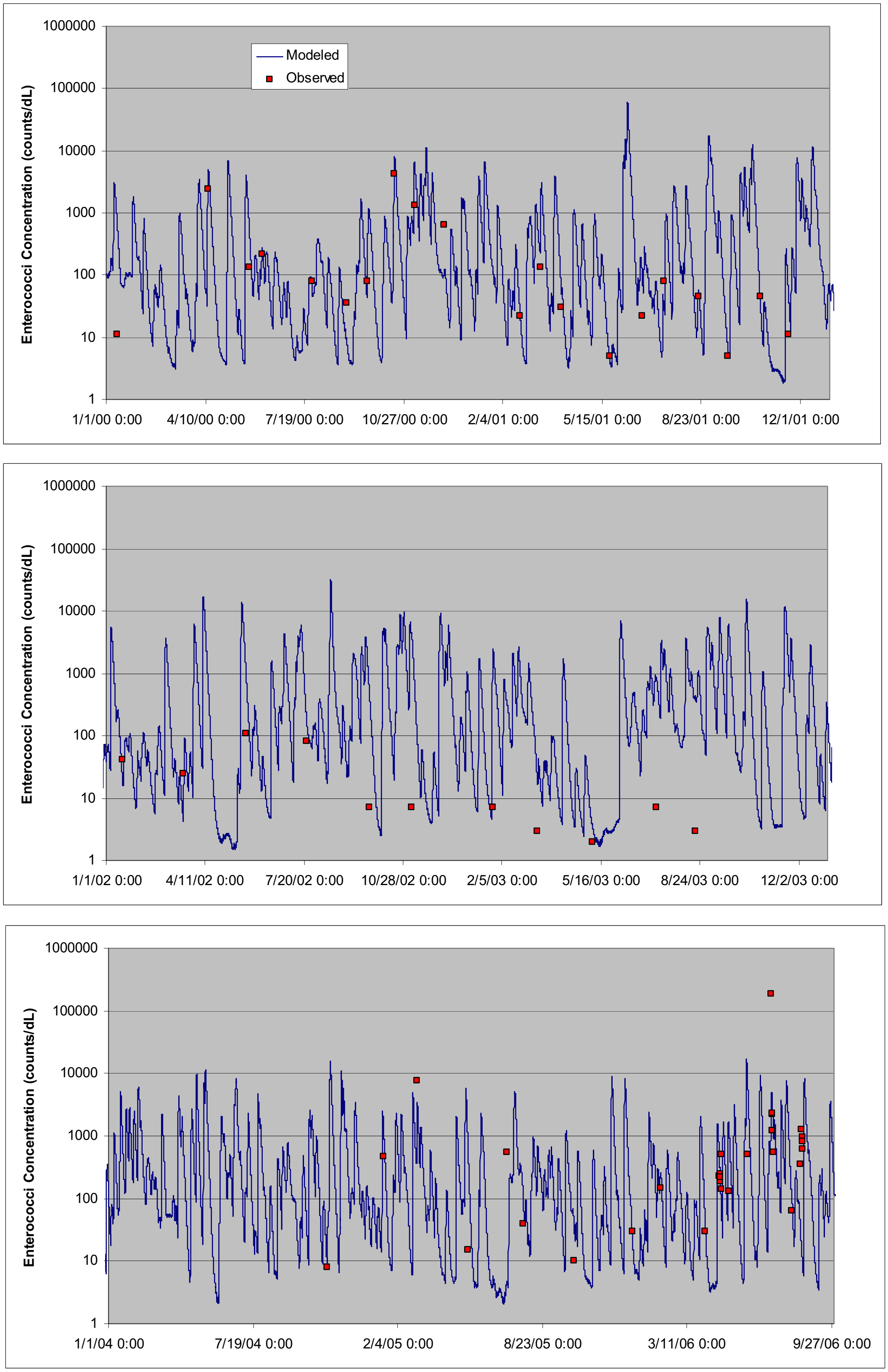


Figure 4-15 Enterococci Levels at Station 16576 (Reach E), Clear Creek Tidal

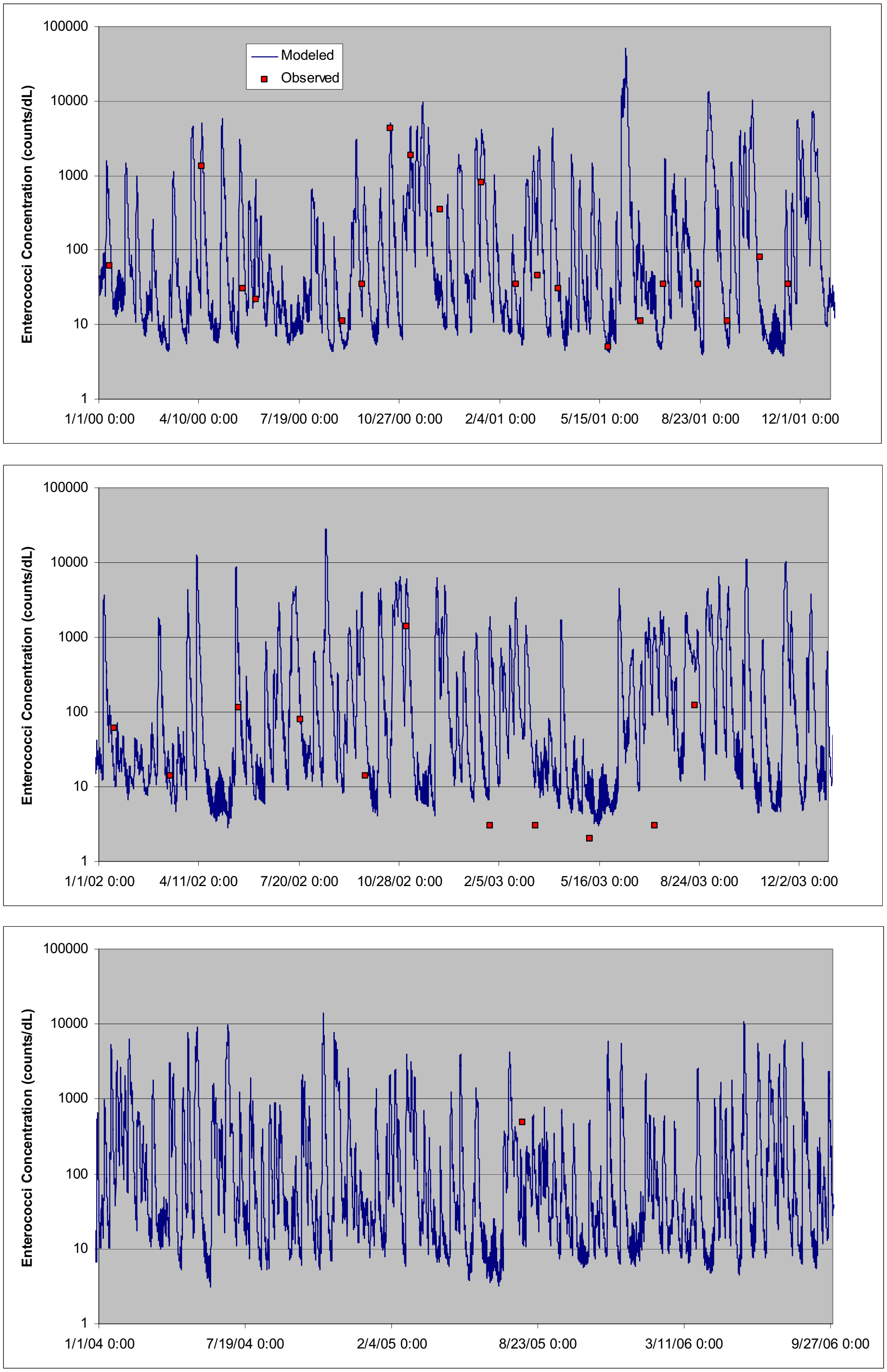


Figure 4-16 Enterococci Levels at Station 16577 (Reach G), Clear Creek Tidal

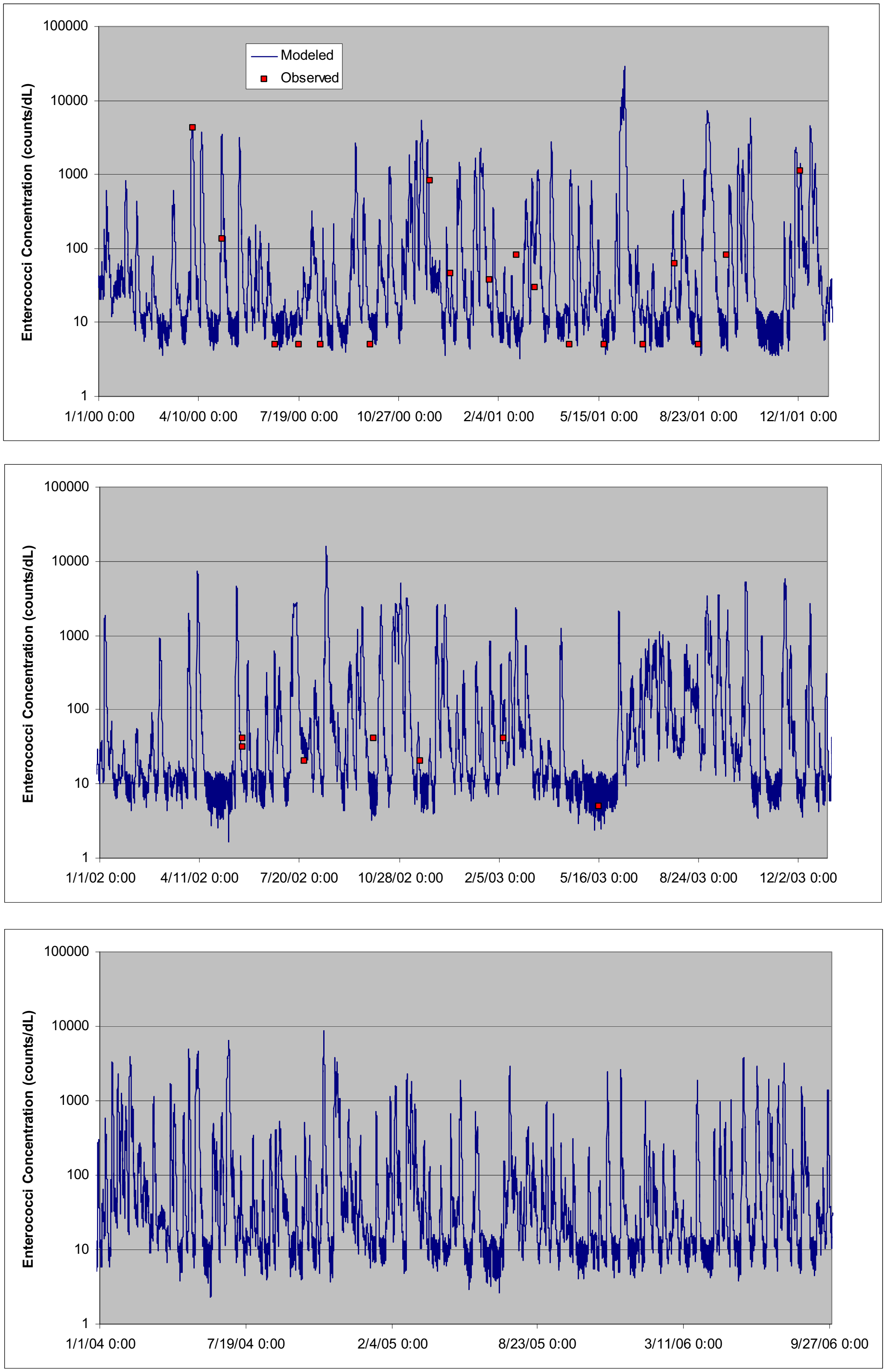


Figure 4-17 Enterococci Levels at Station 16573 (Reach K), Clear Creek Tidal

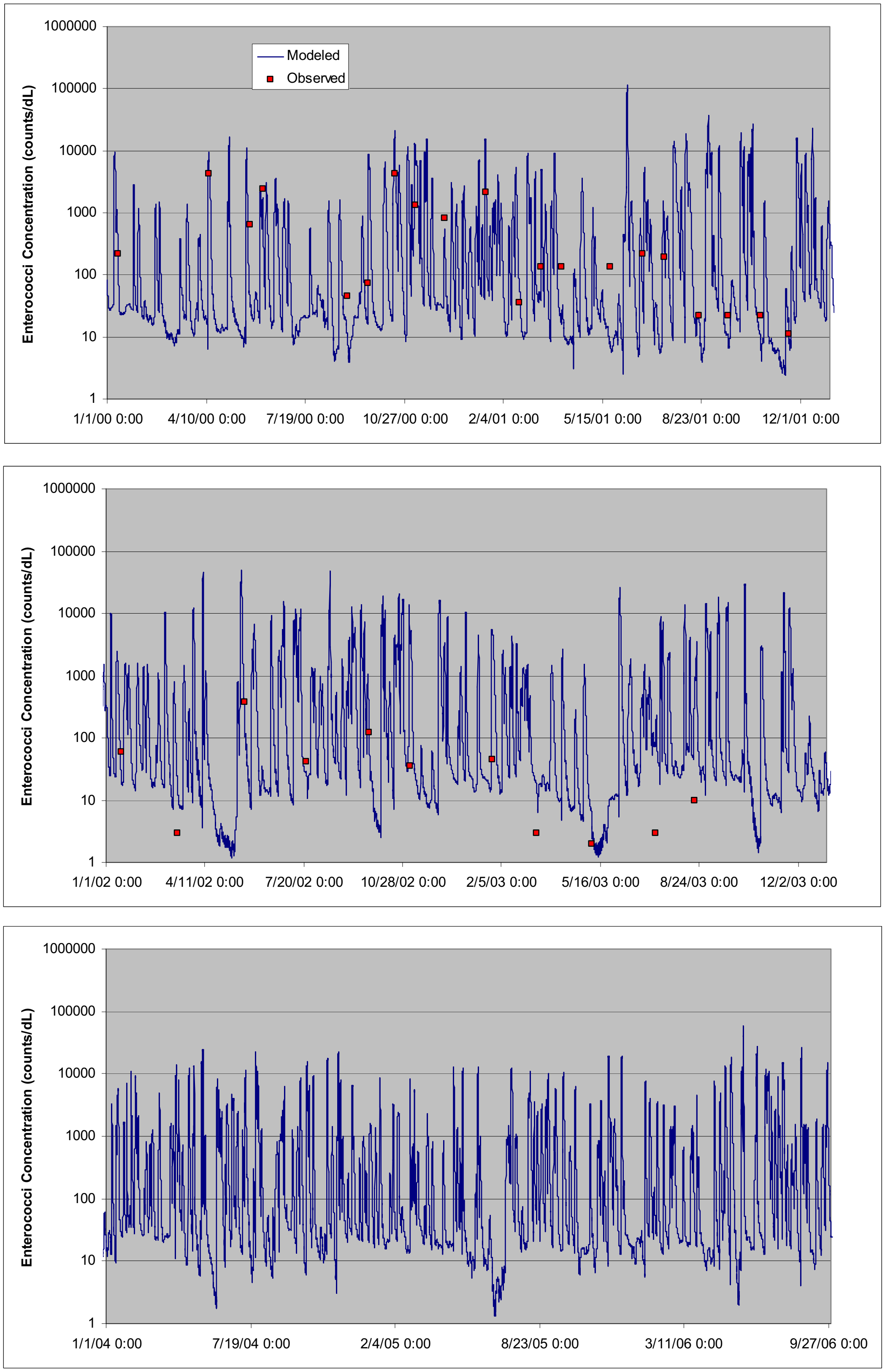


Figure 4-18 Enterococci Levels at Station 16478 (Reach L), Cowart Creek Tidal

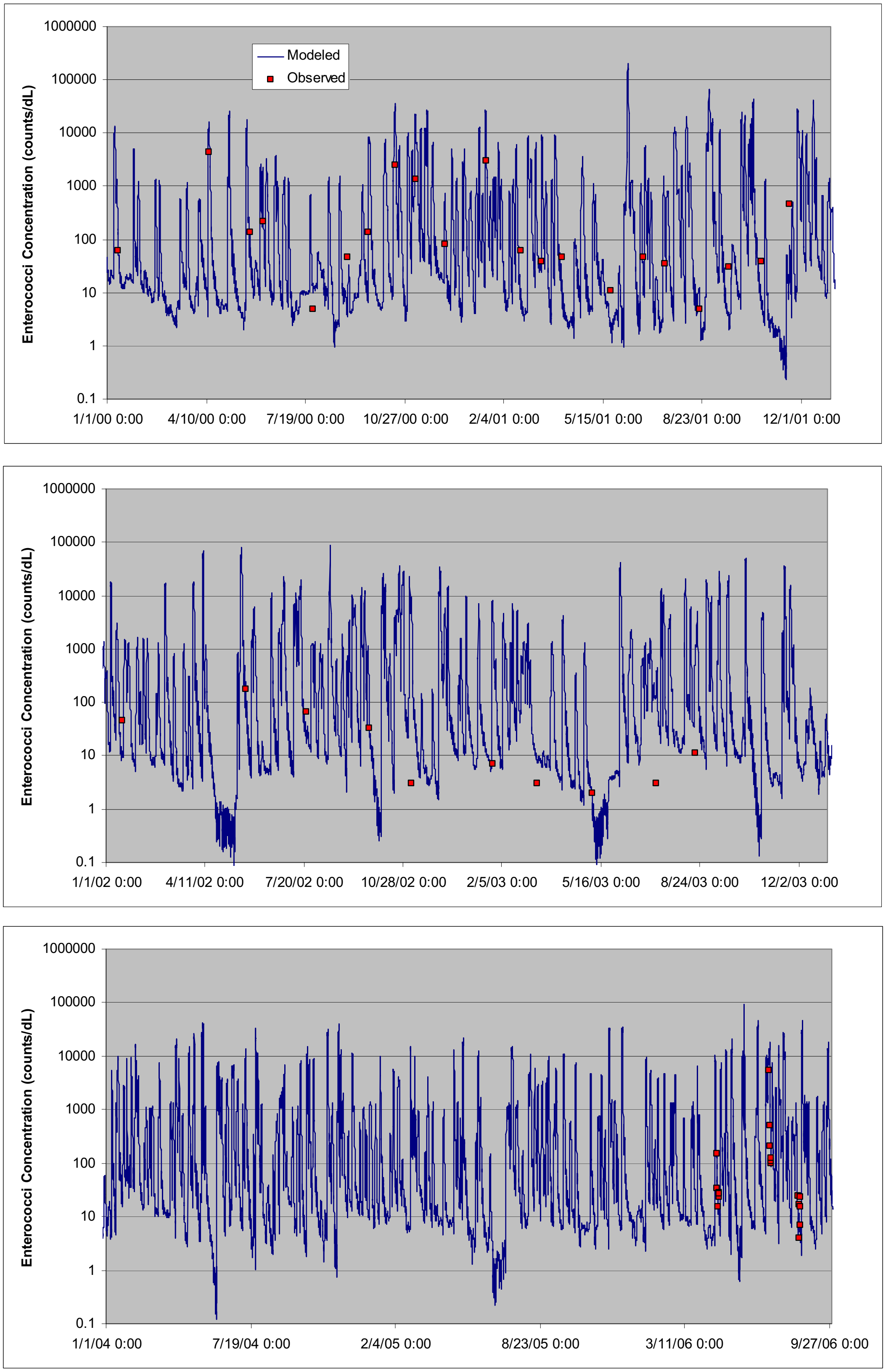


Figure 4-19 Enterococci Levels at Station 16472 (Reach M), Chigger Creek Tidal

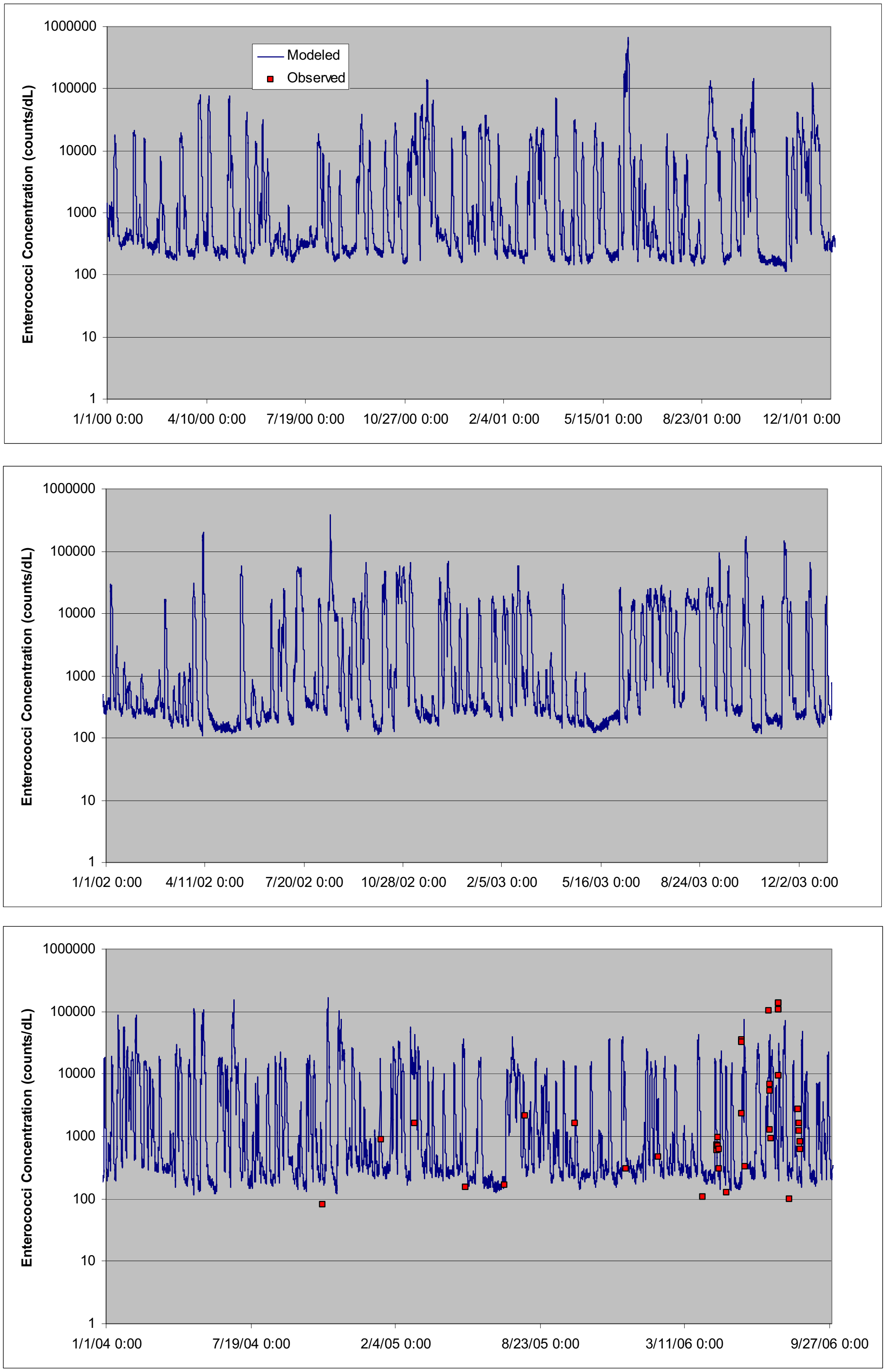
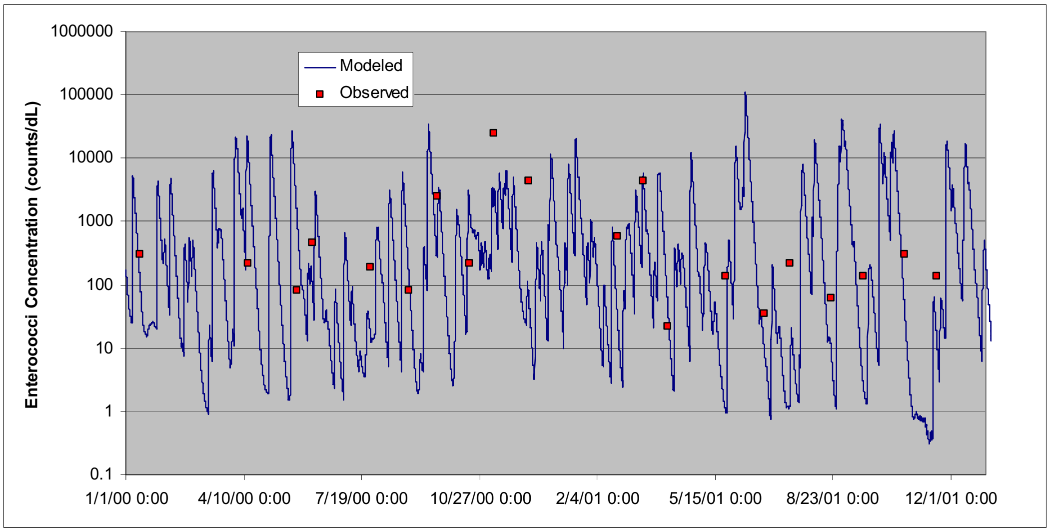
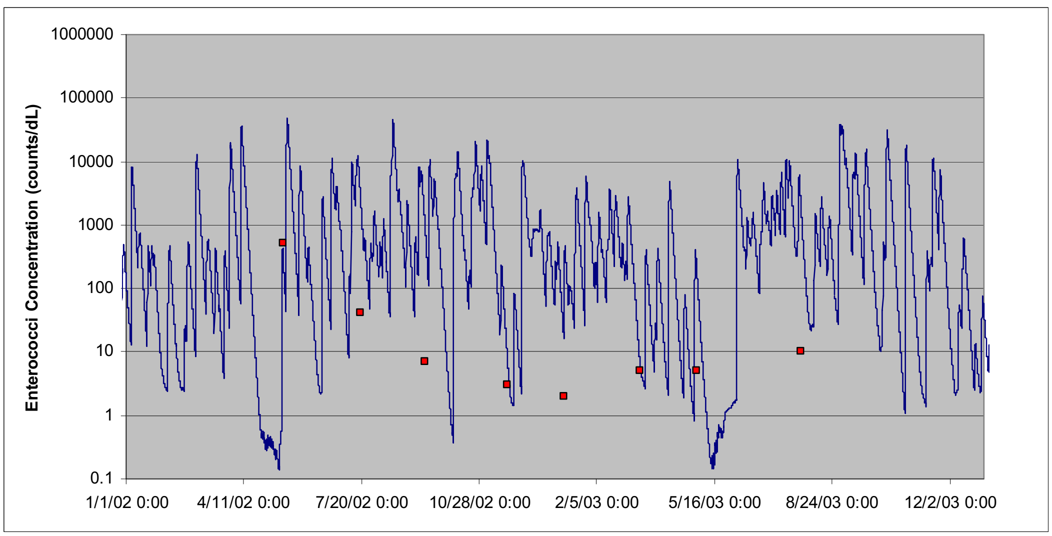


Figure 4-20 Enterococci Levels at Station 16611 (Reach N), Magnolia Creek





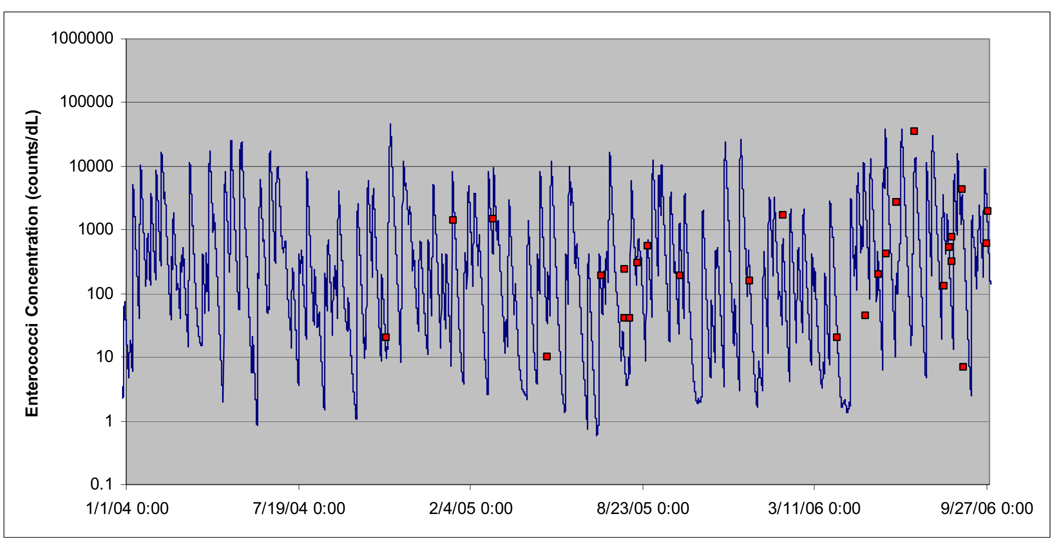


Figure 4-21 Enterococci Levels at Station 16475 (Reach P), Robinson Bayou

4.5.2 Critical Conditions and TMDL Calculation for the Tidal Segments

To calculate the WLA and LA components of the TMDLs for the tidal streams, steps similar to those used for the LDC method are applied. As previously stated, the pollutant load allocation for permitted (point) sources is defined by the WLA. A point source can be either a wastewater (continuous) or storm water permitted discharge. Storm water point sources are typically associated with urban and industrialized areas, and recent USEPA guidance includes NPDES-permitted storm water discharges as point source discharges and, therefore, part of the WLA.

WLAs may be set to zero for watersheds with no existing or planned continuous permitted point sources. For watersheds with permitted point sources, WLAs may be derived from TPDES permit limits. A WLA may be calculated for each active TPDES wastewater discharger using a mass balance approach as shown in the equation below. The permitted flow rate used for each point source discharge and the water quality criterion concentration are used to estimate the WLA for each wastewater facility. Through TPDES permits WLAs for WWTPs are constant across all flow conditions and ensure that WQS will be attained (USEPA 2007). All WLA values for each TPDES wastewater discharger are then summed to represent the total WLA for the watershed.

*WLA = criterion * permitted flow * unit conversion factor (#/day)*

Where: criterion = 35/dL (Enterococci)

flow (mgd) = permitted flow

*unit conversion factor = 37,854,120-dL/day*mgd*

Storm water runoff can contribute both permitted and non-permitted sources of bacteria which must also be accounted for in the TMDL allocations. To be consistent with the LDC method, any storm water runoff originating from the area of a watershed under the jurisdiction of an MS4 permit is considered a point source contribution and is therefore included as part of the WLA calculation. As such the WLA will be split into WWTP WLA and MS4 WLA. Again to be consistent with the LDC method, the estimated loading from storm water runoff within each drainage area is separated into storm water loading from MS4 areas and storm water loading from non-permitted areas. This is done by using the percentage of each drainage area covered by the MS4 permit. An explicit MOS of 5 percent of the criterion is also included in the TMDL calculation. The storm water loading from non-permitted areas is considered the LA. Therefore, another way of expressing the LA from non-permitted storm water runoff is calculated as the TMDL minus the margin of safety minus the WLA (sum of WWTP and MS4).

Percent reduction goals were calculated by changing the loads in the tidal prism model until all the reaches have concentrations lower than or equal to the 35 counts/dL criterion for Enterococci. It is noted that the loads coming from upstream freshwater segments, addressed with LDCs, were assumed to be in compliance with the 126 counts/dL criterion for *E. coli* or 42 counts/dL for Enterococci if the 0.34 ratio is used.

The fact that most the WQM stations on Clear Creek Tidal and Robinson Bayou exceed the geometric mean standard for Enterococci indicates that evaluating mean source inputs (*i.e.*, under mean conditions) via a mass balance approach will be sufficient to ascribe load allocations. The daily load estimates for the simulation period were reduced by a constant such that the geometric mean standard was met (*i.e.*, 35/dL). The percent reduction was computed as follows:

$$\%R = \left(1 - \frac{1}{C_R}\right) \cdot 100 \qquad (8)$$

where C_R is the constant by which the daily Enterococci loadings are reduced and %R is the associated percent reduction in the Enterococci levels.

CHAPTER 5
TMDL CALCULATIONS

5.1 Results of TMDL Calculations

The calculations and results of the TMDLs for the 303(d) listed water bodies in the Clear Creek Watershed are provided in Section 5. The bacteria load allocations derived from the two different technical approaches used for freshwater and tidal water bodies are discussed together in each subsection of Section 5 below.

5.2 Estimated Loading and Critical Conditions

USEPA regulations at 40 CFR 130.7(c) (1) require TMDLs to take into account critical conditions for stream flow, loading, and all applicable water quality standards. To accomplish this, available instream WQM data were evaluated with respect to stream flows, tidal flux, conductivity, and the magnitude of water quality criteria exceedance. TMDLs are derived for specific indicator bacteria in 303(d) listed water bodies at specific WQM stations based on LDCs for freshwater streams and a mass balance calculation using a tidal prism for tidal streams.

To calculate the bacteria load at the criterion for freshwater segments, the flow rate at each flow exceedance percentile is multiplied by a unit conversion factor (*24,465,755 dL/ft3 * seconds/day*) and the criterion specific to each indicator bacteria. This calculation produces the maximum bacteria load in the stream without exceeding the instantaneous standard over the range of flow conditions. In the case of fecal coliform or *E. coli* for freshwater streams, the allowable geometric mean concentrations defined in the SWQS are the TMDL. Fecal coliform and *E. coli* are plotted versus flow exceedance percentiles as a LDC. The x-axis indicates the flow exceedance percentile, while the y-axis is expressed in terms of a bacteria load.

For the tidal streams, the maximum allowable load at the crition is calculated as the sum of the input loads that result in attainment of the water quality criteria for all the reaches in the tidal prism model.

To estimate existing loading, bacteria observations from 2000 to 2006 are paired with the flows measured or estimated in that segment on the same date. Pollutant loads are then calculated by multiplying the measured bacteria concentration by the flow rate and a unit conversion factor of *24,465,755 dL/ft3 * seconds/day*. The associated flow exceedance percentile is then matched with the measured flow from the tables provided in Appendix G. The observed bacteria loads are then added to the LDC plot as points. These points represent individual ambient water quality samples of bacteria. Points above the LDC indicate the bacteria instantaneous standard was exceeded at the time of sampling. Conversely, points under the LDC indicate the sample met the criterion.

The LDC approach recognizes that the assimilative capacity of a waterbody depends on the flow, and that maximum allowable loading varies with flow condition. Existing loading, and load reductions required to meet the TMDL water quality target can also be calculated under different flow conditions. For the tidal segments existing loading is calculated as the average daily input load (permitted and non-permitted runoff and WWTFs) for the simulation period

(1/01/2000 to 9/30/2006). The difference between existing loading and the water quality target is used to calculate the loading reductions required.

Table 5-1 presents the percent reduction goals necessary to achieve the contact recreation standard for select indicator bacteria for each 303(d) listed freshwater stream in the study area, as derived from the LDCs. Percent reduction goals for each 303(d) listed freshwater stream in the study area are based on data analysis using the geometric mean criterion since it is anticipated that achieving the geometric mean over an extended period of time will likely ensure that the single sample criterion will also be achieved. Because the geometric mean criterion is considered more stringent, the TMDL for each of these sampling locations is determined by selecting the highest percent reduction goal calculated for the geometric mean criterion. Attainment of contact recreation standard in response to TMDL implementation will be based on results measured at each of the sampling locations listed in Table 5-1.

The sampling location requiring the highest percent reduction based on the geometric mean criterion was chosen for each freshwater stream. The most-downstream stations were not always found to require the highest percent reductions. Sampling locations located in the upstream portions of Clear Creek above Tidal, Cowart Creek, and Mud Gully were found to require higher percent reductions than the most-downstream stations.

The TMDL percent reduction goals for Clear Creek above Tidal, Cowart Creek, Chigger Creek, Mary's Creek/North Fork Mary's Creek, and Hickory Slough will be based on the geometric mean criterion for E. coli. The TMDL percent reduction goals for Mud Gully and Turkey Creek will be based on the geometric mean criterion for fecal coliform. This is because Mud Gully and Turkey Creek both have limited E. coli data and both were included on the 303(d) list for exceedances of the fecal coliform criterion.

The highest percent reductions for each stream are found in Table 5-1. Appendix A summarizes the methodology used to calculate percent reduction goals for sampling locations using the geometric mean criterion. The pollutant load allocations and percent reduction goals for each flow regime are summarized in Section 5.8. The highest percent reduction goals for each segment were typically found to occur in the flow regime with the highest flows (0–20th percentile). The percent reduction goals range from 67 to 96 percent. However, the overall percent reduction goals range from 25 to 91 percent.

Table 5-1 TMDL Percent Reductions Required to Meet Contact Recreation Standards for Freshwater Segments in the Clear Creek Watershed

Segment	Sampling Location	Stream Name	Indicator Bacteria Species	Highest Reduction		Overall Reduction
				Percent Reduction	Corresponding Flow Regime	
1101B	16493	Chigger Creek	*E. coli*	86%	Highest flows	54%
1102	14229	Clear Creek above Tidal	*E. coli*	83%[a]	Highest flows	37%[a]
1102A	16477	Cowart Creek	*E. coli*	89%[b]	Highest flows	54%[b]
1102B	16473	Mary's Creek/North Fork Mary's Creek	*E. coli*	85%	Highest flows	48%
1102C	17068	Hickory Slough	*E. coli*	67%	Highest flows	25%
1102D	17069	Turkey Creek	Fecal coliform	96%	Highest flows	91%
1102E	17071	Mud Gully	Fecal coliform	91%[c]	Highest flows	86%[c]

a = highest percent reduction was calculated based on WQ data at upstream WQM station 17076
b = highest percent reduction was calculated based on WQ data at upstream WQM station 11426
c = highest percent reduction was calculated based on WQ data at upstream WQM station 17070

The LDCs for each impaired segment are shown in Figures 5-1 through 5-7.

The LDC for Chigger Creek segment 1101B (Figure 5-1) is based on *E. coli* concentrations at WQM station 16493 (Chigger Creek at FM 528 Bridge). The percent reduction goal is calculated so that the geometric mean for *E. coli* is met under all flow conditions. The LDC indicates that *E. coli* levels exceed the instantaneous water quality criterion during mid-range and high flow conditions. This analysis also indicates that most of the *E. coli* observations in the highest flow range were wet weather influenced.

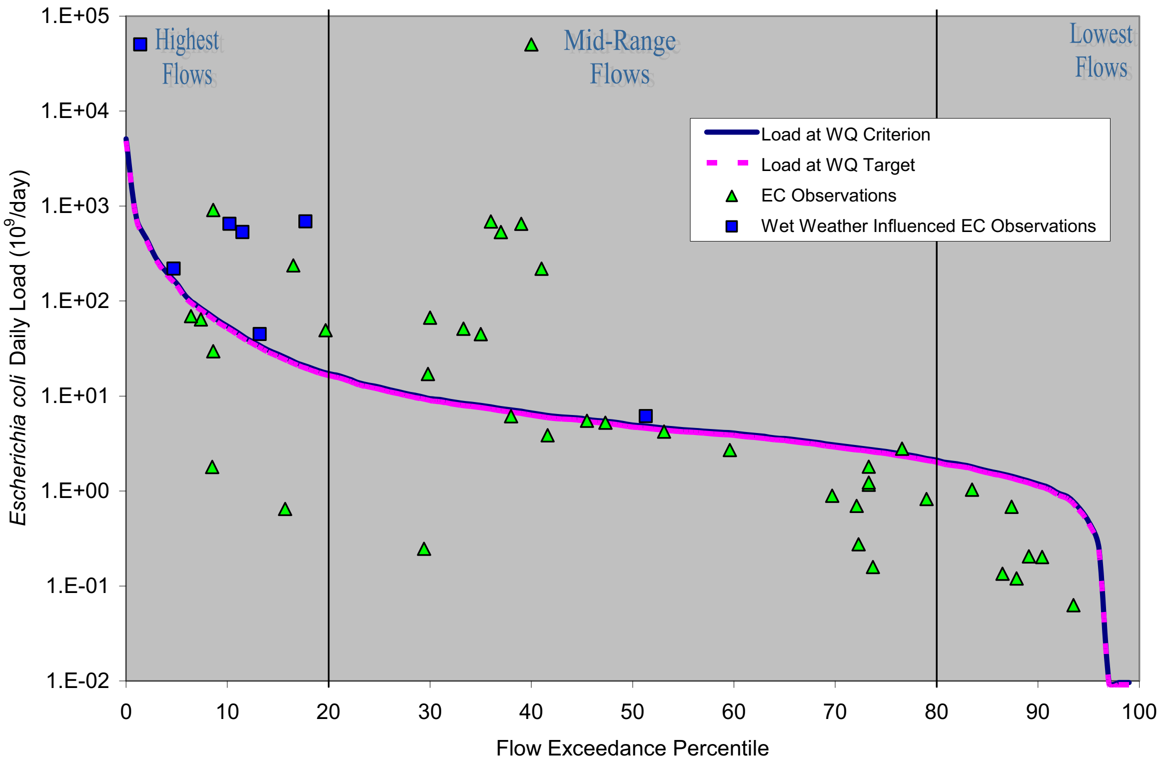


Figure 5-1 Load Duration Curve for *E. coli* in Chigger Creek (1101B)

The LDC for Clear Creek above Tidal segment 1102 (Figure 5-2) is based on *E. coli* concentrations at WQM station 14229 (Clear Creek at Dixie Farm Road). Achieving the percent reduction goal derived from the geometric mean criterion for *E. coli* is conservative and will ensure that the instantaneous criterion will also be met. The LDC indicates that *E. coli* levels occasionally exceed the instantaneous water quality criterion under most flow conditions. This analysis also indicates that wet weather influenced *E. coli* observations exceeded under all flow conditions.

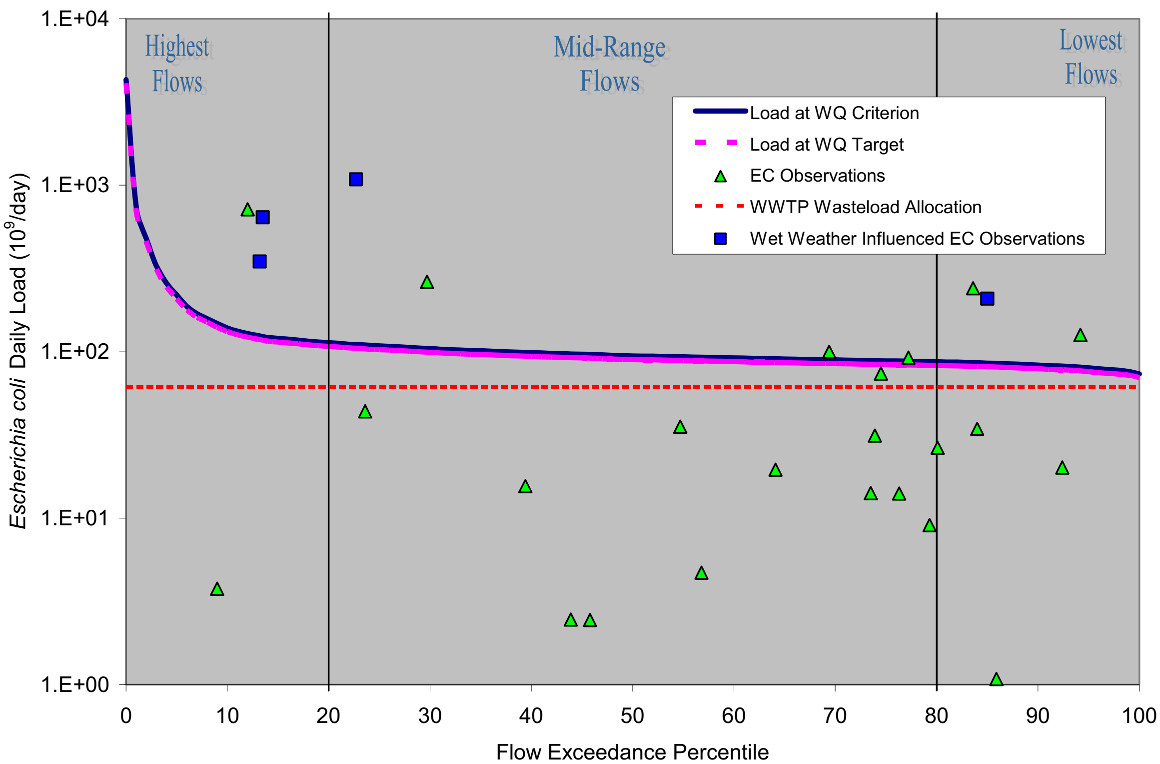


Figure 5-2 Load Duration Curve for *E. coli* in Clear Creek above Tidal (1102)

The LDC for Cowart Creek segment 1102A (Figure 5-3) is based on *E. coli* concentrations at WQM station 16477 (Cowart Creek at Sunset Drive). The percent reduction goal is calculated so that the geometric mean criterion for contact recreation is met under all flow conditions. The LDC indicates that *E. coli* levels exceed the instantaneous water quality criterion primarily during the highest flow conditions, indicative of storm water sources. This is also demonstrated by the wet weather influenced *E. coli* samples occurring during the highest flow conditions.

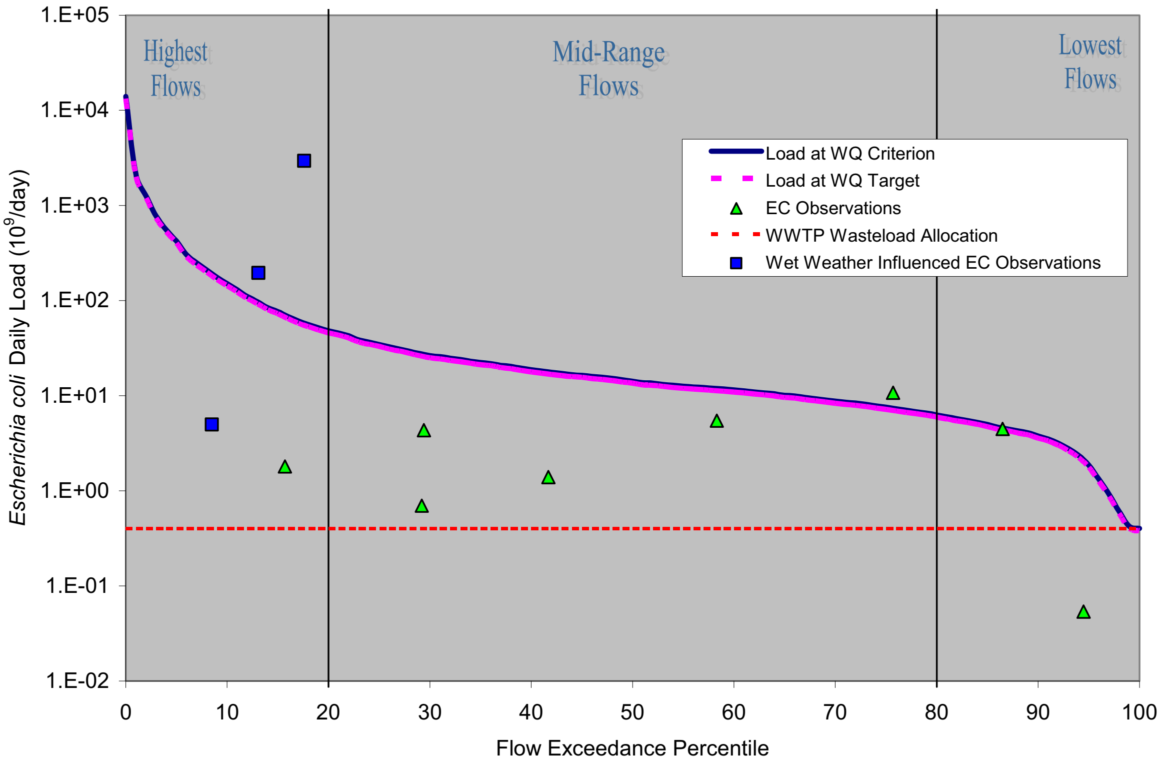


Figure 5-3 Load Duration Curve for *E. coli* in Cowart Creek (1102A)

The LDC for Mary's Creek segment 1102B (Figure 5-4) is based on *E. coli* concentrations at WQM station 16473 (Mary's Creek at Mary's Crossing). The percent reduction goal is calculated so that the geometric mean criterion for contact recreation is met under all flow conditions. The LDC indicates that *E. coli* levels exceed the instantaneous water quality criteria during high and mid-range flow conditions. Wet weather-influenced samples exceeded the criterion mainly during higher flow conditions. This LDC presents some atypical characteristics, where the WWTFs provide essentially all the flow under low flow conditions (greater than the 90th percentile flow exceedance value). Under these conditions the stream is considered effluent dominated and it is assumed that the WWTFs are compliant with permit requirements and, therefore, their discharges will not result in criteria exceedances.

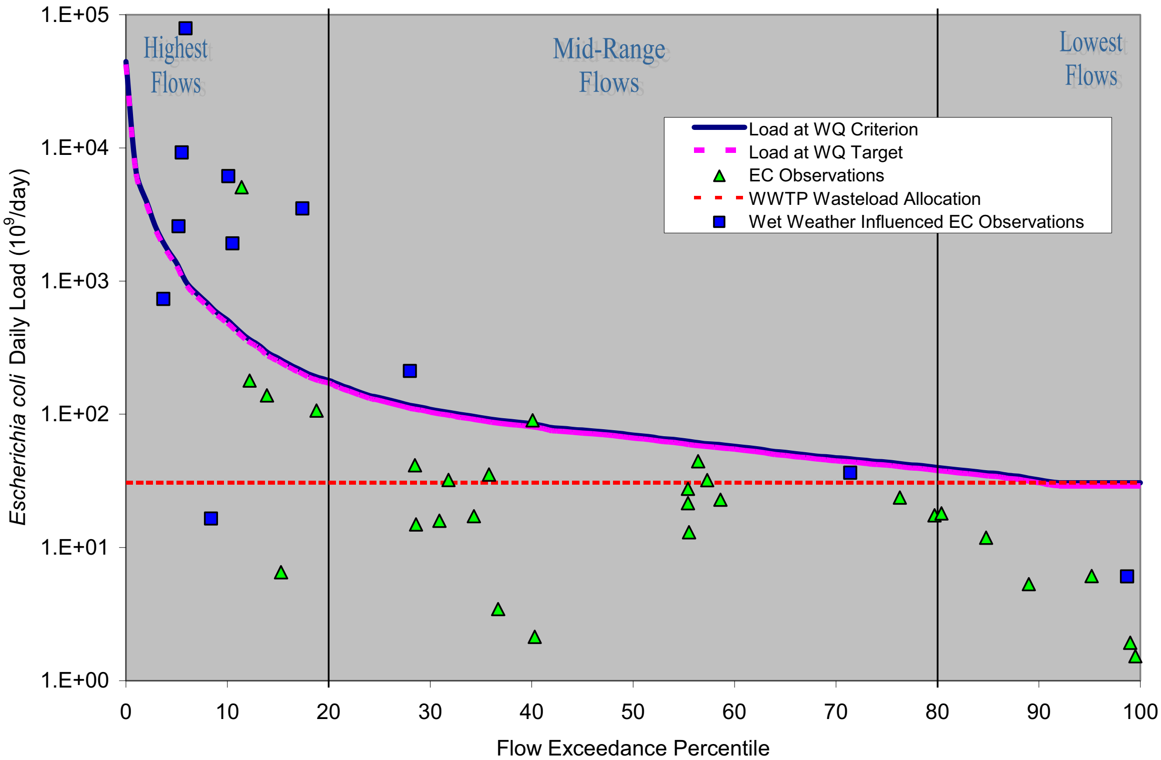


Figure 5-4 Load Duration Curve for *E. coli* in Mary's Creek (1102B)

The LDC for Hickory Slough segment 1102C (Figure 5-5) is based on *E. coli* concentrations at WQM station 17068 (Hickory Slough at Robinson Drive). The percent reduction goal is calculated so that the geometric mean criterion for contact recreation is met under all flow conditions. The LDC indicates that *E. coli* levels exceed the instantaneous water quality criterion during all flow conditions. Wet weather-influenced bacteria samples were exceeded mainly during higher flow conditions.

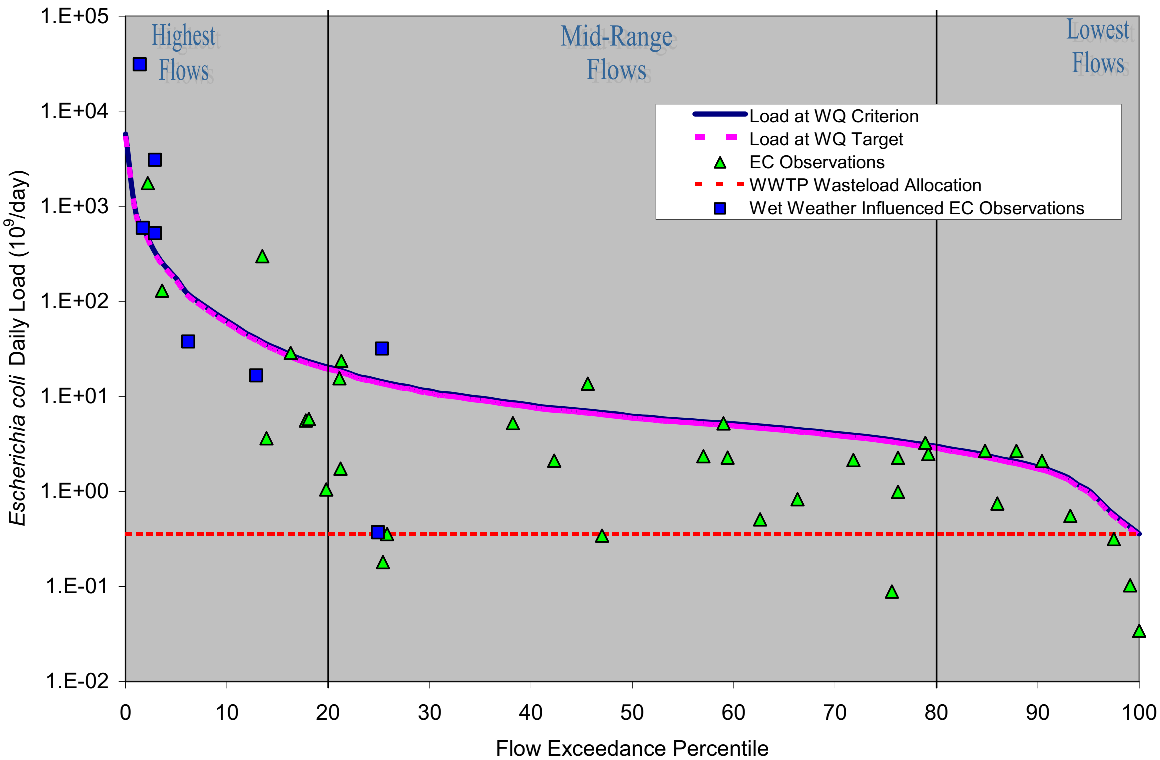


Figure 5-5 Load Duration Curve for *E. coli* in Hickory Slough (1102C)

The LDC for Turkey Creek segment 1102D (Figure 5-6) is based on fecal coliform concentrations at WQM station 17069 (Turkey Creek at Dixie Farm Road). The percent reduction goal is calculated so that the geometric mean criterion for contact recreation is met under all flow conditions. The LDC indicates that fecal coliform levels sometimes exceed the instantaneous water quality criterion during mid-ranged flow conditions. This stream is also effluent-dominated under extreme low flow conditions, above the 91st percentile flow exceedance value. It is assumed the WWTF is compliant with permit requirements and, therefore, its discharge will not result in WQS exceedances.

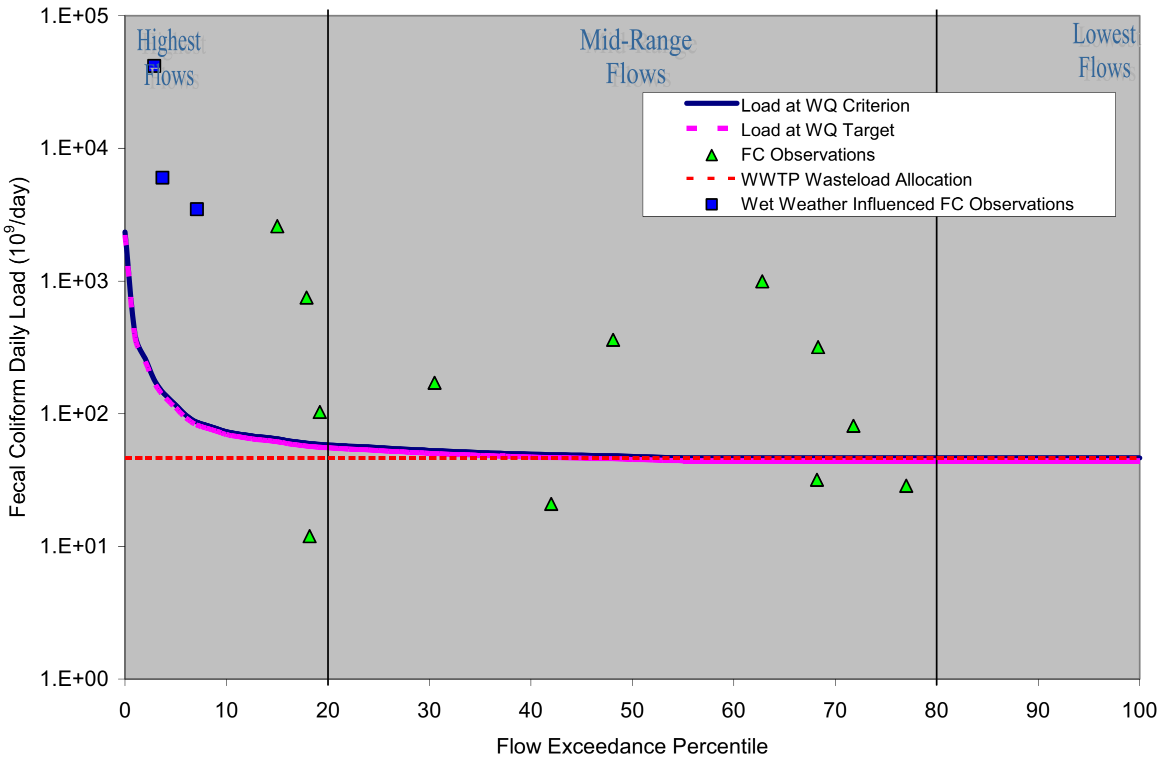


Figure 5-6 Load Duration Curve for Fecal Coliform in Turkey Creek (1102D)

The LDC for Mud Gully segment 1102E (Figure 5-7) is based on fecal coliform concentrations at WQM station 17071 (Mud Gully at Dixie Farm Road). The percent reduction goal is calculated so that the geometric mean criterion for contact recreation is met under all flow conditions. The LDC indicates that fecal coliform levels sometimes exceed the instantaneous water quality criterion during all flow conditions. Wet weather influenced bacteria samples exceeded mainly during higher flow conditions. This stream is effluent-dominated above the 96th percentile flow exceedance value. It is assumed the WWTF is compliant with permit requirements and, therefore, its discharge will not result in WQS exceedances.

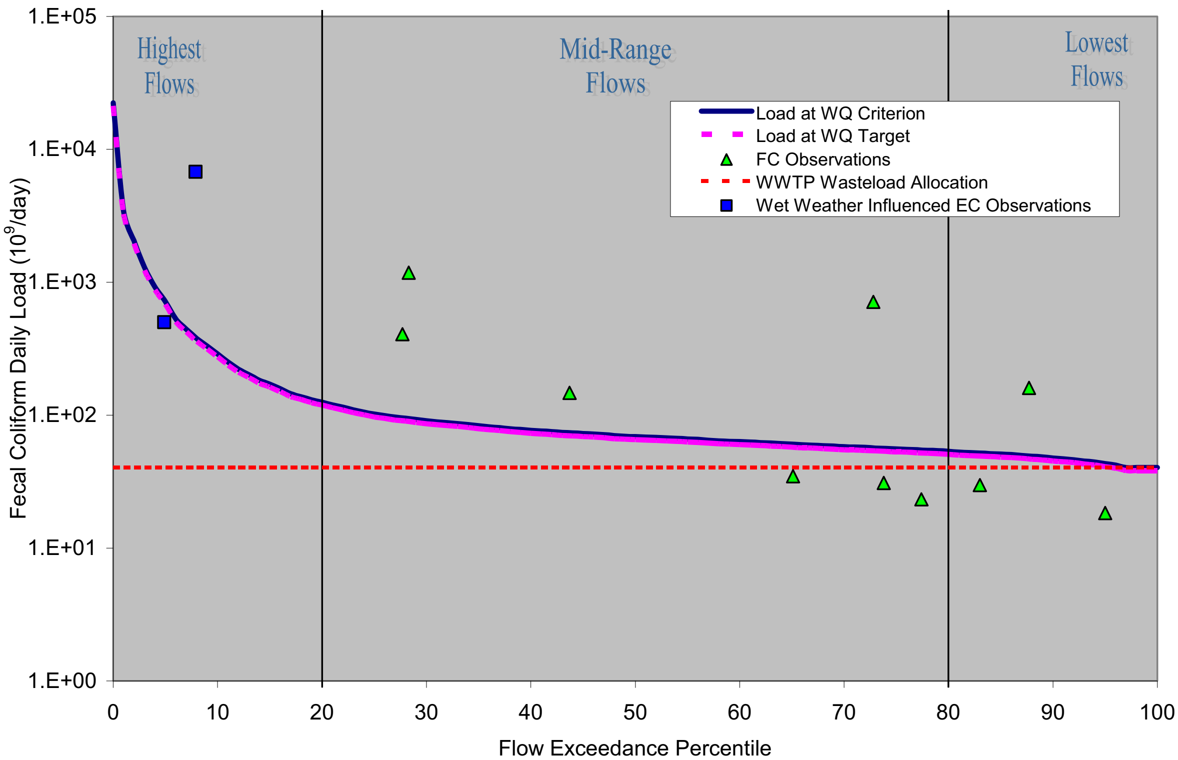


Figure 5-7 Load Duration Curve for Fecal Coliform in Mud Gully (1102E)

Existing Enterococci loads to the tidal segments are summarized in Table 5-2. The estimated existing loads are calculated as the sum of runoff, tributary, and WWTF loads to the various model reaches. To avoid duplication, bacterial indicator loads to Segment 1101 do not include the loads from its tributaries included in the table.

Table 5-2 Estimated Existing Enterococci Loads to Tidal Segments

Segment	Receiving Stream	Enterococci Load (counts/day)
1101	Clear Creek Tidal (Reaches A through K, Tributaries A through E, and TribOne)	1.86E+13
	Magnolia Creek (Reach N and Magnolia Creek above Tidal)	2.73E+12
1102A	Cowart Creek (Reach L)	8.87E+11
1101B	Chigger Creek (Reach M)	9.94E+11
1101D	Robinson Bayou (Reaches O and P and Robinson Bayou above Tidal	8.98E+11

The percent reduction goals that are required to meet the standard for contact recreation in Clear Creek Tidal and its major tributaries are illustrated in Figures 5-8 and 5-9. The required load reductions were calculated at the end of the reach containing the sampling location, and the load reductions for the segment are derived from the reach requiring the greatest load reductions. From the variety of pollutant reduction scenarios for Clear Creek Tidal displayed in Figure 5-8, it is apparent that the loading upstream of station 11448 (Reach B) requires a much larger reduction than the remaining length of the main stem. Consequently, the scenario "Final" in Figure 5-8 recommends a 97 percent reduction for reaches A and B and a 45 percent reduction goal for the remaining downstream reaches of Clear Creek Tidal. Required load reductions ranged from 28 percent in Chigger Creek (Reach M) to 97 percent in Magnolia Creek Table 5-3.

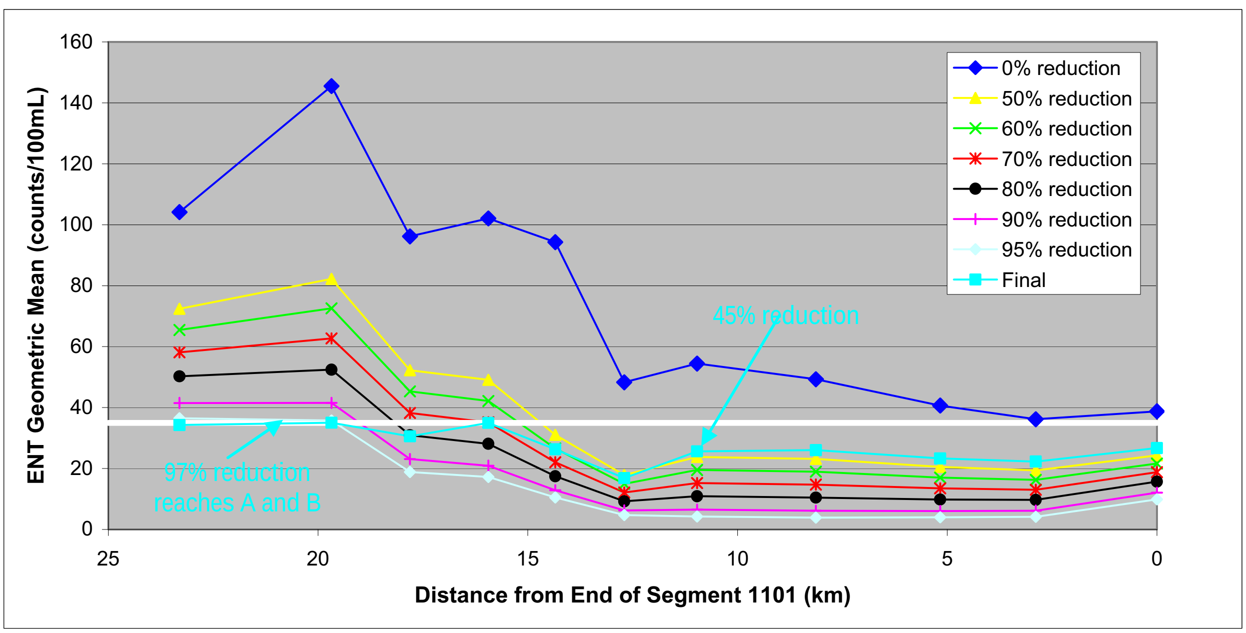


Figure 5-8 Clear Creek Tidal Contact Recreation Standards Attainment – Geometric Mean Criterion

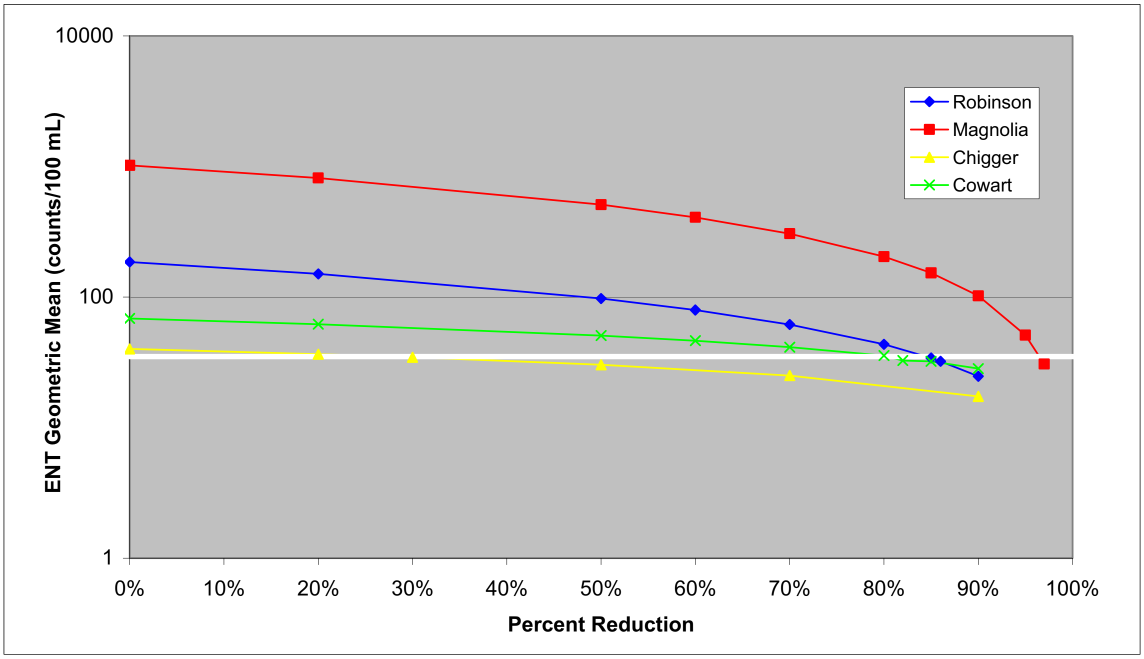


Figure 5-9 Major Tributaries to Clear Creek Tidal Contact Recreation Standards Attainment – Geometric Mean Criterion

Table 5-3 TMDL Percent Reductions Required to Meet Contact Recreation Standards for Tidal Segments in the Clear Creek Watershed

Segment	Sampling Location	Stream Name	Indicator Bacteria Species	Percent Reduction Required
1101	16572	Clear Creek Tidal (Reaches A through K, Tributaries A through E, and TribOne)[a]	Enterococci	49%[b]
	16611	Magnolia Creek (Reach N and Magnolia Creek above Tidal)	Enterococci	97%
1102A	11425	Cowart Creek (Reach L) [a]	Enterococci	82%
1101B	16472	Chigger Creek (Reach M) [a]	Enterococci	28%
1101D	16475	Robinson Bayou (Reaches O and P and Robinson Bayou above Tidal)	Enterococci	86%

[a] *The reductions are calculated assuming that the upstream freshwater segment (addressed using LDC) meet the criterion for E. coli (126 counts/100dL). This concentration was multiplied by the 0.34 ENT/EC ratio to obtain incoming Enterococci concentrations (42 counts/dL)*

[b] *Corresponds to a 97% reduction in loading upstream of station 11448 and 45% thereafter.*

5.3 Wasteload Allocation

TPDES-permitted facilities are allocated a daily wasteload calculated as their permitted discharge flow rate multiplied by the instream geometric mean water quality criterion. In other words, the facilities are required to meet instream criteria at their points of discharge. Table 5-4 summarizes the WLA for the TPDES-permitted facilities within the Study Area. The WWTFs will not be subject to all listed indicator bacteria. The WLA for each facility (WLA_{WWTF}) is derived from the following equation:

*WLA_{WWTF} = criterion * flow * unit conversion factor (#/day)*

Where:

criterion = 35, 200, and 126 counts/dL for Enterococci, fecal coliform, and E. coli respectively

flow (10^6 gal/day) = permitted flow

unit conversion factor = 37,854,120-10^6gal/day

When multiple TPDES facilities occur within a watershed, loads from individual WWTFs are summed and the total load for continuous point sources is included as part of the WLA_{WWTF} component of the TMDL calculation for the corresponding segment. When there are no TPDES WWTFs discharging into the contributing watershed of a WQM station, then WWTF WLA is zero. Compliance with the WLA_{WWTF} will be achieved by adhering to the fecal coliform discharge limits and disinfection requirements of TPDES permits.

Storm water discharges from MS4 areas are considered permitted point sources. Therefore the WLA calculations must also include an allocation for permitted storm water discharges. Given the limited amount of data available and the complexities associated with simulating rainfall runoff and the variability of storm water loading a simplified approach for estimating the WLA_{MS4} areas was used in the development of these TMDLs. For both the LDC and tidal prism method the percentage of each watershed that is under a TPDES MS4 permit is used to estimate the amount of the overall runoff load that should be dedicated as the permitted storm water contribution in the WLA_{MS4} component of the TMDL. The difference between the total storm water runoff load and the portion allocated to WLA_{MS4} constitutes the LA component of the TMDL (direct nonpoint runoff).

Table 5-4 Wasteload Allocations for TPDES-Permitted Facilities

Receiving Water	TPDES Number	Outfall	NPDES Number	Facility Name	Final Permitted Flow (MGD)	Fecal coliform	*E. coli*	Enterococci
Clear Creek Tidal (1101)	10520-001	001	TX0024589	City of Webster	3.30	2.50E+10	1.57E+10	4.37E+09
	10526-001	001	TX0023833	City of Nassau Bay	1.33	1.01E+10	6.34E+09	1.76E+09
	10526-001	002	TX0023833	City of Nassau Bay	1.33[a]	0[b]	0[b]	0[b]
	10568-003	001	TX0071447	City of League City	0.66	5.00E+09	3.15E+09	8.74E+08
	10568-005	001	TX0085618	City of League City	12.0	9.08E+10	5.72E+10	1.59E+10
	11571-001	001	TX0069728	Gulf Coast Waste Disposal Authority	9.25	7.00E+10	4.41E+10	1.23E+10
Clear Creek above Tidal (1102)	10134-002	001	TX0032735	City of Pearland	4.5	3.41E+10	2.15E+10	
	10134-008	001	TX0117501	City of Pearland	2.00	1.51E+10	9.54E+09	
	10134-010	001	TX0032743	City of Pearland	2.50	1.89E+10	1.19E+10	
	10134-010	002	TX0032743	City of Pearland	2.00	1.51E+10	9.54E+09	
	12295-001	001	TX0085383	City of Pearland	0.95	7.19E+09	4.53E+09	
	12939-001	001	TX0095842	Harris County WCID 89	0.95	7.19E+09	4.53E+09	
	13864-001	001	TX0119750	Fresno Manufacturing LLC	0.0084	6.36E+07	4.01E+07	
Cowart Creek (1102A)	12822-001	001	TX0094226	Walker Water Works Inc.	0.035	2.65E+08	1.67E+08	
	13865-001	001	TX0117447	Forestaire Estates	0.049	3.71E+08	2.34E+08	
Mary's Creek (1102B)	10134-007	001	TX0116581	City of Pearland	4.0	3.03E+10	1.91E+10	
	12332-001	001	TX0086118	Brazoria County Mud No. 1	2.4	1.82E+10	1.14E+10	
	12680-001	001	TX0092614	H & R Realty Investments LLC	0.012	9.08E+07	5.72E+07	
Hickory Slough (1102C)	12849-001	001	TX0094463	CMH Parks Inc.	0.075	5.68E+08	3.58E+08	
Turkey Creek (1102D)	10495-075	001	TX0063070	City of Houston	6.14	4.65E+10	2.93E+10	
Mud Gully (1102E)	10495-079	001	TX0035009	City of Houston	5.33	4.04E+10	2.54E+10	

[a] *The total of both outfalls combined cannot exceed 1.33 MGD*
[b] *Total allocated load included in outfall 01 (previous row)*

For the freshwater streams the flow dependent calculations for the MS4 portion of the WLA were derived using LDC and the MS4 percentages provided in Table 3-5. Likewise for the tidal segments, any runoff occurring within the boundaries of an MS4 permit will be considered a point source contribution and will be included in the WLA calculation. The allowable load from all storm water runoff ($LA_{Stormwater}$) will first be calculated as the maximum allowable load (TMDL) minus the margin of safety minus the load allocated to WWTFs (WLA_{WWTF}).. The resulting load ($LA_{Stormwater}$) will be split into WLA_{MS4} component (permitted storm water) and LA component (non-permitted storm water) using the percentages of the drainage areas within the tidal prism model covered by MS4 permits provided in Table 5-5.

Table 5-5 Percentage of Permitted Storm Water (MS4) in each Tidal Drainage Area

Segment	Receiving Stream	TPDES Number	Total Area (acres)	Area under Municipal Separate Storm Sewer System (MS4) (acres)	Percent of Watershed under (MS4)
1101	Clear Creek Tidal (Reaches A through K, Tributaries A through E, and TribOne)	WQ0004685000	19,961	18,456	92%
	Magnolia Creek (Reach N and Magnolia Creek above Tidal)	WQ0004685000	1,895	1,895	100%
1102A	Cowart Creek (Reach L)	WQ0004685000	865	865	100%
1101B	Chigger Creek (Reach M)	WQ0004685000	1,625	1,625	100%
1101D	Robinson Bayou (Reaches O and P and Robinson Bayou above Tidal)	WQ0004685000	3,481	2,281	66%

5.4 Load Allocation

As discussed in Section 3, non-permitted sources of bacteria loading to the receiving streams of each waterbody emanate from a number of different sources. The data analysis demonstrate that exceedances at the WQM stations are the result of a variety of nonpoint source loading. The LAs for each stream segment are calculated as the difference between the TMDL, MOS, WLA, and WLA for MS4 as follows:

$$LA = TMDL - \sum WLA_{WWTF} - \sum WLA_{MS4} - MOS$$

Where:

LA = allowable load from non-permitted sources
TMDL= total allowable load
ΣWLA_{WWTF} = sum of all WWTF loads
ΣWLA_{MS4} = sum of all MS4 loads
MOS = margin of safety

5.5 Seasonal Variability

Federal regulations (40 CFR §130.7(c)(1)) require that TMDLs account for seasonal variation in watershed conditions and pollutant loading. Seasonal variation was accounted for in these TMDLs by using more than 5 years of water quality data and by using the longest period of USGS flow records when estimating flows to develop flow exceedance percentiles.

Analysis of the available data for *E. coli* showed that about 37 percent of the stations exhibited higher geometric mean concentrations for the warmer months than the cooler months. In addition, only 3 out of 46 stations depicted statistical differences in single sample concentrations between the warmer and cooler periods. For Enterococci, a majority of the stations either did not have any data nor had inadequate data to conduct an analysis of seasonal variability. For the stations analyzed, 50 percent of the stations had higher geometric means during the warmer.

5.6 Allowance for Future Growth

Compliance with these TMDLs is based on keeping the indicator bacteria concentrations in the selected waters below the limits that were set as criteria for the individual sites. Future growth of existing or new point sources is not limited by these TMDLs as long as the sources do not cause indicator bacteria to exceed the limits. The assimilative capacity of streams increases as the amount of flow increases. Increases in flow allow for additional indicator bacteria loads if the concentrations are at or below the contact recreation criterion. The addition of any future wastewater discharge facilities will be evaluated on a case-by-case basis.

To account for the high probability that new additional flows from WWTF may occur in any of the segments, a provision for future growth was included in the TMDL calculations by estimating permitted flows to year 2050 using population projections completed by the Texas Water Development Board. A summary of the methodology used to predict waste water flow capacity based on population growth is included in Appendix O. For freshwater segments, the projected WWTF permitted flows were added to the flows from runoff to build the $TMDL_{future}$ for various flows. For the tidally influenced segments, loads calculated using the projected flows and a 35 counts/dL concentration were input in the tidal prism model along with all the other existing loads. The loads were then reduced by different percentages until the contact recreation criterion was met in all the reaches. The reduced loads were then added to calculate the assimilative capacity or $TMDL_{future}$. In both cases, the LA_{WWTF} for future population growth is the difference between the $TMDL_{future}$ and the TMDL calculated using current conditions.

5.7 Margin of Safety

Federal regulations (40 CFR §130.7(c)(1)) require that TMDLs include an MOS. The MOS is a conservative measure incorporated into the TMDL equation that accounts for the uncertainty associated with calculating the allowable pollutant loading to ensure geometric mean criterion are attained. USEPA guidance allows for use of implicit or explicit expressions of the MOS, or both. When conservative assumptions are used in development of the TMDL, or conservative factors are used in the calculations, the MOS is implicit. When a specific percentage of the TMDL is set aside to account for uncertainty, then the MOS is considered explicit.

The TMDLs for freshwater segments incorporate an explicit MOS by setting a more stringent target for indicator bacteria loads that is 5 percent lower than the geometric mean criterion. The explicit margin of safety was used because of the limited amount of data for some of the sampling locations. For contact recreation, this equates to geometric mean of 190 counts/dL and 120 counts/dL for fecal coliform and *E. coli*, respectively. The net effect of the TMDL with MOS is that the assimilative capacity or allowable pollutant loading of each waterbody is slightly reduced. The TMDLs for the freshwater streams in this report incorporate an explicit MOS by using a LDC developed using the 95 percent of the geometric mean criterion. For the tidal segments, the MOS was also explicit. But in this case, the MOS was based on allowable loading not concentration. After the tidal prism model calculated the total assimilative capacity for Enterococci (the TMDL), 5 percent of the allowable load was computed as the MOS.

5.8 TMDL Calculations

The bacteria TMDLs for the 303(d)-listed WQM stations covered in this report were derived using LDCs and the tidal prism model. A TMDL is expressed as the sum of all WLAs (point source loads), LAs (nonpoint source loads), and an appropriate MOS, which attempts to account for uncertainty concerning the relationship between effluent limitations and water quality.

This definition can be expressed by the following equation:

$$TMDL = \Sigma\, WLA + \Sigma\, LA + MOS$$

Table 5-6 summarizes the estimated maximum allowable loads of *E. coli* and fecal coliform for the freshwater segments. For the tidal stream segments, Table 5-7 summarizes the estimated maximum allowable loads of Enterococci that will ensure the contact recreation standard is met. These are calculated from the tidal prism model based on average percent reductions from total existing loading (WWTFs, runoff and tributaries) to the water body (Table 5-3). Table 5-7 includes WLA, LA, and MOS calculations. Tables 5-8 through 5-17 summarize the pollutant load allocations and percent reduction goals, for each flow regime, for freshwater segments.

Table 5-6 Fecal coliform and *E. coli* TMDL Summary Calculations for Freshwater Segments

Segment	Sampling Location	Stream Name	Indicator Bacteria Species	TMDL[a] (counts/day)	WLA_{WWTF}[c] (counts/day)	WLA_{MS4}[d] (counts/day)	LA[f] (counts/day)	MOS[g] (counts/day)	$TMDL_{Future}$[b] (counts/day)	$WLA_{WWTF-Future}$[e] (counts/day)
1101B	16493	Chigger Creek	*E. coli*	1.74E+10	NA	7.16E+09	9.37E+09	8.70E+08	1.75E+10	5.25E+07
1102	14229	Clear Creek above Tidal	*E. coli*	4.44E+10	6.16E+10	NA	0	2.22E+09	1.32E+11	8.73E+10
1102A	16477	Cowart Creek	*E. coli*	4.83E+10	4.01E+08	2.38E+10	2.17E+10	2.41E+09	4.87E+10	3.94E+08
1102B	16473	Marys Creek	*E. coli*	1.63E+11	3.06E+10	1.12E+11	1.27E+10	8.15E+09	2.27E+11	6.42E+10
1102C	17068	Hickory Slough	*E. coli*	1.99E+10	3.58E+08	1.78E+10	7.37E+08	9.97E+08	2.06E+10	7.06E+08
1102D	17069	Turkey Creek	Fecal Coliform	3.66E+10	4.65E+10	NA	0	1.83E+09	8.14E+10	4.48E+10
1102E	17071	Mud Gully	Fecal Coliform	1.45E+11	4.04E+10	8.02E+10	1.68E+10	7.23E+09	1.79E+11	3.49E+10

[a] *Sum of WWTF, WLA MS4, MOS, and LA that result in attainment of the geometric mean criterion.*
[b] *Sum of WWTF with projected permitted flows for 2050, storm water runoff, and tributary loads discharging directly to the WQ segment that result in attainment of the geometric mean criterion.*
[c] *Sum of loads from the WWTF discharging to the segment. Individual loads are calculated as permitted flow * 200 (fecal coliform) or 126 (E. coli) counts/dL*conversion factor (Table 5-4).*
[d] *WLA_{MS4} = (TMDL – MOS – WWTF WLA)*(percent of drainage area covered by MS4 permits).*
[e] *Difference between $TMDL_{Future}$ and the TMDL*
[f] *LA = TMDL – MOS –WLA_{WWTF} –WLA_{MS4}*
[g] *MOS = TMDL x 0.05*
NA= Allocation not applicable at this time. New WWTF must comply with WLA_{WWTF}.

Table 5-7 Enterococci TMDL Calculations for Tidal Segments

Segment	Stream Name	TMDL[a] (counts/day)	WLA_{WWTF}[c] (counts/day)	WLA_{MS4}[d] (counts/day)	LA[f] (counts/day)	MOS[g] (counts/day)	$TMDL_{Future}$[b] (counts/day)	$WLA_{WWTF-Future}$[e] (counts/day)
1101	Clear Creek Tidal (Reaches A through K, Tributaries A through E, and TribOne)	9.37E+12	3.43E+10	8.16E+12	7.09E+11	4.69E+11	9.39E+12	2.11E+10
	Magnolia Creek (Reach N and Magnolia Creek above Tidal)	8.19E+10	8.74E+08	7.69E+10	0	4.09E+09	1.09E+11	2.74E+10
1102A	Cowart Creek (Reach L)	1.60E+11	NA*	1.52E+11	0	7.98E+09	1.60E+11	0**
1101B	Chigger Creek (Reach M)	7.16E+11	NA*	6.80E+11	0	3.58E+10	7.16E+11	0**
1101D	Robinson Bayou (Reaches P and O and Robinson Bayou above Tidal)	1.26E+11	NA*	7.88E+10	4.06E+10	6.28E+09	1.80E+11	5.44E+10

[a] Sum of WWTF, storm water runoff, and tributary loads discharging directly to the WQ segment that result in attainment of the geometric mean criterion

[b] Sum of WWTF with projected permitted flows for 2050, storm water runoff, and tributary loads discharging directly to the WQ segment that result in attainment of the geometric mean criterion

*[c] Sum of loads from the WWTF discharging to the segment. Individual loads are calculated as permitted flow*35 counts/dL*conversion factor (Table 5-4)*

[d] $WLA_{MS4} = (TMDL - MOS - WLA_{WWTF})$ *percent of drainage area covered by MS4 permits

[e] *Difference between* $TMDL_{Future}$ *and the TMDL*

[f] $LA = TMDL - MOS - WLA_{WWTF} - WLA_{MS4}$

[g] $MOS = 0.05 * TMDL$

* *NA – Allocation not applicable at this time. New WWTF must comply with* WLA_{WWTF}

** *Growth for this watershed is addressed in the non-tidal portion (LDC)*

Table 5-8 *E. coli* TMDL Calculations for Chigger Creek (1101B)

Station 16493			
Flow Regime %	**0-20%**	**20-80%**	**80-100%**
Median Flow, Q (cfs)	5.6	0.51	0.12
Target, 0.95*C (counts/dL)	120	120	120
Existing Load (10^9 org/day)	1.15E+02	2.78E+00	1.48E-01
TMDL (Q*C) (10^9 org/day)	1.74E+01	1.58E+00	3.78E-01
MOS (Q*C*0.05) (10^9 org/day)	8.70E-01	7.91E-02	1.89E-02
Allowable Load at Water Quality Target, TMDL-MOS (10^9 org/day)	1.65E+01	1.50E+00	3.59E-01
Load Reduction (10^9 org/day)	9.82E+01	1.28E+00	0
Load Reduction (%)	**85.6%**	46.0%	0%
Overall Load Reduction* (%)	54%		

** - Overall load reduction calculated only for station at the most-downstream location*

Table 5-9 *E. coli* TMDL Calculations for downstream Clear Creek above Tidal (1102)

Station 14229			
Flow Regime %	**0-20%**	**20-80%**	**80-100%**
Median Flow, Q (cfs)	14.4	9.79	8.62
Target, 0.95*C (counts/dL)	120	120	120
Existing Load (10^9 org/day)	1.66E+02	2.81E+01	3.78E+01
TMDL (Q*C) (10^9 org/day)	4.44E+01	3.02E+01	2.66E+01
MOS (Q*C*0.05) (10^9 org/day)	2.22E+00	1.51E+00	1.33E+00
Allowable Load at Water Quality Target, TMDL-MOS (10^9 org/day)	4.22E+01	2.87E+01	2.52E+01
Load Reduction (10^9 org/day)	1.24E+02	0	1.26E+01
Load Reduction (%)	**74.6%**	0%	33.3%
Overall Load Reduction* (%)	37%		

** - Overall load reduction calculated only for station at the most-downstream location*

Table 5-10 *E. coli* TMDL Calculations for upstream Clear Creek above Tidal (1102)

Station 17076			
Flow Regime %	**0-20%**	**20-80%**	**80-100%**
Median Flow, Q (cfs)	3.1	1.18	0.69
Target, 0.95*C (counts/dL)	120	120	120
Existing Load (10^9 org/day)	5.30E+01	3.62E+00	NA
TMDL (Q*C) (10^9 org/day)	9.69E+00	3.64E+00	2.13E+00
MOS (Q*C*0.05) (10^9 org/day)	4.84E-01	1.82E-01	1.06E-01
Allowable Load at Water Quality Target, TMDL-MOS (10^9 org/day)	9.20E+00	3.46E+00	2.02E+00
Load Reduction (10^9 org/day)	4.38E+01	1.58E-01	NA
Load Reduction (%)	**82.6%**	4.4%	NA

Table 5-11 *E. coli* TMDL Calculations for upstream Cowart Creek (1102A)

Station 11426			
Flow Regime %	**0-20%**	**20-80%**	**80-100%**
Median Flow, Q (cfs)	12.6	1.19	0.32
Target, 0.95*C (counts/dL)	120	120	120
Existing Load (10^9 org/day)	3.23E+02	6.88E+00	1.20E+00
TMDL (Q*C) (10^9 org/day)	3.88E+01	3.68E+00	9.96E-01
MOS (Q*C*0.05) (10^9 org/day)	1.94E+00	1.84E-01	4.98E-02
Allowable Load at Water Quality Target, TMDL-MOS (10^9 org/day),	3.69E+01	3.50E+00	9.46E-01
Load Reduction (10^9 org/day)	2.86E+02	3.38E+00	2.54E-01
Load Reduction (%)	**88.6%**	49.1%	21.2%

Table 5-12 *E. coli* TMDL Calculations for downstream Cowart Creek (1102A)

Station 16477			
Flow Regime %	**0-20%**	**20-80%**	**80-100%**
Median Flow, Q (cfs)	15.7	1.48	0.39
Target, 0.95*C counts/dL)	120	120	120
Existing Load (10^9 org/day)	7.66E+01	2.62E+00	5.90E-01
TMDL (Q*C) (10^9 org/day)	4.83E+01	4.55E+00	1.20E+00
MOS (Q*C*0.05) (10^9 org/day)	2.41E+00	2.27E-01	6.00E-02
Allowable Load at Water Quality Target, TMDL-MOS (10^9 org/day)	4.59E+01	4.32E+00	1.14E+00
Load Reduction (10^9 org/day)	3.07E+01	0	0
Load Reduction (%)	**40.1%**	0%	0%
Overall Load Reduction* (%)		54%	

** - Overall load reduction calculated only for station at the most-downstream location*

Table 5-13 *E. coli* TMDL Calculations for Mary's Creek (1102B)

Station 16473			
Flow Regime %	**0-20%**	**20-80%**	**80-100%**
Median Flow, Q (cfs)	52.9	7.25	3.34
Target, 0.95*C (counts/dL)	120	120	120
Existing Load (10^9 org/day)	1.05E+03	2.18E+01	9.24E+00
TMDL (Q*C) (10^9 org/day)	1.63E+02	2.23E+01	1.03E+01
MOS (Q*C*0.05) (10^9 org/day)	8.15E+00	1.12E+00	5.15E-01
Allowable Load at Water Quality Target, TMDL-MOS (10^9 org/day)	1.55E+02	2.12E+01	9.78E+00
Load Reduction (10^9 org/day)	8.98E+02	5.57E-01	0
Load Reduction (%)	**85.3%**	2.6%	0%
Overall Load Reduction* (%)		48%	

** - Overall load reduction calculated only for station at the most-downstream location*

Table 5-14 *E. coli* TMDL Calculations for Hickory Slough (1102C)

Station 17068			
Flow Regime %	**0-20%**	**20-80%**	**80-100%**
Median Flow, Q (cfs)	6.5	0.64	0.19
Target, 0.95*C (counts/dL)	120	120	120
Existing Load (10^9 org/day)	5.70E+01	1.65E+00	5.64E-01
TMDL (Q*C) (10^9 org/day)	1.99E+01	1.98E+00	5.79E-01
MOS (Q*C*0.05) (10^9 org/day)	9.97E-01	9.92E-02	2.90E-02
Allowable Load at Water Quality Target, TMDL-MOS (10^9 org/day)	1.89E+01	1.89E+00	5.50E-01
Load Reduction (10^9 org/day)	3.81E+01	0	1.34E-02
Load Reduction (%)	**66.8%**	0%	2.4%
Overall Load Reduction* (%)	25%		

** - Overall load reduction calculated only for station at the most-downstream location*

Table 5-15 Fecal Coliform TMDL Calculations for Turkey Creek (1102D)

Station 17069			
Flow Regime %	**0-20%**	**20-80%**	**80-100%**
Median Flow, Q (cfs)	7.5	4.87	3.21
Target, 0.95*C (counts/dL)	190	190	190
Existing Load (10^9 org/day)	9.53E+02	1.09E+02	NA
TMDL (Q*C) (10^9 org/day)	3.66E+01	2.38E+01	1.57E+01
MOS (Q*C*0.05) (10^9 org/day)	1.83E+00	1.19E+00	7.84E-01
Allowable Load at Water Quality Target, TMDL-MOS (10^9 org/day)	3.48E+01	2.27E+01	1.49E+01
Load Reduction (10^9 org/day)	9.18E+02	8.60E+01	NA
Load Reduction (%)	**96.3%**	79.2%	NA
Overall Load Reduction* (%)	91%		

** - Overall load reduction calculated only for station at the most-downstream location*

Table 5-16 Fecal Coliform TMDL Calculations for upstream Mud Gully (1102E)

Station 17070			
Flow Regime %	**0-20%**	**20-80%**	**80-100%**
Median Flow, Q (cfs)	24.0	6.55	4.69
Target, 0.95*C (counts/dL)	190	190	190
Existing Load (10^9 org/day)	1.19E+03	2.43E+02	5.18E+01
TMDL (Q*C) (10^9 org/day)	1.18E+02	3.21E+01	2.30E+01
MOS (Q*C*0.05) (10^9 org/day)	5.88E+00	1.60E+00	1.15E+00
Allowable Load at Water Quality Target, TMDL-MOS (10^9 org/day)	1.12E+02	3.05E+01	2.18E+01
Load Reduction (10^9 org/day)	1.08E+03	2.13E+02	3.00E+01
Load Reduction (%)	**90.6%**	87.5%	57.9%

Table 5-17 Fecal Coliform TMDL Calculations for downstream Mud Gully (1102E)

Station 17071			
Flow Regime %	**0-20%**	**20-80%**	**80-100%**
Median Flow, Q (cfs)	29.5	7.04	4.86
Target, 0.95*C (counts/dL)	190	190	190
Existing Load (10^9 org/day)	9.94E+02	1.45E+02	4.41E+01
TMDL (Q*C) (10^9 org/day)	1.45E+02	3.45E+01	2.38E+01
MOS (Q*C*0.05) (10^9 org/day)	7.23E+00	1.72E+00	1.19E+00
Allowable Load at Water Quality Target, TMDL-MOS (10^9 org/day)	1.37E+02	3.27E+01	2.26E+01
Load Reduction (10^9 org/day)	8.56E+02	1.12E+02	2.15E+01
Load Reduction (%)	**86.2%**	77.4%	48.7%
Overall Load Reduction* (%)	86%		

** - Overall load reduction calculated only for station at the most-downstream location*

CHAPTER 6
PUBLIC PARTICIPATION

To provide focused stakeholder involvement in the Clear Creek Bacteria TMDL and the implementation phase, a 24 member steering committee was formed. In accordance with House Bill 2912, the group has balanced representation within the watershed and commitment was formalized. TCEQ approved the formation of a Clear Creek stakeholder group and approved the membership. The group has ground rules and H-GAC maintains a membership roster and has a web page dedicated to the Clear Creek Bacteria TMDL project: (http://www.h-gac.com/HGAC/Programs/Water+Resources/Total+Maximum+Daily+Loads+TMDL+/default.htm).

The responsibility of each stakeholder on the committee is to communicate project information to others being represented and provide personal/organization perspective on all issues; knowledge of the watershed; comments and suggestions during the project; and solicit input from others. Regular meetings have been held and TCEQ solicits stakeholder comment at each project milestone; and assist stakeholders with communications. H-GAC has assisted TCEQ with the public participation and with a facilitator (M.J. Naquin). As contractors to TCEQ, the University of Houston and Parsons provide technical support and presentations at stakeholder meetings.

The first public meeting for the Clear Creek Bacteria TMDLs was held on April 5, 2006. The meeting introduced the TMDL process, identified the impaired segments and the reason for the impairment, a review of historical data, described potential sources of bacteria within the watershed and began the formation of the stakeholder group.

The second public meeting was held on September 21, 2006. The technical team presented the status of the project by reviewing historical data, listing the data that had been collected by the project team, discussed the different types of land use within the watershed, population increases to the year 2020, and potential sources of bacteria within the watershed were also listed. Future plans were also presented which included more water quality sampling to assist with the development of LDCs and mass balance model.

The third public meeting was held on February 7, 2007. The presentation included an overview of the project, a list of completed activities including intensive surveys for flow and water quality, pipe reconnaissance, storm water runoff and wastewater discharge sampling. Bacteria sources in the watershed were also discussed, including septic systems, livestock and permitted WWTFs. Future tasks were also summarized which included completion of LDCs/mass balance and load calculations and allocations on a segment by segment basis.

On November 15, 2007 a fourth public meeting was held at the University of Houston – Clear Lake campus. This meeting focused on summarizing the two different technical approaches that would be used to calculate TMDLs: the LDC method for freshwater streams; and a mass balance approach using tidal prism for the two tidal streams. After presenting data limitations to conducting a pollutant source assessment, stakeholders provided suggestions for how some of the data gaps might be addressed in the future. TCEQ also introduced a proposed strategy for moving from TMDL development into TMDL implementation. Opportunities and constraints of executing TMDL development and TMDL implementation on concurrent tracks were discussed by TCEQ and the stakeholders.

On March 6, 2008, a fifth public meeting was held at the University of Houston–Clear Lake campus. At this meeting, a presentation summarized the findings of the pollutant source assessment and the preliminary TMDL calculations based on LDCs and the tidal prism approach. TCEQ personnel also discussed options for how stakeholders of the Clear Creek Watershed could participate in and initiate the TMDL implementation process. The TCEQ intends to initiate development of an implementation plan in summer 2008.

CHAPTER 7
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APPENDIX A
AMBIENT WATER QUALITY BACTERIA DATA – 1990 TO 2006

APPENDIX A
Ambient Water Quality Bacteria Data - 1990 to 2006

Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101	11446	EC	394	62						08/09/2001
1101	11446	EC	394	243						07/19/2002
1101	11446	EC	394	10						09/12/2002
1101	11446	EC	394	10						11/21/2002
1101	11446	EC	394	5		**24**	**5**	**0**	**0%**	01/08/2003
1101	11446	ENT	89	85						11/29/2000
1101	11446	ENT	89	740	740					02/08/2001
1101	11446	ENT	89	31						05/09/2001
1101	11446	ENT	89	1616	1616					12/03/2001
1101	11446	ENT	89	609	609					02/20/2002
1101	11446	ENT	89	173	173					05/15/2002
1101	11446	ENT	89	40						05/16/2002
1101	11446	ENT	89	86						02/12/2003
1101	11446	ENT	89	5						03/14/2003
1101	11446	ENT	89	5						05/01/2003
1101	11446	ENT	89	20						06/03/2003
1101	11446	ENT	89	41						07/29/2003
1101	11446	ENT	89	85						08/12/2003
1101	11446	ENT	89	158	158					08/14/2003
1101	11446	ENT	89	20						10/23/2003
1101	11446	ENT	89	20						12/08/2003
1101	11446	ENT	89	10						03/11/2004
1101	11446	ENT	89	52						06/03/2004
1101	11446	ENT	89	10						09/14/2004
1101	11446	ENT	89	1						10/29/2004
1101	11446	ENT	89	10						12/14/2004
1101	11446	ENT	89	210	210					01/15/2005
1101	11446	ENT	89	6300	6300					03/03/2005
1101	11446	ENT	89	10						03/15/2005
1101	11446	ENT	89	10						05/05/2005
1101	11446	ENT	89	84						06/16/2005
1101	11446	ENT	89	84						07/07/2005
1101	11446	ENT	89	36						08/03/2005
1101	11446	ENT	89	1						08/09/2005
1101	11446	ENT	89	1						08/18/2005
1101	11446	ENT	89	10						08/24/2005
1101	11446	ENT	89	740	740					08/29/2005
1101	11446	ENT	89	247	247					09/14/2005
1101	11446	ENT	89	10						10/06/2005
1101	11446	ENT	89	10462	10462					12/15/2005
1101	11446	ENT	89	52						12/26/2005
1101	11446	ENT	89	600	600					02/02/2006
1101	11446	ENT	89	10						03/14/2006
1101	11446	ENT	89	85						04/06/2006
1101	11446	ENT	89	20						05/09/2006
1101	11446	ENT	89	410	410					06/02/2006
1101	11446	ENT	89	10						06/08/2006
1101	11446	ENT	89	41						08/08/2006
1101	11446	ENT	89	10						09/13/2006
1101	11446	ENT	89	749	749	**50**	**45**	**13**	**29%**	12/28/2006
1101	11446	FC	400	1640	1640					03/13/1990
1101	11446	FC	400	520	520					09/10/1990
1101	11446	FC	400	30						12/03/1990
1101	11446	FC	400	900	900					03/05/1991
1101	11446	FC	400	8000	8000					06/25/1991
1101	11446	FC	400	425	425					09/09/1991
1101	11446	FC	400	280						12/16/1991
1101	11446	FC	400	530	530					03/10/1992
1101	11446	FC	400	340						06/17/1992
1101	11446	FC	400	450	450					12/07/1994
1101	11446	FC	400	45						04/29/1999
1101	11446	FC	400	500	500					05/12/1999

APPENDIX A
Ambient Water Quality Bacteria Data - 1990 to 2006

Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101	11446	FC	400	180						05/27/1999
1101	11446	FC	400	800	800					06/22/1999
1101	11446	FC	400	170						07/28/1999
1101	11446	FC	400	80						08/09/1999
1101	11446	FC	400	40						09/23/1999
1101	11446	FC	400	70						10/27/1999
1101	11446	FC	400	170						11/12/1999
1101	11446	FC	400	500	500					12/16/1999
1101	11446	FC	400	1400	1400					01/13/2000
1101	11446	FC	400	300						03/08/2000
1101	11446	FC	400	180						03/22/2000
1101	11446	FC	400	1300	1300					04/14/2000
1101	11446	FC	400	220						05/25/2000
1101	11446	FC	400	80						06/07/2000
1101	11446	FC	400	20						07/27/2000
1101	11446	FC	400	110						08/28/2000
1101	11446	FC	400	2400	2400					09/22/2000
1101	11446	FC	400	3000	3000					10/19/2000
1101	11446	FC	400	13000	13000					11/08/2000
1101	11446	FC	400	700	700					12/08/2000
1101	11446	FC	400	230						02/21/2001
1101	11446	FC	400	3000	3000					03/15/2001
1101	11446	FC	400	2400	2400					04/05/2001
1101	11446	FC	400	40						05/24/2001
1101	11446	FC	400	20						07/18/2001
1101	11446	FC	400	20						08/22/2001
1101	11446	FC	400	20						09/18/2001
1101	11446	FC	400	300						10/23/2001
1101	11446	FC	400	40		**282**	**41**	**18**	**44%**	11/20/2001
1101	11447	EC	394	31						03/15/2002
1101	11447	EC	394	160						07/19/2002
1101	11447	EC	394	20						09/12/2002
1101	11447	EC	394	175						11/21/2002
1101	11447	EC	394	5						01/08/2003
1101	11447	EC	394	10						07/29/2003
1101	11447	EC	394	171		**39**	**7**	**0**	**0%**	08/12/2003
1101	11447	ENT	89	1120	1120					05/15/2002
1101	11447	ENT	89	5						03/14/2003
1101	11447	ENT	89	31		**56**	**3**	**1**	**33%**	05/01/2003
1101	11447	FC	400	1700	1700					01/08/1999
1101	11447	FC	400	130						01/28/1999
1101	11447	FC	400	9000	9000					02/08/1999
1101	11447	FC	400	9						02/15/1999
1101	11447	FC	400	1300	1300					03/15/1999
1101	11447	FC	400	200						03/23/1999
1101	11447	FC	400	170						04/14/1999
1101	11447	FC	400	72						04/26/1999
1101	11447	FC	400	100						04/29/1999
1101	11447	FC	400	9200	9200					05/11/1999
1101	11447	FC	400	24000	24000					05/13/1999
1101	11447	FC	400	320						05/20/1999
1101	11447	FC	400	1700	1700					05/27/1999
1101	11447	FC	400	950	950					05/27/1999
1101	11447	FC	400	3500	3500					06/14/1999
1101	11447	FC	400	800	800					06/22/1999
1101	11447	FC	400	190						07/23/1999
1101	11447	FC	400	500	500					07/28/1999
1101	11447	FC	400	40						08/03/1999
1101	11447	FC	400	170						08/09/1999
1101	11447	FC	400	40						08/10/1999
1101	11447	FC	400	130						08/17/1999
1101	11447	FC	400	20						08/19/1999

APPENDIX A
Ambient Water Quality Bacteria Data - 1990 to 2006

Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101	11447	FC	400	110						08/25/1999
1101	11447	FC	400	90						09/21/1999
1101	11447	FC	400	500	500					09/23/1999
1101	11447	FC	400	40						10/27/1999
1101	11447	FC	400	170						11/12/1999
1101	11447	FC	400	170						12/16/1999
1101	11447	FC	400	300						01/13/2000
1101	11447	FC	400	81						03/08/2000
1101	11447	FC	400	510	510					03/22/2000
1101	11447	FC	400	1700	1700					04/14/2000
1101	11447	FC	400	270						05/25/2000
1101	11447	FC	400	170						06/07/2000
1101	11447	FC	400	20						07/27/2000
1101	11447	FC	400	20						08/28/2000
1101	11447	FC	400	9000	9000					09/22/2000
1101	11447	FC	400	3000	3000					10/19/2000
1101	11447	FC	400	30000	30000					11/08/2000
1101	11447	FC	400	1100	1100					12/08/2000
1101	11447	FC	400	80						02/21/2001
1101	11447	FC	400	2400	2400					03/15/2001
1101	11447	FC	400	130						04/05/2001
1101	11447	FC	400	220						05/24/2001
1101	11447	FC	400	110						06/26/2001
1101	11447	FC	400	110						07/18/2001
1101	11447	FC	400	20						08/22/2001
1101	11447	FC	400	20						09/18/2001
1101	11447	FC	400	3000	3000					10/23/2001
1101	11447	FC	400	20		**290**	**51**	**19**	**37%**	11/20/2001
1101	11448	EC	394	3873	3873					01/16/2002
1101	11448	EC	394	121						03/14/2002
1101	11448	EC	394	313						05/21/2002
1101	11448	EC	394	240						07/22/2002
1101	11448	EC	394	52						09/24/2002
1101	11448	EC	394	193						11/05/2002
1101	11448	EC	394	7701	7701					01/27/2003
1101	11448	EC	394	10						03/13/2003
1101	11448	EC	394	5						05/07/2003
1101	11448	EC	394	10						07/11/2003
1101	11448	EC	394	110		**128**	**11**	**2**	**18%**	08/20/2003
1101	11448	ENT	89	100	100					07/28/2005
1101	11448	ENT	89	240	240					04/24/2006
1101	11448	ENT	89	387	387					04/25/2006
1101	11448	ENT	89	968	968					04/25/2006
1101	11448	ENT	89	1723	1723					04/25/2006
1101	11448	ENT	89	189	189					04/26/2006
1101	11448	ENT	89	517	517					04/26/2006
1101	11448	ENT	89	579	579					04/27/2006
1101	11448	ENT	89	54750	54750					7/5/2006
1101	11448	ENT	89	9890	9890					7/6/2006
1101	11448	ENT	89	5203	5203					7/7/2006
1101	11448	ENT	89	2435	2435					7/7/2006
1101	11448	ENT	89	1030	1030					7/8/2006
1101	11448	ENT	89	984	984					8/15/2006
1101	11448	ENT	89	266	266					8/16/2006
1101	11448	ENT	89	464	464					8/16/2006
1101	11448	ENT	89	929	929					8/17/2006
1101	11448	ENT	89	2252	2252					8/17/2006
1101	11448	ENT	89	387	387	**974**	**19**	**19**	**100%**	8/18/2006
1101	11448	FC	400	1700	1700					01/06/1999
1101	11448	FC	400	20						02/10/1999
1101	11448	FC	400	80						03/08/1999

APPENDIX A
Ambient Water Quality Bacteria Data - 1990 to 2006

Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101	11448	FC	400	170						04/06/1999
1101	11448	FC	400	140						04/19/1999
1101	11448	FC	400	10000	10000					04/22/1999
1101	11448	FC	400	43000	43000					04/28/1999
1101	11448	FC	400	150						04/29/1999
1101	11448	FC	400	100						05/04/1999
1101	11448	FC	400	140						05/07/1999
1101	11448	FC	400	900	900					05/10/1999
1101	11448	FC	400	16000	16000					05/11/1999
1101	11448	FC	400	16000	16000					05/13/1999
1101	11448	FC	400	170						05/25/1999
1101	11448	FC	400	1900	1900					05/26/1999
1101	11448	FC	400	9000	9000					05/27/1999
1101	11448	FC	400	160						05/27/1999
1101	11448	FC	400	100						06/03/1999
1101	11448	FC	400	1700	1700					06/10/1999
1101	11448	FC	400	1100	1100					06/15/1999
1101	11448	FC	400	9000	9000					06/16/1999
1101	11448	FC	400	2900	2900					06/22/1999
1101	11448	FC	400	10000	10000					07/06/1999
1101	11448	FC	400	9000	9000					07/14/1999
1101	11448	FC	400	300						07/15/1999
1101	11448	FC	400	4700	4700					07/21/1999
1101	11448	FC	400	100						07/27/1999
1101	11448	FC	400	100						08/02/1999
1101	11448	FC	400	130						08/03/1999
1101	11448	FC	400	3000	3000					08/05/1999
1101	11448	FC	400	300						08/10/1999
1101	11448	FC	400	200						08/11/1999
1101	11448	FC	400	300						08/17/1999
1101	11448	FC	400	200						08/17/1999
1101	11448	FC	400	130						08/19/1999
1101	11448	FC	400	100						08/23/1999
1101	11448	FC	400	100						08/26/1999
1101	11448	FC	400	10						08/30/1999
1101	11448	FC	400	300						09/01/1999
1101	11448	FC	400	110						09/07/1999
1101	11448	FC	400	130						09/08/1999
1101	11448	FC	400	38000	38000					09/27/1999
1101	11448	FC	400	1600	1600					10/05/1999
1101	11448	FC	400	100						10/07/1999
1101	11448	FC	400	40						10/12/1999
1101	11448	FC	400	100						10/13/1999
1101	11448	FC	400	10000	10000					10/18/1999
1101	11448	FC	400	200						10/27/1999
1101	11448	FC	400	200						11/03/1999
1101	11448	FC	400	200						11/10/1999
1101	11448	FC	400	130						11/10/1999
1101	11448	FC	400	100						11/15/1999
1101	11448	FC	400	1200	1200					11/24/1999
1101	11448	FC	400	200						12/01/1999
1101	11448	FC	400	1200	1200					12/06/1999
1101	11448	FC	400	1000	1000					12/15/1999
1101	11448	FC	400	110						12/15/1999
1101	11448	FC	400	700	700					12/20/1999
1101	11448	FC	400	100						01/05/2000
1101	11448	FC	400	230						01/12/2000
1101	11448	FC	400	150						01/13/2000
1101	11448	FC	400	90						01/20/2000
1101	11448	FC	400	9						01/27/2000
1101	11448	FC	400	200000	200000					02/01/2000
1101	11448	FC	400	660	660					02/07/2000

APPENDIX A
Ambient Water Quality Bacteria Data - 1990 to 2006

Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101	11448	FC	400	320						02/14/2000
1101	11448	FC	400	81						02/21/2000
1101	11448	FC	400	45						03/08/2000
1101	11448	FC	400	110						03/22/2000
1101	11448	FC	400	16000	16000					04/13/2000
1101	11448	FC	400	2400	2400					05/24/2000
1101	11448	FC	400	2400	2400					06/06/2000
1101	11448	FC	400	170						08/31/2000
1101	11448	FC	400	20						09/20/2000
1101	11448	FC	400	2400	2400					10/18/2000
1101	11448	FC	400	3000	3000					11/07/2000
1101	11448	FC	400	110						12/07/2000
1101	11448	FC	400	11000	11000					01/17/2001
1101	11448	FC	400	130						02/20/2001
1101	11448	FC	400	500	500					03/14/2001
1101	11448	FC	400	80						04/04/2001
1101	11448	FC	400	170						05/23/2001
1101	11448	FC	400	300						06/25/2001
1101	11448	FC	400	210						07/17/2001
1101	11448	FC	400	110						08/21/2001
1101	11448	FC	400	230						09/19/2001
1101	11448	FC	400	16000	16000					10/22/2001
1101	11448	FC	400	80		**451**	**88**	**33**	**38%**	11/19/2001
1101	15458	EC	394	6371	6371					12/03/2001
1101	15458	EC	394	216						05/24/2002
1101	15458	EC	394	10						02/10/2003
1101	15458	EC	394	10		**108**	**4**	**1**	**25%**	03/17/2003
1101	15458	ENT	89	31						07/25/2002
1101	15458	ENT	89	10						11/18/2002
1101	15458	ENT	89	10		**15**	**3**	**0**	**0%**	05/16/2003
1101	15458	FC	400	45						04/19/1999
1101	15458	FC	400	4000	4000					04/28/1999
1101	15458	FC	400	3200	3200					05/10/1999
1101	15458	FC	400	100						05/26/1999
1101	15458	FC	400	100						06/03/1999
1101	15458	FC	400	900	900					06/10/1999
1101	15458	FC	400	2300	2300					06/16/1999
1101	15458	FC	400	1000	1000					06/22/1999
1101	15458	FC	400	100						07/06/1999
1101	15458	FC	400	100						07/15/1999
1101	15458	FC	400	100						07/21/1999
1101	15458	FC	400	100						07/27/1999
1101	15458	FC	400	100						08/02/1999
1101	15458	FC	400	400						08/05/1999
1101	15458	FC	400	100						08/11/1999
1101	15458	FC	400	100						08/17/1999
1101	15458	FC	400	100						08/23/1999
1101	15458	FC	400	100						08/26/1999
1101	15458	FC	400	300						09/01/1999
1101	15458	FC	400	160						09/27/1999
1101	15458	FC	400	500	500					10/05/1999
1101	15458	FC	400	3000	3000					10/07/1999
1101	15458	FC	400	1400	1400					10/13/1999
1101	15458	FC	400	100						10/18/1999
1101	15458	FC	400	100						10/27/1999
1101	15458	FC	400	100						11/03/1999
1101	15458	FC	400	6000	6000					11/10/1999
1101	15458	FC	400	8000	8000					11/15/1999
1101	15458	FC	400	23000	23000					11/24/1999
1101	15458	FC	400	900	900					12/01/1999
1101	15458	FC	400	4600	4600					12/06/1999
1101	15458	FC	400	1800	1800					12/15/1999

APPENDIX A
Ambient Water Quality Bacteria Data - 1990 to 2006

Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101	15458	FC	400	4000	4000					12/20/1999
1101	15458	FC	400	800	800					01/05/2000
1101	15458	FC	400	620	620					01/13/2000
1101	15458	FC	400	420	420					01/20/2000
1101	15458	FC	400	740	740					01/27/2000
1101	15458	FC	400	440	440					02/01/2000
1101	15458	FC	400	140						02/07/2000
1101	15458	FC	400	370						02/14/2000
1101	15458	FC	400	60						02/21/2000
1101	15458	FC	400	20						04/16/2001
1101	15458	FC	400	20						05/21/2001
1101	15458	FC	400	40						06/29/2001
1101	15458	FC	400	220						07/30/2001
1101	15458	FC	400	20						08/23/2001
1101	15458	FC	400	130		**332**	**47**	**20**	**43%**	09/20/2001
1101	16572	EC	394	3719	3719					12/03/2001
1101	16572	EC	394	10		**193**	**2**	**1**	**50%**	02/10/2003
1101	16572	ENT	89	1						07/25/2002
1101	16572	ENT	89	95	95					10/02/2002
1101	16572	ENT	89	5						11/18/2002
1101	16572	ENT	89	10						05/16/2003
1101	16572	ENT	89	122	122					11/22/2004
1101	16572	ENT	89	10						01/11/2005
1101	16572	ENT	89	2600	2600					03/08/2005
1101	16572	ENT	89	31						05/04/2005
1101	16572	ENT	89	180	180					07/18/2005
1101	16572	ENT	89	52						08/04/2005
1101	16572	ENT	89	58						08/12/2005
1101	16572	ENT	89	20						08/17/2005
1101	16572	ENT	89	1						08/25/2005
1101	16572	ENT	89	1						10/13/2005
1101	16572	ENT	89	250	250					12/27/2005
1101	16572	ENT	89	20						02/06/2006
1101	16572	ENT	89	10						04/07/2006
1101	16572	ENT	89	20						05/10/2006
1101	16572	ENT	89	5						06/08/2006
1101	16572	ENT	89	1		**19**	**20**	**5**	**25%**	08/04/2006
1101	16572	FC	400	500	500					01/11/1999
1101	16572	FC	400	130						02/03/1999
1101	16572	FC	400	20						03/19/1999
1101	16572	FC	400	40						04/19/1999
1101	16572	FC	400	230						05/17/1999
1101	16572	FC	400	20						07/09/1999
1101	16572	FC	400	5000	5000					07/19/1999
1101	16572	FC	400	170						08/23/1999
1101	16572	FC	400	130						09/20/1999
1101	16572	FC	400	110						10/18/1999
1101	16572	FC	400	110						11/29/1999
1101	16572	FC	400	300						12/22/1999
1101	16572	FC	400	9000	9000					04/04/2000
1101	16572	FC	400	700	700					05/04/2000
1101	16572	FC	400	80						06/26/2000
1101	16572	FC	400	20						07/19/2000
1101	16572	FC	400	20						08/10/2000
1101	16572	FC	400	40						09/29/2000
1101	16572	FC	400	1100	1100					11/27/2000
1101	16572	FC	400	70						12/18/2000
1101	16572	FC	400	80						01/26/2001
1101	16572	FC	400	70						02/22/2001
1101	16572	FC	400	300						03/12/2001
1101	16572	FC	400	130						04/16/2001
1101	16572	FC	400	20						05/21/2001

APPENDIX A
Ambient Water Quality Bacteria Data - 1990 to 2006

Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101	16572	FC	400	20						06/29/2001
1101	16572	FC	400	20						07/30/2001
1101	16572	FC	400	20						08/23/2001
1101	16572	FC	400	9000	9000	**130**	**29**	**6**	**21%**	09/20/2001
1101	16573	EC	394	3229	3229	**3229**	**1**	**1**	**100%**	12/03/2001
1101	16573	ENT	89	41						05/24/2002
1101	16573	ENT	89	31						05/24/2002
1101	16573	ENT	89	20						07/25/2002
1101	16573	ENT	89	41						10/02/2002
1101	16573	ENT	89	20						11/18/2002
1101	16573	ENT	89	41						02/10/2003
1101	16573	ENT	89	5		**24**	**7**	**0**	**0%**	05/16/2003
1101	16573	FC	400	170						01/11/1999
1101	16573	FC	400	80						02/03/1999
1101	16573	FC	400	70						03/19/1999
1101	16573	FC	400	20						04/19/1999
1101	16573	FC	400	300						05/17/1999
1101	16573	FC	400	10						07/09/1999
1101	16573	FC	400	500	500					07/19/1999
1101	16573	FC	400	40						08/23/1999
1101	16573	FC	400	10						09/20/1999
1101	16573	FC	400	20						10/18/1999
1101	16573	FC	400	40						11/29/1999
1101	16573	FC	400	230						12/22/1999
1101	16573	FC	400	16000	16000					04/04/2000
1101	16573	FC	400	500	500					05/04/2000
1101	16573	FC	400	20						06/26/2000
1101	16573	FC	400	20						07/19/2000
1101	16573	FC	400	20						08/10/2000
1101	16573	FC	400	20						09/29/2000
1101	16573	FC	400	3000	3000					11/27/2000
1101	16573	FC	400	170						12/18/2000
1101	16573	FC	400	140						01/26/2001
1101	16573	FC	400	300						02/22/2001
1101	16573	FC	400	110						03/12/2001
1101	16573	FC	400	20						04/16/2001
1101	16573	FC	400	20						05/21/2001
1101	16573	FC	400	20						06/29/2001
1101	16573	FC	400	230						07/30/2001
1101	16573	FC	400	20						08/23/2001
1101	16573	FC	400	300		**84**	**29**	**4**	**14%**	09/20/2001
1101	16575	EC	394	121						07/19/2002
1101	16575	EC	394	10						09/12/2002
1101	16575	EC	394	10						11/21/2002
1101	16575	EC	394	31						01/08/2003
1101	16575	EC	394	10		**21**	**5**	**0**	**0%**	07/29/2003
1101	16575	ENT	89	150	150					05/15/2002
1101	16575	ENT	89	5						03/14/2003
1101	16575	ENT	89	5						05/01/2003
1101	16575	ENT	89	226	226					08/12/2003
1101	16575	ENT	89	350	350	**49**	**5**	**3**	**60%**	08/02/2005
1101	16575	FC	400	1100	1100					01/08/1999
1101	16575	FC	400	1700	1700					02/08/1999
1101	16575	FC	400	230						03/15/1999
1101	16575	FC	400	170						04/14/1999
1101	16575	FC	400	1300	1300					05/11/1999
1101	16575	FC	400	800	800					05/12/1999
1101	16575	FC	400	16000	16000					05/13/1999
1101	16575	FC	400	70						05/25/1999
1101	16575	FC	400	300						05/27/1999
1101	16575	FC	400	800	800					06/22/1999

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101	16575	FC	400	70						07/28/1999
1101	16575	FC	400	70						08/03/1999
1101	16575	FC	400	10						08/09/1999
1101	16575	FC	400	20						08/10/1999
1101	16575	FC	400	110						08/17/1999
1101	16575	FC	400	80						08/19/1999
1101	16575	FC	400	130						09/23/1999
1101	16575	FC	400	230						10/27/1999
1101	16575	FC	400	230						11/12/1999
1101	16575	FC	400	230						12/16/1999
1101	16575	FC	400	230						01/13/2000
1101	16575	FC	400	500	500					04/14/2000
1101	16575	FC	400	500	500					05/25/2000
1101	16575	FC	400	80						06/07/2000
1101	16575	FC	400	20						07/27/2000
1101	16575	FC	400	20						08/28/2000
1101	16575	FC	400	2400	2400					09/22/2000
1101	16575	FC	400	800	800					10/19/2000
1101	16575	FC	400	5000	5000					11/08/2000
1101	16575	FC	400	170						12/08/2000
1101	16575	FC	400	170						02/21/2001
1101	16575	FC	400	3000	3000					03/15/2001
1101	16575	FC	400	9000	9000					04/05/2001
1101	16575	FC	400	80						05/24/2001
1101	16575	FC	400	170						06/26/2001
1101	16575	FC	400	300						07/18/2001
1101	16575	FC	400	20						08/22/2001
1101	16575	FC	400	40						09/18/2001
1101	16575	FC	400	300						10/23/2001
1101	16575	FC	400	20		**235**	**40**	**13**	**33%**	11/20/2001
1101	16576	EC	394	122						01/17/2002
1101	16576	EC	394	74						03/20/2002
1101	16576	EC	394	318						05/22/2002
1101	16576	EC	394	243						07/23/2002
1101	16576	EC	394	20						09/24/2002
1101	16576	EC	394	20						11/06/2002
1101	16576	EC	394	20						01/27/2003
1101	16576	EC	394	10						03/13/2003
1101	16576	EC	394	5						05/07/2003
1101	16576	EC	394	20						07/11/2003
1101	16576	EC	394	10		**33**	**11**	**0**	**0%**	08/20/2003
1101	16576	ENT	89	8						10/29/2004
1101	16576	ENT	89	470	470					01/15/2005
1101	16576	ENT	89	7600	7600					03/03/2005
1101	16576	ENT	89	15						05/12/2005
1101	16576	ENT	89	560	560					07/05/2005
1101	16576	ENT	89	40						07/28/2005
1101	16576	ENT	89	10						10/06/2005
1101	16576	ENT	89	30						12/26/2005
1101	16576	ENT	89	150	150					02/03/2006
1101	16576	ENT	89	30						04/05/2006
1101	16576	ENT	89	227	227					04/25/2006
1101	16576	ENT	89	249	249					04/26/2006
1101	16576	ENT	89	186	186					04/26/2006
1101	16576	ENT	89	219	219					04/26/2006
1101	16576	ENT	89	517	517					04/27/2006
1101	16576	ENT	89	143	143					04/27/2006
1101	16576	ENT	89	130	130					05/08/2006
1101	16576	ENT	89	500	500					06/02/2006
1101	16576	ENT	89	185960	185960					7/5/2006
1101	16576	ENT	89	2195	2195					07/06/2006
1101	16576	ENT	89	2308	2308					07/07/2006

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101	16576	ENT	89	1221	1221					07/07/2006
1101	16576	ENT	89	546	546					07/08/2006
1101	16576	ENT	89	63						08/03/2006
1101	16576	ENT	89	360	360					8/15/2006
1101	16576	ENT	89	1252	1252					8/16/2006
1101	16576	ENT	89	617	617					8/17/2006
1101	16576	ENT	89	968	968					8/17/2006
1101	16576	ENT	89	833	833					08/18/2006
1101	16576	ENT	89	607	607	**314**	**30**	**23**	**77%**	8/18/2006
1101	16576	FC	400	5000	5000					01/06/1999
1101	16576	FC	400	40						02/10/1999
1101	16576	FC	400	110						03/08/1999
1101	16576	FC	400	130						04/06/1999
1101	16576	FC	400	20						05/07/1999
1101	16576	FC	400	24000	24000					05/11/1999
1101	16576	FC	400	16000	16000					05/13/1999
1101	16576	FC	400	110						05/25/1999
1101	16576	FC	400	800	800					05/27/1999
1101	16576	FC	400	300						06/15/1999
1101	16576	FC	400	800	800					07/14/1999
1101	16576	FC	400	110						08/03/1999
1101	16576	FC	400	20						08/10/1999
1101	16576	FC	400	80						08/17/1999
1101	16576	FC	400	60						08/19/1999
1101	16576	FC	400	80						08/30/1999
1101	16576	FC	400	40						09/07/1999
1101	16576	FC	400	40						10/12/1999
1101	16576	FC	400	110						11/10/1999
1101	16576	FC	400	1300	1300					12/15/1999
1101	16576	FC	400	40						01/12/2000
1101	16576	FC	400	9000	9000					04/13/2000
1101	16576	FC	400	500	500					05/24/2000
1101	16576	FC	400	800	800					06/06/2000
1101	16576	FC	400	300						07/27/2000
1101	16576	FC	400	130						08/31/2000
1101	16576	FC	400	300						09/20/2000
1101	16576	FC	400	16000	16000					10/18/2000
1101	16576	FC	400	5000	5000					11/07/2000
1101	16576	FC	400	2400	2400					12/07/2000
1101	16576	FC	400	80						02/21/2001
1101	16576	FC	400	500	500					03/14/2001
1101	16576	FC	400	110						04/04/2001
1101	16576	FC	400	20						05/23/2001
1101	16576	FC	400	80						06/25/2001
1101	16576	FC	400	300						07/17/2001
1101	16576	FC	400	170						08/21/2001
1101	16576	FC	400	20						09/19/2001
1101	16576	FC	400	170						10/22/2001
1101	16576	FC	400	40		**253**	**40**	**13**	**33%**	11/19/2001
1101	16577	EC	394	175						01/16/2002
1101	16577	EC	394	41						03/14/2002
1101	16577	EC	394	341						05/21/2002
1101	16577	EC	394	228						07/22/2002
1101	16577	EC	394	41						09/24/2002
1101	16577	EC	394	4106	4106					11/05/2002
1101	16577	EC	394	10						01/27/2003
1101	16577	EC	394	10						03/13/2003
1101	16577	EC	394	5						05/07/2003
1101	16577	EC	394	5						05/07/2003
1101	16577	EC	394	10						07/11/2003
1101	16577	EC	394	364		**56**	**12**	**1**	**8%**	08/20/2003

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101	16577	ENT	89	490	490	**490**	**1**	**1**	**100%**	08/02/2005
1101	16577	FC	400	5000	5000					01/06/1999
1101	16577	FC	400	170						02/10/1999
1101	16577	FC	400	230						03/08/1999
1101	16577	FC	400	110						04/06/1999
1101	16577	FC	400	50						05/07/1999
1101	16577	FC	400	5000	5000					05/11/1999
1101	16577	FC	400	24000	24000					05/13/1999
1101	16577	FC	400	130						05/25/1999
1101	16577	FC	400	800	800					05/27/1999
1101	16577	FC	400	1700	1700					06/15/1999
1101	16577	FC	400	170						07/14/1999
1101	16577	FC	400	10						08/03/1999
1101	16577	FC	400	10						08/10/1999
1101	16577	FC	400	70						08/17/1999
1101	16577	FC	400	20						08/19/1999
1101	16577	FC	400	70						08/30/1999
1101	16577	FC	400	40						09/07/1999
1101	16577	FC	400	60						10/12/1999
1101	16577	FC	400	230						11/10/1999
1101	16577	FC	400	300						12/15/1999
1101	16577	FC	400	230						01/12/2000
1101	16577	FC	400	5000	5000					04/13/2000
1101	16577	FC	400	110						05/24/2000
1101	16577	FC	400	80						06/06/2000
1101	16577	FC	400	40						08/31/2000
1101	16577	FC	400	130						09/20/2000
1101	16577	FC	400	16000	16000					10/18/2000
1101	16577	FC	400	7000	7000					11/07/2000
1101	16577	FC	400	1300	1300					12/07/2000
1101	16577	FC	400	3000	3000					01/17/2001
1101	16577	FC	400	130						02/20/2001
1101	16577	FC	400	170						03/14/2001
1101	16577	FC	400	110						04/04/2001
1101	16577	FC	400	20						05/23/2001
1101	16577	FC	400	40						06/25/2001
1101	16577	FC	400	130						07/17/2001
1101	16577	FC	400	130						08/21/2001
1101	16577	FC	400	40						09/19/2001
1101	16577	FC	400	300						10/22/2001
1101	16577	FC	400	130		**222**	**40**	**10**	**25%**	11/19/2001
1101B	16472	EC	394	131						01/17/2002
1101B	16472	EC	394	521	521					05/22/2002
1101B	16472	EC	394	197						07/23/2002
1101B	16472	EC	394	97						09/24/2002
1101B	16472	EC	394	10						11/06/2002
1101B	16472	EC	394	20						01/27/2003
1101B	16472	EC	394	10						03/13/2003
1101B	16472	EC	394	5						05/07/2003
1101B	16472	EC	394	10						07/11/2003
1101B	16472	EC	394	31						08/20/2003
1101B	16472	EC	394	436	436					4/24/2006
1101B	16472	EC	394	101						4/25/2006
1101B	16472	EC	394	45						4/26/2006
1101B	16472	EC	394	67						4/27/2006
1101B	16472	EC	394	83						4/27/2006
1101B	16472	EC	394	80						4/28/2006
1101B	16472	EC	394	15590	15590					7/5/2006
1101B	16472	EC	394	1490	1490					7/6/2006
1101B	16472	EC	394	620	620					7/7/2006
1101B	16472	EC	394	288						7/8/2006
1101B	16472	EC	394	312						7/8/2006

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101B	16472	EC	394	365						7/8/2006
1101B	16472	EC	394	70						8/15/2006
1101B	16472	EC	394	12						8/16/2006
1101B	16472	EC	394	50						8/16/2006
1101B	16472	EC	394	43						8/17/2006
1101B	16472	EC	394	69						8/17/2006
1101B	16472	EC	394	22		**90**	**28**	**5**	**18%**	8/18/2006
1101B	16472	FC	400	1100	1100					01/06/1999
1101B	16472	FC	400	300						02/10/1999
1101B	16472	FC	400	80						03/08/1999
1101B	16472	FC	400	800	800					04/06/1999
1101B	16472	FC	400	800	800					05/07/1999
1101B	16472	FC	400	16000	16000					05/11/1999
1101B	16472	FC	400	24000	24000					05/13/1999
1101B	16472	FC	400	300						05/25/1999
1101B	16472	FC	400	2200	2200					05/27/1999
1101B	16472	FC	400	300						06/15/1999
1101B	16472	FC	400	3000	3000					07/14/1999
1101B	16472	FC	400	40						08/03/1999
1101B	16472	FC	400	70						08/10/1999
1101B	16472	FC	400	40						08/17/1999
1101B	16472	FC	400	20						08/19/1999
1101B	16472	FC	400	110						08/30/1999
1101B	16472	FC	400	10						09/07/1999
1101B	16472	FC	400	110						10/12/1999
1101B	16472	FC	400	40						11/10/1999
1101B	16472	FC	400	110						12/15/1999
1101B	16472	FC	400	230						01/12/2000
1101B	16472	FC	400	16000	16000					04/13/2000
1101B	16472	FC	400	500	500					05/24/2000
1101B	16472	FC	400	790	790					06/06/2000
1101B	16472	FC	400	20						07/27/2000
1101B	16472	FC	400	170						08/31/2000
1101B	16472	FC	400	500	500					09/20/2000
1101B	16472	FC	400	9000	9000					10/18/2000
1101B	16472	FC	400	5000	5000					11/07/2000
1101B	16472	FC	400	300						12/07/2000
1101B	16472	FC	400	11000	11000					01/17/2001
1101B	16472	FC	400	230						02/21/2001
1101B	16472	FC	400	140						03/14/2001
1101B	16472	FC	400	170						04/04/2001
1101B	16472	FC	400	40						05/23/2001
1101B	16472	FC	400	170						06/25/2001
1101B	16472	FC	400	130						07/17/2001
1101B	16472	FC	400	20						08/21/2001
1101B	16472	FC	400	110						09/19/2001
1101B	16472	FC	400	140						10/22/2001
1101B	16472	FC	400	1700	1700	**319**	**41**	**15**	**37%**	11/19/2001
1101B	16493	EC	394	379						01/17/2002
1101B	16493	EC	394	448	448					03/20/2002
1101B	16493	EC	394	187						05/22/2002
1101B	16493	EC	394	703	703					07/23/2002
1101B	16493	EC	394	10						09/24/2002
1101B	16493	EC	394	512	512					11/06/2002
1101B	16493	EC	394	12997	12997					01/27/2003
1101B	16493	EC	394	243						03/13/2003
1101B	16493	EC	394	5						05/07/2003
1101B	16493	EC	394	10						07/11/2003
1101B	16493	EC	394	10						08/20/2003
1101B	16493	EC	394	63						10/27/2004
1101B	16493	EC	394	4800	4800					01/13/2005
1101B	16493	EC	394	1100	1100					03/01/2005

APPENDIX A
Ambient Water Quality Bacteria Data - 1990 to 2006

Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101B	16493	EC	394	2800	2800					05/10/2005
1101B	16493	EC	394	34						07/05/2005
1101B	16493	EC	394	500	500					07/29/2005
1101B	16493	EC	394	4000	4000					10/10/2005
1101B	16493	EC	394	380						12/19/2005
1101B	16493	EC	394	2400	2400					02/01/2006
1101B	16493	EC	394	360						04/05/2006
1101B	16493	EC	394	5172	5172					4/24/2006
1101B	16493	EC	394	96						4/25/2006
1101B	16493	EC	394	258						4/26/2006
1101B	16493	EC	394	167						4/27/2006
1101B	16493	EC	394	176						4/27/2006
1101B	16493	EC	394	147						4/28/2006
1101B	16493	EC	394	32						05/08/2006
1101B	16493	EC	394	4800	4800					06/01/2006
1101B	16493	EC	394	30760	30760					7/5/2006
1101B	16493	EC	394	512	512					7/6/2006
1101B	16493	EC	394	299						7/7/2006
1101B	16493	EC	394	170						7/8/2006
1101B	16493	EC	394	268						7/8/2006
1101B	16493	EC	394	260						08/03/2006
1101B	16493	EC	394	38						8/15/2006
1101B	16493	EC	394	23						8/16/2006
1101B	16493	EC	394	227						8/16/2006
1101B	16493	EC	394	69						8/17/2006
1101B	16493	EC	394	114						8/17/2006
1101B	16493	EC	394	35		**260**	**41**	**14**	**34%**	8/18/2006
1101B	16493	FC	400	9000	9000					01/06/1999
1101B	16493	FC	400	40						02/10/1999
1101B	16493	FC	400	170						03/08/1999
1101B	16493	FC	400	500	500					04/06/1999
1101B	16493	FC	400	130						05/07/1999
1101B	16493	FC	400	9200	9200					05/11/1999
1101B	16493	FC	400	9200	9200					05/13/1999
1101B	16493	FC	400	80						05/25/1999
1101B	16493	FC	400	5000	5000					05/27/1999
1101B	16493	FC	400	1400	1400					06/15/1999
1101B	16493	FC	400	24000	24000					07/14/1999
1101B	16493	FC	400	140						08/10/1999
1101B	16493	FC	400	500	500					08/17/1999
1101B	16493	FC	400	80						08/19/1999
1101B	16493	FC	400	16000	16000					08/30/1999
1101B	16493	FC	400	170						09/07/1999
1101B	16493	FC	400	170						10/12/1999
1101B	16493	FC	400	700	700					12/15/1999
1101B	16493	FC	400	500	500					01/12/2000
1101B	16493	FC	400	16000	16000					04/13/2000
1101B	16493	FC	400	500	500					05/24/2000
1101B	16493	FC	400	300						06/06/2000
1101B	16493	FC	400	5000	5000					08/31/2000
1101B	16493	FC	400	16000	16000					09/20/2000
1101B	16493	FC	400	2200	2200					10/18/2000
1101B	16493	FC	400	5000	5000					11/07/2000
1101B	16493	FC	400	500	500					12/07/2000
1101B	16493	FC	400	8000	8000					01/17/2001
1101B	16493	FC	400	500	500					02/20/2001
1101B	16493	FC	400	500	500					03/14/2001
1101B	16493	FC	400	170						04/04/2001
1101B	16493	FC	400	170						05/23/2001
1101B	16493	FC	400	130						06/25/2001
1101B	16493	FC	400	230						07/17/2001
1101B	16493	FC	400	40						08/21/2001

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101B	16493	FC	400	170						09/19/2001
1101B	16493	FC	400	800	800					10/22/2001
1101B	16493	FC	400	16000	16000	**824**	**38**	**23**	**61%**	11/19/2001
1101B	17072	EC	394	331						01/14/2002
1101B	17072	EC	394	1515	1515					03/08/2002
1101B	17072	EC	394	10						05/13/2002
1101B	17072	EC	394	8164	8164					07/16/2002
1101B	17072	EC	394	10						11/19/2002
1101B	17072	EC	394	1775	1775					01/13/2003
1101B	17072	EC	394	5						05/02/2003
1101B	17072	EC	394	10						07/18/2003
1101B	17072	EC	394	10						08/11/2003
1101B	17072	EC	394	28						10/27/2004
1101B	17072	EC	394	4800	4800					01/13/2005
1101B	17072	EC	394	920	920					03/01/2005
1101B	17072	EC	394	2400	2400					05/10/2005
1101B	17072	EC	394	49						07/05/2005
1101B	17072	EC	394	88						10/10/2005
1101B	17072	EC	394	320						12/19/2005
1101B	17072	EC	394	79						02/03/2006
1101B	17072	EC	394	34						04/05/2006
1101B	17072	EC	394	120						05/08/2006
1101B	17072	EC	394	4800	4800					06/01/2006
1101B	17072	EC	394	365						07/08/2006
1101B	17072	EC	394	200		**173**	**22**	**7**	**32%**	08/03/2006
1101B	17072	FC	400	80						09/19/2000
1101B	17072	FC	400	11000	11000					11/06/2000
1101B	17072	FC	400	40						12/06/2000
1101B	17072	FC	400	16000	16000					01/16/2001
1101B	17072	FC	400	800	800					02/19/2001
1101B	17072	FC	400	220						03/13/2001
1101B	17072	FC	400	800	800					04/03/2001
1101B	17072	FC	400	20						05/22/2001
1101B	17072	FC	400	70						06/15/2001
1101B	17072	FC	400	20						07/16/2001
1101B	17072	FC	400	20						08/20/2001
1101B	17072	FC	400	500	500					09/17/2001
1101B	17072	FC	400	230						10/24/2001
1101B	17072	FC	400	20		**193**	**14**	**5**	**36%**	11/15/2001
1101B	17078	EC	394	135						01/14/2002
1101B	17078	EC	394	933	933					03/08/2002
1101B	17078	EC	394	20						05/13/2002
1101B	17078	EC	394	2209	2209					07/16/2002
1101B	17078	EC	394	10						11/19/2002
1101B	17078	EC	394	2141	2141					01/13/2003
1101B	17078	EC	394	10						05/02/2003
1101B	17078	EC	394	10						07/18/2003
1101B	17078	EC	394	20		**85**	**9**	**3**	**33%**	08/11/2003
1101B	17078	FC	400	800	800					02/19/2001
1101B	17078	FC	400	20						05/22/2001
1101B	17078	FC	400	500	500					06/15/2001
1101B	17078	FC	400	80						07/16/2001
1101B	17078	FC	400	800	800					08/20/2001
1101B	17078	FC	400	300						09/17/2001
1101B	17078	FC	400	40						10/24/2001
1101B	17078	FC	400	70		**160**	**8**	**3**	**38%**	11/15/2001
1101D	16475	EC	394	121						07/19/2002
1101D	16475	EC	394	20						09/12/2002
1101D	16475	EC	394	10						11/21/2002
1101D	16475	EC	394	5						01/08/2003
1101D	16475	EC	394	30						07/29/2003

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101D	16475	EC	394	104620	104620					7/5/2006
1101D	16475	EC	394	1553	1553					8/15/2006
1101D	16475	EC	394	1553	1553					8/15/2006
1101D	16475	EC	394	929	929					8/17/2006
1101D	16475	EC	394	2203	2203	**267**	**10**	**5**	**50%**	8/17/2006
1101D	16475	ENT	89	517	517					05/15/2002
1101D	16475	ENT	89	5						03/14/2003
1101D	16475	ENT	89	5						05/01/2003
1101D	16475	ENT	89	20						10/29/2004
1101D	16475	ENT	89	1400	1400					01/15/2005
1101D	16475	ENT	89	1500	1500					03/03/2005
1101D	16475	ENT	89	10						05/05/2005
1101D	16475	ENT	89	190	190					07/07/2005
1101D	16475	ENT	89	240	240					08/03/2005
1101D	16475	ENT	89	41						08/03/2005
1101D	16475	ENT	89	41						08/09/2005
1101D	16475	ENT	89	300	300					08/18/2005
1101D	16475	ENT	89	550	550					08/29/2005
1101D	16475	ENT	89	190	190					10/06/2005
1101D	16475	ENT	89	160	160					12/26/2005
1101D	16475	ENT	89	1700	1700					02/02/2006
1101D	16475	ENT	89	20						04/06/2006
1101D	16475	ENT	89	45						05/09/2006
1101D	16475	ENT	89	196	196					5/24/2006
1101D	16475	ENT	89	420	420					06/02/2006
1101D	16475	ENT	89	2726	2726					6/14/2006
1101D	16475	ENT	89	130	130					08/08/2006
1101D	16475	ENT	89	4352	4352					8/29/2006
1101D	16475	ENT	89	7						8/31/2006
1101D	16475	ENT	89	617	617					9/27/2006
1101D	16475	ENT	89	1986	1986					9/28/2006
1101D	16475	ENT	89	62		**158**	**27**	**17**	**63%**	10/06/2006
1101D	16475	FC	400	500	500					01/08/1999
1101D	16475	FC	400	10						02/08/1999
1101D	16475	FC	400	10						03/15/1999
1101D	16475	FC	400	1100	1100					04/14/1999
1101D	16475	FC	400	3000	3000					05/11/1999
1101D	16475	FC	400	600	600					05/12/1999
1101D	16475	FC	400	9200	9200					05/13/1999
1101D	16475	FC	400	2400	2400					05/25/1999
1101D	16475	FC	400	24000	24000					05/27/1999
1101D	16475	FC	400	300						06/22/1999
1101D	16475	FC	400	300						07/28/1999
1101D	16475	FC	400	220						08/03/1999
1101D	16475	FC	400	1300	1300					08/09/1999
1101D	16475	FC	400	5000	5000					08/10/1999
1101D	16475	FC	400	1100	1100					08/17/1999
1101D	16475	FC	400	1100	1100					08/19/1999
1101D	16475	FC	400	300						09/23/1999
1101D	16475	FC	400	130						10/27/1999
1101D	16475	FC	400	300						11/12/1999
1101D	16475	FC	400	500	500					12/16/1999
1101D	16475	FC	400	1100	1100					01/13/2000
1101D	16475	FC	400	800	800					04/14/2000
1101D	16475	FC	400	300						05/25/2000
1101D	16475	FC	400	1700	1700					06/07/2000
1101D	16475	FC	400	700	700					07/27/2000
1101D	16475	FC	400	300						08/28/2000
1101D	16475	FC	400	9000	9000					09/22/2000
1101D	16475	FC	400	800	800					10/19/2000
1101D	16475	FC	400	90000	90000					11/08/2000
1101D	16475	FC	400	16000	16000					12/08/2000

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101D	16475	FC	400	2200	2200					02/21/2001
1101D	16475	FC	400	16000	16000					03/15/2001
1101D	16475	FC	400	80						04/05/2001
1101D	16475	FC	400	500	500					05/24/2001
1101D	16475	FC	400	130						06/26/2001
1101D	16475	FC	400	800	800					07/18/2001
1101D	16475	FC	400	230						08/22/2001
1101D	16475	FC	400	500	500					09/18/2001
1101D	16475	FC	400	1100	1100					10/23/2001
1101D	16475	FC	400	500	500	**824**	**40**	**27**	**68%**	11/20/2001
1101D	16486	EC	394	1019	1019					01/18/2002
1101D	16486	EC	394	771	771					03/15/2002
1101D	16486	EC	394	158						07/19/2002
1101D	16486	EC	394	20						09/12/2002
1101D	16486	EC	394	85						11/21/2002
1101D	16486	EC	394	52						01/08/2003
1101D	16486	EC	394	20						05/01/2003
1101D	16486	EC	394	20						07/29/2003
1101D	16486	EC	394	63						08/12/2003
1101D	16486	EC	394	7284	7284					4/24/2006
1101D	16486	EC	394	1236	1236	**165**	**11**	**4**	**36%**	4/24/2006
1101D	16486	ENT	89	1553	1553					05/15/2002
1101D	16486	ENT	89	51						03/14/2003
1101D	16486	ENT	89	2300	2300					07/29/2005
1101D	16486	ENT	89	95630	95630					7/5/2006
1101D	16486	ENT	89	5475	5475					7/6/2006
1101D	16486	ENT	89	3455	3455					7/6/2006
1101D	16486	ENT	89	2769	2769					7/7/2006
1101D	16486	ENT	89	5508	5508					7/8/2006
1101D	16486	ENT	89	407	407					8/15/2006
1101D	16486	ENT	89	479	479					8/15/2006
1101D	16486	ENT	89	339	339					8/16/2006
1101D	16486	ENT	89	412	412					8/16/2006
1101D	16486	ENT	89	392	392					8/17/2006
1101D	16486	ENT	89	335	335					8/17/2006
1101D	16486	ENT	89	770	770	**1191**	**15**	**14**	**93%**	8/17/2006
1101D	16486	FC	400	3000	3000					01/08/1999
1101D	16486	FC	400	9000	9000					02/08/1999
1101D	16486	FC	400	2400	2400					03/15/1999
1101D	16486	FC	400	9000	9000					04/14/1999
1101D	16486	FC	400	2200	2200					05/12/1999
1101D	16486	FC	400	3000	3000					06/22/1999
1101D	16486	FC	400	800	800					07/28/1999
1101D	16486	FC	400	9000	9000					08/09/1999
1101D	16486	FC	400	24000	24000					09/23/1999
1101D	16486	FC	400	9000	9000					10/27/1999
1101D	16486	FC	400	170						11/12/1999
1101D	16486	FC	400	3000	3000					12/16/1999
1101D	16486	FC	400	16000	16000					01/13/2000
1101D	16486	FC	400	300						04/14/2000
1101D	16486	FC	400	3000	3000					05/25/2000
1101D	16486	FC	400	3000	3000					06/07/2000
1101D	16486	FC	400	16000	16000					07/27/2000
1101D	16486	FC	400	16000	16000					08/28/2000
1101D	16486	FC	400	5000	5000					09/22/2000
1101D	16486	FC	400	3000	3000					10/19/2000
1101D	16486	FC	400	24000	24000					11/08/2000
1101D	16486	FC	400	230						12/08/2000
1101D	16486	FC	400	9000	9000					02/21/2001
1101D	16486	FC	400	5000	5000					03/15/2001
1101D	16486	FC	400	110						04/05/2001

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1101D	16486	FC	400	5000	5000					05/24/2001
1101D	16486	FC	400	1700	1700					06/26/2001
1101D	16486	FC	400	16000	16000					07/18/2001
1101D	16486	FC	400	16000	16000					08/22/2001
1101D	16486	FC	400	3000	3000					09/18/2001
1101D	16486	FC	400	130						10/23/2001
1101D	16486	FC	400	300		**3061**	**32**	**26**	**81%**	11/20/2001
1102	11449	EC	394	52						01/16/2002
1102	11449	EC	394	30						03/14/2002
1102	11449	EC	394	364						05/21/2002
1102	11449	EC	394	122						07/22/2002
1102	11449	EC	394	20						09/24/2002
1102	11449	EC	394	61						11/05/2002
1102	11449	EC	394	31						01/27/2003
1102	11449	EC	394	10						03/13/2003
1102	11449	EC	394	5						05/07/2003
1102	11449	EC	394	10						07/11/2003
1102	11449	EC	394	10						08/20/2003
1102	11449	EC	394	70						5/24/2006
1102	11449	EC	394	56						6/14/2006
1102	11449	EC	394	181						8/23/2006
1102	11449	EC	394	429	429					8/29/2006
1102	11449	EC	394	86						8/31/2006
1102	11449	EC	394	76						9/27/2006
1102	11449	EC	394	67						9/28/2006
1102	11449	EC	394	61						9/29/2006
1102	11449	EC	394	51						9/29/2006
1102	11449	EC	394	158		**51**	**21**	**1**	**5%**	11/10/2006
1102	11449	FC	400	3000	3000					01/06/1999
1102	11449	FC	400	70						02/10/1999
1102	11449	FC	400	140						03/08/1999
1102	11449	FC	400	170						04/06/1999
1102	11449	FC	400	80						05/07/1999
1102	11449	FC	400	16000	16000					05/11/1999
1102	11449	FC	400	9200	9200					05/13/1999
1102	11449	FC	400	500	500					05/25/1999
1102	11449	FC	400	5000	5000					05/27/1999
1102	11449	FC	400	800	800					06/15/1999
1102	11449	FC	400	3000	3000					07/14/1999
1102	11449	FC	400	130						08/03/1999
1102	11449	FC	400	500	500					08/10/1999
1102	11449	FC	400	80						08/17/1999
1102	11449	FC	400	80						08/19/1999
1102	11449	FC	400	3000	3000					08/30/1999
1102	11449	FC	400	20						09/07/1999
1102	11449	FC	400	170						10/12/1999
1102	11449	FC	400	40						11/10/1999
1102	11449	FC	400	800	800					12/15/1999
1102	11449	FC	400	170						01/12/2000
1102	11449	FC	400	16000	16000					04/13/2000
1102	11449	FC	400	170						05/24/2000
1102	11449	FC	400	3000	3000					06/06/2000
1102	11449	FC	400	130						08/31/2000
1102	11449	FC	400	20						09/20/2000
1102	11449	FC	400	9000	9000					10/18/2000
1102	11449	FC	400	3000	3000					11/07/2000
1102	11449	FC	400	3000	3000					12/07/2000
1102	11449	FC	400	5000	5000					01/17/2001
1102	11449	FC	400	80						02/20/2001
1102	11449	FC	400	230						03/14/2001
1102	11449	FC	400	80						04/04/2001
1102	11449	FC	400	80						05/23/2001

APPENDIX A
Ambient Water Quality Bacteria Data - 1990 to 2006

Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102	11449	FC	400	1300	1300					07/17/2001
1102	11449	FC	400	170						08/21/2001
1102	11449	FC	400	800	800					09/19/2001
1102	11449	FC	400	170						10/22/2001
1102	11449	FC	400	300		**461**	**39**	**18**	**46%**	11/19/2001
1102	11450	EC	394	4786	4786					08/09/2001
1102	11450	EC	394	733	733					01/16/2002
1102	11450	EC	394	17329	17329					02/20/2002
1102	11450	EC	394	97						03/14/2002
1102	11450	EC	394	487	487					05/21/2002
1102	11450	EC	394	74						07/22/2002
1102	11450	EC	394	199						08/29/2002
1102	11450	EC	394	235						09/24/2002
1102	11450	EC	394	74						11/05/2002
1102	11450	EC	394	10						01/27/2003
1102	11450	EC	394	10						03/13/2003
1102	11450	EC	394	5						05/07/2003
1102	11450	EC	394	160						06/03/2003
1102	11450	EC	394	10						07/11/2003
1102	11450	EC	394	52						08/20/2003
1102	11450	EC	394	260						09/14/2004
1102	11450	EC	394	118						10/27/2004
1102	11450	EC	394	4800	4800					01/13/2005
1102	11450	EC	394	740	740					03/01/2005
1102	11450	EC	394	189						03/15/2005
1102	11450	EC	394	160						05/12/2005
1102	11450	EC	394	98						06/16/2005
1102	11450	EC	394	27						07/05/2005
1102	11450	EC	394	910	910					07/27/2005
1102	11450	EC	394	12033	12033					09/14/2005
1102	11450	EC	394	110						10/10/2005
1102	11450	EC	394	14136	14136					12/15/2005
1102	11450	EC	394	6100	6100					12/19/2005
1102	11450	EC	394	230						02/01/2006
1102	11450	EC	394	63						03/14/2006
1102	11450	EC	394	355						4/24/2006
1102	11450	EC	394	911	911					4/25/2006
1102	11450	EC	394	2493	2493					4/26/2006
1102	11450	EC	394	903	903					4/27/2006
1102	11450	EC	394	1729	1729					4/27/2006
1102	11450	EC	394	460	460					4/28/2006
1102	11450	EC	394	118						06/08/2006
1102	11450	EC	394	19110	19110					7/5/2006
1102	11450	EC	394	5248	5248					7/6/2006
1102	11450	EC	394	1566	1566					7/7/2006
1102	11450	EC	394	526	526					7/8/2006
1102	11450	EC	394	9725	9725					7/8/2006
1102	11450	EC	394	599	599					7/8/2006
1102	11450	EC	394	179						8/15/2006
1102	11450	EC	394	184						8/15/2006
1102	11450	EC	394	84						8/16/2006
1102	11450	EC	394	112						8/16/2006
1102	11450	EC	394	114						8/17/2006
1102	11450	EC	394	727	727					8/17/2006
1102	11450	EC	394	196						8/18/2006
1102	11450	EC	394	253						09/13/2006
1102	11450	EC	394	379		**358**	**52**	**22**	**42%**	12/28/2006
1102	11450	ENT	89	556	556					11/29/2000
1102	11450	ENT	89	171	171					05/09/2001
1102	11450	ENT	89	1401	1401					12/03/2001
1102	11450	ENT	89	266	266					05/16/2002
1102	11450	ENT	89	262	262					02/12/2003

APPENDIX A
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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102	11450	ENT	89	30						08/14/2003
1102	11450	ENT	89	10						10/23/2003
1102	11450	ENT	89	20						12/08/2003
1102	11450	ENT	89	31						03/11/2004
1102	11450	ENT	89	120	120					06/03/2004
1102	11450	ENT	89	20		**92**	**11**	**6**	**55%**	12/14/2004
1102	11450	FC	400	3360	3360					03/13/1990
1102	11450	FC	400	12000	12000					09/10/1990
1102	11450	FC	400	195						12/03/1990
1102	11450	FC	400	260						03/05/1991
1102	11450	FC	400	3000	3000					06/25/1991
1102	11450	FC	400	1700	1700					09/09/1991
1102	11450	FC	400	435	435					12/16/1991
1102	11450	FC	400	510	510					03/10/1992
1102	11450	FC	400	1500	1500					12/07/1994
1102	11450	FC	400	16000	16000					01/06/1999
1102	11450	FC	400	220						02/10/1999
1102	11450	FC	400	170						03/08/1999
1102	11450	FC	400	500	500					04/06/1999
1102	11450	FC	400	270						04/29/1999
1102	11450	FC	400	260						05/07/1999
1102	11450	FC	400	16000	16000					05/11/1999
1102	11450	FC	400	16000	16000					05/13/1999
1102	11450	FC	400	230						05/25/1999
1102	11450	FC	400	700	700					05/27/1999
1102	11450	FC	400	700	700					05/27/1999
1102	11450	FC	400	1300	1300					06/15/1999
1102	11450	FC	400	3000	3000					07/14/1999
1102	11450	FC	400	170						08/03/1999
1102	11450	FC	400	500	500					08/10/1999
1102	11450	FC	400	80						08/17/1999
1102	11450	FC	400	300						08/19/1999
1102	11450	FC	400	24000	24000					08/30/1999
1102	11450	FC	400	300						09/07/1999
1102	11450	FC	400	220						10/12/1999
1102	11450	FC	400	300						11/10/1999
1102	11450	FC	400	300						11/10/1999
1102	11450	FC	400	16000	16000					12/15/1999
1102	11450	FC	400	230						01/12/2000
1102	11450	FC	400	5000	5000					04/13/2000
1102	11450	FC	400	300						05/24/2000
1102	11450	FC	400	3000	3000					06/06/2000
1102	11450	FC	400	500	500					08/31/2000
1102	11450	FC	400	800	800					09/20/2000
1102	11450	FC	400	16000	16000					10/18/2000
1102	11450	FC	400	2100	2100					11/07/2000
1102	11450	FC	400	1300	1300					12/07/2000
1102	11450	FC	400	30000	30000					01/17/2001
1102	11450	FC	400	1780	1780					02/08/2001
1102	11450	FC	400	20						02/20/2001
1102	11450	FC	400	300						03/14/2001
1102	11450	FC	400	500	500					04/04/2001
1102	11450	FC	400	170						05/23/2001
1102	11450	FC	400	500	500					06/25/2001
1102	11450	FC	400	900	900					07/17/2001
1102	11450	FC	400	800	800					08/21/2001
1102	11450	FC	400	230						09/19/2001
1102	11450	FC	400	300						10/22/2001
1102	11450	FC	400	130		**833**	**53**	**31**	**58%**	11/19/2001
1102	11451	EC	394	243						01/14/2002
1102	11451	EC	394	1455	1455					03/08/2002
1102	11451	EC	394	97						05/13/2002

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102	11451	EC	394	1989	1989					07/16/2002
1102	11451	EC	394	10						11/19/2002
1102	11451	EC	394	1100	1100					01/13/2003
1102	11451	EC	394	31						03/06/2003
1102	11451	EC	394	10						05/02/2003
1102	11451	EC	394	10						07/18/2003
1102	11451	EC	394	20						08/11/2003
1102	11451	EC	394	1700	1700					02/25/2004
1102	11451	EC	394	1200	1200					04/21/2004
1102	11451	EC	394	108						07/14/2004
1102	11451	EC	394	909	909					08/24/2004
1102	11451	EC	394	150						10/25/2004
1102	11451	EC	394	790	790					12/28/2004
1102	11451	EC	394	930	930					02/15/2005
1102	11451	EC	394	31						04/19/2005
1102	11451	EC	394	85						06/22/2005
1102	11451	EC	394	190						07/27/2005
1102	11451	EC	394	20						08/29/2005
1102	11451	EC	394	230						11/09/2005
1102	11451	EC	394	63						12/28/2005
1102	11451	EC	394	31						02/23/2006
1102	11451	EC	394	10						04/27/2006
1102	11451	EC	394	3100	3100					06/21/2006
1102	11451	EC	394	200		**146**	**27**	**9**	**33%**	08/30/2006
1102	11451	FC	400	230						09/19/2000
1102	11451	FC	400	16000	16000					10/17/2000
1102	11451	FC	400	24000	24000					11/06/2000
1102	11451	FC	400	500	500					12/06/2000
1102	11451	FC	400	16000	16000					01/16/2001
1102	11451	FC	400	70						02/19/2001
1102	11451	FC	400	800	800					03/13/2001
1102	11451	FC	400	3000	3000					04/03/2001
1102	11451	FC	400	500	500					05/22/2001
1102	11451	FC	400	1300	1300					06/15/2001
1102	11451	FC	400	220						07/16/2001
1102	11451	FC	400	3000	3000					08/20/2001
1102	11451	FC	400	170						09/17/2001
1102	11451	FC	400	1300	1300					10/24/2001
1102	11451	FC	400	80						11/15/2001
1102	11451	FC	400	920	920					02/25/2004
1102	11451	FC	400	190						04/21/2004
1102	11451	FC	400	200						07/14/2004
1102	11451	FC	400	800	800					08/24/2004
1102	11451	FC	400	180						10/25/2004
1102	11451	FC	400	890	890					12/28/2004
1102	11451	FC	400	660	660					02/15/2005
1102	11451	FC	400	55						04/19/2005
1102	11451	FC	400	210						06/22/2005
1102	11451	FC	400	27						08/29/2005
1102	11451	FC	400	91						11/09/2005
1102	11451	FC	400	18						12/28/2005
1102	11451	FC	400	64						02/23/2006
1102	11451	FC	400	18						04/27/2006
1102	11451	FC	400	100000	100000					06/21/2006
1102	11451	FC	400	190		**458**	**31**	**15**	**48%**	08/30/2006
1102	11452	EC	394	121						11/29/2000
1102	11452	EC	394	332						05/09/2001
1102	11452	EC	394	150						08/09/2001
1102	11452	EC	394	728	728					12/03/2001
1102	11452	EC	394	5172	5172					02/20/2002
1102	11452	EC	394	237						05/16/2002
1102	11452	EC	394	96						08/29/2002

APPENDIX A
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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102	11452	EC	394	650	650					02/12/2003
1102	11452	EC	394	10						06/03/2003
1102	11452	EC	394	132						08/14/2003
1102	11452	EC	394	140						10/23/2003
1102	11452	EC	394	52						12/08/2003
1102	11452	EC	394	1700	1700					02/25/2004
1102	11452	EC	394	31						03/11/2004
1102	11452	EC	394	490	490					04/21/2004
1102	11452	EC	394	180						06/03/2004
1102	11452	EC	394	410	410					07/14/2004
1102	11452	EC	394	10						08/24/2004
1102	11452	EC	394	20						09/14/2004
1102	11452	EC	394	10						10/25/2004
1102	11452	EC	394	410	410					12/14/2004
1102	11452	EC	394	63						12/28/2004
1102	11452	EC	394	570	570					02/15/2005
1102	11452	EC	394	199						03/15/2005
1102	11452	EC	394	110						04/19/2005
1102	11452	EC	394	41						06/16/2005
1102	11452	EC	394	96						06/22/2005
1102	11452	EC	394	150						07/26/2005
1102	11452	EC	394	10						08/29/2005
1102	11452	EC	394	1076	1076					09/14/2005
1102	11452	EC	394	660	660					11/09/2005
1102	11452	EC	394	7701	7701					12/15/2005
1102	11452	EC	394	240000	240000					12/28/2005
1102	11452	EC	394	82000	82000					02/23/2006
1102	11452	EC	394	250						03/14/2006
1102	11452	EC	394	25						4/24/2006
1102	11452	EC	394	30						4/25/2006
1102	11452	EC	394	53						4/25/2006
1102	11452	EC	394	44						4/26/2006
1102	11452	EC	394	16						4/27/2006
1102	11452	EC	394	65						4/28/2006
1102	11452	EC	394	20						06/08/2006
1102	11452	EC	394	11000	11000					06/21/2006
1102	11452	EC	394	27685	27685					7/5/2006
1102	11452	EC	394	5458	5458					7/6/2006
1102	11452	EC	394	749	749					7/7/2006
1102	11452	EC	394	862	862					7/7/2006
1102	11452	EC	394	186						7/8/2006
1102	11452	EC	394	20						8/15/2006
1102	11452	EC	394	11						8/16/2006
1102	11452	EC	394	29						8/16/2006
1102	11452	EC	394	7						8/17/2006
1102	11452	EC	394	17						8/17/2006
1102	11452	EC	394	75						8/18/2006
1102	11452	EC	394	52						08/30/2006
1102	11452	EC	394	10						09/13/2006
1102	11452	EC	394	109		**170**	**57**	**18**	**32%**	12/28/2006
1102	11452	FC	400	180						04/19/1999
1102	11452	FC	400	29000	29000					04/28/1999
1102	11452	FC	400	90						04/29/1999
1102	11452	FC	400	300						05/04/1999
1102	11452	FC	400	29000	29000					05/10/1999
1102	11452	FC	400	290						05/27/1999
1102	11452	FC	400	400	400					06/03/1999
1102	11452	FC	400	300						06/10/1999
1102	11452	FC	400	8000	8000					06/16/1999
1102	11452	FC	400	1900	1900					06/22/1999
1102	11452	FC	400	1000	1000					07/06/1999
1102	11452	FC	400	2500	2500					07/12/1999

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102	11452	FC	400	500	500					07/15/1999
1102	11452	FC	400	600	600					07/21/1999
1102	11452	FC	400	500	500					07/27/1999
1102	11452	FC	400	100						08/02/1999
1102	11452	FC	400	400	400					08/05/1999
1102	11452	FC	400	100						08/11/1999
1102	11452	FC	400	300						08/17/1999
1102	11452	FC	400	300						08/23/1999
1102	11452	FC	400	500	500					09/01/1999
1102	11452	FC	400	400	400					09/08/1999
1102	11452	FC	400	260						09/27/1999
1102	11452	FC	400	200						10/05/1999
1102	11452	FC	400	600	600					10/07/1999
1102	11452	FC	400	400	400					10/13/1999
1102	11452	FC	400	100						10/18/1999
1102	11452	FC	400	200						10/27/1999
1102	11452	FC	400	100						11/03/1999
1102	11452	FC	400	200						11/10/1999
1102	11452	FC	400	200						11/15/1999
1102	11452	FC	400	3600	3600					11/24/1999
1102	11452	FC	400	900	900					12/01/1999
1102	11452	FC	400	1600	1600					12/06/1999
1102	11452	FC	400	400	400					12/15/1999
1102	11452	FC	400	3000	3000					12/20/1999
1102	11452	FC	400	300						01/05/2000
1102	11452	FC	400	140						01/13/2000
1102	11452	FC	400	90						01/20/2000
1102	11452	FC	400	220						01/27/2000
1102	11452	FC	400	840	840					02/01/2000
1102	11452	FC	400	370						02/07/2000
1102	11452	FC	400	130						02/14/2000
1102	11452	FC	400	27						02/21/2000
1102	11452	FC	400	99						03/08/2000
1102	11452	FC	400	99						03/22/2000
1102	11452	FC	400	1920	1920					02/08/2001
1102	11452	FC	400	1700	1700					02/25/2004
1102	11452	FC	400	400	400					04/21/2004
1102	11452	FC	400	73						07/14/2004
1102	11452	FC	400	10						08/24/2004
1102	11452	FC	400	18						10/25/2004
1102	11452	FC	400	120						12/28/2004
1102	11452	FC	400	130						02/15/2005
1102	11452	FC	400	18						04/19/2005
1102	11452	FC	400	210						06/22/2005
1102	11452	FC	400	130						08/29/2005
1102	11452	FC	400	320						11/09/2005
1102	11452	FC	400	68000	68000					12/28/2005
1102	11452	FC	400	2100	2100					02/23/2006
1102	11452	FC	400	10						04/27/2006
1102	11452	FC	400	100000	100000					06/21/2006
1102	11452	FC	400	190		**381**	**63**	**27**	**43%**	08/30/2006
1102	14229	EC	394	158						01/17/2002
1102	14229	EC	394	97						03/14/2002
1102	14229	EC	394	616	616					05/22/2002
1102	14229	EC	394	85						07/23/2002
1102	14229	EC	394	10						09/24/2002
1102	14229	EC	394	2046	2046					11/06/2002
1102	14229	EC	394	3873	3873					01/27/2003
1102	14229	EC	394	10						03/13/2003
1102	14229	EC	394	5						05/07/2003
1102	14229	EC	394	10						07/11/2003
1102	14229	EC	394	158						08/20/2003

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102	14229	EC	394	2200	2200					02/25/2004
1102	14229	EC	394	120						04/21/2004
1102	14229	EC	394	413	413					07/14/2004
1102	14229	EC	394	958	958					08/24/2004
1102	14229	EC	394	63						10/25/2004
1102	14229	EC	394	440	440					12/28/2004
1102	14229	EC	394	990	990					02/15/2005
1102	14229	EC	394	41						04/19/2005
1102	14229	EC	394	63						06/22/2005
1102	14229	EC	394	62						08/29/2005
1102	14229	EC	394	140						11/09/2005
1102	14229	EC	394	1100	1100					12/28/2005
1102	14229	EC	394	150						02/23/2006
1102	14229	EC	394	330						04/27/2006
1102	14229	EC	394	1100	1100					06/21/2006
1102	14229	EC	394	20		**161**	**27**	**10**	**37%**	08/30/2006
1102	14229	FC	400	420	420					04/29/1999
1102	14229	FC	400	300						05/07/1999
1102	14229	FC	400	16000	16000					05/11/1999
1102	14229	FC	400	2400	2400					05/13/1999
1102	14229	FC	400	3000	3000					05/25/1999
1102	14229	FC	400	580	580					05/27/1999
1102	14229	FC	400	1100	1100					05/27/1999
1102	14229	FC	400	800	800					06/15/1999
1102	14229	FC	400	9000	9000					07/14/1999
1102	14229	FC	400	110						08/03/1999
1102	14229	FC	400	500	500					08/10/1999
1102	14229	FC	400	20						08/17/1999
1102	14229	FC	400	500	500					08/19/1999
1102	14229	FC	400	800	800					08/30/1999
1102	14229	FC	400	500	500					09/07/1999
1102	14229	FC	400	110						10/12/1999
1102	14229	FC	400	80						11/10/1999
1102	14229	FC	400	800	800					12/15/1999
1102	14229	FC	400	300						01/12/2000
1102	14229	FC	400	90						03/08/2000
1102	14229	FC	400	420	420					03/22/2000
1102	14229	FC	400	16000	16000					04/13/2000
1102	14229	FC	400	1100	1100					05/24/2000
1102	14229	FC	400	800	800					06/06/2000
1102	14229	FC	400	130						08/31/2000
1102	14229	FC	400	800	800					09/20/2000
1102	14229	FC	400	16000	16000					10/18/2000
1102	14229	FC	400	2200	2200					11/07/2000
1102	14229	FC	400	2400	2400					12/07/2000
1102	14229	FC	400	17000	17000					01/17/2001
1102	14229	FC	400	230						02/20/2001
1102	14229	FC	400	500	500					03/14/2001
1102	14229	FC	400	500	500					04/04/2001
1102	14229	FC	400	20						05/23/2001
1102	14229	FC	400	800	800					06/25/2001
1102	14229	FC	400	40						07/17/2001
1102	14229	FC	400	20						08/21/2001
1102	14229	FC	400	500	500					09/19/2001
1102	14229	FC	400	300						10/22/2001
1102	14229	FC	400	220						11/19/2001
1102	14229	FC	400	2500	2500					02/25/2004
1102	14229	FC	400	140						04/21/2004
1102	14229	FC	400	570	570					07/14/2004
1102	14229	FC	400	10						08/24/2004
1102	14229	FC	400	200						10/25/2004
1102	14229	FC	400	390						12/28/2004

APPENDIX A
Ambient Water Quality Bacteria Data - 1990 to 2006

Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102	14229	FC	400	310						02/15/2005
1102	14229	FC	400	82						04/19/2005
1102	14229	FC	400	27						06/22/2005
1102	14229	FC	400	55						08/29/2005
1102	14229	FC	400	82						11/09/2005
1102	14229	FC	400	110						12/28/2005
1102	14229	FC	400	380						02/23/2006
1102	14229	FC	400	600	600					04/27/2006
1102	14229	FC	400	41000	41000					06/21/2006
1102	14229	FC	400	190		**435**	**56**	**30**	**54%**	08/30/2006
1102	17073	EC	394	63						01/15/2002
1102	17073	EC	394	181						03/07/2002
1102	17073	EC	394	1439	1439					05/14/2002
1102	17073	EC	394	10						11/25/2002
1102	17073	EC	394	563	563					01/14/2003
1102	17073	EC	394	71						03/07/2003
1102	17073	EC	394	201						05/20/2003
1102	17073	EC	394	10						07/21/2003
1102	17073	EC	394	10						08/19/2003
1102	17073	EC	394	3200	3200					02/25/2004
1102	17073	EC	394	10						04/21/2004
1102	17073	EC	394	330						06/22/2004
1102	17073	EC	394	15						08/24/2004
1102	17073	EC	394	10						10/25/2004
1102	17073	EC	394	100						12/28/2004
1102	17073	EC	394	410	410					02/15/2005
1102	17073	EC	394	20						04/19/2005
1102	17073	EC	394	31		**75**	**18**	**4**	**22%**	08/29/2005
1102	17073	FC	400	230						09/19/2000
1102	17073	FC	400	80						10/17/2000
1102	17073	FC	400	24000	24000					11/06/2000
1102	17073	FC	400	70						12/06/2000
1102	17073	FC	400	500	500					12/06/2000
1102	17073	FC	400	2400	2400					01/16/2001
1102	17073	FC	400	20						02/19/2001
1102	17073	FC	400	90						03/13/2001
1102	17073	FC	400	800	800					04/03/2001
1102	17073	FC	400	800	800					05/22/2001
1102	17073	FC	400	1300	1300					06/15/2001
1102	17073	FC	400	500	500					07/16/2001
1102	17073	FC	400	2400	2400					08/20/2001
1102	17073	FC	400	230						09/17/2001
1102	17073	FC	400	40						10/24/2001
1102	17073	FC	400	40						11/15/2001
1102	17073	FC	400	3000	3000					02/25/2004
1102	17073	FC	400	10						04/21/2004
1102	17073	FC	400	260						06/22/2004
1102	17073	FC	400	36						08/24/2004
1102	17073	FC	400	10						10/25/2004
1102	17073	FC	400	36						12/28/2004
1102	17073	FC	400	300						02/15/2005
1102	17073	FC	400	18						04/19/2005
1102	17073	FC	400	36		**185**	**25**	**9**	**36%**	08/29/2005
1102	17074	EC	394	73						01/14/2002
1102	17074	EC	394	243						03/08/2002
1102	17074	EC	394	10						05/13/2002
1102	17074	EC	394	771	771					07/17/2002
1102	17074	EC	394	10						11/19/2002
1102	17074	EC	394	10						01/13/2003
1102	17074	EC	394	20						03/06/2003
1102	17074	EC	394	10						05/02/2003
1102	17074	EC	394	10						07/18/2003

Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102	17074	EC	394	10						08/11/2003
1102	17074	EC	394	2800	2800					02/25/2004
1102	17074	EC	394	110						04/21/2004
1102	17074	EC	394	216						07/14/2004
1102	17074	EC	394	209						08/24/2004
1102	17074	EC	394	10						10/25/2004
1102	17074	EC	394	170						12/28/2004
1102	17074	EC	394	910	910					02/15/2005
1102	17074	EC	394	52						04/19/2005
1102	17074	EC	394	140						06/22/2005
1102	17074	EC	394	140						07/26/2005
1102	17074	EC	394	47000	47000					07/26/2005
1102	17074	EC	394	63						08/29/2005
1102	17074	EC	394	270						11/09/2005
1102	17074	EC	394	120						12/28/2005
1102	17074	EC	394	10						02/23/2006
1102	17074	EC	394	510	510					04/27/2006
1102	17074	EC	394	16						6/14/2006
1102	17074	EC	394	3000	3000					06/21/2006
1102	17074	EC	394	617	617					8/23/2006
1102	17074	EC	394	24						8/29/2006
1102	17074	EC	394	10						08/30/2006
1102	17074	EC	394	13						8/31/2006
1102	17074	EC	394	15						9/27/2006
1102	17074	EC	394	14						9/27/2006
1102	17074	EC	394	23						9/28/2006
1102	17074	EC	394	30		**75**	**36**	**7**	**19%**	9/29/2006
1102	17074	FC	400	700	700					09/19/2000
1102	17074	FC	400	16000	16000					10/17/2000
1102	17074	FC	400	30000	30000					11/06/2000
1102	17074	FC	400	1700	1700					12/06/2000
1102	17074	FC	400	2200	2200					01/16/2001
1102	17074	FC	400	80						02/19/2001
1102	17074	FC	400	800	800					03/13/2001
1102	17074	FC	400	1300	1300					04/03/2001
1102	17074	FC	400	230						05/22/2001
1102	17074	FC	400	800	800					06/15/2001
1102	17074	FC	400	40						07/16/2001
1102	17074	FC	400	80						08/20/2001
1102	17074	FC	400	300						09/17/2001
1102	17074	FC	400	2400	2400					02/25/2004
1102	17074	FC	400	170						04/21/2004
1102	17074	FC	400	182						07/14/2004
1102	17074	FC	400	500	500					08/24/2004
1102	17074	FC	400	54						10/25/2004
1102	17074	FC	400	73						12/28/2004
1102	17074	FC	400	690	690					02/15/2005
1102	17074	FC	400	27						04/19/2005
1102	17074	FC	400	890	890					06/22/2005
1102	17074	FC	400	18						08/29/2005
1102	17074	FC	400	140						11/09/2005
1102	17074	FC	400	27						12/28/2005
1102	17074	FC	400	10						02/23/2006
1102	17074	FC	400	140						04/27/2006
1102	17074	FC	400	100000	100000					06/21/2006
1102	17074	FC	400	120		**348**	**29**	**13**	**45%**	08/30/2006
1102	17076	EC	394	399	399					01/15/2002
1102	17076	EC	394	211						03/07/2002
1102	17076	EC	394	135						05/14/2002
1102	17076	EC	394	10						11/25/2002
1102	17076	EC	394	84						01/14/2003
1102	17076	EC	394	20						03/07/2003

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102	17076	EC	394	161						07/21/2003
1102	17076	EC	394	4611	4611					08/19/2003
1102	17076	EC	394	850	850					02/25/2004
1102	17076	EC	394	230						04/21/2004
1102	17076	EC	394	960	960					06/22/2004
1102	17076	EC	394	359						08/24/2004
1102	17076	EC	394	170						10/25/2004
1102	17076	EC	394	160						12/28/2004
1102	17076	EC	394	660	660					02/15/2005
1102	17076	EC	394	330						04/19/2005
1102	17076	EC	394	160						06/22/2005
1102	17076	EC	394	140						07/26/2005
1102	17076	EC	394	310						08/29/2005
1102	17076	EC	394	41						11/09/2005
1102	17076	EC	394	160						12/28/2005
1102	17076	EC	394	41						02/23/2006
1102	17076	EC	394	150						04/27/2006
1102	17076	EC	394	230						06/28/2006
1102	17076	EC	394	210		**189**	**25**	**5**	**20%**	08/30/2006
1102	17076	FC	400	170						09/19/2000
1102	17076	FC	400	16000	16000					10/17/2000
1102	17076	FC	400	13000	13000					11/06/2000
1102	17076	FC	400	130						12/06/2000
1102	17076	FC	400	16000	16000					01/16/2001
1102	17076	FC	400	170						02/19/2001
1102	17076	FC	400	700	700					03/13/2001
1102	17076	FC	400	230						04/03/2001
1102	17076	FC	400	500	500					05/22/2001
1102	17076	FC	400	500	500					06/15/2001
1102	17076	FC	400	1300	1300					07/16/2001
1102	17076	FC	400	1100	1100					08/20/2001
1102	17076	FC	400	300						09/17/2001
1102	17076	FC	400	170						10/24/2001
1102	17076	FC	400	80						11/15/2001
1102	17076	FC	400	460	460					02/25/2004
1102	17076	FC	400	260						04/21/2004
1102	17076	FC	400	700	700					06/22/2004
1102	17076	FC	400	200						08/24/2004
1102	17076	FC	400	210						10/25/2004
1102	17076	FC	400	110						12/28/2004
1102	17076	FC	400	270						02/15/2005
1102	17076	FC	400	280						04/19/2005
1102	17076	FC	400	310						06/22/2005
1102	17076	FC	400	330						08/29/2005
1102	17076	FC	400	82						11/09/2005
1102	17076	FC	400	73						12/28/2005
1102	17076	FC	400	27						02/23/2006
1102	17076	FC	400	180						04/27/2006
1102	17076	FC	400	380		**368**	**30**	**10**	**33%**	08/30/2006
1102	17077	EC	394	146						01/15/2002
1102	17077	EC	394	399	399					03/07/2002
1102	17077	EC	394	1						05/14/2002
1102	17077	EC	394	10						11/25/2002
1102	17077	EC	394	92						01/14/2003
1102	17077	EC	394	10						03/07/2003
1102	17077	EC	394	5						05/20/2003
1102	17077	EC	394	20						07/21/2003
1102	17077	EC	394	1421	1421					08/19/2003
1102	17077	EC	394	1600	1600					02/25/2004
1102	17077	EC	394	250						04/21/2004
1102	17077	EC	394	337						07/14/2004
1102	17077	EC	394	74						08/24/2004

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102	17077	EC	394	85						10/25/2004
1102	17077	EC	394	140						12/28/2004
1102	17077	EC	394	710	710					02/15/2005
1102	17077	EC	394	85						04/19/2005
1102	17077	EC	394	120						06/22/2005
1102	17077	EC	394	10						08/29/2005
1102	17077	EC	394	63						11/09/2005
1102	17077	EC	394	200						12/28/2005
1102	17077	EC	394	120						02/23/2006
1102	17077	EC	394	31						04/27/2006
1102	17077	EC	394	160						06/28/2006
1102	17077	EC	394	51		**79**	**25**	**4**	**16%**	08/30/2006
1102	17077	FC	400	130						09/19/2000
1102	17077	FC	400	9000	9000					10/17/2000
1102	17077	FC	400	13000	13000					11/06/2000
1102	17077	FC	400	800	800					12/06/2000
1102	17077	FC	400	16000	16000					01/16/2001
1102	17077	FC	400	40						02/19/2001
1102	17077	FC	400	700	700					03/13/2001
1102	17077	FC	400	500	500					04/03/2001
1102	17077	FC	400	80						05/22/2001
1102	17077	FC	400	130						06/15/2001
1102	17077	FC	400	90						07/16/2001
1102	17077	FC	400	20						08/20/2001
1102	17077	FC	400	80						09/17/2001
1102	17077	FC	400	300						10/24/2001
1102	17077	FC	400	70						11/15/2001
1102	17077	FC	400	1200	1200					02/25/2004
1102	17077	FC	400	230						04/21/2004
1102	17077	FC	400	260						07/14/2004
1102	17077	FC	400	10						08/24/2004
1102	17077	FC	400	100						10/25/2004
1102	17077	FC	400	55						12/28/2004
1102	17077	FC	400	82						02/15/2005
1102	17077	FC	400	82						04/19/2005
1102	17077	FC	400	360						06/22/2005
1102	17077	FC	400	73						08/29/2005
1102	17077	FC	400	120						11/09/2005
1102	17077	FC	400	120						12/28/2005
1102	17077	FC	400	130						02/23/2006
1102	17077	FC	400	57						04/27/2006
1102	17077	FC	400	690	690	**210**	**30**	**8**	**27%**	08/30/2006
1102	17079	EC	394	31						01/15/2002
1102	17079	EC	394	189						03/07/2002
1102	17079	EC	394	1039	1039					05/14/2002
1102	17079	EC	394	10						11/25/2002
1102	17079	EC	394	81						01/14/2003
1102	17079	EC	394	5						03/07/2003
1102	17079	EC	394	10						07/21/2003
1102	17079	EC	394	3076	3076					08/19/2003
1102	17079	EC	394	200						02/25/2004
1102	17079	EC	394	110						04/21/2004
1102	17079	EC	394	980	980					06/22/2004
1102	17079	EC	394	131						08/24/2004
1102	17079	EC	394	1500	1500					10/25/2004
1102	17079	EC	394	86						12/28/2004
1102	17079	EC	394	680	680					02/15/2005
1102	17079	EC	394	330						04/19/2005
1102	17079	EC	394	15						06/22/2005
1102	17079	EC	394	100						07/26/2005
1102	17079	EC	394	41						08/29/2005
1102	17079	EC	394	36						11/09/2005

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102	17079	EC	394	52						12/28/2005
1102	17079	EC	394	10						02/23/2006
1102	17079	EC	394	188						4/25/2006
1102	17079	EC	394	223						4/25/2006
1102	17079	EC	394	154						4/25/2006
1102	17079	EC	394	97						4/26/2006
1102	17079	EC	394	97						4/27/2006
1102	17079	EC	394	100						04/27/2006
1102	17079	EC	394	154						4/28/2006
1102	17079	EC	394	410	410					06/28/2006
1102	17079	EC	394	34						8/15/2006
1102	17079	EC	394	44						8/16/2006
1102	17079	EC	394	68						8/16/2006
1102	17079	EC	394	55						8/17/2006
1102	17079	EC	394	116						8/17/2006
1102	17079	EC	394	124						8/17/2006
1102	17079	EC	394	50						08/18/2006
1102	17079	EC	394	52		**99**	**38**	**6**	**16%**	08/30/2006
1102	17079	FC	400	300						03/13/2001
1102	17079	FC	400	230						04/03/2001
1102	17079	FC	400	300						05/22/2001
1102	17079	FC	400	230						06/15/2001
1102	17079	FC	400	130						09/17/2001
1102	17079	FC	400	260						10/24/2001
1102	17079	FC	400	800	800					11/15/2001
1102	17079	FC	400	40						02/25/2004
1102	17079	FC	400	180						04/21/2004
1102	17079	FC	400	27						06/22/2004
1102	17079	FC	400	200						08/24/2004
1102	17079	FC	400	6400	6400					10/25/2004
1102	17079	FC	400	10						12/28/2004
1102	17079	FC	400	340						02/15/2005
1102	17079	FC	400	240						04/19/2005
1102	17079	FC	400	45						06/22/2005
1102	17079	FC	400	73						08/29/2005
1102	17079	FC	400	18						11/09/2005
1102	17079	FC	400	10						12/28/2005
1102	17079	FC	400	10						02/23/2006
1102	17079	FC	400	73						04/27/2006
1102	17079	FC	400	280		**117**	**22**	**2**	**9%**	08/30/2006
1102A	11425	EC	394	549	549					10/27/2004
1102A	11425	EC	394	4800	4800					01/13/2005
1102A	11425	EC	394	1400	1400					03/01/2005
1102A	11425	EC	394	1200	1200					05/10/2005
1102A	11425	EC	394	69						07/05/2005
1102A	11425	EC	394	260						07/28/2005
1102A	11425	EC	394	290						10/10/2005
1102A	11425	EC	394	440	440					12/19/2005
1102A	11425	EC	394	220						02/01/2006
1102A	11425	EC	394	180						04/04/2006
1102A	11425	EC	394	483	483					4/24/2006
1102A	11425	EC	394	131						4/25/2006
1102A	11425	EC	394	1,152	1152					4/26/2006
1102A	11425	EC	394	208						4/27/2006
1102A	11425	EC	394	380						4/27/2006
1102A	11425	EC	394	1						4/28/2006
1102A	11425	EC	394	1200	1200					05/08/2006
1102A	11425	EC	394	4800	4800					06/01/2006
1102A	11425	EC	394	2339	2339					7/6/2006
1102A	11425	EC	394	2578	2578					7/6/2006
1102A	11425	EC	394	825	825					7/7/2006

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102A	11425	EC	394	214						7/8/2006
1102A	11425	EC	394	282						7/8/2006
1102A	11425	EC	394	110						08/03/2006
1102A	11425	EC	394	112						8/15/2006
1102A	11425	EC	394	33						8/16/2006
1102A	11425	EC	394	37						8/16/2006
1102A	11425	EC	394	60						8/17/2006
1102A	11425	EC	394	694	694	**314**	**29**	**13**	**45%**	8/17/2006
1102A	11425	FC	400	2400	2400					01/06/1999
1102A	11425	FC	400	70						02/10/1999
1102A	11425	FC	400	140						03/08/1999
1102A	11425	FC	400	1100	1100					04/06/1999
1102A	11425	FC	400	1300	1300					05/07/1999
1102A	11425	FC	400	16000	16000					05/11/1999
1102A	11425	FC	400	16000	16000					05/13/1999
1102A	11425	FC	400	230						05/25/1999
1102A	11425	FC	400	24000	24000					05/27/1999
1102A	11425	FC	400	1700	1700					06/15/1999
1102A	11425	FC	400	470	470					07/14/1999
1102A	11425	FC	400	130						08/03/1999
1102A	11425	FC	400	170						08/10/1999
1102A	11425	FC	400	40						08/17/1999
1102A	11425	FC	400	130						08/19/1999
1102A	11425	FC	400	500	500					08/30/1999
1102A	11425	FC	400	170		**628**	**17**	**9**	**53%**	09/07/1999
1102A	11426	EC	394	370						03/23/2004
1102A	11426	EC	394	120						05/26/2004
1102A	11426	EC	394	231						07/27/2004
1102A	11426	EC	394	30						09/29/2004
1102A	11426	EC	394	96						11/29/2004
1102A	11426	EC	394	500	500					05/18/2005
1102A	11426	EC	394	2000	2000					08/29/2005
1102A	11426	EC	394	200						11/09/2005
1102A	11426	EC	394	640	640					12/28/2005
1102A	11426	EC	394	120						02/23/2006
1102A	11426	EC	394	1100	1100					04/27/2006
1102A	11426	EC	394	550	550					06/21/2006
1102A	11426	EC	394	85		**259**	**13**	**5**	**38%**	08/30/2006
1102A	11426	FC	400	300						03/23/2004
1102A	11426	FC	400	320						05/26/2004
1102A	11426	FC	400	460	460					07/27/2004
1102A	11426	FC	400	64						09/29/2004
1102A	11426	FC	400	600	600					11/29/2004
1102A	11426	FC	400	73						05/18/2005
1102A	11426	FC	400	2600	2600					08/29/2005
1102A	11426	FC	400	160						11/09/2005
1102A	11426	FC	400	260						12/28/2005
1102A	11426	FC	400	210						02/23/2006
1102A	11426	FC	400	330						04/27/2006
1102A	11426	FC	400	4800	4800					06/21/2006
1102A	11426	FC	400	310		**354**	**13**	**4**	**31%**	08/30/2006
1102A	16477	EC	394	181						01/16/2002
1102A	16477	EC	394	573	573					03/20/2002
1102A	16477	EC	394	384						05/22/2002
1102A	16477	EC	394	63						07/23/2002
1102A	16477	EC	394	10						09/24/2002
1102A	16477	EC	394	805	805					11/06/2002
1102A	16477	EC	394	19863	19863					01/27/2003
1102A	16477	EC	394	31						03/13/2003
1102A	16477	EC	394	10						05/07/2003
1102A	16477	EC	394	10						07/11/2003

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102A	16477	EC	394	10		**102**	**11**	**3**	**27%**	08/20/2003
1102A	16477	FC	400	5000	5000					01/06/1999
1102A	16477	FC	400	800	800					02/10/1999
1102A	16477	FC	400	110						03/08/1999
1102A	16477	FC	400	300						04/06/1999
1102A	16477	FC	400	10						05/07/1999
1102A	16477	FC	400	16000	16000					05/11/1999
1102A	16477	FC	400	24000	24000					05/13/1999
1102A	16477	FC	400	220						05/25/1999
1102A	16477	FC	400	1700	1700					05/27/1999
1102A	16477	FC	400	1100	1100					06/15/1999
1102A	16477	FC	400	410	410					07/14/1999
1102A	16477	FC	400	500	500					08/03/1999
1102A	16477	FC	400	300						08/10/1999
1102A	16477	FC	400	5000	5000					08/17/1999
1102A	16477	FC	400	1300	1300					08/19/1999
1102A	16477	FC	400	3000	3000					08/30/1999
1102A	16477	FC	400	220						09/07/1999
1102A	16477	FC	400	300						10/12/1999
1102A	16477	FC	400	220						11/10/1999
1102A	16477	FC	400	80						12/15/1999
1102A	16477	FC	400	80						01/12/2000
1102A	16477	FC	400	16000	16000					04/13/2000
1102A	16477	FC	400	300						05/24/2000
1102A	16477	FC	400	300						06/06/2000
1102A	16477	FC	400	20						08/31/2000
1102A	16477	FC	400	1100	1100					09/20/2000
1102A	16477	FC	400	9000	9000					10/18/2000
1102A	16477	FC	400	3000	3000					11/07/2000
1102A	16477	FC	400	300						12/07/2000
1102A	16477	FC	400	13000	13000					01/17/2001
1102A	16477	FC	400	1300	1300					02/20/2001
1102A	16477	FC	400	500	500					03/14/2001
1102A	16477	FC	400	800	800					04/04/2001
1102A	16477	FC	400	230						05/23/2001
1102A	16477	FC	400	130						06/25/2001
1102A	16477	FC	400	130						07/17/2001
1102A	16477	FC	400	80						08/21/2001
1102A	16477	FC	400	110						09/19/2001
1102A	16477	FC	400	40						10/22/2001
1102A	16477	FC	400	80		**520**	**40**	**19**	**48%**	11/19/2001
1102A	16478	EC	394	173						01/16/2002
1102A	16478	EC	394	10						03/14/2002
1102A	16478	EC	394	1090	1090					05/21/2002
1102A	16478	EC	394	120						07/22/2002
1102A	16478	EC	394	359						09/24/2002
1102A	16478	EC	394	107						11/05/2002
1102A	16478	EC	394	131						01/27/2003
1102A	16478	EC	394	10						03/13/2003
1102A	16478	EC	394	5						05/07/2003
1102A	16478	EC	394	10						07/11/2003
1102A	16478	EC	394	30		**56**	**11**	**1**	**9%**	08/20/2003
1102A	16478	FC	400	140						10/12/1999
1102A	16478	FC	400	300						11/10/1999
1102A	16478	FC	400	16000	16000					12/15/1999
1102A	16478	FC	400	800	800					01/12/2000
1102A	16478	FC	400	16000	16000					04/13/2000
1102A	16478	FC	400	2400	2400					05/24/2000
1102A	16478	FC	400	9000	9000					06/06/2000
1102A	16478	FC	400	170						08/31/2000
1102A	16478	FC	400	270						09/20/2000
1102A	16478	FC	400	16000	16000					10/18/2000

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102A	16478	FC	400	5000	5000					11/07/2000
1102A	16478	FC	400	3000	3000					12/07/2000
1102A	16478	FC	400	8000	8000					01/17/2001
1102A	16478	FC	400	130						02/20/2001
1102A	16478	FC	400	500	500					03/14/2001
1102A	16478	FC	400	500	500					04/04/2001
1102A	16478	FC	400	500	500					05/23/2001
1102A	16478	FC	400	800	800					06/25/2001
1102A	16478	FC	400	700	700					07/17/2001
1102A	16478	FC	400	80						08/21/2001
1102A	16478	FC	400	80						09/19/2001
1102A	16478	FC	400	80						10/22/2001
1102A	16478	FC	400	40		**777**	**23**	**14**	**61%**	11/19/2001
1102B	16473	EC	394	135						01/16/2002
1102B	16473	EC	394	171						03/14/2002
1102B	16473	EC	394	285						05/21/2002
1102B	16473	EC	394	122						07/22/2002
1102B	16473	EC	394	51						09/24/2002
1102B	16473	EC	394	143						11/05/2002
1102B	16473	EC	394	6488	6488					01/27/2003
1102B	16473	EC	394	10						03/13/2003
1102B	16473	EC	394	63						05/07/2003
1102B	16473	EC	394	10						07/11/2003
1102B	16473	EC	394	10						08/20/2003
1102B	16473	EC	394	219						10/27/2004
1102B	16473	EC	394	4800	4800					01/13/2005
1102B	16473	EC	394	220						03/01/2005
1102B	16473	EC	394	710	710					05/10/2005
1102B	16473	EC	394	210						07/05/2005
1102B	16473	EC	394	150						07/28/2005
1102B	16473	EC	394	160						10/10/2005
1102B	16473	EC	394	420	420					12/19/2005
1102B	16473	EC	394	190						02/01/2006
1102B	16473	EC	394	180						04/05/2006
1102B	16473	EC	394	173						4/24/2006
1102B	16473	EC	394	153						4/25/2006
1102B	16473	EC	394	82						4/26/2006
1102B	16473	EC	394	69						4/27/2006
1102B	16473	EC	394	128						4/27/2006
1102B	16473	EC	394	92						4/28/2006
1102B	16473	EC	394	310						05/08/2006
1102B	16473	EC	394	4800	4800					06/01/2006
1102B	16473	EC	394	29635	29635					7/5/2006
1102B	16473	EC	394	3032	3032					7/6/2006
1102B	16473	EC	394	778	778					7/7/2006
1102B	16473	EC	394	1582	1582					7/8/2006
1102B	16473	EC	394	30120	30120					7/8/2006
1102B	16473	EC	394	96						08/03/2006
1102B	16473	EC	394	59						8/15/2006
1102B	16473	EC	394	70						8/16/2006
1102B	16473	EC	394	142						8/16/2006
1102B	16473	EC	394	15						8/17/2006
1102B	16473	EC	394	193						8/17/2006
1102B	16473	EC	394	186		**231**	**41**	**10**	**24%**	8/18/2006
1102B	16473	FC	400	800	800					01/06/1999
1102B	16473	FC	400	230						02/10/1999
1102B	16473	FC	400	500	500					03/08/1999
1102B	16473	FC	400	800	800					04/06/1999
1102B	16473	FC	400	1100	1100					05/07/1999
1102B	16473	FC	400	16000	16000					05/11/1999
1102B	16473	FC	400	24000	24000					05/13/1999
1102B	16473	FC	400	220						05/25/1999

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Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102B	16473	FC	400	1100	1100					05/27/1999
1102B	16473	FC	400	300						06/15/1999
1102B	16473	FC	400	1100	1100					07/14/1999
1102B	16473	FC	400	230						08/03/1999
1102B	16473	FC	400	300						08/10/1999
1102B	16473	FC	400	230						08/17/1999
1102B	16473	FC	400	300						08/19/1999
1102B	16473	FC	400	2400	2400					08/30/1999
1102B	16473	FC	400	1700	1700					09/07/1999
1102B	16473	FC	400	2200	2200					10/12/1999
1102B	16473	FC	400	130						11/10/1999
1102B	16473	FC	400	500	500					12/15/1999
1102B	16473	FC	400	230						01/12/2000
1102B	16473	FC	400	1700	1700					04/13/2000
1102B	16473	FC	400	2400	2400					05/24/2000
1102B	16473	FC	400	70						06/06/2000
1102B	16473	FC	400	220						08/31/2000
1102B	16473	FC	400	170						09/20/2000
1102B	16473	FC	400	9000	9000					10/18/2000
1102B	16473	FC	400	1700	1700					11/07/2000
1102B	16473	FC	400	16000	16000					12/07/2000
1102B	16473	FC	400	8000	8000					01/17/2001
1102B	16473	FC	400	130						02/20/2001
1102B	16473	FC	400	230						03/14/2001
1102B	16473	FC	400	170						04/04/2001
1102B	16473	FC	400	300						05/23/2001
1102B	16473	FC	400	500	500					06/25/2001
1102B	16473	FC	400	800	800					07/17/2001
1102B	16473	FC	400	300						08/21/2001
1102B	16473	FC	400	230						09/19/2001
1102B	16473	FC	400	1700	1700					10/22/2001
1102B	16473	FC	400	500	500	**711**	**40**	**22**	**55%**	11/19/2001
1102B	17917	EC	394	135						01/14/2002
1102B	17917	EC	394	187						03/08/2002
1102B	17917	EC	394	1860	1860					05/13/2002
1102B	17917	EC	394	644	644					07/17/2002
1102B	17917	EC	394	10						11/19/2002
1102B	17917	EC	394	191						01/13/2003
1102B	17917	EC	394	10						03/06/2003
1102B	17917	EC	394	10						07/18/2003
1102B	17917	EC	394	20						08/11/2003
1102B	17917	EC	394	41						03/23/2004
1102B	17917	EC	394	120						05/26/2004
1102B	17917	EC	394	30						07/27/2004
1102B	17917	EC	394	130						09/29/2004
1102B	17917	EC	394	41						11/29/2004
1102B	17917	EC	394	160						01/19/2005
1102B	17917	EC	394	310						03/30/2005
1102B	17917	EC	394	63						05/18/2005
1102B	17917	EC	394	160						07/20/2005
1102B	17917	EC	394	74						10/12/2005
1102B	17917	EC	394	41						01/25/2006
1102B	17917	EC	394	160						04/05/2006
1102B	17917	EC	394	98						05/17/2006
1102B	17917	EC	394	120		**85**	**23**	**2**	**9%**	07/24/2006
1102B	17917	FC	400	260						03/23/2004
1102B	17917	FC	400	260						05/26/2004
1102B	17917	FC	400	18						07/27/2004
1102B	17917	FC	400	300						09/29/2004
1102B	17917	FC	400	73						11/29/2004
1102B	17917	FC	400	82						01/19/2005
1102B	17917	FC	400	330						03/30/2005

Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102B	17917	FC	400	45						05/18/2005
1102B	17917	FC	400	310						07/20/2005
1102B	17917	FC	400	36						10/12/2005
1102B	17917	FC	400	110						01/25/2006
1102B	17917	FC	400	10						04/05/2006
1102B	17917	FC	400	82						05/17/2006
1102B	17917	FC	400	3600	3600	**119**	**14**	**1**	**7%**	07/24/2006
1102B	17918	EC	394	148						01/14/2002
1102B	17918	EC	394	638	638					03/08/2002
1102B	17918	EC	394	201						05/13/2002
1102B	17918	EC	394	413	413					07/17/2002
1102B	17918	EC	394	10						11/19/2002
1102B	17918	EC	394	183						01/13/2003
1102B	17918	EC	394	10						03/06/2003
1102B	17918	EC	394	5						05/02/2003
1102B	17918	EC	394	10						07/18/2003
1102B	17918	EC	394	30						08/11/2003
1102B	17918	EC	394	63						03/23/2004
1102B	17918	EC	394	150						05/26/2004
1102B	17918	EC	394	41						07/27/2004
1102B	17918	EC	394	10						09/29/2004
1102B	17918	EC	394	74						11/29/2004
1102B	17918	EC	394	190						01/19/2005
1102B	17918	EC	394	10						03/30/2005
1102B	17918	EC	394	10						05/18/2005
1102B	17918	EC	394	110						07/20/2005
1102B	17918	EC	394	86						10/12/2005
1102B	17918	EC	394	41						01/25/2006
1102B	17918	EC	394	10						04/05/2006
1102B	17918	EC	394	130						05/17/2006
1102B	17918	EC	394	130		**51**	**24**	**2**	**8%**	07/24/2006
1102B	17918	FC	400	20						03/23/2004
1102B	17918	FC	400	18						05/26/2004
1102B	17918	FC	400	27						07/27/2004
1102B	17918	FC	400	10						09/29/2004
1102B	17918	FC	400	45						11/29/2004
1102B	17918	FC	400	170						01/19/2005
1102B	17918	FC	400	18						03/30/2005
1102B	17918	FC	400	10						05/18/2005
1102B	17918	FC	400	200						07/20/2005
1102B	17918	FC	400	73						10/12/2005
1102B	17918	FC	400	36						01/25/2006
1102B	17918	FC	400	10						04/05/2006
1102B	17918	FC	400	130						05/17/2006
1102B	17918	FC	400	1800	1800	**46**	**14**	**1**	**7%**	07/24/2006
1102C	17068	EC	394	171						01/15/2002
1102C	17068	EC	394	1						03/07/2002
1102C	17068	EC	394	464	464					05/14/2002
1102C	17068	EC	394	10						11/25/2002
1102C	17068	EC	394	10						01/14/2003
1102C	17068	EC	394	5						03/07/2003
1102C	17068	EC	394	10						07/21/2003
1102C	17068	EC	394	3100	3100					02/25/2004
1102C	17068	EC	394	130						04/21/2004
1102C	17068	EC	394	213						07/14/2004
1102C	17068	EC	394	41						08/24/2004
1102C	17068	EC	394	170						10/25/2004
1102C	17068	EC	394	20						12/28/2004
1102C	17068	EC	394	880	880					02/15/2005
1102C	17068	EC	394	110						04/19/2005
1102C	17068	EC	394	97						06/22/2005
1102C	17068	EC	394	40						07/26/2005

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1102C	17068	EC	394	20						08/29/2005
1102C	17068	EC	394	390						11/09/2005
1102C	17068	EC	394	510	510					12/28/2005
1102C	17068	EC	394	240						02/23/2006
1102C	17068	EC	394	761	761					4/24/2006
1102C	17068	EC	394	140						4/25/2006
1102C	17068	EC	394	161						4/26/2006
1102C	17068	EC	394	317						4/26/2006
1102C	17068	EC	394	260						04/27/2006
1102C	17068	EC	394	114						4/27/2006
1102C	17068	EC	394	437	437					4/28/2006
1102C	17068	EC	394	216						6/14/2006
1102C	17068	EC	394	160						06/21/2006
1102C	17068	EC	394	16645	16645					7/5/2006
1102C	17068	EC	394	3598	3598					7/6/2006
1102C	17068	EC	394	368						7/7/2006
1102C	17068	EC	394	589	589					7/7/2006
1102C	17068	EC	394	123						7/8/2006
1102C	17068	EC	394	1389	1389					7/31/2006
1102C	17068	EC	394	411	411					8/15/2006
1102C	17068	EC	394	318						8/16/2006
1102C	17068	EC	394	492	492					8/16/2006
1102C	17068	EC	394	411	411					8/16/2006
1102C	17068	EC	394	92						8/17/2006
1102C	17068	EC	394	98						8/17/2006
1102C	17068	EC	394	36						8/18/2006
1102C	17068	EC	394	192						8/23/2006
1102C	17068	EC	394	73		**159**	**45**	**13**	**29%**	08/30/2006
1102C	17068	FC	400	800	800					09/19/2000
1102C	17068	FC	400	9000	9000					10/17/2000
1102C	17068	FC	400	5000	5000					11/06/2000
1102C	17068	FC	400	80						12/06/2000
1102C	17068	FC	400	16000	16000					01/16/2001
1102C	17068	FC	400	70						02/19/2001
1102C	17068	FC	400	170						03/13/2001
1102C	17068	FC	400	130						04/03/2001
1102C	17068	FC	400	210						05/22/2001
1102C	17068	FC	400	130						06/15/2001
1102C	17068	FC	400	1100	1100					07/16/2001
1102C	17068	FC	400	170						08/20/2001
1102C	17068	FC	400	40						09/17/2001
1102C	17068	FC	400	130						10/24/2001
1102C	17068	FC	400	2200	2200					11/15/2001
1102C	17068	FC	400	1600	1600					02/25/2004
1102C	17068	FC	400	460	460					04/21/2004
1102C	17068	FC	400	320						07/14/2004
1102C	17068	FC	400	118						08/24/2004
1102C	17068	FC	400	18						10/25/2004
1102C	17068	FC	400	10						12/28/2004
1102C	17068	FC	400	260						02/15/2005
1102C	17068	FC	400	100						04/19/2005
1102C	17068	FC	400	940	940					06/22/2005
1102C	17068	FC	400	55						08/29/2005
1102C	17068	FC	400	45						11/09/2005
1102C	17068	FC	400	18						12/28/2005
1102C	17068	FC	400	130						02/23/2006
1102C	17068	FC	400	590	590					04/27/2006
1102C	17068	FC	400	7800	7800					06/21/2006
1102C	17068	FC	400	120		**267**	**31**	**11**	**35%**	08/30/2006
1102D	17069	EC	394	246						01/15/2002
1102D	17069	EC	394	882	882					05/14/2002
1102D	17069	EC	394	10						11/25/2002

APPENDIX A
Ambient Water Quality Bacteria Data - 1990 to 2006

Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102D	17069	EC	394	323						01/15/2003
1102D	17069	EC	394	5						03/07/2003
1102D	17069	EC	394	5						05/20/2003
1102D	17069	EC	394	5						05/20/2003
1102D	17069	EC	394	41						07/21/2003
1102D	17069	EC	394	4400	4400					07/27/2005
1102D	17069	EC	394	4800	4800	**97**	**10**	**3**	**30%**	07/27/2005
1102D	17069	FC	400	300						09/19/2000
1102D	17069	FC	400	16000	16000					10/17/2000
1102D	17069	FC	400	90000	90000					11/06/2000
1102D	17069	FC	400	170						12/06/2000
1102D	17069	FC	400	16000	16000					01/16/2001
1102D	17069	FC	400	300						02/19/2001
1102D	17069	FC	400	700	700					03/13/2001
1102D	17069	FC	400	3000	3000					04/03/2001
1102D	17069	FC	400	800	800					05/22/2001
1102D	17069	FC	400	16000	16000					06/15/2001
1102D	17069	FC	400	9000	9000					07/16/2001
1102D	17069	FC	400	5000	5000					08/20/2001
1102D	17069	FC	400	80						09/17/2001
1102D	17069	FC	400	1300	1300					10/24/2001
1102D	17069	FC	400	3000	3000	**2196**	**15**	**11**	**73%**	11/15/2001
1102E	17070	EC	394	173						01/16/2002
1102E	17070	EC	394	6.3						03/14/2002
1102E	17070	EC	394	2187	2187					05/21/2002
1102E	17070	EC	394	5172	5172					07/23/2002
1102E	17070	EC	394	31						09/24/2002
1102E	17070	EC	394	20						11/05/2002
1102E	17070	EC	394	328						01/27/2003
1102E	17070	EC	394	10						03/13/2003
1102E	17070	EC	394	5						05/07/2003
1102E	17070	EC	394	10						07/11/2003
1102E	17070	EC	394	10		**54**	**11**	**2**	**18%**	08/20/2003
1102E	17070	FC	400	1700	1700					05/24/2000
1102E	17070	FC	400	9000	9000					06/06/2000
1102E	17070	FC	400	300						08/31/2000
1102E	17070	FC	400	2400	2400					09/20/2000
1102E	17070	FC	400	16000	16000					10/18/2000
1102E	17070	FC	400	2100	2100					11/07/2000
1102E	17070	FC	400	5000	5000					12/07/2000
1102E	17070	FC	400	3000	3000					01/17/2001
1102E	17070	FC	400	500	500					02/20/2001
1102E	17070	FC	400	500	500					02/20/2001
1102E	17070	FC	400	500	500					03/14/2001
1102E	17070	FC	400	700	700					03/14/2001
1102E	17070	FC	400	1100	1100					04/04/2001
1102E	17070	FC	400	230						05/23/2001
1102E	17070	FC	400	2400	2400					06/25/2001
1102E	17070	FC	400	800	800					07/17/2001
1102E	17070	FC	400	9000	9000					08/21/2001
1102E	17070	FC	400	1100	1100					09/19/2001
1102E	17070	FC	400	300						10/22/2001
1102E	17070	FC	400	500	500	**1340**	**20**	**17**	**85%**	11/19/2001
1102E	17071	EC	394	156						01/17/2002
1102E	17071	EC	394	63						03/14/2002
1102E	17071	EC	394	323						05/22/2002
1102E	17071	EC	394	145						07/22/2002
1102E	17071	EC	394	10						09/24/2002
1102E	17071	EC	394	20						11/06/2002
1102E	17071	EC	394	10						01/27/2003
1102E	17071	EC	394	10						03/13/2003

APPENDIX A
Ambient Water Quality Bacteria Data - 1990 to 2006

Segment	Station ID	Description	Single Sample Criterion	Value	Sample Exceeding	Geometric Mean (MPN/100ml)	Number of Samples	Number of Samples Exceeding Criteria	% of Samples Exceeding	Sampling Date
1102E	17071	EC	394	5						05/07/2003
1102E	17071	EC	394	31						07/11/2003
1102E	17071	EC	394	206						08/20/2003
1102E	17071	EC	394	510	510	**48**	**12**	**1**	**8%**	07/27/2005
1102E	17071	FC	400	5000	5000					12/07/2000
1102E	17071	FC	400	7000	7000					01/17/2001
1102E	17071	FC	400	220						02/20/2001
1102E	17071	FC	400	270						03/14/2001
1102E	17071	FC	400	170						04/04/2001
1102E	17071	FC	400	170						05/23/2001
1102E	17071	FC	400	1700	1700					06/25/2001
1102E	17071	FC	400	1300	1300					07/17/2001
1102E	17071	FC	400	5000	5000					08/21/2001
1102E	17071	FC	400	800	800					09/19/2001
1102E	17071	FC	400	230						10/22/2001
1102E	17071	FC	400	230		**743**	**12**	**6**	**50%**	11/19/2001

APPENDIX B
USGS FLOW DATA AND CLEAR CREEK INSTANTANEOUS FLOW DATA

APPENDIX B
USGS Flow Data

GAGE NO.	08077000*	08072730	08074500	08075000	08075400	08075730	08075770
Name	Clear Ck nr Pearland, TX	Bear Ck nr Barker, TX	Whiteoak Bayou at Houston, TX	Brays Bayou at Houston, TX	Sims Bayou at Hiram Clarke St, Houston, TX	Vince Bayou at Pasadena, TX	Hunting Bayou at IH 610, Houston, TX
Drainage Area (sq. miles)	38.7	23.9	86.0	94.3	20.7	7.6	15.9
CN	73.4	78.7	87.1	88.7	83.2	89.2	89.2
Precipitation (Inches)	51.4	46.9	50.0	49.9	50.3	53.1	50.8
Mean Q (cfs)	38.2	30.5	152.8	203.9	35.6	17.0	28.8
Percentile							
0	2030	1568	19062	13876	4641	1720	2945
1	659	517	2164	3490	701	282	409
2	409	332	1407	2160	416	173	277
3	288	238	1069	1410	257	126	210
4	219	179	807	1162	184	99	159
5	174	156	671	894	140	82	122
6	142	132	578	772	100	65	99
7	119	110	494	661	82	52	79
8	97	97	424	574	69	45	69
9	83	82	383	505	58	38	61
10	71	73	341	450	50	31	51
11	62	65	318	406	43	27	45
12	54	56	281	354	37	23	39
13	48	51	245	310	32	19	35
14	43	46	222	276	28	17	32
15	39	40	199	253	26	14	30
16	36	36	183	228	23	12	28
17	33	32	167	204	20	11	26
18	30	28	151	185	19	9.5	25
19	28	23	143	173	17	8.4	23
20	26	20	131	156	16	7.8	22
21	24	17	120	139	15	7.2	20
22	23	15	108	129	14	6.7	18
23	22	13	97	117	13	6.3	17
24	20	11	89	107	12	5.9	16
25	20	10	80	97	12	5.6	16
26	18	9.4	73	89	11	5.2	15
27	17	8.1	65	83	10	5.0	14
28	16	7.1	61	77	10	4.8	13
29	16	6.3	56	71	9.4	4.6	12
30	15	5.7	53	67	9.0	4.4	12
31	14	5.2	48	62	8.8	4.2	11
32	14	4.9	44	58	8.4	4.1	11
33	13	4.5	40	55	8.1	4.0	10
34	12	4.1	38	52	7.9	3.9	9.8
35	12	3.8	37	49	7.7	3.8	9.5
36	11	3.5	35	46	7.4	3.7	9.3
37	11	3.2	33	44	7.1	3.6	8.8
38	10	3.0	32	42	6.9	3.5	8.5
39	9.9	2.8	30	40	6.7	3.4	8.3
40	9.5	2.5	29	38	6.4	3.3	8.1
41	9.2	2.3	28	36	6.2	3.2	7.9
42	8.8	2.2	27	35	6.0	3.1	7.7
43	8.4	2.0	26	33	5.9	3.0	7.5
44	8.1	1.9	25	32	5.8	2.9	7.3
45	7.8	1.8	24	31	5.7	2.9	7.2

APPENDIX B
USGS Flow Data

GAGE NO.	08077000*	08072730	08074500	08075000	08075400	08075730	08075770
Name	Clear Ck nr Pearland, TX	Bear Ck nr Barker, TX	Whiteoak Bayou at Houston, TX	Brays Bayou at Houston, TX	Sims Bayou at Hiram Clarke St, Houston, TX	Vince Bayou at Pasadena, TX	Hunting Bayou at IH 610, Houston, TX
Drainage Area (sq. miles)	38.7	23.9	86.0	94.3	20.7	7.6	15.9
CN	73.4	78.7	87.1	88.7	83.2	89.2	89.2
Precipitation (Inches)	51.4	46.9	50.0	49.9	50.3	53.1	50.8
Mean Q (cfs)	38.2	30.5	152.8	203.9	35.6	17.0	28.8
Percentile							
46	7.4	1.6	23	30	5.5	2.8	7.0
47	7.1	1.5	23	28	5.4	2.7	6.9
48	6.8	1.4	22	27	5.3	2.6	6.7
49	6.6	1.3	21	26	5.1	2.6	6.6
50	6.3	1.2	21	25	4.9	2.5	6.5
51	6	1.2	20	25	4.8	2.4	6.3
52	5.8	1.1	20	24	4.7	2.4	6.3
53	5.6	1.0	19	23	4.6	2.3	6.2
54	5.4	0.94	19	22	4.5	2.2	6.0
55	5.1	0.87	18	21	4.4	2.2	5.9
56	5	0.81	18	21	4.4	2.1	5.8
57	4.8	0.75	18	20	4.3	2.1	5.7
58	4.6	0.68	17	20	4.2	2.0	5.6
59	4.4	0.61	17	19	4.2	2.0	5.5
60	4.2	0.55	16	19	4.1	1.9	5.4
61	4.1	0.49	16	18	4.0	1.9	5.3
62	3.9	0.44	15	18	3.9	1.8	5.2
63	3.8	0.38	15	17	3.8	1.8	5.0
64	3.6	0.34	15	17	3.7	1.7	4.9
65	3.5	0.29	14	16	3.7	1.7	4.8
66	3.3	0.26	14	15	3.6	1.7	4.7
67	3.1	0.22	14	15	3.5	1.6	4.6
68	3	0.18	13	14	3.4	1.6	4.5
69	2.9	0.14	13	14	3.3	1.5	4.4
70	2.8	0.10	13	14	3.2	1.5	4.3
71	2.6	0.07	12	13	3.1	1.5	4.1
72	2.5	0.04	12	13	3.0	1.4	4.1
73	2.4	0	12	12	2.9	1.4	4.0
74	2.3	0	11	12	2.8	1.4	3.9
75	2.2	0	11	11	2.8	1.3	3.8
76	2.1	0	11	11	2.7	1.3	3.7
77	2	0	10	10	2.6	1.3	3.6
78	1.9	0	10	9.5	2.5	1.2	3.5
79	1.7	0	9.7	8.9	2.4	1.2	3.4
80	1.6	0	9.5	8.4	2.3	1.2	3.4
81	1.5	0	9.3	7.8	2.2	1.1	3.3
82	1.4	0	8.9	7.4	2.1	1.1	3.2
83	1.3	0	8.6	6.7	2.1	1.0	3.1
84	1.2	0	8.4	6.2	2.0	1.0	3.1
85	1.1	0	7.9	5.7	1.9	0.98	3.0
86	1	0	7.6	4.8	1.8	0.94	2.9
87	0.98	0	7.3	4.2	1.7	0.91	2.8
88	0.85	0	6.9	3.5	1.6	0.88	2.7
89	0.8	0	6.7	2.8	1.6	0.84	2.6
90	0.7	0	6.5	2.1	1.5	0.79	2.6
91	0.6	0	5.8	1.0	1.4	0.76	2.5

APPENDIX B
USGS Flow Data

GAGE NO.	08077000*	08072730	08074500	08075000	08075400	08075730	08075770
Name	Clear Ck nr Pearland, TX	Bear Ck nr Barker, TX	Whiteoak Bayou at Houston, TX	Brays Bayou at Houston, TX	Sims Bayou at Hiram Clarke St, Houston, TX	Vince Bayou at Pasadena, TX	Hunting Bayou at IH 610, Houston, TX
Drainage Area (sq. miles)	38.7	23.9	86.0	94.3	20.7	7.6	15.9
CN	73.4	78.7	87.1	88.7	83.2	89.2	89.2
Precipitation (Inches)	51.4	46.9	50.0	49.9	50.3	53.1	50.8
Mean Q (cfs)	38.2	30.5	152.8	203.9	35.6	17.0	28.8
Percentile							
92	0.5	0	5.5	0.24	1.3	0.72	2.3
93	0.4	0	4.8	0	1.2	0.68	2.3
94	0.3	0	4.3	0	1.0	0.63	2.1
95	0.2	0	3.5	0	0.82	0.60	2.0
96	0.19	0	2.7	0	0.62	0.56	1.9
97	0.1	0	1.8	0	0.34	0.51	1.7
98	0	0	0.68	0	0.09	0.45	1.5
99	0	0	0	0	0	0.35	0.86
100	0	0	0	0	0	0.10	0

*Data from 8/1/1944 - 9/4/1994 was used to create Flow Exceedance Percentile

APPENDIX C
TIDE DATA*

**** See attached CD***

APPENDIX D
CONDUCTIVITY DATA – 1970 TO 2007

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11446	3/13/74	11:20	8750						
1101	11446	5/20/74	10:20	4800						
1101	11446	6/18/74	11:00	6700						
1101	11446	8/21/74	11:30	7900						
1101	11446	9/11/74	9:50	9650						
1101	11446	11/6/74	9:30	18000						
1101	11446	12/10/74	9:30	17500						
1101	11446	2/19/75	9:45	3800						
1101	11446	3/18/75	10:15	9250						
1101	11446	3/11/76	14:25	6800						
1101	11446	5/25/76	15:20	11000						
1101	11446	9/16/76	2:00	21000						
1101	11446	10/27/76	11:20	25000						
1101	11446	10/27/76	11:20	26000						
1101	11446	12/22/76	9:30	490						
1101	11446	12/22/76	9:30	500						
1101	11446	12/28/76	10:25	500						
1101	11446	1/10/77	11:20	250						
1101	11446	1/20/77	13:10	7000						
1101	11446	1/20/77	13:10	13000						
1101	11446	2/28/77	14:50	9500						
1101	11446	2/28/77	14:50	15000						
1101	11446	3/29/77	12:45	7000						
1101	11446	3/29/77	12:45	14000						
1101	11446	4/28/77	11:50	1300						
1101	11446	4/28/77	11:50	7600						
1101	11446	5/24/77	13:15	6800						
1101	11446	5/24/77	13:15	9000						
1101	11446	6/30/77	13:30	13000						
1101	11446	6/30/77	13:30	15000						
1101	11446	7/13/77	15:15	9800						
1101	11446	7/13/77	15:15	15000						
1101	11446	9/27/77	15:00	15000						
1101	11446	9/27/77	15:00	22000						
1101	11446	10/24/77	13:15	18500						
1101	11446	10/24/77	13:15	20000						
1101	11446	11/30/77	10:45	2700						
1101	11446	11/30/77	10:45	5225						
1101	11446	12/7/77	13:15	8700						
1101	11446	12/7/77	13:15	25000						
1101	11446	1/9/78	14:05	4200						
1101	11446	1/9/78	14:05	27000						
1101	11446	2/16/78	13:00	670						
1101	11446	3/7/78	14:50	6800						
1101	11446	3/7/78	14:50	12000						
1101	11446	4/3/78	11:30	21000						
1101	11446	4/3/78	11:30	25000						
1101	11446	5/31/78	15:55	13000						
1101	11446	5/31/78	15:55	27000						
1101	11446	6/26/78	11:30	12000						
1101	11446	6/26/78	11:30	19000						
1101	11446	7/26/78	15:20	3900						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11446	7/26/78	15:20	19000						
1101	11446	8/21/78	14:40	25000						
1101	11446	8/21/78	14:40	27000						
1101	11446	9/19/78	14:10	6700						
1101	11446	9/19/78	14:10	17500						
1101	11446	10/19/78	12:45	14100						
1101	11446	10/19/78	12:45	20100						
1101	11446	11/29/78	13:30	1200						
1101	11446	11/29/78	13:30	2700						
1101	11446	12/7/78	11:35	8500						
1101	11446	12/7/78	11:35	22000						
1101	11446	1/24/79	12:30	490						
1101	11446	1/24/79	12:30	510						
1101	11446	2/21/79	10:50	3400						
1101	11446	2/21/79	10:50	9500						
1101	11446	3/27/79	13:00	1900						
1101	11446	3/27/79	13:00	3600						
1101	11446	5/30/79	14:05	2500						
1101	11446	5/30/79	14:05	4000						
1101	11446	8/2/79	13:25	350						
1101	11446	10/31/79	11:05	1300						
1101	11446	1/17/80	11:20	8000						
1101	11446	1/17/80	11:20	17000						
1101	11446	4/23/80	11:40	5270						
1101	11446	4/23/80	11:40	10570						
1101	11446	7/30/80	12:10	6600						
1101	11446	7/30/80	12:10	13790						
1101	11446	10/21/80	12:05	22000						
1101	11446	10/21/80	12:05	28000						
1101	11446	1/21/81	12:20	3360						
1101	11446	1/21/81	12:20	24900						
1101	11446	4/27/81	12:20	2900						
1101	11446	4/27/81	12:20	13930						
1101	11446	7/8/81	11:50	452						
1101	11446	7/8/81	11:50	454						
1101	11446	10/21/81	11:45	11220						
1101	11446	10/21/81	11:45	11660						
1101	11446	1/20/82	13:25	9650						
1101	11446	1/20/82	13:25	10320						
1101	11446	4/8/82	10:25	15660						
1101	11446	4/8/82	10:25	19200						
1101	11446	7/21/82	11:25	14000						
1101	11446	7/21/82	11:25	14800						
1101	11446	10/25/82	12:05	27800						
1101	11446	10/25/82	12:05	29100						
1101	11446	4/28/83	11:00	22000						
1101	11446	4/28/83	11:00	22500						
1101	11446	1/4/84	10:00	19400						
1101	11446	1/4/84	10:00	21000						
1101	11446	5/10/84	11:40	25400						
1101	11446	5/10/84	11:40	26700						
1101	11446	7/26/84	11:10	24500						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11446	7/26/84	11:10	25200						
1101	11446	5/23/85	11:55	10420						
1101	11446	1/15/86	10:16	5150						
1101	11446	4/16/86	8:25	12500						
1101	11446	4/16/86	8:25	19000						
1101	11446	4/16/86	8:25	22000						
1101	11446	5/28/86	9:25	5200						
1101	11446	5/28/86	9:25	7070						
1101	11446	5/28/86	9:25	13090						
1101	11446	7/23/86	14:57	12260						
1101	11446	7/23/86	14:57	12390						
1101	11446	7/23/86	14:57	12450						
1101	11446	12/9/86	12:14	2750						
1101	11446	12/9/86	12:14	4460						
1101	11446	12/9/86	12:14	5000						
1101	11446	3/27/87	11:00	7600						
1101	11446	6/4/87	12:43	6690						
1101	11446	6/4/87	12:43	8210						
1101	11446	9/17/87	12:11	9890						
1101	11446	9/17/87	12:11	12820						
1101	11446	9/17/87	12:11	14700						
1101	11446	9/17/87	12:11	15700						
1101	11446	12/9/87	11:40	16200						
1101	11446	12/9/87	11:40	24100						
1101	11446	12/9/87	11:40	25200						
1101	11446	3/14/88	10:50	5660						
1101	11446	3/14/88	10:50	6940						
1101	11446	3/14/88	10:50	12900						
1101	11446	9/1/88	11:05	25700						
1101	11446	9/1/88	11:05	30400						
1101	11446	9/1/88	11:05	30500						
1101	11446	9/1/88	11:05	30600						
1101	11446	12/20/88	11:09	27100						
1101	11446	12/20/88	11:09	34600						
1101	11446	12/20/88	11:09	35700						
1101	11446	3/28/89	10:20	19700						
1101	11446	3/28/89	10:20	20100						
1101	11446	3/28/89	10:20	21900						
1101	11446	3/28/89	10:20	22600						
1101	11446	6/8/89	11:36	8400						
1101	11446	6/8/89	11:36	8500						
1101	11446	9/26/89	10:45	19300						
1101	11446	9/26/89	10:45	19400						
1101	11446	9/26/89	10:45	19700						
1101	11446	12/11/89	12:05	20800						
1101	11446	12/11/89	12:05	22600						
1101	11446	12/11/89	12:05	26600						
1101	11446	3/13/90	12:15	7400						
1101	11446	3/13/90	12:15	7600						
1101	11446	3/13/90	12:15	11800						
1101	11446	3/13/90	12:15	13600						
1101	11446	6/5/90	11:51	6900						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11446	6/5/90	11:51	7100						
1101	11446	6/5/90	11:51	7200						
1101	11446	9/10/90	10:50	19300						
1101	11446	9/10/90	10:50	21800						
1101	11446	9/10/90	10:50	23800						
1101	11446	9/10/90	10:50	24000						
1101	11446	12/3/90	9:25	19400						
1101	11446	12/3/90	9:25	21600						
1101	11446	12/3/90	9:25	25500						
1101	11446	3/5/91	9:20	2710						
1101	11446	3/5/91	9:20	3030						
1101	11446	3/5/91	9:20	7730						
1101	11446	6/25/91	12:50	697						
1101	11446	6/25/91	12:50	967						
1101	11446	6/25/91	12:50	1000						
1101	11446	6/25/91	12:50	1040						
1101	11446	9/9/91	13:30	1540						
1101	11446	9/9/91	13:30	5080						
1101	11446	9/9/91	13:30	8520						
1101	11446	9/9/91	13:30	8590						
1101	11446	12/16/91	11:12	5850						
1101	11446	12/16/91	11:12	16600						
1101	11446	12/16/91	11:12	16900						
1101	11446	3/10/92	9:25	936						
1101	11446	3/10/92	9:25	944						
1101	11446	3/10/92	9:25	978						
1101	11446	6/17/92	14:19	6570						
1101	11446	6/17/92	14:19	6900						
1101	11446	6/17/92	14:19	7100						
1101	11446	12/7/92	12:30	4700						
1101	11446	12/7/92	12:30	10150						
1101	11446	6/7/93	12:45	7980						
1101	11446	9/14/93	11:14	22500						
1101	11446	9/14/93	11:14	24600						
1101	11446	9/14/93	11:14	25500						
1101	11446	9/14/93	11:14	26200						
1101	11446	12/1/93	11:58	911						
1101	11446	12/1/93	11:27	8560						
1101	11446	12/1/93	11:27	9520						
1101	11446	12/1/93	11:27	10020						
1101	11446	3/9/94	12:25	6050						
1101	11446	3/9/94	12:25	6100						
1101	11446	3/9/94	12:25	6110						
1101	11446	6/8/94	13:25	567						
1101	11446	6/8/94	13:25	575						
1101	11446	6/8/94	13:25	607						
1101	11446	6/8/94	13:25	608						
1101	11446	12/7/94	9:07	247						
1101	11446	12/7/94	9:07	250						
1101	11446	12/7/94	9:07	251						
1101	11446	3/8/95	8:45	313						
1101	11446	6/14/95	13:47	2100						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11446	6/14/95	13:47	2120						
1101	11446	6/14/95	13:47	2150						
1101	11446	9/13/95	11:25	13710						
1101	11446	9/13/95	11:25	16820						
1101	11446	9/13/95	11:25	18240						
1101	11446	9/13/95	11:25	18450						
1101	11446	12/20/95	8:45	252						
1101	11446	3/13/96	10:48	7240						
1101	11446	3/13/96	10:48	15600						
1101	11446	3/13/96	10:48	20400						
1101	11446	6/3/96	11:18	25600						
1101	11446	6/3/96	11:18	26200						
1101	11446	6/3/96	11:18	26300						
1101	11446	10/2/96	11:53	3840						
1101	11446	10/2/96	11:53	4730						
1101	11446	10/2/96	11:53	5840						
1101	11446	10/2/96	11:53	6730						
1101	11446	12/4/96	8:45	7870						
1101	11446	12/4/96	8:45	15000						
1101	11446	12/4/96	8:45	19900						
1101	11446	12/4/96	8:45	20800						
1101	11446	3/4/97	10:15	680						
1101	11446	3/4/97	10:15	682						
1101	11446	3/4/97	10:15	686						
1101	11446	6/24/97	12:33	3630						
1101	11446	6/24/97	12:33	3810						
1101	11446	6/24/97	12:33	3870						
1101	11446	10/15/97	13:15	238						
1101	11446	10/15/97	13:15	239						
1101	11446	2/25/98	11:11	284						
1101	11446	2/25/98	11:11	286						
1101	11446	3/11/98	11:20	1620						
1101	11446	3/11/98	11:20	1870						
1101	11446	3/11/98	11:20	3980						
1101	11446	3/18/98	11:07	203						
1101	11446	3/18/98	11:07	205						
1101	11446	3/18/98	11:07	206						
1101	11446	3/18/98	11:07	209						
1101	11446	3/23/98	10:30	433						
1101	11446	3/23/98	10:30	434						
1101	11446	3/23/98	10:30	437						
1101	11446	3/31/98	11:11	2760						
1101	11446	3/31/98	11:11	2840						
1101	11446	3/31/98	11:11	3070						
1101	11446	3/31/98	11:11	3080						
1101	11446	4/7/98	12:55	2600						
1101	11446	4/7/98	12:55	2860						
1101	11446	4/7/98	12:55	4880						
1101	11446	4/7/98	12:55	5030						
1101	11446	5/27/98	11:52	15400						
1101	11446	5/27/98	11:52	15500						
1101	11446	6/3/98	12:23	11700						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11446	6/3/98	12:23	11900						
1101	11446	6/3/98	12:23	16200						
1101	11446	6/9/98	12:00	17000						
1101	11446	6/9/98	12:00	17100						
1101	11446	6/17/98	13:07	17100						
1101	11446	6/17/98	13:07	18000						
1101	11446	6/17/98	13:07	18300						
1101	11446	6/25/98	13:15	19000						
1101	11446	6/25/98	13:15	19100						
1101	11446	8/26/98	13:35	2680						
1101	11446	8/26/98	13:35	4350						
1101	11446	8/26/98	13:35	10500						
1101	11446	8/26/98	13:35	13400						
1101	11446	11/3/98	9:42	800						
1101	11446	11/3/98	9:42	805						
1101	11446	11/3/98	9:42	806						
1101	11446	2/3/99	8:45	7580						
1101	11446	2/3/99	8:45	13300						
1101	11446	2/3/99	8:45	15900						
1101	11446	2/3/99	8:45	16100						
1101	11446	5/6/99	12:20	11000						
1101	11446	5/6/99	12:20	12000						
1101	11446	5/6/99	12:20	12500						
1101	11446	5/6/99	12:20	12800						
1101	11446	6/22/99	10:30	432						
1101	11446	7/28/99	10:26	9280						
1101	11446	8/9/99	10:14	13200						
1101	11446	8/26/99	11:20	18900						
1101	11446	8/26/99	11:20	19200						
1101	11446	8/26/99	11:20	19400						
1101	11446	8/26/99	11:20	19500						
1101	11446	9/23/99	10:49	28100						
1101	11446	10/27/99	10:44	14300						
1101	11446	11/12/99	9:45	19800						
1101	11446	11/16/99	9:20	22800						
1101	11446	11/16/99	9:20	23900						
1101	11446	11/16/99	9:20	26400						
1101	11446	12/16/99	9:34	11900						
1101	11446	1/13/00	9:47	11500						
1101	11446	2/15/00	10:15	11900						
1101	11446	2/15/00	10:15	20900						
1101	11446	2/15/00	10:15	24600						
1101	11446	2/15/00	10:15	25000						
1101	11446	4/14/00	10:48	380						
1101	11446	5/4/00	9:45	1260						
1101	11446	5/4/00	9:45	1330						
1101	11446	5/4/00	9:45	1640						
1101	11446	5/4/00	9:45	2440						
1101	11446	5/25/00	10:43	2360						
1101	11446	6/7/00	10:48	7400						
1101	11446	7/11/00	15:25	13300						
1101	11446	7/11/00	15:25	13490						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11446	7/11/00	15:25	18100						
1101	11446	7/13/00	16:59	14933						
1101	11446	7/27/00	10:18	21800						
1101	11446	8/10/00	10:00	19000						
1101	11446	8/10/00	10:00	21300						
1101	11446	8/10/00	10:00	22100						
1101	11446	8/10/00	10:00	23800						
1101	11446	8/28/00	10:57	24000						
1101	11446	9/22/00	11:45	7100						
1101	11446	10/19/00	11:26	1400						
1101	11446	11/8/00	9:46	310						
1101	11446	11/29/00	11:05	910						
1101	11446	11/29/00	11:05	1010						
1101	11446	11/29/00	11:05	5900						
1101	11446	12/8/00	9:37	2100						
1101	11446	1/18/01	9:20	245						
1101	11446	2/8/01	9:15	3310						
1101	11446	2/8/01	9:15	3360						
1101	11446	2/8/01	9:15	3750						
1101	11446	2/8/01	9:15	6950						
1101	11446	2/21/01	9:39	2870						
1101	11446	3/15/01	9:42	338						
1101	11446	4/5/01	11:37	569						
1101	11446	5/9/01	12:15	4602						
1101	11446	5/9/01	12:15	4640						
1101	11446	5/9/01	12:15	4653						
1101	11446	5/9/01	12:15	4667						
1101	11446	5/24/01	11:11	8400						
1101	11446	6/26/01	11:21	760						
1101	11446	7/18/01	11:35	10600						
1101	11446	8/9/01	9:44	3270						
1101	11446	8/9/01	9:44	4080						
1101	11446	8/9/01	9:44	10700						
1101	11446	8/9/01	9:44	12100						
1101	11446	8/22/01	11:20	14900						
1101	11446	9/18/01	11:26	2320						
1101	11446	10/23/01	11:22	2900						
1101	11446	11/20/01	10:30	3000						
1101	11446	12/3/01	9:30	231.5						
1101	11446	12/3/01	9:30	231.8						
1101	11446	1/18/02	10:17	2200						
1101	11446	2/20/02	10:30	3352						
1101	11446	2/20/02	10:30	8950						
1101	11446	2/20/02	10:30	14581						
1101	11446	3/15/02	11:10	5860						
1101	11446	5/15/02	10:15	3200						
1101	11446	5/16/02	10:05	7457						
1101	11446	5/16/02	10:05	7458						
1101	11446	5/16/02	10:05	7548						
1101	11446	5/16/02	10:05	7584						
1101	11446	7/19/02	10:36	300						
1101	11446	8/15/02	8:45	2703						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11446	8/15/02	8:45	2782						
1101	11446	8/15/02	8:45	3421						
1101	11446	8/15/02	8:45	4871						
1101	11446	8/29/02	7:50	1304						
1101	11446	9/12/02	10:50	394						
1101	11446	1/8/03	9:24	670						
1101	11446	2/12/03	11:45	671						
1101	11446	2/12/03	11:45	682						
1101	11446	2/12/03	11:45	2203						
1101	11446	3/14/03	10:51	720						
1101	11446	5/1/03	10:16	9440						
1101	11446	6/3/03	15:00	13480						
1101	11446	6/3/03	15:00	13640						
1101	11446	7/29/03	10:32	4240						
1101	11446	8/12/03	9:54	8590						
1101	11446	8/14/03	9:50	3930						
1101	11446	8/14/03	9:50	6620						
1101	11446	8/14/03	9:50	13620						
1101	11446	10/23/03	8:50	660						
1101	11446	12/8/03	9:30	3260						
1101	11446	12/8/03	9:30	3820						
1101	11446	12/8/03	9:30	6290						
1101	11446	12/8/03	9:30	7730						
1101	11446	3/11/04	14:00	930						
1101	11446	3/11/04	14:00	940						
1101	11446	6/3/04	10:24	810						
1101	11446	8/25/04	15:42	6180						
1101	11446	9/14/04	7:50	5600						
1101	11446	9/14/04	7:50	6200						
1101	11446	9/14/04	7:50	7060						
1101	11446	10/29/04	8:26	11000						
1101	11446	12/14/04	9:25	580						
1101	11446	12/14/04	9:25	590						
1101	11446	1/15/05	13:46	976						
1101	11446	3/3/05	13:42	439						
1101	11446	3/15/05	13:25	519						
1101	11446	3/15/05	13:25	520						
1101	11446	3/15/05	13:25	523						
1101	11446	5/5/05	10:59	7890						
1101	11446	6/16/05	11:19	7760						
1101	11446	6/16/05	11:19	11690						
1101	11446	6/16/05	11:19	16570						
1101	11446	6/16/05	11:19	18330						
1101	11446	7/7/05	8:32	14200						
1101	11446	8/3/05	6:35	566						
1101	11446	8/9/05	8:07	901						
1101	11446	8/18/05	9:32	6370						
1101	11446	8/24/05	9:15	5200						
1101	11446	8/29/05	8:49	12500						
1101	11446	9/14/05	10:30	5500						
1101	11446	9/14/05	10:30	6900						
1101	11446	9/14/05	10:30	7940						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11446	10/6/05	9:18	10400						
1101	11446	10/6/05	9:18	16500						
1101	11446	10/6/05	9:19	19700						
1101	11446	12/15/05	8:58	450						
1101	11446	12/15/05	8:58	12200						
1101	11446	12/15/05	8:58	12300						
1101	11446	12/26/05	10:29	1500						
1101	11446	12/26/05	10:29	1570						
1101	11446	12/26/05	10:30	16700						
1101	11446	2/2/06	11:12	4860						
1101	11446	2/2/06	11:12	17600						
1101	11446	2/2/06	11:13	25800						
1101	11446	2/2/06	11:14	26800						
1101	11446	3/14/06	12:52	13500						
1101	11446	4/6/06	8:52	11400						
1101	11446	4/6/06	8:52	19900						
1101	11446	4/6/06	8:52	25800						
1101	11446	5/9/06	9:51	5930						
1101	11446	5/9/06	9:51	9580						
1101	11446	6/2/06	9:43	297						
1101	11446	6/8/06	13:03	1700						
1101	11446	6/8/06	13:03	2200						
1101	11446	6/8/06	13:03	2430						
1101	11446	8/8/06	9:20	850						
1101	11446	9/13/06	12:45	3500						
1101	11446	9/13/06	12:45	4100						
1101	11446	9/13/06	12:45	10100						
1101	11446	10/6/06	10:51	12600						
1101	11446	10/6/06	10:51	13100						
1101	11446	10/6/06	10:51	14000						
1101	11446	12/28/06	13:14	419						
1101	11446	2/5/07	10:31	568						
1101	11446	2/5/07	10:31	569						
1101	11446	2/5/07	10:31	572						
1101	11446	3/20/07	13:00	380						
1101	11446	3/20/07	13:00	25020						
1101	11446	3/20/07	13:00	35900						
1101	11446	3/20/07	13:00	40800						
1101	11446	6/7/07	12:22	990						
1101	11446	6/7/07	12:22	1000						
1101	11446	6/7/07	12:22	1100						
1101	11446	6/7/07	12:22	1120						
1101	11446	10/10/07	12:52	330						
1101	11446	10/10/07	12:52	332						
1101	11446	10/10/07	12:52	333	**461**	**203**	**40800**	**10143**	**8687**	**7730**
1101	11447	3/11/76	15:00	4000						
1101	11447	9/16/76	2:00	14000						
1101	11447	10/27/76	11:05	20000						
1101	11447	10/27/76	11:05	25000						
1101	11447	12/22/76	9:00	490						
1101	11447	1/21/77	13:30	1800						
1101	11447	1/21/77	13:30	12000						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11447	2/28/77	15:20	7000						
1101	11447	2/28/77	15:20	16000						
1101	11447	3/29/77	13:00	1700						
1101	11447	3/29/77	13:00	14000						
1101	11447	4/28/77	11:30	510						
1101	11447	4/28/77	11:30	520						
1101	11447	5/24/77	13:00	3100						
1101	11447	5/24/77	13:00	6900						
1101	11447	6/30/77	13:50	8500						
1101	11447	6/30/77	13:50	17000						
1101	11447	7/13/77	15:30	6500						
1101	11447	7/13/77	15:30	14000						
1101	11447	9/27/77	15:20	8600						
1101	11447	9/27/77	15:20	21000						
1101	11447	10/24/77	13:30	14000						
1101	11447	10/24/77	13:30	18500						
1101	11447	11/30/77	11:10	2500						
1101	11447	12/7/77	13:35	3400						
1101	11447	12/7/77	13:35	26000						
1101	11447	1/9/78	11:20	3500						
1101	11447	1/9/78	11:20	27000						
1101	11447	2/16/78	13:15	600						
1101	11447	3/7/78	11:10	3800						
1101	11447	3/7/78	11:10	9000						
1101	11447	4/3/78	11:30	13500						
1101	11447	4/3/78	11:30	18700						
1101	11447	5/31/78	13:30	6300						
1101	11447	5/31/78	13:30	29200						
1101	11447	6/26/78	14:05	9200						
1101	11447	6/26/78	14:05	16000						
1101	11447	7/26/78	12:15	2000						
1101	11447	7/26/78	12:15	14000						
1101	11447	8/21/78	13:40	17000						
1101	11447	8/21/78	13:40	20000						
1101	11447	9/19/78	11:30	1250						
1101	11447	9/19/78	11:30	12000						
1101	11447	10/19/78	11:20	9100						
1101	11447	10/19/78	11:20	17200						
1101	11447	11/29/78	12:00	700						
1101	11447	11/29/78	12:00	1500						
1101	11447	12/7/78	11:15	2500						
1101	11447	12/7/78	11:15	17000						
1101	11447	1/24/79	11:30	600						
1101	11447	2/21/79	11:50	1900						
1101	11447	2/21/79	11:50	6500						
1101	11447	3/27/79	10:55	900						
1101	11447	5/30/79	12:05	1900						
1101	11447	8/2/79	12:00	500						
1101	11447	1/17/80	11:25	7200						
1101	11447	10/21/80	12:30	10200						
1101	11447	10/21/80	12:30	23000						
1101	11447	1/21/81	11:55	1250						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11447	1/21/81	11:55	16000						
1101	11447	4/27/81	11:05	5100						
1101	11447	4/27/81	11:05	25500						
1101	11447	7/8/81	11:05	350						
1101	11447	10/22/81	11:50	2840						
1101	11447	10/22/81	11:50	9380						
1101	11447	1/21/82	11:20	2110						
1101	11447	1/21/82	11:20	18930						
1101	11447	4/6/82	9:35	2480						
1101	11447	4/6/82	9:35	10980						
1101	11447	7/20/82	9:50	4000						
1101	11447	10/26/82	11:05	14000						
1101	11447	10/26/82	11:05	25300						
1101	11447	4/13/83	10:05	7730						
1101	11447	4/13/83	10:05	13460						
1101	11447	1/8/99	9:41	575						
1101	11447	2/8/99	9:06	3650						
1101	11447	3/15/99	9:38	984						
1101	11447	4/14/99	10:12	8920						
1101	11447	6/22/99	10:45	403						
1101	11447	7/28/99	10:36	2880						
1101	11447	8/9/99	10:34	6530						
1101	11447	9/23/99	11:02	20700						
1101	11447	10/27/99	10:58	12000						
1101	11447	11/12/99	10:03	15300						
1101	11447	12/16/99	10:28	5880						
1101	11447	1/13/00	10:16	6300						
1101	11447	4/14/00	11:20	300						
1101	11447	5/25/00	11:18	880						
1101	11447	6/7/00	11:15	3980						
1101	11447	7/27/00	10:55	15000						
1101	11447	8/28/00	11:29	15400						
1101	11447	9/20/00	14:15	3358						
1101	11447	9/20/00	14:20	3358						
1101	11447	9/22/00	12:15	2800						
1101	11447	10/19/00	11:53	500						
1101	11447	11/8/00	10:19	280						
1101	11447	12/8/00	10:04	780						
1101	11447	1/18/01	9:50	247						
1101	11447	2/21/01	10:05	1370						
1101	11447	3/15/01	10:10	303						
1101	11447	4/5/01	12:04	465						
1101	11447	5/24/01	11:36	3350						
1101	11447	6/26/01	11:49	710						
1101	11447	7/18/01	11:55	5900						
1101	11447	8/22/01	11:40	10100						
1101	11447	9/18/01	11:48	605						
1101	11447	10/23/01	11:45	837						
1101	11447	11/20/01	10:53	1600						
1101	11447	1/18/02	10:38	1100						
1101	11447	3/15/02	11:46	2120						
1101	11447	5/15/02	10:46	4700						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11447	7/19/02	10:56	300						
1101	11447	9/12/02	11:13	328						
1101	11447	11/21/02	10:37	400						
1101	11447	1/8/03	9:54	706						
1101	11447	3/14/03	11:10	724						
1101	11447	5/1/03	10:40	4740						
1101	11447	7/29/03	11:16	971						
1101	11447	8/12/03	10:22	3600	**119**	**247**	**29200**	**7614**	**7597**	**4000**
1101	11448	6/9/70	12:10	750						
1101	11448	10/19/71	14:00	2100						
1101	11448	10/19/71	14:00	8000						
1101	11448	10/19/71	14:00	13000						
1101	11448	3/17/72	14:30	750						
1101	11448	4/19/72	9:30	1600						
1101	11448	4/19/72	9:30	7000						
1101	11448	4/19/72	9:30	14000						
1101	11448	5/30/72	16:30	1500						
1101	11448	6/15/72	14:25	1300						
1101	11448	9/14/72	11:30	1400						
1101	11448	11/2/72	14:15	1300						
1101	11448	12/7/72	15:45	1500						
1101	11448	1/2/73	15:50	750						
1101	11448	3/11/76	15:30	1100						
1101	11448	5/25/76	14:30	1900						
1101	11448	12/28/76	11:25	550						
1101	11448	12/28/76	11:30	550						
1101	11448	1/20/77	12:10	800						
1101	11448	1/20/77	12:20	840						
1101	11448	2/28/77	13:30	1500						
1101	11448	2/28/77	13:30	1500						
1101	11448	3/29/77	10:55	680						
1101	11448	3/29/77	11:00	700						
1101	11448	4/28/77	11:55	920						
1101	11448	4/28/77	11:55	1100						
1101	11448	5/24/77	12:10	1100						
1101	11448	5/24/77	12:25	1100						
1101	11448	6/30/77	11:45	1900						
1101	11448	6/30/77	11:45	5400						
1101	11448	7/13/77	11:50	950						
1101	11448	7/13/77	11:50	5900						
1101	11448	8/29/77	11:55	1500						
1101	11448	8/29/77	11:55	14500						
1101	11448	9/27/77	11:45	1350						
1101	11448	9/27/77	11:55	10500						
1101	11448	10/24/77	11:15	2400						
1101	11448	10/24/77	11:15	3800						
1101	11448	11/30/77	11:15	100						
1101	11448	12/7/77	10:20	1100						
1101	11448	1/9/78	12:15	600						
1101	11448	1/9/78	12:15	14500						
1101	11448	2/16/78	11:25	750						
1101	11448	3/7/78	10:35	1300						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11448	4/3/78	10:55	2100						
1101	11448	4/3/78	10:55	12500						
1101	11448	5/31/78	13:05	1000						
1101	11448	5/31/78	13:10	1900						
1101	11448	5/31/78	13:10	17700						
1101	11448	6/26/78	13:40	2000						
1101	11448	6/26/78	13:40	11800						
1101	11448	7/26/78	11:55	800						
1101	11448	7/26/78	11:55	900						
1101	11448	8/21/78	13:15	3000						
1101	11448	9/19/78	11:10	1000						
1101	11448	10/19/78	11:05	200						
1101	11448	10/19/78	11:05	10500						
1101	11448	11/29/78	11:40	500						
1101	11448	12/7/78	11:00	900						
1101	11448	2/21/79	11:30	1250						
1101	11448	3/27/79	10:35	1200						
1101	11448	5/30/79	11:55	2100						
1101	11448	5/30/79	11:55	2300						
1101	11448	8/2/79	11:30	500						
1101	11448	8/2/79	11:30	600						
1101	11448	1/17/80	11:00	1600						
1101	11448	10/21/80	12:10	1200						
1101	11448	10/21/80	12:10	16000						
1101	11448	1/21/81	11:40	600						
1101	11448	1/21/81	11:40	700						
1101	11448	4/27/81	10:45	1300						
1101	11448	4/27/81	10:45	21000						
1101	11448	7/8/81	10:50	350						
1101	11448	10/22/81	12:10	812						
1101	11448	10/22/81	12:10	827						
1101	11448	1/21/82	11:40	2020						
1101	11448	1/21/82	11:40	2030						
1101	11448	4/6/82	10:05	1490						
1101	11448	4/6/82	10:05	1495						
1101	11448	7/20/82	10:10	1400						
1101	11448	10/26/82	11:20	4800						
1101	11448	4/13/83	10:20	1440						
1101	11448	1/15/86	12:04	1000						
1101	11448	4/16/86	9:20	1300						
1101	11448	4/16/86	9:20	1400						
1101	11448	7/23/86	15:24	550						
1101	11448	7/23/86	15:24	1061						
1101	11448	7/23/86	15:24	1073						
1101	11448	12/9/86	12:40	1192						
1101	11448	3/27/87	13:18	1500						
1101	11448	6/4/87	13:11	463						
1101	11448	6/4/87	13:11	1161						
1101	11448	6/4/87	13:11	1174						
1101	11448	9/17/87	13:12	860						
1101	11448	9/17/87	13:12	869						
1101	11448	9/17/87	13:12	881						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11448	9/17/87	13:12	1096						
1101	11448	12/9/87	12:13	2050						
1101	11448	3/14/88	10:20	1146						
1101	11448	3/14/88	10:20	1148						
1101	11448	3/14/88	10:20	1150						
1101	11448	6/7/88	12:52	770						
1101	11448	6/7/88	12:52	777						
1101	11448	6/7/88	12:52	1720						
1101	11448	12/20/88	12:20	5280						
1101	11448	12/20/88	12:20	30200						
1101	11448	12/20/88	12:20	31300						
1101	11448	6/8/89	12:10	760						
1101	11448	10/15/97	12:15	250						
1101	11448	2/25/98	10:51	405						
1101	11448	3/11/98	12:25	1450						
1101	11448	3/11/98	12:25	1460						
1101	11448	3/18/98	12:08	172						
1101	11448	3/23/98	10:15	1020						
1101	11448	3/31/98	12:22	1500						
1101	11448	3/31/98	12:22	1520						
1101	11448	3/31/98	12:22	1560						
1101	11448	4/7/98	13:53	1590						
1101	11448	4/7/98	13:53	1700						
1101	11448	5/27/98	9:35	1560						
1101	11448	5/27/98	9:35	1630						
1101	11448	5/27/98	9:35	1740						
1101	11448	6/3/98	13:30	1570						
1101	11448	6/3/98	13:30	1850						
1101	11448	6/3/98	13:30	4030						
1101	11448	6/9/98	13:00	976						
1101	11448	6/17/98	14:12	2090						
1101	11448	6/17/98	14:12	2780						
1101	11448	6/17/98	14:12	9920						
1101	11448	6/25/98	14:15	1570						
1101	11448	8/26/98	11:05	456						
1101	11448	8/26/98	11:05	457						
1101	11448	8/26/98	11:05	460						
1101	11448	1/6/99	8:23	575						
1101	11448	2/10/99	8:08	1570						
1101	11448	4/6/99	9:15	1180						
1101	11448	4/19/99	13:00	1530						
1101	11448	4/22/99	10:20	1300						
1101	11448	4/28/99	10:45	1560						
1101	11448	5/4/99	12:15	1840						
1101	11448	5/7/99	9:10	1390						
1101	11448	5/10/99	12:15	1620						
1101	11448	5/26/99	14:20	1220						
1101	11448	6/3/99	11:30	451						
1101	11448	6/10/99	10:25	522						
1101	11448	6/15/99	9:15	412						
1101	11448	6/16/99	11:35	372						
1101	11448	6/22/99	11:00	349						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11448	7/6/99	13:15	675						
1101	11448	7/14/99	9:16	411						
1101	11448	7/15/99	11:20	465						
1101	11448	7/21/99	12:10	574						
1101	11448	7/27/99	11:15	803						
1101	11448	8/2/99	12:55	1240						
1101	11448	8/5/99	12:15	1078						
1101	11448	8/11/99	13:10	1001						
1101	11448	8/17/99	12:10	2140						
1101	11448	8/23/99	11:25	2530						
1101	11448	8/26/99	14:00	2100						
1101	11448	8/30/99	9:25	2230						
1101	11448	9/1/99	12:25	2070						
1101	11448	9/7/99	9:20	2390						
1101	11448	9/8/99	14:10	2030						
1101	11448	9/27/99	11:55	2080						
1101	11448	10/5/99	11:25	801						
1101	11448	10/7/99	10:00	979						
1101	11448	10/12/99	9:55	1850						
1101	11448	10/13/99	9:45	1540						
1101	11448	10/18/99	10:45	1940						
1101	11448	10/27/99	10:25	2890						
1101	11448	11/3/99	9:05	3140						
1101	11448	11/10/99	9:15	2390						
1101	11448	11/10/99	8:15	2990						
1101	11448	11/15/99	8:30	2480						
1101	11448	11/24/99	8:40	1600						
1101	11448	12/1/99	8:45	2080						
1101	11448	12/6/99	9:10	378						
1101	11448	12/15/99	8:30	1440						
1101	11448	12/15/99	8:22	1460						
1101	11448	12/20/99	8:00	1252						
1101	11448	1/5/00	9:05	2120						
1101	11448	1/12/00	8:34	1394						
1101	11448	1/13/00	9:05	1310						
1101	11448	1/20/00	8:40	3580						
1101	11448	1/27/00	8:45	3910						
1101	11448	2/1/00	10:30	440						
1101	11448	2/7/00	10:37	13400						
1101	11448	2/14/00	11:00	6480						
1101	11448	2/21/00	10:00	18300						
1101	11448	4/13/00	9:20	250						
1101	11448	5/24/00	9:23	500						
1101	11448	6/6/00	9:18	539						
1101	11448	7/26/00	9:55	1880						
1101	11448	8/31/00	9:10	1750						
1101	11448	9/20/00	9:19	630						
1101	11448	10/18/00	9:29	350						
1101	11448	11/7/00	8:14	290						
1101	11448	12/7/00	8:20	1050						
1101	11448	1/17/01	8:31	196						
1101	11448	2/20/01	8:25	1260						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	11448	3/14/01	8:22	705						
1101	11448	4/4/01	10:23	645						
1101	11448	5/23/01	10:13	1240						
1101	11448	6/25/01	10:19	720						
1101	11448	7/17/01	10:02	1220						
1101	11448	8/21/01	10:29	1390						
1101	11448	9/19/01	10:17	808						
1101	11448	10/22/01	9:59	796						
1101	11448	11/19/01	8:30	1390						
1101	11448	1/16/02	9:25	1070						
1101	11448	3/14/02	10:00	890						
1101	11448	5/21/02	9:10	678						
1101	11448	7/22/02	9:09	535						
1101	11448	9/24/02	9:05	590						
1101	11448	11/5/02	8:30	178						
1101	11448	1/27/03	8:08	481						
1101	11448	3/13/03	7:55	681						
1101	11448	7/11/03	9:01	447						
1101	11448	8/20/03	9:09	748						
1101	11448	7/28/05	13:20	660						
1101	11448	4/24/06	20:20	651						
1101	11448	4/25/06	10:32	728						
1101	11448	4/25/06	16:10	466						
1101	11448	4/26/06	10:30	988						
1101	11448	4/26/06	15:30	792						
1101	11448	4/27/06	11:45	1236						
1101	11448	7/5/06	12:28	372						
1101	11448	7/6/06	13:45	43294						
1101	11448	7/7/06	16:12	569						
1101	11448	7/7/06	10:35	351						
1101	11448	7/8/06	11:55	510						
1101	11448	8/15/06	16:40	569						
1101	11448	8/16/06	10:30	655						
1101	11448	8/16/06	15:25	770						
1101	11448	8/17/06	10:45	709						
1101	11448	8/17/06	16:50	786						
1101	11448	8/18/06	9:10	762	**237**	**100**	**43294**	**2548**	**4977**	**1220**
1101	15458	4/19/99	12:30	14400						
1101	15458	4/28/99	10:15	14600						
1101	15458	5/4/99	11:45	15400						
1101	15458	5/10/99	11:45	12270						
1101	15458	5/26/99	13:05	10700						
1101	15458	6/3/99	11:00	8710						
1101	15458	6/10/99	9:05	9880						
1101	15458	6/16/99	10:55	1016						
1101	15458	6/22/99	10:15	2360						
1101	15458	7/6/99	12:25	6560						
1101	15458	7/15/99	10:35	8440						
1101	15458	7/21/99	11:45	9478						
1101	15458	7/27/99	10:30	9998						
1101	15458	8/2/99	12:25	12700						
1101	15458	8/5/99	11:50	12400						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	15458	8/11/99	12:40	17600						
1101	15458	8/17/99	11:35	18800						
1101	15458	8/23/99	11:00	21300						
1101	15458	8/26/99	13:30	21000						
1101	15458	9/1/99	11:45	22400						
1101	15458	9/27/99	11:26	26000						
1101	15458	10/5/99	12:00	12440						
1101	15458	10/7/99	10:35	11710						
1101	15458	10/13/99	10:15	13400						
1101	15458	10/18/99	11:05	18800						
1101	15458	10/27/99	10:50	13600						
1101	15458	11/3/99	9:30	15700						
1101	15458	11/10/99	9:45	16500						
1101	15458	11/15/99	8:55	16200						
1101	15458	11/24/99	8:55	16400						
1101	15458	12/1/99	9:10	15800						
1101	15458	12/6/99	9:30	12170						
1101	15458	12/15/99	8:55	10700						
1101	15458	12/20/99	8:20	6190						
1101	15458	1/5/00	9:25	12120						
1101	15458	1/13/00	9:25	11070						
1101	15458	1/20/00	8:55	19600						
1101	15458	1/27/00	9:05	21500						
1101	15458	2/1/00	9:43	550						
1101	15458	2/7/00	9:40	1110						
1101	15458	2/14/00	10:36	2870						
1101	15458	2/21/00	9:38	3340						
1101	15458	4/16/01	11:15	2200						
1101	15458	6/29/01	11:27	2889						
1101	15458	7/30/01	11:58	14300						
1101	15458	8/23/01	11:30	22100						
1101	15458	9/20/01	11:13	5300						
1101	15458	10/18/01	12:00	1100						
1101	15458	12/3/01	11:00	268						
1101	15458	1/22/02	11:20	3720						
1101	15458	3/18/02	9:39	9500						
1101	15458	5/24/02	10:18	318						
1101	15458	7/25/02	10:15	7000						
1101	15458	10/2/02	9:50	11100						
1101	15458	11/18/02	10:08	625						
1101	15458	2/10/03	10:38	1140						
1101	15458	3/17/03	8:47	3080						
1101	15458	5/16/03	11:15	16100	**58**	**268**	**26000**	**10837**	**6852**	**11405**
1101	16572	1/11/99	8:55	5910						
1101	16572	2/3/99	9:15	18400						
1101	16572	3/19/99	8:51	15900						
1101	16572	4/19/99	10:15	14700						
1101	16572	5/17/99	10:04	4800						
1101	16572	7/9/99	9:34	7710						
1101	16572	7/19/99	10:00	4700						
1101	16572	8/23/99	9:55	21000						
1101	16572	9/20/99	10:05	26500						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	16572	10/18/99	10:05	25300						
1101	16572	11/29/99	9:32	23300						
1101	16572	12/22/99	9:05	18700						
1101	16572	4/4/00	11:10	1530						
1101	16572	5/4/00	10:20	9160						
1101	16572	6/26/00	8:27	18700						
1101	16572	7/19/00	10:24	21400						
1101	16572	8/10/00	10:25	24200						
1101	16572	9/29/00	9:51	15800						
1101	16572	10/27/00	12:00	11300						
1101	16572	11/27/00	9:08	1800						
1101	16572	12/18/00	9:43	13000						
1101	16572	1/26/01	9:35	1800						
1101	16572	2/22/01	9:22	8900						
1101	16572	3/12/01	9:31	1630						
1101	16572	4/16/01	11:04	2800						
1101	16572	6/29/01	11:12	3046						
1101	16572	7/30/01	11:48	14100						
1101	16572	8/23/01	11:20	23400						
1101	16572	9/20/01	11:04	6570						
1101	16572	10/18/01	11:47	1390						
1101	16572	12/3/01	10:50	322						
1101	16572	1/22/02	11:05	5890						
1101	16572	3/18/02	10:25	10300						
1101	16572	7/25/02	10:05	5800						
1101	16572	10/2/02	9:41	10400						
1101	16572	11/18/02	9:33	1550						
1101	16572	2/10/03	10:16	2600						
1101	16572	3/17/03	8:40	5310						
1101	16572	5/16/03	11:01	16200						
1101	16572	11/22/04	14:06	271						
1101	16572	1/11/05	10:04	9630						
1101	16572	3/8/05	8:17	669						
1101	16572	5/4/05	9:35	18500						
1101	16572	7/18/05	6:25	2360						
1101	16572	8/4/05	6:40	4020						
1101	16572	8/12/05	6:56	9920						
1101	16572	8/17/05	8:55	11700						
1101	16572	8/25/05	8:36	16500						
1101	16572	10/13/05	7:35	20200						
1101	16572	12/27/05	9:38	9990						
1101	16572	2/6/06	12:43	16300						
1101	16572	4/7/06	11:29	20300						
1101	16572	5/10/06	11:13	16400						
1101	16572	6/8/06	9:52	6490						
1101	16572	8/4/06	8:20	2330						
1101	16572	10/9/06	9:58	17800						
1101	16572	2/12/07	9:40	1540	**57**	**271**	**26500**	**10715**	**7758**	**9920**
1101	16573	1/11/99	8:45	5500						
1101	16573	2/3/99	8:30	16900						
1101	16573	3/19/99	8:43	15800						
1101	16573	4/19/99	10:06	15000						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	16573	5/17/99	9:55	5500						
1101	16573	7/9/99	9:27	8150						
1101	16573	7/19/99	9:50	9030						
1101	16573	8/23/99	10:05	20300						
1101	16573	9/20/99	9:55	26900						
1101	16573	10/18/99	9:53	28300						
1101	16573	11/29/99	9:23	25300						
1101	16573	12/22/99	8:55	19400						
1101	16573	4/4/00	10:57	1278						
1101	16573	5/4/00	10:04	11100						
1101	16573	6/26/00	8:20	18700						
1101	16573	7/19/00	10:11	20900						
1101	16573	8/10/00	10:15	24600						
1101	16573	9/29/00	9:42	20900						
1101	16573	10/27/00	12:00	12400						
1101	16573	11/27/00	8:55	2600						
1101	16573	12/18/00	9:34	11800						
1101	16573	1/26/01	9:23	3200						
1101	16573	2/22/01	9:13	9100						
1101	16573	3/12/01	9:20	4200						
1101	16573	4/16/01	10:54	3300						
1101	16573	6/29/01	10:58	2638						
1101	16573	7/30/01	11:35	14300						
1101	16573	8/23/01	11:10	22700						
1101	16573	9/20/01	10:54	8340						
1101	16573	10/18/01	11:31	1560						
1101	16573	12/3/01	10:39	5580						
1101	16573	1/22/02	10:55	7080						
1101	16573	3/18/02	10:06	12800						
1101	16573	5/24/02	10:07	325						
1101	16573	5/24/02	9:56	365						
1101	16573	7/25/02	9:55	6800						
1101	16573	10/2/02	9:31	12300						
1101	16573	11/18/02	9:18	831						
1101	16573	2/10/03	9:54	4220						
1101	16573	3/17/03	8:30	6750						
1101	16573	5/16/03	10:49	16500	**41**	**325**	**28300**	**11299**	**8124**	**9100**
1101	16575	1/8/99	9:24	498						
1101	16575	2/8/99	8:52	5100						
1101	16575	3/15/99	9:24	1130						
1101	16575	4/14/99	9:57	11600						
1101	16575	6/22/99	10:20	431						
1101	16575	7/28/99	10:13	3820						
1101	16575	8/9/99	10:20	8880						
1101	16575	9/23/99	10:38	22800						
1101	16575	10/27/99	10:36	15900						
1101	16575	11/12/99	9:52	18600						
1101	16575	12/16/99	9:43	11300						
1101	16575	1/13/00	9:57	8700						
1101	16575	4/14/00	10:58	370						
1101	16575	5/25/00	10:55	1225						
1101	16575	6/7/00	10:58	5500						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	16575	7/27/00	10:30	16200						
1101	16575	8/28/00	11:07	16700						
1101	16575	9/22/00	12:00	3900						
1101	16575	10/19/00	11:36	680						
1101	16575	11/8/00	9:28	300						
1101	16575	12/8/00	9:47	1300						
1101	16575	1/18/01	9:30	250						
1101	16575	2/21/01	9:49	1970						
1101	16575	3/15/01	9:53	328						
1101	16575	4/5/01	11:46	489						
1101	16575	5/24/01	11:20	5700						
1101	16575	6/26/01	11:35	672						
1101	16575	7/18/01	11:43	8700						
1101	16575	8/22/01	11:29	11700						
1101	16575	9/18/01	11:36	960						
1101	16575	10/23/01	11:31	1300						
1101	16575	11/20/01	10:39	2300						
1101	16575	1/18/02	10:25	1500						
1101	16575	3/15/02	11:23	3810						
1101	16575	5/15/02	10:25	6760						
1101	16575	7/19/02	10:46	300						
1101	16575	9/12/02	10:58	352						
1101	16575	11/21/02	10:23	200						
1101	16575	1/8/03	9:36	644						
1101	16575	3/14/03	11:00	703						
1101	16575	5/1/03	10:25	6020						
1101	16575	7/29/03	10:45	2070						
1101	16575	8/12/03	10:02	4900						
1101	16575	8/2/05	10:15	360	**44**	**200**	**22800**	**4930**	**5877**	**2020**
1101	16577	1/6/99	8:06	352						
1101	16577	2/10/99	7:51	3180						
1101	16577	4/6/99	9:00	1320						
1101	16577	5/7/99	8:50	3630						
1101	16577	6/15/99	8:55	304						
1101	16577	7/14/99	8:53	621						
1101	16577	8/30/99	9:04	7900						
1101	16577	9/7/99	8:55	10000						
1101	16577	10/12/99	9:26	5530						
1101	16577	11/10/99	7:59	11100						
1101	16577	12/15/99	7:54	3760						
1101	16577	1/12/00	8:08	3837						
1101	16577	4/13/00	9:00	380						
1101	16577	5/24/00	8:55	403						
1101	16577	6/6/00	8:50	2021						
1101	16577	7/26/00	9:30	10400						
1101	16577	8/31/00	8:45	8200						
1101	16577	9/20/00	13:00	1428						
1101	16577	9/20/00	13:05	1428						
1101	16577	9/20/00	13:10	1428						
1101	16577	9/20/00	13:15	1428						
1101	16577	9/20/00	13:20	1428						
1101	16577	9/20/00	13:25	1428						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101	16577	9/20/00	13:30	1428						
1101	16577	9/20/00	13:35	1428						
1101	16577	9/20/00	8:56	1500						
1101	16577	9/20/00	14:00	1695						
1101	16577	9/20/00	14:05	1695						
1101	16577	9/20/00	14:10	1695						
1101	16577	10/18/00	9:02	360						
1101	16577	11/7/00	7:50	350						
1101	16577	12/7/00	7:53	710						
1101	16577	1/17/01	8:05	192						
1101	16577	2/20/01	8:06	1130						
1101	16577	3/14/01	7:52	473						
1101	16577	4/4/01	9:56	437						
1101	16577	5/23/01	9:51	1380						
1101	16577	6/25/01	9:54	782						
1101	16577	7/17/01	9:45	3180						
1101	16577	8/21/01	9:54	636						
1101	16577	9/19/01	9:54	543						
1101	16577	10/22/01	9:33	429						
1101	16577	11/19/01	8:05	1690						
1101	16577	1/16/02	8:57	723						
1101	16577	1/16/02	8:57	723						
1101	16577	3/14/02	9:40	1232						
1101	16577	5/21/02	8:50	360						
1101	16577	7/22/02	8:36	382						
1101	16577	9/24/02	8:40	449						
1101	16577	11/5/02	8:05	154						
1101	16577	1/27/03	7:40	600						
1101	16577	3/13/03	7:31	686						
1101	16577	5/7/03	8:43	3390						
1101	16577	5/7/03	8:44	3390						
1101	16577	7/11/03	8:28	423						
1101	16577	8/20/03	8:45	1240						
1101	16577	8/2/05	11:00	350	**57**	**154**	**11100**	**2059**	**2618**	**1320**
1101B	16472	1/6/99	10:24	857						
1101B	16472	2/10/99	10:02	1670						
1101B	16472	4/6/99	11:15	1280						
1101B	16472	5/7/99	11:00	900						
1101B	16472	6/15/99	11:40	284						
1101B	16472	7/14/99	11:16	582						
1101B	16472	8/30/99	11:25	820						
1101B	16472	9/7/99	11:22	1120						
1101B	16472	10/12/99	11:40	900						
1101B	16472	11/10/99	10:19	1490						
1101B	16472	12/15/99	10:28	590						
1101B	16472	1/12/00	10:58	501						
1101B	16472	4/13/00	12:05	430						
1101B	16472	5/24/00	12:15	460						
1101B	16472	6/6/00	12:13	570						
1101B	16472	7/27/00	11:55	1700						
1101B	16472	8/31/00	12:00	620						
1101B	16472	9/20/00	11:40	530						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101B	16472	10/18/00	12:10	290						
1101B	16472	11/7/00	11:00	380						
1101B	16472	12/7/00	11:10	780						
1101B	16472	1/17/01	10:52	189						
1101B	16472	2/21/01	10:55	1330						
1101B	16472	3/14/01	11:05	1032						
1101B	16472	4/4/01	12:58	827						
1101B	16472	5/23/01	12:34	1310						
1101B	16472	6/25/01	12:41	1020						
1101B	16472	7/17/01	12:06	1320						
1101B	16472	8/21/01	13:22	737						
1101B	16472	9/19/01	13:24	1040						
1101B	16472	10/22/01	12:29	1070						
1101B	16472	1/17/02	11:00	1250						
1101B	16472	3/20/02	11:08	1880						
1101B	16472	5/22/02	10:30	670						
1101B	16472	7/23/02	11:31	607						
1101B	16472	9/24/02	12:23	1000						
1101B	16472	11/6/02	9:23	198						
1101B	16472	1/27/03	11:26	336						
1101B	16472	3/13/03	11:10	1470						
1101B	16472	5/7/03	12:16	1770						
1101B	16472	7/11/03	12:23	399						
1101B	16472	8/20/03	12:38	625						
1101B	16472	4/24/06	19:45	608						
1101B	16472	4/25/06	15:15	687						
1101B	16472	4/26/06	13:47	981						
1101B	16472	4/27/06	11:05	698						
1101B	16472	4/27/06	18:30	700						
1101B	16472	4/28/06	8:45	912						
1101B	16472	7/5/06	17:30	392						
1101B	16472	7/6/06	17:20	491						
1101B	16472	7/7/06	13:15	538						
1101B	16472	7/8/06	12:35	1380						
1101B	16472	7/8/06	11:40	1282						
1101B	16472	8/15/06	20:00	782						
1101B	16472	8/16/06	13:20	576						
1101B	16472	8/16/06	20:00	728						
1101B	16472	8/17/06	12:50	682						
1101B	16472	8/17/06	20:10	735						
1101B	16472	8/18/06	11:40	819	**59**	**189**	**1880**	**844**	**409**	**737**
1101B	16493	1/6/99	10:12	948						
1101B	16493	2/10/99	9:50	1770						
1101B	16493	4/6/99	11:05	1540						
1101B	16493	5/7/99	10:50	970						
1101B	16493	6/15/99	11:10	278						
1101B	16493	7/14/99	11:07	673						
1101B	16493	8/30/99	11:12	605						
1101B	16493	9/7/99	11:15	818						
1101B	16493	10/12/99	11:25	993						
1101B	16493	12/15/99	10:16	488						
1101B	16493	1/12/00	10:49	532						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101B	16493	4/13/00	11:47	470						
1101B	16493	5/24/00	11:57	470						
1101B	16493	6/6/00	11:55	670						
1101B	16493	7/26/00	12:26	998						
1101B	16493	8/31/00	11:40	680						
1101B	16493	9/20/00	11:24	930						
1101B	16493	10/18/00	11:54	370						
1101B	16493	11/7/00	10:47	470						
1101B	16493	12/7/00	10:53	790						
1101B	16493	1/17/01	10:32	180						
1101B	16493	2/20/01	11:15	1320						
1101B	16493	3/14/01	10:45	1110						
1101B	16493	4/4/01	12:40	1168						
1101B	16493	5/23/01	12:22	1150						
1101B	16493	6/25/01	12:28	1174						
1101B	16493	7/17/01	11:55	1200						
1101B	16493	8/21/01	13:05	1100						
1101B	16493	9/19/01	12:50	1140						
1101B	16493	10/22/01	12:15	992						
1101B	16493	1/17/02	10:40	1470						
1101B	16493	3/20/02	10:36	1970						
1101B	16493	5/22/02	10:15	965						
1101B	16493	7/23/02	11:14	788						
1101B	16493	9/24/02	11:59	1120						
1101B	16493	11/6/02	9:07	200						
1101B	16493	1/27/03	11:01	346						
1101B	16493	3/13/03	10:25	1440						
1101B	16493	5/7/03	12:05	1410						
1101B	16493	7/11/03	12:05	818						
1101B	16493	8/20/03	12:04	635						
1101B	16493	8/25/04	13:54	810						
1101B	16493	9/13/04	14:50	1270						
1101B	16493	10/27/04	11:33	997						
1101B	16493	1/13/05	13:32	451						
1101B	16493	3/1/05	14:18	440						
1101B	16493	5/10/05	11:15	753						
1101B	16493	7/5/05	10:14	1220						
1101B	16493	7/29/05	7:55	1120						
1101B	16493	10/10/05	9:50	641						
1101B	16493	12/19/05	12:34	584						
1101B	16493	2/1/06	13:35	1270						
1101B	16493	4/5/06	11:52	1240						
1101B	16493	4/24/06	19:10	1102						
1101B	16493	4/25/06	16:13	1275						
1101B	16493	4/26/06	13:10	1272						
1101B	16493	4/27/06	10:45	1013						
1101B	16493	4/27/06	18:00	1018						
1101B	16493	4/28/06	9:13	1250						
1101B	16493	5/8/06	10:54	1040						
1101B	16493	6/1/06	11:16	322						
1101B	16493	7/5/06	16:40	409						
1101B	16493	7/6/06	16:40	520						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101B	16493	7/7/06	17:06	580						
1101B	16493	7/8/06	12:55	1776						
1101B	16493	7/8/06	11:12	1670						
1101B	16493	8/3/06	8:29	1010						
1101B	16493	8/15/06	19:35	1130						
1101B	16493	8/16/06	13:00	1135						
1101B	16493	8/16/06	19:35	1125						
1101B	16493	8/17/06	12:35	953						
1101B	16493	8/17/06	19:40	1315						
1101B	16493	8/18/06	11:15	1412						
1101B	16493	10/5/06	10:00	1050						
1101B	16493	2/4/07	12:36	947	**75**	**180**	**1970**	**950**	**392**	**997**
1101D	16475	1/8/99	9:09	2530						
1101D	16475	2/8/99	8:38	10100						
1101D	16475	3/15/99	9:10	766						
1101D	16475	4/14/99	9:44	12400						
1101D	16475	6/22/99	10:07	2600						
1101D	16475	7/28/99	10:00	7047						
1101D	16475	8/9/99	10:03	11200						
1101D	16475	9/23/99	10:25	26700						
1101D	16475	10/27/99	10:21	21400						
1101D	16475	11/12/99	9:30	24200						
1101D	16475	12/16/99	9:20	13600						
1101D	16475	1/13/00	9:33	24300						
1101D	16475	4/14/00	10:32	430						
1101D	16475	5/25/00	10:30	9000						
1101D	16475	6/7/00	10:35	9900						
1101D	16475	7/27/00	10:04	22000						
1101D	16475	8/28/00	10:42	24700						
1101D	16475	9/22/00	10:30	9000						
1101D	16475	10/19/00	11:12	980						
1101D	16475	11/8/00	9:11	170						
1101D	16475	12/8/00	9:21	3700						
1101D	16475	1/18/01	9:06	260						
1101D	16475	2/21/01	9:23	3700						
1101D	16475	3/15/01	9:25	228						
1101D	16475	4/5/01	11:20	1155						
1101D	16475	5/24/01	10:57	6500						
1101D	16475	6/26/01	11:06	720						
1101D	16475	7/18/01	11:21	6900						
1101D	16475	8/22/01	11:07	16700						
1101D	16475	9/18/01	11:12	2200						
1101D	16475	10/23/01	11:11	1100						
1101D	16475	11/20/01	10:16	6800						
1101D	16475	1/18/02	10:02	1800						
1101D	16475	3/15/02	10:53	9280						
1101D	16475	5/15/02	9:45	7300						
1101D	16475	7/19/02	10:19	366						
1101D	16475	9/12/02	10:36	555						
1101D	16475	11/21/02	9:57	200						
1101D	16475	1/8/03	9:09	845						
1101D	16475	3/14/03	10:37	1570						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101D	16475	5/1/03	10:00	13700						
1101D	16475	7/29/03	10:03	3420						
1101D	16475	8/25/04	17:25	12000						
1101D	16475	10/29/04	10:10	14300						
1101D	16475	1/15/05	13:10	372						
1101D	16475	3/3/05	14:42	486						
1101D	16475	5/5/05	12:02	14500						
1101D	16475	7/7/05	9:09	23200						
1101D	16475	8/3/05	6:51	2140						
1101D	16475	8/3/05	10:45	3280						
1101D	16475	8/9/05	8:50	5440						
1101D	16475	8/18/05	9:57	4250						
1101D	16475	8/24/05	9:55	10600						
1101D	16475	8/29/05	8:31	5620						
1101D	16475	10/6/05	9:41	20700						
1101D	16475	10/6/05	9:41	24100						
1101D	16475	10/6/05	9:42	26000						
1101D	16475	12/26/05	10:47	7640						
1101D	16475	2/2/06	11:53	25200						
1101D	16475	2/2/06	11:54	27600						
1101D	16475	2/2/06	11:53	27700						
1101D	16475	4/6/06	9:33	26500						
1101D	16475	4/6/06	9:33	27300						
1101D	16475	4/24/06	11:34	18615						
1101D	16475	4/25/06	9:10	18075						
1101D	16475	4/25/06	16:45	19040						
1101D	16475	4/26/06	12:20	17900						
1101D	16475	4/26/06	17:45	18300						
1101D	16475	4/27/06	16:56	18040						
1101D	16475	4/27/06	13:45	18238						
1101D	16475	5/9/06	10:15	13600						
1101D	16475	5/9/06	10:15	14500						
1101D	16475	6/2/06	10:01	345						
1101D	16475	6/2/06	10:01	347						
1101D	16475	6/2/06	10:01	353						
1101D	16475	7/5/06	15:05	232						
1101D	16475	7/6/06	10:00	40316						
1101D	16475	7/6/06	18:15	486						
1101D	16475	7/7/06	14:05	531						
1101D	16475	7/8/06	8:55	27.1						
1101D	16475	8/8/06	8:50	386						
1101D	16475	8/15/06	13:45	2379						
1101D	16475	8/15/06	19:45	1175						
1101D	16475	8/16/06	12:01	2501						
1101D	16475	8/16/06	17:40	2143						
1101D	16475	8/17/06	13:07	4062						
1101D	16475	8/17/06	18:45	3550						
1101D	16475	10/6/06	10:20	9740						
1101D	16475	2/5/07	10:54	613						
1101D	16475	2/5/07	10:54	616	**90**	**27**	**40316**	**9523**	**9563**	**6650**
1101D	16486	1/8/99	8:54	657						
1101D	16486	2/8/99	8:28	900						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101D	16486	3/15/99	9:00	579						
1101D	16486	4/14/99	9:32	749						
1101D	16486	6/22/99	9:57	772						
1101D	16486	7/28/99	9:52	725						
1101D	16486	8/9/99	9:55	608						
1101D	16486	9/23/99	10:15	1110						
1101D	16486	10/27/99	10:10	801						
1101D	16486	11/12/99	9:26	832						
1101D	16486	12/16/99	9:01	464						
1101D	16486	1/13/00	9:20	574						
1101D	16486	4/14/00	10:20	400						
1101D	16486	5/25/00	10:16	630						
1101D	16486	6/7/00	10:21	690						
1101D	16486	7/27/00	9:48	370						
1101D	16486	8/28/00	10:29	475						
1101D	16486	9/22/00	10:09	310						
1101D	16486	10/19/00	10:48	340						
1101D	16486	11/8/00	9:01	140						
1101D	16486	12/8/00	9:06	760						
1101D	16486	1/18/01	8:55	291						
1101D	16486	2/21/01	9:03	774						
1101D	16486	3/15/01	9:06	252						
1101D	16486	4/5/01	11:03	814						
1101D	16486	5/24/01	10:44	760						
1101D	16486	6/26/01	10:54	651						
1101D	16486	7/18/01	11:05	657						
1101D	16486	8/22/01	10:58	554						
1101D	16486	9/18/01	10:57	773						
1101D	16486	10/23/01	11:00	758						
1101D	16486	11/20/01	9:42	700						
1101D	16486	1/18/02	9:45	836						
1101D	16486	3/15/02	10:35	823						
1101D	16486	5/15/02	9:35	830						
1101D	16486	7/19/02	10:00	400						
1101D	16486	9/12/02	10:17	537						
1101D	16486	11/21/02	9:39	300						
1101D	16486	1/8/03	8:56	809						
1101D	16486	3/14/03	10:21	828						
1101D	16486	5/1/03	9:50	821						
1101D	16486	7/29/03	9:53	385						
1101D	16486	8/12/03	9:35	492						
1101D	16486	7/29/05	7:00	250						
1101D	16486	4/24/06	10:21	430						
1101D	16486	4/25/06	8:35	371						
1101D	16486	4/26/06	11:34	579						
1101D	16486	4/26/06	17:01	532						
1101D	16486	4/27/06	12:50	507						
1101D	16486	4/27/06	16:37	498						
1101D	16486	7/5/06	14:40	218						
1101D	16486	7/6/06	9:25	43696						
1101D	16486	7/6/06	17:40	420						
1101D	16486	7/7/06	13:55	455						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1101D	16486	7/8/06	9:30	474						
1101D	16486	8/15/06	13:10	422						
1101D	16486	8/15/06	19:20	393						
1101D	16486	8/16/06	11:25	441						
1101D	16486	8/16/06	17:14	400						
1101D	16486	8/17/06	12:20	411						
1101D	16486	8/17/06	18:10	425	**61**	**140**	**43696**	**1276**	**5526**	**554**
1102	11449	3/11/76	15:45	700						
1102	11449	12/28/76	10:55	500						
1102	11449	1/20/77	11:45	600						
1102	11449	1/20/77	11:55	600						
1102	11449	2/28/77	12:30	1300						
1102	11449	2/28/77	12:40	1300						
1102	11449	3/29/77	10:20	700						
1102	11449	4/28/77	11:35	760						
1102	11449	5/24/77	11:40	1000						
1102	11449	6/30/77	11:10	800						
1102	11449	6/30/77	11:10	3000						
1102	11449	7/13/77	11:15	900						
1102	11449	8/29/77	11:30	900						
1102	11449	9/27/77	11:20	950						
1102	11449	9/27/77	11:25	1000						
1102	11449	10/24/77	10:55	1600						
1102	11449	10/24/77	10:55	1700						
1102	11449	11/30/77	10:55	100						
1102	11449	11/30/77	10:55	300						
1102	11449	12/7/77	10:00	1100						
1102	11449	1/9/78	11:45	600						
1102	11449	1/9/78	11:45	1700						
1102	11449	2/16/78	11:00	600						
1102	11449	3/7/78	10:15	1250						
1102	11449	4/3/78	10:45	1400						
1102	11449	4/3/78	10:45	1500						
1102	11449	5/31/78	12:40	2100						
1102	11449	6/26/78	13:20	1100						
1102	11449	6/26/78	13:20	4000						
1102	11449	7/26/78	11:25	800						
1102	11449	8/21/78	12:45	2400						
1102	11449	8/21/78	12:45	12000						
1102	11449	9/19/78	10:50	900						
1102	11449	10/19/78	10:45	1300						
1102	11449	10/19/78	10:45	7100						
1102	11449	11/29/78	11:20	500						
1102	11449	12/7/78	10:40	700						
1102	11449	12/7/78	10:40	750						
1102	11449	1/24/79	11:00	500						
1102	11449	2/21/79	11:10	900						
1102	11449	3/27/79	10:10	1100						
1102	11449	5/30/79	11:45	1800						
1102	11449	5/30/79	11:45	2000						
1102	11449	8/2/79	11:15	450						
1102	11449	1/17/80	10:45	1800						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1102	11449	10/21/80	11:50	1000						
1102	11449	1/21/81	11:10	600						
1102	11449	4/27/81	10:20	1400						
1102	11449	7/8/81	10:30	250						
1102	11449	10/22/81	12:40	1042						
1102	11449	10/22/81	12:40	1050						
1102	11449	1/21/82	12:05	1468						
1102	11449	1/21/82	12:05	1470						
1102	11449	1/6/99	8:54	610						
1102	11449	2/10/99	8:38	1400						
1102	11449	4/6/99	9:45	1130						
1102	11449	5/7/99	9:28	1290						
1102	11449	6/15/99	9:48	448						
1102	11449	7/14/99	9:42	456						
1102	11449	8/30/99	9:43	1320						
1102	11449	9/7/99	9:40	1720						
1102	11449	10/12/99	10:15	1340						
1102	11449	11/10/99	8:41	1820						
1102	11449	12/15/99	8:46	940						
1102	11449	1/12/00	9:16	820						
1102	11449	4/13/00	9:50	230						
1102	11449	5/24/00	9:50	550						
1102	11449	6/6/00	9:48	474						
1102	11449	7/26/00	10:24	861						
1102	11449	8/31/00	9:35	1340						
1102	11449	9/19/00	12:00	795						
1102	11449	9/19/00	12:05	795						
1102	11449	9/19/00	12:10	795						
1102	11449	9/20/00	13:45	795						
1102	11449	9/20/00	13:48	795						
1102	11449	9/20/00	13:50	795						
1102	11449	9/20/00	13:55	795						
1102	11449	9/20/00	9:39	840						
1102	11449	10/18/00	9:52	380						
1102	11449	11/7/00	8:38	290						
1102	11449	12/7/00	8:43	890						
1102	11449	1/17/01	8:47	194						
1102	11449	2/20/01	8:53	1170						
1102	11449	3/14/01	8:46	822						
1102	11449	4/4/01	10:44	693						
1102	11449	5/23/01	10:38	1230						
1102	11449	6/25/01	10:42	693						
1102	11449	7/17/01	10:15	1200						
1102	11449	8/21/01	10:53	1230						
1102	11449	9/19/01	10:42	782						
1102	11449	10/22/01	10:21	799						
1102	11449	11/19/01	8:52	1360						
1102	11449	1/16/02	9:55	917						
1102	11449	3/14/02	10:45	1127						
1102	11449	5/21/02	9:40	524						
1102	11449	7/22/02	9:35	521						
1102	11449	9/24/02	9:40	591						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1102	11449	11/5/02	8:57	186						
1102	11449	1/27/03	8:40	470						
1102	11449	3/13/03	8:22	871						
1102	11449	5/7/03	9:26	1260						
1102	11449	7/11/03	9:35	402						
1102	11449	8/20/03	9:30	902	**103**	**100**	**12000**	**1165**	**1361**	**900**
1102	11450	3/13/74	11:00	1500						
1102	11450	5/20/74	9:55	1000						
1102	11450	6/18/74	10:30	920						
1102	11450	8/21/74	11:00	1050						
1102	11450	9/11/74	9:30	1100						
1102	11450	11/6/74	9:00	1000						
1102	11450	12/10/74	9:00	1250						
1102	11450	2/19/75	9:25	1450						
1102	11450	3/18/75	9:55	600						
1102	11450	3/11/76	15:10	1200						
1102	11450	5/25/76	13:50	700						
1102	11450	9/16/76	2:00	1300						
1102	11450	12/28/76	10:30	500						
1102	11450	1/10/77	10:55	300						
1102	11450	1/20/77	10:30	620						
1102	11450	2/28/77	11:40	1300						
1102	11450	3/29/77	9:40	580						
1102	11450	3/29/77	9:45	700						
1102	11450	4/28/77	11:00	960						
1102	11450	5/24/77	11:20	1000						
1102	11450	6/30/77	10:45	1000						
1102	11450	7/13/77	10:55	900						
1102	11450	8/29/77	10:55	600						
1102	11450	9/27/77	11:00	1400						
1102	11450	10/24/77	10:40	1000						
1102	11450	10/24/77	10:40	1200						
1102	11450	12/7/77	9:35	1100						
1102	11450	1/9/78	11:30	1000						
1102	11450	2/16/78	10:40	600						
1102	11450	3/7/78	9:55	1250						
1102	11450	4/3/78	10:15	1500						
1102	11450	5/31/78	12:10	1000						
1102	11450	5/31/78	12:15	2300						
1102	11450	6/26/78	13:05	1000						
1102	11450	6/26/78	13:05	1200						
1102	11450	7/26/78	11:05	700						
1102	11450	7/26/78	11:05	800						
1102	11450	8/21/78	12:20	1400						
1102	11450	8/21/78	12:20	1450						
1102	11450	9/19/78	10:30	1000						
1102	11450	10/19/78	10:20	1900						
1102	11450	11/29/78	10:55	500						
1102	11450	12/7/78	10:20	800						
1102	11450	1/24/79	10:50	500						
1102	11450	2/21/79	10:50	1000						
1102	11450	3/27/79	9:55	1200						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1102	11450	5/30/79	11:25	2100						
1102	11450	8/2/79	11:00	450						
1102	11450	1/17/80	10:30	1900						
1102	11450	10/21/80	11:35	1100						
1102	11450	1/21/81	10:55	600						
1102	11450	4/27/81	10:10	1400						
1102	11450	7/8/81	10:15	250						
1102	11450	7/8/81	10:15	350						
1102	11450	10/22/81	13:00	1022						
1102	11450	1/21/82	12:25	1490						
1102	11450	1/21/82	12:25	1510						
1102	11450	4/6/82	10:40	1480						
1102	11450	4/6/82	10:40	1490						
1102	11450	7/20/82	10:30	1440						
1102	11450	10/26/82	11:35	1580						
1102	11450	4/13/83	10:40	1170						
1102	11450	1/15/86	12:42	975						
1102	11450	4/16/86	10:15	960						
1102	11450	7/23/86	15:58	937						
1102	11450	3/27/87	13:37	1100						
1102	11450	6/4/87	13:55	762						
1102	11450	6/4/87	13:55	943						
1102	11450	9/17/87	14:43	728						
1102	11450	9/17/87	14:43	730						
1102	11450	12/9/87	12:48	997						
1102	11450	12/9/87	12:48	999						
1102	11450	3/14/88	9:46	1119						
1102	11450	6/7/88	14:07	885						
1102	11450	6/7/88	14:07	886						
1102	11450	9/1/88	12:05	917						
1102	11450	12/20/88	13:50	1071						
1102	11450	3/28/89	11:08	1018						
1102	11450	3/28/89	11:08	1019						
1102	11450	6/8/89	13:42	860						
1102	11450	9/26/89	11:25	1200						
1102	11450	12/11/89	13:00	1100						
1102	11450	3/13/90	11:08	700						
1102	11450	6/5/90	10:41	1100						
1102	11450	9/10/90	10:15	240						
1102	11450	12/3/90	8:55	1070						
1102	11450	3/5/91	8:40	720						
1102	11450	6/25/91	12:02	464						
1102	11450	6/25/91	12:02	465						
1102	11450	9/9/91	11:42	645						
1102	11450	9/9/91	11:42	647						
1102	11450	12/16/91	9:50	860						
1102	11450	3/10/92	10:06	949						
1102	11450	6/17/92	11:20	975						
1102	11450	12/7/92	11:45	793						
1102	11450	6/7/93	13:25	1060						
1102	11450	9/15/93	11:45	686						
1102	11450	9/15/93	11:45	691						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1102	11450	3/9/94	12:03	564						
1102	11450	6/8/94	13:55	767						
1102	11450	12/7/94	9:38	430						
1102	11450	3/8/95	9:12	269						
1102	11450	6/14/95	14:24	989						
1102	11450	9/13/95	11:55	936						
1102	11450	12/19/95	8:12	177						
1102	11450	3/13/96	7:55	1417						
1102	11450	6/3/96	11:45	1083						
1102	11450	10/2/96	13:28	1149						
1102	11450	12/4/96	6:50	1110						
1102	11450	3/4/97	7:28	937						
1102	11450	6/24/97	7:58	573						
1102	11450	10/15/97	12:42	242						
1102	11450	2/25/98	10:28	485						
1102	11450	3/11/98	12:41	1060						
1102	11450	3/18/98	12:24	169						
1102	11450	3/23/98	11:33	837						
1102	11450	3/31/98	12:39	1400						
1102	11450	4/7/98	14:07	1230						
1102	11450	5/27/98	9:57	1470						
1102	11450	6/3/98	13:52	1970						
1102	11450	6/9/98	13:16	1090						
1102	11450	6/17/98	14:40	1390						
1102	11450	6/30/98	8:58	518						
1102	11450	7/1/98	11:30	671						
1102	11450	8/26/98	10:35	624						
1102	11450	11/3/98	11:30	781						
1102	11450	1/6/99	9:20	705						
1102	11450	2/3/99	10:52	1790						
1102	11450	2/10/99	9:02	1070						
1102	11450	4/6/99	10:10	970						
1102	11450	5/6/99	10:46	1000						
1102	11450	5/7/99	9:50	2120						
1102	11450	6/15/99	10:20	560						
1102	11450	7/14/99	10:20	399						
1102	11450	8/26/99	13:34	989						
1102	11450	8/30/99	10:08	914						
1102	11450	9/7/99	10:05	1180						
1102	11450	10/12/99	10:38	1480						
1102	11450	11/10/99	9:14	706						
1102	11450	11/10/99	9:05	1430						
1102	11450	11/16/99	10:34	1100						
1102	11450	12/15/99	9:19	930						
1102	11450	1/12/00	9:50	793						
1102	11450	2/15/00	9:30	1260						
1102	11450	4/13/00	10:05	220						
1102	11450	5/4/00	9:20	300						
1102	11450	5/24/00	10:20	770						
1102	11450	6/6/00	10:20	453						
1102	11450	6/13/00	11:07	761						
1102	11450	6/16/00	10:10	1497						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1102	11450	7/26/00	10:52	880						
1102	11450	8/8/00	13:54	1105						
1102	11450	8/10/00	12:30	848						
1102	11450	8/31/00	9:55	970						
1102	11450	9/20/00	10:02	1000						
1102	11450	10/18/00	10:26	250						
1102	11450	11/7/00	9:00	270						
1102	11450	11/29/00	9:40	700						
1102	11450	12/7/00	9:17	850						
1102	11450	1/17/01	9:05	189						
1102	11450	2/8/01	8:40	1031						
1102	11450	2/20/01	9:25	870						
1102	11450	3/14/01	9:02	1020						
1102	11450	4/4/01	11:01	857						
1102	11450	5/9/01	10:10	679						
1102	11450	5/23/01	11:01	1490						
1102	11450	6/25/01	11:08	905						
1102	11450	7/17/01	10:30	800						
1102	11450	8/9/01	11:50	566						
1102	11450	8/21/01	11:30	1400						
1102	11450	9/19/01	11:09	837						
1102	11450	10/22/01	10:48	899						
1102	11450	11/19/01	9:18	773						
1102	11450	12/3/01	8:05	212						
1102	11450	1/16/02	10:45	979						
1102	11450	2/20/02	10:00	891.8						
1102	11450	3/14/02	11:04	1236						
1102	11450	5/16/02	12:15	1365						
1102	11450	5/21/02	10:33	588						
1102	11450	7/22/02	9:57	570						
1102	11450	8/15/02	11:15	144						
1102	11450	8/29/02	9:59	589						
1102	11450	9/24/02	10:00	708						
1102	11450	11/5/02	9:24	179						
1102	11450	1/27/03	9:20	588						
1102	11450	2/12/03	8:40	685						
1102	11450	3/13/03	8:50	892						
1102	11450	5/7/03	9:55	1160						
1102	11450	6/3/03	13:05	1420						
1102	11450	7/11/03	10:11	329						
1102	11450	8/14/03	11:55	680						
1102	11450	8/20/03	10:01	689						
1102	11450	10/23/03	8:20	1250						
1102	11450	12/8/03	14:30	1000						
1102	11450	3/11/04	14:35	980						
1102	11450	6/3/04	11:10	1110						
1102	11450	8/25/04	9:45	657						
1102	11450	9/14/04	11:00	742						
1102	11450	10/27/04	8:35	1030						
1102	11450	12/14/04	13:30	740						
1102	11450	1/13/05	10:42	335						
1102	11450	3/1/05	9:48	632						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1102	11450	3/15/05	13:50	746						
1102	11450	5/12/05	11:45	852						
1102	11450	6/16/05	11:53	680						
1102	11450	7/5/05	7:24	961						
1102	11450	7/27/05	9:07	670						
1102	11450	9/14/05	13:10	410						
1102	11450	10/10/05	7:37	1190						
1102	11450	12/15/05	11:35	264						
1102	11450	12/19/05	9:07	589						
1102	11450	2/1/06	10:54	854						
1102	11450	2/1/06	10:54	856						
1102	11450	3/14/06	10:02	1170						
1102	11450	4/24/06	16:40	662						
1102	11450	4/25/06	13:00	837						
1102	11450	4/26/06	11:25	851						
1102	11450	4/27/06	9:00	756						
1102	11450	4/27/06	16:10	722						
1102	11450	4/28/06	10:45	915						
1102	11450	6/8/06	10:45	800						
1102	11450	7/5/06	15:50	220						
1102	11450	7/6/06	14:30	326						
1102	11450	7/7/06	11:45	377						
1102	11450	7/8/06	16:12	409						
1102	11450	7/8/06	9:15	378						
1102	11450	8/15/06	17:30	662						
1102	11450	8/16/06	11:25	669						
1102	11450	8/16/06	18:10	720						
1102	11450	8/17/06	11:00	740						
1102	11450	8/17/06	17:55	773						
1102	11450	8/18/06	10:45	9.44						
1102	11450	9/13/06	13:10	600						
1102	11450	12/28/06	10:19	464						
1102	11450	3/20/07	10:15	400						
1102	11450	6/7/07	9:48	730						
1102	11450	10/10/07	10:27	370	**237**	**9**	**2300**	**886**	**390**	**880**
1102	14229	5/7/99	10:15	3070						
1102	14229	6/15/99	10:40	694						
1102	14229	7/14/99	10:38	430						
1102	14229	8/30/99	10:35	1130						
1102	14229	9/7/99	10:45	1110						
1102	14229	10/12/99	10:56	2630						
1102	14229	11/10/99	9:28	2140						
1102	14229	12/15/99	9:47	800						
1102	14229	1/12/00	10:18	892						
1102	14229	4/13/00	10:58	190						
1102	14229	5/24/00	11:10	900						
1102	14229	6/6/00	11:05	627						
1102	14229	7/26/00	11:36	915						
1102	14229	8/31/00	10:52	1800						
1102	14229	9/20/00	10:40	1060						
1102	14229	10/18/00	11:05	180						
1102	14229	11/7/00	10:07	314						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1102	14229	12/7/00	10:09	1300						
1102	14229	1/17/01	9:53	195						
1102	14229	2/20/01	10:59	1110						
1102	14229	3/14/01	10:00	1173						
1102	14229	4/4/01	11:54	882						
1102	14229	5/23/01	11:41	1880						
1102	14229	6/25/01	11:41	932						
1102	14229	7/17/01	11:16	2250						
1102	14229	8/21/01	12:12	2500						
1102	14229	9/19/01	11:58	922						
1102	14229	10/22/01	11:34	560						
1102	14229	11/19/01	10:05	916						
1102	14229	1/17/02	9:06	985						
1102	14229	3/14/02	12:21	1530						
1102	14229	5/22/02	9:30	1310						
1102	14229	7/23/02	8:57	700						
1102	14229	9/24/02	11:11	771						
1102	14229	11/6/02	7:59	199						
1102	14229	1/27/03	10:16	696						
1102	14229	3/13/03	9:43	1260						
1102	14229	7/11/03	10:58	358						
1102	14229	8/20/03	11:16	758						
1102	14229	2/25/04	13:55	368						
1102	14229	4/21/04	13:20	1070						
1102	14229	7/14/04	13:05	768						
1102	14229	8/24/04	11:55	656						
1102	14229	10/25/04	11:30	1170						
1102	14229	12/28/04	12:00	993						
1102	14229	2/15/05	11:40	445						
1102	14229	4/19/05	11:25	1320						
1102	14229	6/22/05	11:20	1840						
1102	14229	8/29/05	11:21	1090						
1102	14229	11/9/05	12:03	1110						
1102	14229	12/28/05	12:13	1160						
1102	14229	2/23/06	11:20	920						
1102	14229	4/27/06	12:05	885						
1102	14229	6/21/06	13:20	159						
1102	14229	8/30/06	12:15	701						
1102	14229	10/24/06	12:40	323						
1102	14229	12/27/06	12:05	393						
1102	14229	2/26/07	12:22	874	**58**	**159**	**3070**	**1005**	**623**	**916**
1102A	11425	3/7/83	10:45	4690						
1102A	11425	1/6/99	8:38	1280						
1102A	11425	2/10/99	8:21	3160						
1102A	11425	4/6/99	9:30	1730						
1102A	11425	5/7/99	9:20	2370						
1102A	11425	6/15/99	9:37	381						
1102A	11425	7/14/99	9:30	693						
1102A	11425	8/30/99	9:34	1520						
1102A	11425	9/7/99	9:31	1780						
1102A	11425	8/25/04	11:48	903						
1102A	11425	10/27/04	10:34	1110						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1102A	11425	1/13/05	9:32	462						
1102A	11425	3/1/05	11:58	990						
1102A	11425	5/10/05	12:12	669						
1102A	11425	7/5/05	9:10	1970						
1102A	11425	7/28/05	9:55	920						
1102A	11425	10/10/05	8:50	1090						
1102A	11425	10/10/05	8:50	1100						
1102A	11425	12/19/05	10:56	602						
1102A	11425	2/1/06	13:05	1090						
1102A	11425	4/4/06	11:37	1350						
1102A	11425	4/24/06	18:40	1715						
1102A	11425	4/25/06	15:45	1583						
1102A	11425	4/26/06	12:40	1237						
1102A	11425	4/27/06	10:15	976						
1102A	11425	4/27/06	17:40	998						
1102A	11425	4/28/06	9:35	1182						
1102A	11425	5/8/06	9:25	738						
1102A	11425	6/1/06	10:19	268						
1102A	11425	7/6/06	16:15	410						
1102A	11425	7/7/06	12:46	343						
1102A	11425	7/8/06	10:48	407						
1102A	11425	7/8/06	13:20	551						
1102A	11425	8/3/06	8:05	866						
1102A	11425	8/15/06	19:10	2180						
1102A	11425	8/16/06	12:40	2240						
1102A	11425	8/16/06	19:15	2294						
1102A	11425	8/17/06	12:10	2463						
1102A	11425	8/17/06	19:10	2184						
1102A	11425	10/5/06	9:05	1720						
1102A	11425	2/4/07	11:13	1360	**41**	**268**	**4690**	**1355**	**871**	**1110**
1102A	16477	1/6/99	9:57	1420						
1102A	16477	2/10/99	9:38	2720						
1102A	16477	4/6/99	10:50	2102						
1102A	16477	5/7/99	10:30	3780						
1102A	16477	6/15/99	11:00	403						
1102A	16477	7/14/99	10:55	759						
1102A	16477	8/30/99	11:00	2430						
1102A	16477	9/7/99	10:57	2440						
1102A	16477	10/12/99	11:11	1020						
1102A	16477	11/10/99	9:38	1900						
1102A	16477	12/15/99	10:05	1080						
1102A	16477	1/12/00	10:34	792						
1102A	16477	4/13/00	11:30	350						
1102A	16477	5/24/00	11:40	690						
1102A	16477	6/6/00	11:33	1200						
1102A	16477	7/26/00	12:12	1720						
1102A	16477	8/31/00	11:23	1860						
1102A	16477	9/20/00	11:12	810						
1102A	16477	10/18/00	11:39	280						
1102A	16477	11/7/00	10:31	410						
1102A	16477	12/7/00	10:45	1500						
1102A	16477	1/17/01	10:20	213						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1102A	16477	2/20/01	11:35	2460						
1102A	16477	3/14/01	10:32	1530						
1102A	16477	4/4/01	12:28	2127						
1102A	16477	5/23/01	12:07	1740						
1102A	16477	6/25/01	12:13	1670						
1102A	16477	7/17/01	11:44	2100						
1102A	16477	8/21/01	12:49	1660						
1102A	16477	9/19/01	12:27	1940						
1102A	16477	10/22/01	12:01	1080						
1102A	16477	3/20/02	10:20	3150						
1102A	16477	5/22/02	10:03	1480						
1102A	16477	7/23/02	10:24	1200						
1102A	16477	9/24/02	11:44	1720						
1102A	16477	11/6/02	8:50	313						
1102A	16477	1/27/03	11:19	432						
1102A	16477	3/13/03	10:45	1070						
1102A	16477	5/7/03	11:50	3200						
1102A	16477	7/11/03	11:40	264						
1102A	16477	8/20/03	12:21	1030	**41**	**213**	**3780**	**1465**	**881**	**1480**
1102A	16478	10/12/99	10:08	1120						
1102A	16478	11/10/99	8:28	2220						
1102A	16478	12/15/99	8:33	690						
1102A	16478	1/12/00	9:05	1019						
1102A	16478	4/13/00	9:40	330						
1102A	16478	5/24/00	9:38	580						
1102A	16478	6/6/00	9:34	954						
1102A	16478	7/26/00	10:10	1100						
1102A	16478	8/31/00	9:25	928						
1102A	16478	9/20/00	9:30	650						
1102A	16478	10/18/00	9:42	230						
1102A	16478	11/7/00	8:28	390						
1102A	16478	12/7/00	8:35	1180						
1102A	16478	1/17/01	8:43	204						
1102A	16478	2/20/01	8:40	2065						
1102A	16478	3/14/01	8:36	1308						
1102A	16478	4/4/01	10:34	1847						
1102A	16478	5/23/01	10:30	1120						
1102A	16478	6/25/01	10:37	1920						
1102A	16478	7/17/01	10:11	1260						
1102A	16478	8/21/01	10:42	1340						
1102A	16478	9/19/01	10:30	1610						
1102A	16478	10/22/01	10:12	1030						
1102A	16478	11/19/01	8:40	1780						
1102A	16478	1/16/02	9:37	1260						
1102A	16478	3/14/02	10:30	1360						
1102A	16478	5/21/02	9:35	922						
1102A	16478	7/22/02	9:24	962						
1102A	16478	9/24/02	9:27	1160						
1102A	16478	11/5/02	8:45	168						
1102A	16478	1/27/03	8:24	392						
1102A	16478	3/13/03	8:10	2610						
1102A	16478	5/7/03	9:15	2420						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1102A	16478	7/11/03	9:20	481						
1102A	16478	8/20/03	9:22	794	**35**	**168**	**2610**	**1126**	**633**	**1100**
1102A	16678	7/28/05	11:45	950						
1102A	16678	4/24/06	18:05	901						
1102A	16678	4/25/06	15:20	973						
1102A	16678	4/26/06	12:10	1008						
1102A	16678	4/27/06	9:55	860						
1102A	16678	4/27/06	17:05	878						
1102A	16678	4/28/06	10:05	1093						
1102A	16678	7/5/06	17:01	336						
1102A	16678	7/6/06	15:30	410						
1102A	16678	7/7/06	12:21	362						
1102A	16678	7/8/06	17:45	417						
1102A	16678	7/8/06	10:18	418						
1102A	16678	7/8/06	13:45	571						
1102A	16678	8/15/06	18:40	1995						
1102A	16678	8/16/06	12:10	2464						
1102A	16678	8/16/06	18:50	2452						
1102A	16678	8/17/06	11:45	3149						
1102A	16678	8/17/06	18:45	2827						
1102A	16678	8/18/06	11:40	2928	**19**	**336**	**3149**	**1315**	**976**	**950**
1102B	16473	1/6/99	9:10	600						
1102B	16473	2/10/99	8:51	1140						
1102B	16473	4/6/99	10:00	1000						
1102B	16473	5/7/99	9:40	980						
1102B	16473	6/15/99	10:07	359						
1102B	16473	7/14/99	10:10	707						
1102B	16473	8/30/99	9:58	763						
1102B	16473	9/7/99	9:55	723						
1102B	16473	10/12/99	10:25	1130						
1102B	16473	11/10/99	8:48	1330						
1102B	16473	12/15/99	9:11	940						
1102B	16473	1/12/00	9:36	690						
1102B	16473	4/13/00	10:20	270						
1102B	16473	5/24/00	10:10	410						
1102B	16473	6/6/00	10:05	708						
1102B	16473	7/26/00	10:40	1170						
1102B	16473	8/31/00	10:09	960						
1102B	16473	9/20/00	9:51	760						
1102B	16473	10/18/00	10:13	400						
1102B	16473	11/7/00	9:12	380						
1102B	16473	12/7/00	9:00	810						
1102B	16473	1/17/01	9:14	229						
1102B	16473	2/20/01	9:10	968						
1102B	16473	3/14/01	9:13	749						
1102B	16473	4/4/01	11:11	783						
1102B	16473	5/23/01	10:50	908						
1102B	16473	6/25/01	10:56	686						
1102B	16473	7/17/01	10:35	1450						
1102B	16473	8/21/01	11:14	782						

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1102B	16473	9/19/01	10:56	844						
1102B	16473	10/22/01	10:35	827						
1102B	16473	11/19/01	9:05	803						
1102B	16473	1/16/02	10:10	982						
1102B	16473	3/14/02	11:18	885						
1102B	16473	5/21/02	10:07	788						
1102B	16473	7/22/02	11:08	548						
1102B	16473	9/24/02	10:18	704						
1102B	16473	11/5/02	9:10	201						
1102B	16473	1/27/03	9:04	368						
1102B	16473	3/13/03	8:38	850						
1102B	16473	5/7/03	9:39	1030						
1102B	16473	7/11/03	9:54	299						
1102B	16473	8/20/03	9:44	707						
1102B	16473	8/25/04	10:18	618						
1102B	16473	10/27/04	9:30	887						
1102B	16473	1/13/05	11:25	346						
1102B	16473	3/1/05	10:53	764						
1102B	16473	5/10/05	13:39	433						
1102B	16473	7/5/05	8:07	1170						
1102B	16473	7/28/05	10:59	690						
1102B	16473	10/10/05	7:57	995						
1102B	16473	12/19/05	9:28	580						
1102B	16473	2/1/06	11:57	853						
1102B	16473	2/1/06	11:57	854						
1102B	16473	4/5/06	10:42	892						
1102B	16473	4/24/06	17:20	564						
1102B	16473	4/25/06	13:51	698						
1102B	16473	4/26/06	11:49	812						
1102B	16473	4/27/06	9:30	686						
1102B	16473	4/27/06	16:38	689						
1102B	16473	4/28/06	10:25	975						
1102B	16473	5/8/06	8:39	677						
1102B	16473	6/1/06	9:50	216						
1102B	16473	7/5/06	16:10	187						
1102B	16473	7/6/06	14:50	366						
1102B	16473	7/7/06	11:58	319						
1102B	16473	7/8/06	9:38	338						
1102B	16473	7/8/06	16:35	451						
1102B	16473	8/3/06	6:41	667						
1102B	16473	8/15/06	18:05	513						
1102B	16473	8/16/06	11:45	711						
1102B	16473	8/16/06	18:30	631						
1102B	16473	8/17/06	11:20	667						
1102B	16473	8/17/06	18:15	584						
1102B	16473	8/18/06	11:10	811						
1102B	16473	10/5/06	8:13	952						
1102B	16473	2/4/07	10:16	726	**77**	**187**	**1450**	**714**	**268**	**711**

APPENDIX D
Conductivity Data – 1970-2007

Segment	Station	Date	Time	Specific Conductance Field (µS/cm)	n	Min	Max	Mean	St. Dev	Median
1102D	F1	4/24/06	15:50	711						
1102D	F1	4/25/06	12:35	710						
1102D	F1	4/26/06	10:40	805						
1102D	F1	4/27/06	8:20	638						
1102D	F1	4/27/06	15:45	638						
1102D	F1	4/28/06	11:15	785						
1102D	F1	7/5/06	15:30	203						
1102D	F1	7/7/06	11:28	382						
1102D	F1	7/8/06	15:30	481						
1102D	F1	7/8/06	8:55	436						
1102D	F1	8/15/06	17:05	624						
1102D	F1	8/16/06	11:00	721						
1102D	F1	8/16/06	17:40	674						
1102D	F1	8/17/06	10:35	760						
1102D	F1	8/17/06	17:25	812						
1102D	F1	8/18/06	10:25	1009	**16**	**203**	**1009**	**649**	**195**	**692**
1102E	17071	12/7/00	9:53	740						
1102E	17071	1/17/01	9:44	229						
1102E	17071	2/20/01	10:39	760						
1102E	17071	3/14/01	9:48	808						
1102E	17071	4/4/01	11:45	881						
1102E	17071	5/23/01	11:31	788						
1102E	17071	6/25/01	11:34	764						
1102E	17071	7/17/01	11:10	785						
1102E	17071	8/21/01	12:04	842						
1102E	17071	9/19/01	11:45	830						
1102E	17071	10/22/01	11:24	694						
1102E	17071	11/19/01	9:59	791						
1102E	17071	1/17/02	8:50	786						
1102E	17071	3/14/02	12:06	799						
1102E	17071	5/22/02	9:15	680						
1102E	17071	7/22/02	11:30	699						
1102E	17071	9/24/02	10:57	590						
1102E	17071	11/6/02	8:15	233						
1102E	17071	1/27/03	10:05	436						
1102E	17071	3/13/03	9:28	760						
1102E	17071	5/7/03	10:46	806						
1102E	17071	7/11/03	10:45	319						
1102E	17071	8/20/03	11:06	709						
1102E	17071	7/27/05	15:15	650						
1102E	17071	8/23/05	8:45	760	**25**	**229**	**881**	**1033**	**184**	**760**

APPENDIX E
DISCHARGE MONITORING REPORTS – 1999 TO 2007

APPENDIX E
Discharge Monitoring Reports – 1999 to 2005

Table E-1 DMR Data for Municipal Wastewater Permits in the Clear Creek Watershed

NPDES Number	TPDES Number	Facility Name	TCEQ Segment Number	Pipe	Date	Monthly Average Flow (mgd)	Monthly Geometric Mean (cfu/100ml)	Max Concentration (cfu/100 ml)	Permitted Flow (mgd)	FC Daily Load (cfu) =F*G*37854120	Max Theoretical FC Daily Load (cfu) =I*400*37854120
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-May-00	4.915	5	8	9.25	9.30E+08	1.40E+11
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Jun-00	4.409	4	7		6.68E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jul-00	4.207	2	2		3.19E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Aug-00	4.248	2	2		3.22E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Sep-00	4.436	2	2		3.36E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Oct-00	4.856	3	6		5.51E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Nov-00	6.519	4	10		9.87E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Dec-00	5.029	2	4		3.81E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jan-01	5.649	5	53		1.07E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	28-Feb-01	4.65	2	2		3.52E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Mar-01	5.668	11	13		2.36E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Apr-01	4.759	3	5		5.40E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-May-01	4.515	2	3		3.42E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Jun-01	6.223	5	13		1.18E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jul-01	4.736	11	17		1.97E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Aug-01	5.535	14	53		2.93E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Sep-01	5.586	7	15		1.48E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Oct-01	5.656	4	7		8.56E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Nov-01	5.327	4	28		8.07E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Dec-01	6.88	4	10		1.04E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jan-02	5.694	2	2		4.31E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	28-Feb-02	4.841	2	4		3.67E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Mar-02	5.132	2	2		3.89E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Apr-02	5.344	2	4		4.05E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-May-02	5.362	6	21		1.22E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Jun-02	5.587	3	5		6.34E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jul-02	6.342	4	6		9.60E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Aug-02	6.041	3	5		6.86E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Sep-02	6.196	11	16		2.58E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Oct-02	6.795	33	46		8.49E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Nov-02	5.814	7	31		1.54E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Dec-02	6.481	3	4		7.36E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jan-03	5.504	4	7		8.33E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	28-Feb-03	5.783	7	17		1.53E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Mar-03	5.066	6	10		1.15E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Apr-03	4.737	33	52		5.92E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-May-03	4.589	6	52		1.04E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Jun-03	4.864	3	6		5.52E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jul-03	5.402	3	8		6.13E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Aug-03	5.386	3	4		6.12E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Sep-03	6.905	10	49		2.61E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Oct-03	5.262	2	4		3.98E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Nov-03	5.257	5	7		9.95E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Dec-03	5.236	3	4		5.95E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jan-04	5.645	3	5		6.41E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	29-Feb-04	6.33	3	6		7.19E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Mar-04	4.883	11	20		2.03E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Apr-04	5.066	14	27		2.68E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-May-04	5.651	9	24		1.93E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Jun-04	5.736	22	61		4.78E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jul-04	4.91	22	55		4.09E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Aug-04	4.56	46	61		7.94E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Sep-04	4.503	11	80		1.88E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Oct-04	4.948	3	8		5.62E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Nov-04	6.497	40	76		9.84E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Dec-04	5.057	29	44		5.55E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jan-05	4.918	13	36		2.42E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	28-Feb-05	5.886	17	24		3.79E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Mar-05	5.36	15	22		3.04E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Apr-05	4.43	4	7		6.71E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-May-05	4.6	7	9		1.22E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Jun-05	4.578	5	11		8.66E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jul-05	5.168	11	31		2.15E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Aug-05	4.883	15	26		2.77E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Sep-05	4.509	11	32		1.88E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Oct-05	4.577	10	19		1.73E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Nov-05	4.693	6	17		1.07E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Dec-05	5.057	2	3		3.83E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jan-06	5.196	4	10		7.87E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	28-Feb-06	5.407	4	8		8.19E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Mar-06	4.753	3	5		5.40E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Apr-06	4.591	5	7		8.69E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-May-06	5.239	8	13		1.59E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Jun-06	5.433	3	28		6.17E+08	

APPENDIX E
Discharge Monitoring Reports – 1999 to 2005

Table E-1 DMR Data for Municipal Wastewater Permits in the Clear Creek Watershed

NPDES Number	TPDES Number	Facility Name	TCEQ Segment Number	Pipe	Date	Monthly Average Flow (mgd)	Monthly Geometric Mean (cfu/100ml)	Max Concentration (cfu/100 ml)	Permitted Flow (mgd)	FC Daily Load (cfu) =F*G*37854120	Max Theoretical FC Daily Load (cfu) =I*400*37854120
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jul-06	6.725	34	71		8.66E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Aug-06	5.095	4	15		7.71E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Sep-06	4.788	3	7		5.44E+08	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Oct-06	6.541	5	15		1.24E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Nov-06	4.954	9	22		1.69E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Dec-06	5.496	6	20		1.25E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jan-07	6.659	11	28		2.77E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	28-Feb-07	5.216	19	59		3.75E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Mar-07	5.797	9	10		1.97E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Apr-07	5.395	33	58		6.74E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-May-07	5.41	12	24		2.46E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Jun-07	5.13	11	19		2.14E+09	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Jul-07	6.753	103	204		2.63E+10	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	31-Aug-07	5.687	55	106		1.18E+10	
TX0069728	11571-001	DISPOSAL AUTH	1101	001A	30-Sep-07	5.362	28	73		5.68E+09	
TX0071447	10568-003	OF	1101	Q	30-Sep-01	0.3832	15	15	0.66	2.18E+08	9.99E+09
TX0085618	10568-005	OF	1101	001A	31-Mar-04	5.19	4	4	7.5	7.86E+08	1.14E+11
TX0085618	10568-005	OF	1101	001A	30-Apr-04	5.201	10	16		1.97E+09	
TX0085618	10568-005	OF	1101	001A	31-May-04	6.034	14	40		3.20E+09	
TX0085618	10568-005	OF	1101	001A	30-Jun-04	6.49	24	112		5.90E+09	
TX0085618	10568-005	OF	1101	001A	31-Jul-04	4.303	4	5		6.52E+08	
TX0085618	10568-005	OF	1101	001A	31-Aug-04	4.187	2	4		3.17E+08	
TX0085618	10568-005	OF	1101	001A	30-Sep-04	4.163	6	26		9.46E+08	
TX0085618	10568-005	OF	1101	001A	31-Oct-04	4.46	5	7		8.44E+08	
TX0085618	10568-005	OF	1101	001A	30-Nov-04	8.364	9	20		2.85E+09	
TX0085618	10568-005	OF	1101	001A	31-Dec-04	6.943	10	21		2.63E+09	
TX0085618	10568-005	OF	1101	001A	31-Jan-05	7.021	5	8		1.33E+09	
TX0085618	10568-005	OF	1101	001A	28-Feb-05	7.894	5	6		1.49E+09	
TX0085618	10568-005	OF	1101	001A	31-Mar-05	6.397	5	11		1.21E+09	
TX0085618	10568-005	OF	1101	001A	31-Dec-06	5.919	17	18		3.81E+09	
TX0085618	10568-005	OF	1101	001A	31-Jan-07	7.735	16	18		4.68E+09	
TX0085618	10568-005	OF	1101	001A	28-Feb-07	5.835	21	25		4.64E+09	
TX0085618	10568-005	OF	1101	001A	31-Mar-07	6.704	17	20		4.31E+09	
TX0085618	10568-005	OF	1101	001A	30-Apr-07	6.219	47	89		1.11E+10	
TX0085618	10568-005	OF	1101	001A	31-May-07	5.566	30	41		6.32E+09	
TX0085618	10568-005	OF	1101	001A	30-Jun-07	5.263	28	37		5.58E+09	
TX0085618	10568-005	OF	1101	001A	31-Jul-07	8.775	25	35		8.30E+09	
TX0085618	10568-005	OF	1101	001A	31-Aug-07	6.589	17	21		4.24E+09	
TX0085618	10568-005	OF	1101	001A	30-Sep-07	6.667	25	38		6.31E+09	
TX0086118	12332-001	MUD NO. 1	1102	Q	31-Dec-99	0.6459	1	1	2.4	2.44E+07	3.63E+10
TX0086118	12332-001	MUD NO. 1	1102	Q	31-Mar-00	0.621	10	10		2.35E+08	
TX0094226	12822-001	WORKS, INC.	1101	Q	31-Mar-00	0.0088	64	64	0.035	2.13E+07	5.30E+08
TX0094226	12822-001	WORKS, INC.	1101	Q	30-Jun-00	0.01795	108	108		7.34E+07	
TX0094463	12849-001	(RAINTREE ACRES	1102	Q	31-Dec-99	0.035	1	1	0.075	1.32E+06	1.14E+09
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	29-Feb-00		58	184	2.0		3.03E+10
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Apr-00	0.3304	140	46		1.75E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-May-00	0.95529	1	286351		3.62E+07	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Jun-00	0.9558	2920	425.71		1.06E+11	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jul-00	0.923548	2400	407.14		8.39E+10	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Sep-00	1.0402	965	178.57		3.80E+10	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Oct-00	1.050096	850	171.4		3.38E+10	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Dec-00	1.141484	5000	742.8		2.16E+11	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jan-01	1.577677	165	280		9.85E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Mar-01	1.097741	380	1375		1.58E+10	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-May-01	0.774097	24.838	59.285		7.28E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jul-01	0.855	17.58	16.4		5.69E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Aug-01	1.194	139	522.8		6.28E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Sep-01	1.295	237	548		1.16E+10	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Oct-01	1.202	46.29	113.571		2.11E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Nov-01	0.995	33.8	26.42		1.27E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Dec-01	1.35	66.4	215.7		3.39E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jan-02	1.084	74.83	220		3.07E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	28-Feb-02	1.024	97.03	250		3.76E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Mar-02	1.076	10	10		4.07E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Apr-02	1.16	259.6	1038.5		1.14E+10	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-May-02	0.946	27.4	64.28		9.81E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Jun-02	0.896	11	12.85		3.73E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jul-02	1.078	15.161	18.57		6.19E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Aug-02	1.316	89.2	278.5		4.44E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Sep-02	1.093	111.16	182.85		4.60E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Oct-02	1.699	312	1043.5		2.01E+10	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Nov-02	1.254	93.6	368.5		4.44E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Dec-02	1.336	52.74	106.42		2.67E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jan-03	1.218	16.9	37.14		7.79E+08	

APPENDIX E
Discharge Monitoring Reports – 1999 to 2005

Table E-1 DMR Data for Municipal Wastewater Permits in the Clear Creek Watershed

NPDES Number	TPDES Number	Facility Name	TCEQ Segment Number	Pipe	Date	Monthly Average Flow (mgd)	Monthly Geometric Mean (cfu/100ml)	Max Concentration (cfu/100 ml)	Permitted Flow (mgd)	FC Daily Load (cfu) =F*G*37854120	Max Theoretical FC Daily Load (cfu) =I*400*37854120
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	28-Feb-03	1.295	22.3	45		1.09E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Mar-03	1.108	24.1	46.23		1.01E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Apr-03	1.019	84.6	177.1		3.26E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-May-03	1.063	176.4	260		7.10E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Jun-03	1.151	336.3	1404		1.47E+10	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jul-03	1.166	21.45	44		9.47E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Aug-03	1.2808	498	2161		2.41E+10	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Sep-03	1.464	77	244.16		4.27E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Oct-03	1.043	98.2	394.2		3.88E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Nov-03	0.994	374	1498.5		1.41E+10	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Dec-03	1.052	53.5	222.5		2.13E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jan-04	1.217	11.9	17.14		5.48E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	29-Feb-04	1.442	42.75	107.14		2.33E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Mar-04	1.131	75.1	185		3.22E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Apr-04	1.096	44.1	90		1.83E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-May-04	1.5	501	1171.4		2.84E+10	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Jun-04	1.524	105	382.1		6.06E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jul-04	1.15	35.7	48.5		1.55E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Aug-04	1.05	29.3	86.4		1.16E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Sep-04	1.04	30.1	59.2		1.18E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Oct-04	1.07	107.4	199.2		4.35E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Nov-04	1.868	39	2495.1		2.76E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Dec-04	1.57	13	67.14		7.73E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jan-05	1.23	10	10		4.66E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	28-Feb-05	1.67	11	13.5		6.95E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Mar-05	1.45	13	247		7.14E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Apr-05	1.151	11	12		4.79E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-May-05	1.303	13	20		6.41E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-May-05	1.303	13	20		6.41E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Jun-05	1.32	10	11.1		5.00E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jul-05	1.954	19	33		1.41E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Aug-05	1.316	11	13		5.48E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Sep-05	1.18	11	13		4.91E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Oct-05	1.237	13	20		6.09E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Nov-05	1.25	11	24		5.20E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Dec-05	1.27	10	10		4.81E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jan-06	1.33	14	22		7.05E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	28-Feb-06	1.274	10	12		4.82E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Mar-06	1.23	14	43		6.52E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Apr-06	1.27	11	12		5.29E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-May-06	1.4	21	173		1.11E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Jun-06	1.523	25	125		1.44E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jul-06	1.773	19	44		1.28E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Aug-06	1.56	35	72		2.07E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Sep-06	1.199	13	23		5.90E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Oct-06	1.77	32	282		2.14E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Nov-06	1.141	16	37		6.91E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Dec-06	1.26	23	142		1.10E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jan-07	2.051	167	471		1.30E+10	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	28-Feb-07	1.189	80	359		3.60E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Mar-07	1.4	35	347		1.85E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Apr-07	1.45	24	34		1.32E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-May-07	1.582	18	65		1.08E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Jun-07	1.484	15	118		8.43E+08	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Jul-07	2.05	20	47		1.55E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	31-Aug-07	1.479	29	70		1.62E+09	
TX0116581	10134-007	PEARLAND, CITY OF	1102	001A	30-Sep-07	1.6	14	19		8.48E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Aug-03	0.168	259	432	2.0	1.65E+09	3.03E+10
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Sep-03	0.08	57.33	132.5		1.74E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Oct-03	0.163	80.59	235		4.97E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Nov-03	0.152	10.8	12.5		6.21E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Dec-03	0.082	12.1	17.5		3.76E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Jan-04	0.149	70	277.5		3.95E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	29-Feb-04	0.183	10	8.57		6.93E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Mar-04	0.13	10	10		4.92E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Apr-04	0.18	11.3	12.86		7.70E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-May-04	0.388	66.5	147.29		9.77E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Jun-04	0.29	37.3	137.5		4.09E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Jul-04	0.209	11.3	15.2		8.94E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Aug-04	0.13	149.3	334		7.35E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Sep-04	0.124	36.58	72		1.72E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Oct-04	0.189	413.5	1786		2.96E+09	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Nov-04	0.227	11	16		9.45E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Dec-04	0.14	15	1084.2		7.95E+07	

APPENDIX E
Discharge Monitoring Reports – 1999 to 2005

Table E-1 DMR Data for Municipal Wastewater Permits in the Clear Creek Watershed

NPDES Number	TPDES Number	Facility Name	TCEQ Segment Number	Pipe	Date	Monthly Average Flow (mgd)	Monthly Geometric Mean (cfu/100ml)	Max Concentration (cfu/100 ml)	Permitted Flow (mgd)	FC Daily Load (cfu) =F*G*37854120	Max Theoretical FC Daily Load (cfu) =I*400*37854120
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Jan-05	0.235	10	13.4		8.90E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	28-Feb-05	0.232	18	104		1.58E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Mar-05	0.189	11	17.7		7.87E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Apr-05	0.219	10	10		8.29E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-May-05	0.167	10	10		6.32E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Jun-05	0.199	10	10		7.53E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Jul-05	0.314	10	11.14		1.19E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Aug-05	0.196	10	10		7.42E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Sep-05	0.18	10	10		6.81E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Oct-05	0.211	13	62.8		1.04E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Nov-05	0.221	10	10		8.37E+07	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Dec-05	0.246	15	58		1.40E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Jan-06	0.264	15	180.8		1.50E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	28-Feb-06	0.281	14	29.4		1.49E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Mar-06	0.289	11	13		1.20E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Apr-06	0.244	12	18		1.11E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-May-06	0.269	13	21		1.32E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Jun-06	0.33	17	32		2.12E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Jul-06	0.392	18	42		2.67E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Aug-06	0.385	19	73		2.77E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Sep-06	0.355	13	20		1.75E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Oct-06	0.516	27	64		5.27E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Nov-06	0.356	14	22		1.89E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Dec-06	0.408	13	14		2.01E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Jan-07	0.5	14	20		2.65E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	28-Feb-07	0.408	11	15		1.70E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Mar-07	0.442	19	139		3.18E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Apr-07	0.422	15	29		2.40E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-May-07	0.459	15	47		2.61E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Jun-07	0.515	30	106		5.85E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Jul-07	0.603	23	65		5.25E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	31-Aug-07	0.556	23	53		4.84E+08	
TX0117501	10134-008	PEARLAND, CITY OF	1102	001A	30-Sep-07	0.498	15	23		2.83E+08	

APPENDIX E
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Table E-2 DMR Flows (Average Monthly WWTP flows summarized by NPDES facility (MGD)

NPDES NUMBER	TX0032735	TX0085383	TX0094463	TX0095842	TX0117501	TX0094226	TX0117447	TX0086118	TX0092614	TX0116581	TX0094463	TX0063070	TX0035009
TPDES NUMBER	10134-002	12295-001	12849-001	12939-001	10134-008	12822-001	13865-001	12332-001	12680-001	10134-007	12849-001	10495-075	10495-079
Date													
1/31/1990												2.976	1.721
2/28/1990												2.832	1.819
3/31/1990												3.009	1.846
4/30/1990												2.639	1.963
5/31/1990												2.773	2.162
6/30/1990												2.093	1.724
7/31/1990												2.196	1.7
8/31/1990												2.129	1.561
9/30/1990												2.935	1.819
10/31/1990												2.413	1.923
11/30/1990												2.451	2.247
12/31/1990												2.523	1.952
1/31/1991												3.578	2.567
2/28/1991												2.79	2.415
3/31/1991												1.962	1.76
4/30/1991												3.042	2.615
5/31/1991												3.193	2.51
6/30/1991												2.868	2.414
7/31/1991												2.73	1.933
8/31/1991												2.494	1.688
9/30/1991	1.391916											3.086	1.943
10/31/1991	1.341923											2.43	1.542
11/30/1991	1.542303											2.712	1.943
12/31/1991	2.327											3.346	2.523
1/31/1992	2.990203											3.918	3.268
2/29/1992	2.782962											3.809	3.123
3/31/1992	1.876226											2.73	2.177
4/30/1992	1.876063											2.948	2.479
5/31/1992	1.828109											3.008	2.422
6/30/1992	1.776633											3.354	2.644
7/31/1992	1.2715											2.583	2.109
8/31/1992	1.171738											2.265	2.004
9/30/1992	1.46937											2.408	2.471
10/31/1992	1.168038											2.217	2.169
11/30/1992	1.840928											2.761	3.102
12/31/1992	1.969754											2.958	2.369
1/31/1993	2.3316											3.714	3.035
2/28/1993	2.222039											2.654	2.525
3/31/1993	2.411513											2.903	2.652
4/30/1993	2.0737											2.88	2.591
5/31/1993	1.9645											2.391	2.33
6/30/1993	2.815781											3.064	2.443
7/31/1993	1.395016											2.392	1.823
8/31/1993	1.289187											2.106	1.75
9/30/1993	1.379007											1.965	1.712
10/31/1993	1.889681											2.65	2.113
11/30/1993	1.994193											3.313	2.148
12/31/1993	1.652703											2.536	1.812
1/31/1994	1.922635											2.927	1.96
2/28/1994	1.804346											2.666	2.113
3/31/1994	1.672397											2.674	2.069
4/30/1994	1.678603											3.002	2.017
5/31/1994	1.990045											3.311	2.243
6/30/1994	1.81152											3.174	2.219
7/31/1994	1.258787											2.637	1.927
8/31/1994	1.398003											2.705	1.889
9/30/1994	1.404783											2.766	1.996
10/31/1994	2.71549											3.85	2.492
11/30/1994	1.763123											2.247	1.748
12/31/1994	2.534148											2.683	2.374
1/31/1995	3.061368											2.917	2.412
2/28/1995	2.260443											2.644	2.159
3/31/1995	2.93259											2.866	2.665
4/30/1995	2.398277											2.54	2.626
5/31/1995	2.15281											2.502	2.323
6/30/1995	2.070883											2.331	2.04
7/31/1995	1.773387											2.364	2.074
8/31/1995	1.83829											2.396	1.888
9/30/1995	1.669367											2.356	1.864
10/31/1995	1.693097											2.376	1.859
11/30/1995	2.6718											2.63	2.132
12/31/1995	2.224355											2.639	2.278
1/31/1996	2.091645											2.46	2.034
2/29/1996	1.821517											2.24	1.951
3/31/1996	1.738225											2.12	1.925
4/30/1996	1.702833											2.016	1.791
5/31/1996	1.754484											2	1.791
6/30/1996	2.157											2.316	2.098
7/31/1996	1.453774											2.086	1.78
8/31/1996	2.869884											3.052	2.26
9/30/1996	2.875533	0.376										2.937	2.291
10/31/1996	1.887961	0.307						0.349				2.165	1.838
11/30/1996	1.712533	0.275						0.348				1.918	1.726
12/31/1996	2.023032	0.276						0.3755				2.096	1.954
1/31/1997	2.757258	0.306						0.406				2.462	2.154
2/28/1997	3.026821	0.322						0.449				2.511	2.534
3/31/1997	3.371	0.384						0.458				2.929	2.59
4/30/1997	3.34	0.372						0.425				2.952	2.768
5/31/1997	2.52	0.38						0.4147				2.465	2.504

APPENDIX E
Discharge Monitoring Reports – 1999 to 2005

Table E-2 DMR Flows (Average Monthly WWTP flows summarized by NPDES facility (MGD)

NPDES NUMBER	TX0032735	TX0085383	TX0094463	TX0095842	TX0117501	TX0094226	TX0117447	TX0086118	TX0092614	TX0116581	TX0094463	TX0063070	TX0035009
6/30/1997	1.846	0.38						0.4128				2.237	2.093
7/31/1997	1.774419	0.371						0.4099				1.974	1.826
8/31/1997	1.906	0.378						0.0486				2.023	1.842
9/30/1997	2.579	0.414						0.519				2.453	2.171
10/31/1997	3.67	0.418	0.035					0.551			0.035	3.311	2.754
11/30/1997	2.684	0.302	0.025					0.475			0.025	2.163	1.921
12/31/1997	2.776	0.315	0.039					0.516			0.039	2.584	2.482
1/31/1998	3.069	0.327	0.035					0.5205			0.035	2.892	2.892
2/28/1998	3.042	0.333	0.0355					0.516			0.0355	2.589	3.237
3/31/1998	2.193	0.311	0.0355					0.4966			0.0355	1.991	2.76
4/30/1998	1.714	0.3	0.036					0.4842			0.036	1.738	2.262
5/31/1998	1.612	0.331	0.036					0.489			0.036	1.81	2.246
6/30/1998	1.538	0.367	0.035					0.561			0.035	1.942	2.398
7/31/1998	1.504	0.353	0.039					0.523			0.039	1.925	2.383
8/31/1998	1.868	0.3825	0.0279			0.0135		0.578			0.0279	2.016	2.533
9/30/1998	2.426	0.3825	0.054			0.013		0.6683			0.054	2.909	3.376
10/31/1998	2.737	0.3825	0.064			0.013		0.6562			0.064	3.16	3.843
11/30/1998	2.787	0.412	0.074			0.0107		0.6417			0.074	2.519	3.54
12/31/1998	2.668	0.353	0.63			0.0108		0.5662			0.063	2.202	3.015
1/31/1999	2.83	0.353	0.049			0.0128		0.5905			0.049	2.331	3.331
2/28/1999	1.772	0.316	0.059			0.0098		0.5314			0.059	1.901	2.394
3/31/1999	1.908	0.347	0.043			0.0103		0.5427			0.043	1.951	2.611
4/30/1999	1.704	0.38	0.049			0.0146		0.55			0.049	1.928	2.416
5/31/1999	2.064	0.444	0.055			0.0175		0.6221			0.055	2.436	2.916
6/30/1999	2.421	0.517	0.055			0.0239		0.6753			0.055	2.59	3.487
7/31/1999	2.164	0.469	0.08			0.0076		0.6146			0.08	2.063	
8/31/1999	1.887	0.403	0.062			0.0115		0.5903			0.062	1.944	
9/30/1999	1.642	0.343	0.005					0.5873			0.005	1.766	
10/31/1999	1.409	0.305	0.058	0.0426		0.001953		0.5706	0.0111		0.058	1.592	
11/30/1999	1.516		0.017	0.0416		0.0189		0.5861	0.0095		0.017	1.672	
12/31/1999	1.725		0.035	0.0449		0.0147		0.6459	0.0095		0.035	1.766	
1/31/2000	1.665064		0.017	0.0452		0.01349		0.6117	0.0081		0.017	1.731	
2/29/2000	1.672		0.051	0.0436		0.00914		0.6119	0.0095		0.051	1.991	
3/31/2000	1.632		0.065	0.0446		0.0088		0.621			0.065	2.025	
4/30/2000	1.851		0.059	0.0483		0.0208		0.6752		0.3304	0.059	2.438	
5/31/2000	1.3		0.067	0.0447		0.0231		0.7028	0.0134	0.95529	0.067	2.507	
6/30/2000	0.711		0.085	0.0486		0.01795		0.6476	0.0095	0.9558	0.085	2.094	
7/31/2000	0.688		0.044	0.0654		0.0134		0.6554	0.0111	0.923548	0.044	2.048	
8/31/2000	0.638		0.066	0.0571		0.0135		0.664	0.0081		0.066	2.125	
9/30/2000	0.67		0.062	0.0602		0.0149		0.7043	0.0081	1.0402	0.062	2.414	
10/31/2000	0.723		0.067	0.0568		0.0107		0.7008	0.0111	1.050096	0.067	3.089	
11/30/2000	1.897		0.054	0.0776		0.0312	0.074	0.8416	0.0111		0.054	4.441	
12/31/2000	0.761		0.057	0.069		0.0192	0.0466	0.6024	0.0081	1.141484	0.057	2.837	
1/31/2001			0.054	0.0773		0.0234	0.053	0.6725	0.0111	1.577677	0.054	3.46	
2/28/2001	0.816		0.055	0.07		0.0152	0.027	0.5732	0.0081		0.055	2.753	
3/31/2001	1.761		0.066	0.0741		0.0183	0.069	0.6797	0.01	1.097741	0.066	3.406	
4/30/2001	1.062	0.4223	0.043	0.0779		0.018	0.048	0.6756	0.0111		0.043	2.718	2.8
5/31/2001	1.112	0.4068	0.039	0.0706		0.0135	0.027	0.6759	0.0141	0.774097	0.039	2.643	2.613
6/30/2001	2.169233		0.029	0.0873		0.0241	0.108	0.9311	0.0069	1.365233	0.029	3.76	5.049
7/31/2001	1.009	0.3938	0.017	0.0748		0.0148	0.024	0.6875	0.009	0.855	0.017	2.881	2.681
8/31/2001	1.477	0.49		0.0832		0.0192	0.0172	1.0047	0.0099	1.194		3.745	3.616
9/30/2001	1.99	0.53	0.046	0.0854		0.0277	0.035	0.8987	0.0111	1.295	0.046	3.881	4.232
10/31/2001	1.256	0.4651		0.0734		0.0172	0.042	0.7884	0.0111	1.202		3.44	3.526
11/30/2001	1.1	0.4488	0.036	0.0741		0.0125	0.051	0.7981	0.0099	0.995	0.036	3.184	3.107
12/31/2001	1.979	0.5737	0.036	0.0978		0.029	0.0152	0.8011	0.0069	1.35	0.036	3.825	4.168
1/31/2002	1.141	0.4129	0.028	0.0732		0.02	0.0357	0.765	0.0069	1.084	0.028	3.098	3.179
2/28/2002	0.957	0.4205	0.034	0.0652		0.007		0.6416	0.0052	1.024	0.034	2.76	2.663
3/31/2002	1.067	0.4293	0.031	0.074		0.0112	0.03	0.6803	0.0088	1.076	0.031	2.978	3.002
4/30/2002	1.248	0.4362	0.029	0.0728		0.0164	0.04	0.7208	0.0069	1.16	0.029	3.105	3.362
5/31/2002	1.027	0.4006	0.034	0.0707		0.0148	0.026	0.7055	0.0052	0.946	0.034	2.97	2.777
6/30/2002	1.014	0.4314	0.042	0.0756		0.0179	0.017	0.8082	0.006	0.896	0.042	3.103	2.929
7/31/2002	1.138	0.4887	0.039	0.0754		0.022	0.031	0.9096	0.008	1.078	0.039	3.548	3.434
8/31/2002	1.379	0.5297	0.054	0.0829		0.0224	0.031	0.9696	0.006	1.316	0.054	3.584	3.812
9/30/2002	1.441	0.492	0.055	0.0763	0.054	0.02	0.024	0.9078	0.0052	1.093	0.055	3.212	2.934
10/31/2002	2.481	0.5972	0.074	0.0972	0.165	0.028	0.056	1.1076		1.699	0.074	4.403	4.581
11/30/2002	1.833	0.5157	0.074	0.0772	0.069	0.01153	0.035	0.8979	0.0069	1.254	0.074	3.376	3.37
12/31/2002	1.959	0.5462	0.056	0.0729	0.099	0.0307	0.031	0.831	0.0038	1.336	0.056	3.581	3.631
1/31/2003	1.762	0.4903	0.061	0.0683	0.059	0.02	0.045	0.8565	0.0045	1.218	0.061	3.019	2.991
2/28/2003	1.957	0.5061	0.066	0.0794	0.068	0.01025	0.026	0.889	0.0027	1.295	0.066	3.286	3.425
3/31/2003	1.674	0.4918	0.06	0.0649	0.066	0.013	0.019	0.861	0.0008	1.108	0.06	2.93	2.997
4/30/2003	1.416	0.4433	0.034	0.062	0.022	0.013	0.0209	0.815	0.0011	1.019	0.034	2.805	2.763
5/31/2003	1.315	0.4442	0.036	0.0568	0.023	0.019	0.02	0.83	0.0027	1.063	0.036	2.876	2.745
6/30/2003	1.438	0.4828	0.018	0.0633	0.038	0.0156	0.0229	0.957	0.0052	1.151	0.018	3.302	3.055
7/31/2003	1.548	0.5236	0.07	0.0679	0.009258	0.0199	0.028	0.985	0.0014	1.166	0.07	3.241	2.981
8/31/2003	1.337	0.4936	0.07	0.0557	0.168	0.016	0.0215	0.986	0.0018	1.2808	0.07	2.923	3.008
9/30/2003	2.435	0.5655	0.059	0.0825	0.08	0.023	0.026	1.096	0.0045	1.464	0.059	3.339	4.201
10/31/2003	1.732	0.4987	0.067	0.0726	0.163	0.0195	0.022	0.971	0.006	1.043	0.067	3.286	3.12
11/30/2003	1.6	0.5039	0.06	0.0736	0.152	0.024	0.026	0.974	0.0027	0.994	0.06	3.178	3.842
12/31/2003	1.618	0.5041	0.069	0.0704	0.082	0.0297	0.024	0.976	0.0027	1.052	0.069	3.096	3.404
1/31/2004	1.845	0.5777	0.018	0.08	0.149	0.032	0.03	1.013	0.0008	1.217	0.018	3.555	3.167
2/29/2004	2.06	0.6225	0.032	0.0912	0.183	0.036	0.013	1.022	0.0041	1.442	0.032	4.017	3.813
3/31/2004	1.03	0.5215	0.022	0.0787	0.13	0.0233	0.02	0.867	0.0014	1.131	0.022	3.058	2.783
4/30/2004	1.131	0.5257		0.0804	0.18	0.0246	0.019	0.926	0.0014	1.096		3.081	2.845
5/31/2004	1.53	0.6079	0.03	0.0972	0.388	0.0264	0.024	1.144	0.0027	1.5	0.03	3.813	3.634
6/30/2004	1.998	0.5832	0.035	0.0997	0.29	0.0368	0.012	1.138	0.0038	1.524	0.035	3.465	3.717
7/31/2004	1.28	0.4778	0.039	0.0721	0.209	0.0274	0.0096	0.95	0.0018	1.15	0.039	3.274	2.981
8/31/2004	0.99	0.4857	0.023	0.0816	0.13	0.0178	0.0117	0.985	0.0018	1.05	0.023	2.979	2.512
9/30/2004	1.032	0.4841	0.03	0.0814	0.124	0.023		0.984	0.0018	1.04	0.03	2.928	2.321
10/31/2004	1.059	0.5161	0.024	0.0889	0.189	0.0184	0.0119	1.037	0.0027	1.07	0.024	3.027	2.448
11/30/2004	2.09	0.6164	0.044	0.1238	0.227		0.0106	1.182	0.006	1.868	0.044	4.492	4.051
12/31/2004	1.094	0.5225	0.039	0.0981	0.14		0.011	1.032	0.0032	1.57	0.039	3.21	3.325

APPENDIX E
Discharge Monitoring Reports – 1999 to 2005

Table E-2 DMR Flows (Average Monthly WWTP flows summarized by NPDES facility (MGD)

NPDES NUMBER	TX0032735	TX0085383	TX0094463	TX0095842	TX0117501	TX0094226	TX0117447	TX0086118	TX0092614	TX0116581	TX0094463	TX0063070	TX0035009
1/31/2005	1.004	0.4632	0.032	0.09	0.235	0.0223	0.022	0.986		1.23	0.032	3.076	3.161
2/28/2005	1.66	0.5251	0.024	0.0968	0.232		0.0144	1.089	0.0038	1.67	0.024	3.58	4.061
3/31/2005	1.445	0.5303		0.0879	0.189	0.027	0.0122	1.05	0.0032	1.45		3.267	4.598
4/30/2005	0.859	0.4987	0.028	0.0913	0.219	0.0128		0.971	0.0027	1.151	0.028	2.84	3.092
5/31/2005	0.838	0.5154	0.028	0.1087	0.167	0.0145	0.007	1.023	0.0022	1.303	0.028	2.96	3.207
6/30/2005		0.4843	0.028	0.1177	0.199	0.012	0.008	0.963	0.0027	1.32	0.028	2.894	3.06
7/31/2005	1.68	0.6175	0.022	0.1475	0.314	0.018	0.012	1.263	0.0032	1.954	0.022	3.367	4.296
8/31/2005	0.979	0.5171	0.018	0.1325	0.196	0.016	0.012	1.132	0.0052	1.316	0.018	3.14	3.31
9/30/2005	0.98	0.4861	0.022	0.1228	0.18	0.0246	0.01	1.069	0.0038	1.18	0.022	3.117	3.087
10/31/2005	0.93	0.4851	0.029	0.1106	0.211	0.023	0.01	1.109	0.0032	1.237	0.029	2.881	3.119
11/30/2005	0.989	0.5189	0.026	0.1268	0.221	0.019	0.02	1.124		1.25	0.026	2.929	3.299
12/31/2005		0.4656	0.03	0.1349	0.246		0.009	1.06	0.0018	1.27	0.03	3.086	
1/31/2006	1.036	0.4151	0.024	0.1372	0.264	0.02	0.012	0.995	0.0027	1.33	0.024	2.997	3.197
2/28/2006	1.195	0.4082	0.02	0.1336	0.281	0.0225	0.009	0.998		1.274	0.02	2.606	3.002
3/31/2006	1.109	0.4063	0.021	0.179	0.289	0.018	0.009	0.962	0.0036	1.23	0.021	2.4	2.601
4/30/2006	1.09	0.4396	0.02	0.1653	0.244	0.019	0.009	1.001	0.0014	1.27	0.02	2.813	2.606
5/31/2006	1.314	0.4183	0.019	0.1642	0.269	0.0203	0.008	0.996	0.0058	1.4	0.019	3.242	2.848
6/30/2006	1.626	0.413	0.029	0.1599	0.33	0.02	0.009	1.047	0.0027	1.523	0.029	3.527	3.326
7/31/2006	2.212	0.5001	0.035	0.1738	0.392	0.027	0.006	1.195	0.0032	1.773	0.035	4.23	3.805
8/31/2006	1.146	0.4626	0.031	0.1841	0.385	0.0158	0.006	1.09	0.0026	1.56	0.031	3.116	2.539
9/30/2006	1.356	0.4427	0.028	0.1748	0.355	0.017	0.007	1.055		1.199	0.028	3.008	2.406
10/31/2006	2.67	0.5903	0.034	0.2332	0.516	0.0302		1.299	0.007	1.77	0.034	4.131	4.219
11/30/2006	1.441	0.4673	0.031	0.185	0.356	0.02	0.005	1.021	0.0085	1.141	0.031	2.851	2.408
12/31/2006	2.003	0.517	0.028	0.2073	0.408	0.027	0.005	1.103	0.00893	1.26	0.028	3.225	2.888
1/31/2007	2.081	0.612	0.033	0.2361	0.5	0.0262	0.008	1.209	0.01	2.051	0.033	3.866	3.772
2/28/2007	1.62	0.515	0.032	0.2089	0.408		0.008	1.056	0.0067	1.189	0.032	3.044	2.795
3/31/2007				0.1805			0.006	1.249				3.617	3.872

APPENDIX F
SANITARY SEWER OVERFLOW DATA SUMMARY – 2000 TO 2005

APPENDIX F
Sanitary Sewer Overflow Data Summary - 2000 to 2005

TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
10134-001	PEARLAND, CITY OF	SALOMON ROCHA	06/15/04	1500	SEPTIC TANK OVERFLOW	DITCH
10134-001	PEARLAND, CITY OF	4001 DOG WOOD	06/28/03	3150	POWER OUTAGE	STORM DRAIN
10134-001	PEARLAND, CITY OF	4001 ELM WOOD	06/28/03	3150	POWER OUTAGE	STORM DRAIN
10134-001	PEARLAND, CITY OF	4001 CEDAR WOOD	06/28/03	3150	POWER OUTAGE	STORM DRAIN
10134-001	PEARLAND, CITY OF	4001 BEECH WOOD	06/28/03	3150	POWER OUTAGE	STORM DRAIN
10134-001	PEARLAND, CITY OF	4001 ASHWOOD	06/28/03	3150	POWER OUTAGE	STORM DRAIN
10134-001	PEARLAND, CITY OF	3911 BEECH WOOD	06/28/03	3150	POWER OUTAGE	STORM DRAIN
10134-001	PEARLAND, CITY OF	3911 ASHWOOD	06/28/03	3150	POWER OUTAGE	STORM DRAIN
10134-002	PEARLAND, CITY OF	HICKORY SLOUGH and MYKAWA	03/17/03	200	CONTRACTOR ERROR	HICKORY SLOUGH
10134-002	PEARLAND, CITY OF	5607 MEGAN	01/25/04	400	HEAVY RAINFALL	STORMDRAIN
10134-002	PEARLAND, CITY OF	3213 WHEATRIDGE	12/14/00	400	CONTROL PROBLEM	STORM DRAIN
10134-002	PEARLAND, CITY OF	DAVID L SMITH RD	02/27/03	400	CONTRACTOR ERROR	STORM DRAIN
10134-002	PEARLAND, CITY OF	5616 MEGAN	01/25/04	420	HEAVY RAINFALL	STORMDRAIN
10134-002	PEARLAND, CITY OF	2300 BLOCK SCHLEIDER	01/21/04	500	CLAMP FAILED	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3902 OAKWOOD DR.	10/28/02	600	RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	1902 E. OAK HOLLOW DR.	10/28/02	600	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	2637 N. HATFIELD	01/25/04	650	HEAVY RAINFALL	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3201 REGAL OAKS	10/28/02	900	RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3420 LIBERTY	09/12/02	1000	FORCE MAIN BREAK	MARY CREEK
10134-002	PEARLAND, CITY OF	2801 CHESTER	11/20/04	1,035	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	5606 MEGAN	06/23/04	1,125	BLOWN FUSE	STORM DRAIN
10134-002	PEARLAND, CITY OF	5702 TYLER	06/23/04	1,125	BLOWN FUSE	STORM DRAIN
10134-002	PEARLAND, CITY OF	3114 BISHOPTON/3302 GLAST	09/10/04	1,200	FLOAT CONTROL PROBLEM	STORM DRAIN
10134-002	PEARLAND, CITY OF	3902 OAKWOOD	10/21/02	1300	I/I DUE TO RAINFALL	STORM DRAIN
10134-002	PEARLAND, CITY OF	1902 E OAK HOLLOW	10/21/02	1300	I/I DUE TO RAINFALL	STORM DRAIN
10134-002	PEARLAND, CITY OF	3408 RANDALL	12/13/03	1360	HEAVY RAINFALL	STORM DRAIN
10134-002	PEARLAND, CITY OF	3303 RANDALL	12/13/03	1380	HEAVY RAINFALL	STORM DRAIN
10134-002	PEARLAND, CITY OF	OAKWICK/BARRETS GLEN	02/27/05	1500	CONTROL PANEL OVERLOAD	STORM DRAIN
10134-002	PEARLAND, CITY OF	5515 W BROADWAY	09/03/03	1800	BLOWN FUSE	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	ORANGE and MYKAWA	08/30/01	2000	HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	ORANGE and MYKAWA	09/01/01	2000	HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	WOODY and COMAL	12/12/01	2000	I/I DUE TO HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	E WALNUT and HOUSTON	09/12/03	2000	HIGH FLOW	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	WHEATFIELD MANHOLES	02/25/04	2,000	GREASE	STORM DRAIN
10134-002	PEARLAND, CITY OF	5607 MEGAN	10/21/02	2100	I/I DUE TO RAINFALL	STORM DRAIN
10134-002	PEARLAND, CITY OF	KNAPP and ROBERT	07/15/05	2100	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	ORANGE and MYKAWA	10/09/03	2257	HEAVY RAINFALL	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	5616 MEGAN	11/20/04	2,280	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	ORANGE and WOODY	08/16/02	2400	HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	5616 MEGAN	07/15/05	2700	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	5616 MEGAN	08/16/02	3000	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	ORANGE and MAYKAWA	09/21/03	3000	HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3303 RANDAL	10/09/03	3195	HEAVY RAINFALL	STORM DRAIN
10134-002	PEARLAND, CITY OF	3406 RANDALL	10/09/03	3195	HEAVY RAINFALL	STORM DRAIN
10134-002	PEARLAND, CITY OF	3303 RANDALL	05/01/04	3525	HEAVY RAIN	STORM DRAIN

APPENDIX F
Sanitary Sewer Overflow Data Summary - 2000 to 2005

TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
10134-002	PEARLAND, CITY OF	3406 RANDALL	05/01/04	3525	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	2637 N. HATFIELD and W. BRO	10/25/02	3600	HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	ORANGE ST. EAST OF RAILR	08/15/02	3600	HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	WOODY and COMAL	06/06/01	3800	I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	5616 MEGAN	10/09/03	3915	HEAVY RAINFALL	STORM DRAIN
10134-002	PEARLAND, CITY OF	5607 MEGAN	10/09/03	3915	HEAVY RAINFALL	STORM DRAIN
10134-002	PEARLAND, CITY OF	2102 WOODY	10/09/03	3915	HEAVY RAINFALL	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3711 PINE LAWN DR.	10/25/02	4125	RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	5607 MEGAN	03/02/05	4125	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	WOODY and COMAL	10/09/03	4425	HEAVY RAINFALL	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	CHERRY and MYKAWA	10/09/03	4470	HEAVY RAINFALL	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	2637 N. HATFIELD	06/23/04	4,500	BLOWN FUSE	STORM DRAIN
10134-002	PEARLAND, CITY OF	5606 MEGAN	07/15/05	4500	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	4820 COMAL	09/21/03	4500	HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	4810 APPLE SPRINGS	08/30/01	5000	HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	ORANGE and RAILROAD TRACKS	06/05/01	5000	I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	2102 WOODY	07/15/05	5250	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3406 RANDALL	11/20/04	5,550	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	ORANGE and MYKAWA	08/15/02	5625	HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	2102 WOODY	11/20/04	5,775	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	6711 BROADWAY	04/03/00	5830	INFILTRATION	STORM DRAIN
10134-002	PEARLAND, CITY OF	5616 MEGAN	09/03/03	6000	BLOWN FUSE	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	2102 WOODY	09/03/03	6000	HEAVY RAINFALL	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	WOODY and COMAL	08/15/02	6000	HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	5515 W. BROADWAY	05/01/04	6500	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	5607 MEGAN	05/01/04	6575	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3303 RANDALL	04/08/02	6740	I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3406 RANDALL	11/17/04	6,900	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3303 RANDALL	11/17/04	6,950	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	CHERRY and MYKAWA	05/01/04	7000	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	2801 CHESTER	05/01/04	7200	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	KNAPP ROAD	01/10/01	7200	HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	HATFIELD and W. BROADWAY	08/15/02	7200	HEAVY RAIN	
10134-002	PEARLAND, CITY OF	KNAPP and NANCY	08/30/01	7300	HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	KNAPP and NANCY	09/01/01	7300	HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	ORANGE and MYKAWA	06/05/01	7600	I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3902 OAKWOOD DR.	10/25/02	8250	RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	1902 E. OAK HOLLOW DR.	10/25/02	8250	RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3406 RANDALL ST.	10/25/02	8250	RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3005 LIVINGSTON	05/01/04	8500	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	2837 N. HATFIELD	05/01/04	8550	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3303 RANDALL ST.	08/15/02	8550	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3406 RANDALL ST.	08/15/02	8550	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	5616 MEGAN	05/01/04	8575	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	WOODY and COMAL	10/25/02	9000	HEAVY RAIN	DRAINAGE DITCH

Sanitary Sewer Overflow Data Summary - 2000 to 2005

TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
10134-002	PEARLAND, CITY OF	KNAPP ROAD and NANCY	01/16/01	9200	HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	RXR TRACKS and ORANGE ST	08/31/01	9500	HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3303 RANDALL	07/15/05	9750	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	5616 MEGAN	10/25/02	9750	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	1902 E. OAK HOLLOW DR.	10/27/02	9900	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	WOODY and COMAL	05/01/04	9925	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	CHERRY and MYKAWA	08/30/01	10000	HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	ORANGE and RAIL ROAD TRACKS	06/09/01	10000	I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	KNAPP and ROBERT	08/30/01	10200	HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	5616 MEGAN	12/12/02	10400	HEAVY RAINFALL	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	5607 MEGAN	12/12/02	10400	HEAVY RAINFALL	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	2102 WOODY	12/12/02	10400	HEAVY RAINFALL	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	BROADWAY ON HATFIELD	12/12/02	10400	HEAVY RAINFALL	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	MEGAN	04/03/00	10706	INFILTRATION	STORM DRAIN
10134-002	PEARLAND, CITY OF	5607 MEGAN	11/20/04	11,250	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	5606 MEGAN	09/03/03	12000	BLOWN FUSE	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	KNAPP and ROBERT	06/06/01	12000	I/I FROM EXCESSIVE RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	WOODY and COMAL	02/11/04	14,175	HEAVY RAINFALL	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	2201 ALEXANDER LANE	07/14/02	14500	LINE BLOCKAGE	
10134-002	PEARLAND, CITY OF	3303 RANDALL	06/05/01	15000	I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3303 RANDALL ST	08/30/01	15000	HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3201 REGAL	04/08/02	15100	I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3406 RANDALL	04/08/02	15175	I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3201 REGAL OAKS	10/27/02	16000	HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3201 REGAL OAKS	10/25/02	16500	RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3303 RANDALL ST.	10/25/02	16500	RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	5607 MEGAN	04/08/02	16900	I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	1902 E OAK HOLLOW	11/20/04	17,100	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	WOODY and ORANGE	04/08/02	17150	I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	KNAPP and NANCY	04/08/02	17300	I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	2637 N HATFIELD	09/03/03	18000	BLOWN FUSE	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	2102 WOODY	10/25/02	18000	HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	ORANGE ST and MYKAWA	09/04/03	18000	BLOWN FUSE	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3205 S MAIN	11/20/04	19,400	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3406 RANDALL	07/15/05	19500	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	5607 MEGAN	12/13/01	20500	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	KNAPP ROAD	11/18/00	21624	PUMP FAILURE	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	WESTMINSTER	04/08/02	21750	I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	WOODY and COMAL	12/13/01	22,500	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	WALNUT and HOUSTON	12/13/01	23200	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3303 RANDALL	12/13/01	23200	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	ORANGE and MYKAWA	12/13/01	23200	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	ORANGE ST. and MYKAWA	10/25/02	24000	HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	4802 WOODY	04/08/02	24729	I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3201 REGAL OAKS	11/20/04	27,400	HEAVY RAIN	STORM DRAIN

APPENDIX F
Sanitary Sewer Overflow Data Summary - 2000 to 2005

TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
10134-002	PEARLAND, CITY OF	2637 N. HATFIELD	08/16/02	28500	HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	KNAPP and NANCY	06/05/01	29000	I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	5607 MEGAN	08/30/01	30000	HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	WOODY and COMAL	08/30/01	30000	HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	1902 OAK HOLLOW	04/08/02	30850	I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	CHERRY and MYKAWA	04/08/02	31900	I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	ORANGE and MYKAWA	04/08/02	31900	I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	5606 MEGAN	10/27/02	32000	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	WOODY and COMAL	04/08/02	32050	I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	KNAPP and NANCY	04/03/00	32436	INFILTRATION	STORM DRAIN
10134-002	PEARLAND, CITY OF	3902 OAKWOOD DR.	10/27/02	33000	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	5515 W. BROADWAY @ HATFIE	10/25/02	36000	HEAVY RAIN	
10134-002	PEARLAND, CITY OF	5606 MEGAN	08/16/02	37500	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	5606 MEGAN	10/25/02	39000	HEAVY RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	ORANGE and MYKAWA	06/09/01	40000	I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	HATFIELD and W BROADWAY	12/13/01	43800	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	HATFIELD and W BROADWAY	08/30/01	57000	HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	10/28/02	57750	RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	2201 SLEEPYHOLLOW	12/12/02	58500	HEAVY RAINFALL	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	ORANGE and WOODY	12/13/01	67650	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	10/21/02	72000	I/I DUE TO RAINFALL	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	10/25/02	81000	RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	10/27/02	181500	HEAVY RAINFALL	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	518 and GRAND	06/21/00	UNKNOWN	LINE SEPERATION	STORM DRAIN
10134-002	PEARLAND, CITY OF	3902 OAKWOOD	04/08/02		I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3711 PINE LAWN DRIVE	06/09/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	2801 CHATER	06/05/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3005 LIVINGSTON	06/05/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3005 LIVINGSTON	06/09/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3005 LIVINGSTON	08/30/01		HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	3005 LIVINGSTON	04/08/02		I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	4810 APPLE SPRINGS	06/09/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	1919 SLEEPY HOLLOW	04/08/02		I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	2801 CHESTER	06/09/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	2801 CHESTER	08/30/01		HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	2801 CHESTER	04/08/02		I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	5415 CAMDEN	04/08/02		I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	SLEEPY HOLLOW and YOST	04/08/02		I/I DUE TO HEAVY RAINS	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	7737 BROADWAY	09/13/00		PUMP FAILURE	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	HATFIELD and W BROADWAY	06/08/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3303 RANDALL	06/09/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3406 RANDALL	06/09/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	3500 E BROADWAY	03/22/02		BREAK IN SEWER LINE	STORM SEWER
10134-002	PEARLAND, CITY OF	CHERRY and MYKAWA	06/05/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	CHERRY and MYKAWA	06/09/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN

APPENDIX F
Sanitary Sewer Overflow Data Summary - 2000 to 2005

TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
10134-002	PEARLAND, CITY OF	CHERRY and MYKAWA	12/13/01		I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	1525 NORTH MAIN	07/12/02		CONTRACTOR	
10134-002	PEARLAND, CITY OF	1445 MYKAWA	10/18/00		LINE BREAK	GROUND
10134-002	PEARLAND, CITY OF	WOODY and COMAL	06/08/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	KNAPP ROAD	11/22/00		BROKEN MAIN	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	KNAPP ROAD and NANCY	02/13/01		LINE STOPAGE	DRAINAGE DITCH
10134-002	PEARLAND, CITY OF	KNAPP ROAD and NANCY	06/09/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-002	PEARLAND, CITY OF	WWTP	11/03/03		BAR SCREEN TOO FULL	GROUND
10134-002	PEARLAND, CITY OF	WWTP	01/18/04		SO2 BROKEN	EFFLUENT CHANNEL
10134-002	PEARLAND, CITY OF	WWTP	05/02/04		LIGHTNING	PLANT SITE
10134-003	PEARLAND, CITY OF	2602 GREEN TEE DRIVE	09/15/00	200	CONTROL PROBLEMS	CLEAR CREEK
10134-003	PEARLAND, CITY OF	2433 E BROADWAY	09/01/01	400	BROKEN LINE	GROUND
10134-003	PEARLAND, CITY OF	3902 OAKWOOD	11/28/01	500	HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	3420 LIBERTY	09/30/01	500	BROKEN FORCE MAIN	DRAINAGE
10134-003	PEARLAND, CITY OF	3420 LIBERTY	11/26/01	1000		STORM DRAIN
10134-003	PEARLAND, CITY OF	SLEEPY HOLLOW and YOST	11/28/01	1000	HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	2602 GREEN TEE	12/06/01	2800	POWER OUTAGE	STORM DRAIN
10134-003	PEARLAND, CITY OF	3202 OAKWOOD	12/02/01	3000	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	3902 OAKWOOD DRIVE	01/10/01	3200	HEAVY RAINS	STORM DRAIN
10134-003	PEARLAND, CITY OF	3902 OAKWOOD DRIVE	12/12/01	5000	I/I DUE TO HEAVY RAIN	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	3201 REGAL OAKS	12/12/01	5000	I/I DUE TO HEAVY RAIN	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	3902 OAKWOOD	06/07/01	6000	I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-003	PEARLAND, CITY OF	3201 REGAL OAKS	12/02/01	6000	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	SLEEPY HOLLOW	01/11/01	12720	HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	3902 OAKWOOD	08/30/01	20000	HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	3902 OAKWOOD	09/01/01	20000	HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	5607 MEGAN	06/05/01	20000	I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-003	PEARLAND, CITY OF	SLEEPY HOLLOW and YOST	12/12/01	20000	I/I DUE TO HEAVY RAIN	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	3902 OAKWOOD DR	11/18/00	20352	HEAVY RAINS	STORM DRAIN
10134-003	PEARLAND, CITY OF	3201 REGAL OAKS	11/18/00	21200	HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	1914 SLEEPY HOLLOW	11/18/00	21200	HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	3902 OAKWOOD	12/13/01	22000	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	1902 OAK HOLLOW	12/13/01	22000	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	SLEEPY HOLLOW and YOST	12/02/01	22500	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	3201 REGAL OAKS	12/13/01	22950	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	3201 REGAL OAKS	06/05/01	24000	I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-003	PEARLAND, CITY OF	1919 SLEEPY HOLLOW	11/18/00	31800	HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	SLEEPY HOLLOW and YOST	11/18/00	31800	HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	1919 SLEEPY HOLLOW	12/13/01	45200	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	3201 REGAL OAKS	08/30/01	60000	HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	SLEEPY HOLLOW and YOST	12/13/01	68100	I/I FROM HEAVY RAIN	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	3902 OAKWOOD DRIVE	06/09/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-003	PEARLAND, CITY OF	3420 LIBERTY DRIVE	12/11/01		BREAK ON MAIN LINE	STORM DRAIN
10134-003	PEARLAND, CITY OF	3201 REGAL OAKS	06/09/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-003	PEARLAND, CITY OF	1201 MYRTLE WOOD	03/07/01		PUMP & CONTROL PROBELM	DRAINAGE DITCH

Sanitary Sewer Overflow Data Summary - 2000 to 2005

TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
10134-003	PEARLAND, CITY OF	1914 SLEEPY HOLLOW	06/05/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-003	PEARLAND, CITY OF	1914 SLEEPY HOLLOW	06/09/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-003	PEARLAND, CITY OF	1914 SLEEPY HOLLOW	08/30/01		HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	1914 SLEEPY HOLLOW	09/01/01		HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	1919 SLEEPY HOLLOW	06/05/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-003	PEARLAND, CITY OF	1919 SLEEPY HOLLOW	06/09/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-003	PEARLAND, CITY OF	1919 SLEEPY HOLLOW	08/30/01		HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	1919 SLEEPY HOLLOW	09/01/01		HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	5607 MEGAN	06/09/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-003	PEARLAND, CITY OF	SLEEPY HOLLOW and YAST	08/30/01		HEAVY RAINS	DRAINAGE DITCH
10134-003	PEARLAND, CITY OF	SLEEPY HOLLOW and YOST	06/05/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-003	PEARLAND, CITY OF	SLEEPY HOLLOW and YOST	06/09/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-003	PEARLAND, CITY OF	WWTP	03/06/01		PUMP FAILURE	GROUND
10134-007	PEARLAND, CITY OF	3111 S MAIN	12/04/00	100	LINE BREAK	STORM DRAIN
10134-007	PEARLAND, CITY OF	7737 WEST BROADWAY	10/05/00	500	PUMPED CLOGGED	DRAINAGE DITCH
10134-007	PEARLAND, CITY OF	4654 DIXIE FARM RD	06/14/03	1000	LINE BREAK	DRAINAGE DITCH
10134-007	PEARLAND, CITY OF	5002 RYAN ACRES	06/17/02	1000	ELECTRICAL	DRAINAGE DITCH
10134-007	PEARLAND, CITY OF	2637 LAZY BEND	07/18/05	1000	HEAVY RAIN	DITCH
10134-007	PEARLAND, CITY OF	ASHWOOD and ELMWOOD	07/03/04	1,200	BLOWN FUSE	STORM DRAIN
10134-007	PEARLAND, CITY OF	5002 RYAN ACRES	07/19/03	1500	POWER FAILURE	DRAINAGE DITCH
10134-007	PEARLAND, CITY OF	4001 FERNWOOD DR	08/26/02	3000	LS FAILURE	STORM DRAIN
10134-007	PEARLAND, CITY OF	VETERANS and MAGNOLIA	10/09/03	4470	HEAVY RAINFALL	DRAINAGE DITCH
10134-007	PEARLAND, CITY OF	OFVETERANS and MAGNOLIA	08/15/02	4500	HEAVY RAIN	DRAINAGE DITCH
10134-007	PEARLAND, CITY OF	VETERANS MAGNOLIA	08/31/01	5100	HEAVY RAINS	DRAINAGE DITCH
10134-007	PEARLAND, CITY OF	3126 BRUNO WAY	01/19/04	7000	GREASE AND DEBRIS	STORM DRAIN
10134-007	PEARLAND, CITY OF	5607 MEGAN	11/18/00	8586	HEAVY RAINS	STORM DRAIN
10134-007	PEARLAND, CITY OF	W BROADWAY and ROY	06/14/03	12000	CONTRACTOR ERROR	DRAINAGE DITCH
10134-007	PEARLAND, CITY OF	7737 WEST BROADWAY	11/18/00	17172	HEAVY RAINS	DRAINAGE DITCH
10134-007	PEARLAND, CITY OF	HATFIELD and W BROADWAY	06/05/01	20000	I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-007	PEARLAND, CITY OF	3904 OAKWOOD DR	11/02/04	24,750	HEAVY RAIN	STORM DRAIN
10134-007	PEARLAND, CITY OF	1902 E OAK HOLLOW	11/02/04	25,125	HEAVY RAIN	STORM DRAIN
10134-007	PEARLAND, CITY OF	3406 RANDALL	11/02/04	29,500	HEAVY RAIN	STORM DRAIN
10134-007	PEARLAND, CITY OF	3201 REGAL OAKS	11/02/04	46,500	HEAVY RAIN	STORM DRAIN
10134-007	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	11/02/04	63,000	HEAVY RAIN	STORM DRAIN
10134-007	PEARLAND, CITY OF	5203 CAPROCK	03/12/01		BREAKER TRIPPED	STORM DRAIN
10134-007	PEARLAND, CITY OF	7737 W BROADWAY	06/05/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-007	PEARLAND, CITY OF	7737 W BROADWAY	06/08/01		I/I FROM EXCESSIVE RAIN	STORM DRAIN
10134-007	PEARLAND, CITY OF	5517 W. BROADWAY	03/10/01		BROKEN CAP	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1302 1/2 E BROADWAY	03/07/03	200	BREAKERS OFF	STORM DRAIN
10134-010	PEARLAND, CITY OF	2718 COUNTRY CLUB	08/31/03	500	HEAVY RAINFALL	STORM DRAIN
10134-010	PEARLAND, CITY OF	1902 E OAK HOLLOW	10/09/03	600	HEAVY RAINFALL	STORM DRAIN
10134-010	PEARLAND, CITY OF	3711 PINE LAWN	10/09/03	750	HEAVY RAINFALL	STORM DRAIN
10134-010	PEARLAND, CITY OF	1908 OAK HOLLOW	11/05/02	1000	LINE BROKEN BY OPERATOR	STORM DRAIN
10134-010	PEARLAND, CITY OF	2202 GREEN TEE	09/21/03	1000	HEAVY RAIN	STORM DRAIN
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	01/25/04	1140	HEAVY RAINFALL	DRAINAGE DITCH

APPENDIX F
Sanitary Sewer Overflow Data Summary - 2000 to 2005

TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
10134-010	PEARLAND, CITY OF	1814 OAKTREE CIRCLE	05/11/04	1200	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	3902 OAKWOOD	11/05/02	1200	HEAVY RAIN	STORM DRAIN
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	01/17/04	1300	HEAVY RAINFALL	STORM DRAIN
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	07/10/04	1,500	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	2410 LONDONDERRY	05/31/03	1750	CONTRACTOR ERROR	STORM DRAIN
10134-010	PEARLAND, CITY OF	3902 OAKWOOD DRIVE	08/05/02	1800	POWER OUTAGE	STORM DRAIN
10134-010	PEARLAND, CITY OF	3201REGAL OAKS	12/04/02	1950	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1814 OAK TREE CIRCLE	02/05/04	2,700	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1902 E OAK HOLLOW	02/05/04	2,700	HEAVY RAINFALL	STORM DRAIN
10134-010	PEARLAND, CITY OF	1814 OAK TREE CIRCLE	12/13/03	2875	HEAVY RAINFALL	STORM DRAIN
10134-010	PEARLAND, CITY OF	3902 OAKWOOD	12/04/02	3000	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1902 E HOLLOW DR	12/04/02	3000	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	2800 BLK OF COUNTRY CLUB	10/17/02	3000	LS CONTROL PROBLEMS	STORM DRAIN
10134-010	PEARLAND, CITY OF	1902 E OAK HOLLOW	12/13/03	3025	HEAVY RAINFALL	STORM DRAIN
10134-010	PEARLAND, CITY OF	3201 REGAL OAKS	03/02/05	3125	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	3201 REGAL OAKS	10/09/03	3150	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	3201 REGAL OAKS	12/13/03	3175	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1812 OAK TREE	11/17/04	3,450	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1902 E OAK HOLLOW	11/17/04	3,500	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	OAK HOLLOW	08/31/03	3750	HEAVY RAINFALL	STORM DRAIN
10134-010	PEARLAND, CITY OF	3902 OAKWOOD	09/08/02	4000	HEAVY RAINFALL/I&I	STORM DRAIN
10134-010	PEARLAND, CITY OF	3711 PINE LAWN	08/16/02	4125	HEAVY RAIN	STORM DRAIN
10134-010	PEARLAND, CITY OF	3902 OAK WOOD	11/17/04	4,590	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1814 OAK TREE CIRCLE	05/01/04	4625	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	3201 REGAL OAKS	08/15/02	4650	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1902 OAKHOLLOW	05/17/02	4800	I/I DUE TO RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	3201 REGAL OAKS	07/15/05	5000	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	02/08/05	5000	NEW MANHOLE INSTALLED	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	WWTP	11/09/03	5000	ELECTRICAL SHORT	GROUND
10134-010	PEARLAND, CITY OF	1814 OAK TREE	03/02/05	5250	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	3902 OAKWOOD	08/21/02	5250	HEAVY RAINFALL	STORMDRAIN
10134-010	PEARLAND, CITY OF	1902 E OAK HOLLOW	03/02/05	5250	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1919 SLEEPY HOLLOW	12/04/02	5250	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	3600 BLK OAK BENT	07/17/05	5400	SYSTEM OVERCHARGED	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	3201 REGAL OAKS	05/01/04	6500	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1902 EAST OAK HOLLOW	08/16/02	6800	HEAVY RAIN	STORM DRAIN
10134-010	PEARLAND, CITY OF	1812 OAK TREE CIRCLE	07/15/05	7500	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1814 OAK TREE CIRCLE	07/10/04	7,500	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1902 E OAK HOLLOW	07/10/04	7,500	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1902 E OAK HOLLOW	07/15/05	7500	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1902 OAK HOLLOW	09/08/02	8000	HEAVY RAINFALL/I&I	STORM DRAIN
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	06/04/03	9000	I/I DUE TO RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	GREEN TEE DRIVE	08/31/03	9000	HEAVY RAINFALL	STORM DRAIN
10134-010	PEARLAND, CITY OF	SLEEPY HOLLOW and YOST ROAD	06/29/02	9000	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1914 SLEEPY HOLLOW	05/01/04	10000	HEAVY RAINFALL	DRAINAGE DITCH

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TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
10134-010	PEARLAND, CITY OF	1919 SLEEPY HOLLOW	05/01/04	10000	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	08/31/03	15000	HEAVY RAINFALL	STORM DRAIN
10134-010	PEARLAND, CITY OF	OAKWOOD	08/31/03	15000	HEAVY RAINFALL	STORM DRAIN
10134-010	PEARLAND, CITY OF	SLEEPY HOLLOW and YOST	07/15/02	15250	HEAVY RAIN	
10134-010	PEARLAND, CITY OF	3902 OAKWOOD DR.	08/16/02	17250	HEAVY RAIN	STORM DRAIN
10134-010	PEARLAND, CITY OF	3201 REGAL OAKS	11/17/04	17,350	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	02/05/04	18,000	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	3002 OAK HOLLOW	09/01/03	20000	HEAVY RAINFALL	STORM DRAIN
10134-010	PEARLAND, CITY OF	1902 E OAK HOLLOW	09/06/03	21000	POWER OUTAGE	STORM DRAIN
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	08/21/02	22500	HEAVY RAINFALL	STORMDRAIN
10134-010	PEARLAND, CITY OF	SLEEPY HOLLOW and YOST	05/17/02	24000	I/I DUE TO RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	05/01/04	27000	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	11/05/02	30000	HEAVY RAIN	STORM DRAIN
10134-010	PEARLAND, CITY OF	1814 OAK TREE CIRCLE	02/10/04	30,875	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1902 E OAK HOLLOW	02/10/04	30,950	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	3201 REGAL OAKS	02/10/04	31,500	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	12/13/03	34925	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	11/17/04	36,000	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	3902 OAKWOOD	09/06/03	42000	POWER OUTAGE	STORM DRAIN
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	05/11/04	42,000	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	09/01/03	54000	HEAVY RAINFALL	STORM DRAIN
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	12/04/02	57750	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	3902 OAKWOOD	09/01/03	63000	HEAVY RAINFALL	STORM DRAIN
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	10/09/03	78750	HEAVY RAINFALL	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1914 SLEEPY HOLLOW	08/16/02	88000	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1919 SLEEPY HOLLOW	08/16/02	88000	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1911 SLEEPY HOLLOW	08/16/02	90000	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	09/21/03	90000	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	SLEEPY HOLLOW and YOST	08/16/02	180000	HEAVY RAIN	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	3616 OAK BENT	07/25/05	UKN	DEBRIS IN MANHOLE	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	1814 OAK TREE CIRCLE	11/18/03		COLL SYSTEM SUR-CHARGED	STORM SEWER
10134-010	PEARLAND, CITY OF	3109 1/2 DIXIE FARM ROAD	01/20/04		FORCE MAIN BREAK	DRAINAGE DITCH
10134-010	PEARLAND, CITY OF	2201 SLEEPY HOLLOW	11/18/03		COLL SYSTEM SUR-CHARGED	STORM SEWER
10134-010	PEARLAND, CITY OF	2202 GREEN TEE	09/12/03		I/I & HEAVY RAINFALL	STORM DRAIN
10495-075	Sagemont	10826 Sageberry	3/22/00	7	Collection system grease blockage	
10495-075	Sagemont	11102 Sagevalley	3/13/00	23	Collection system grease blockage	
10495-075	Sagemont	12542 SANDY HOOK	7/8/04	27	Collection system temporary blockage	
10495-075	Sagemont	11931 POMPTON	5/15/04	30	Collection system temporary blockage	
10495-075	Sagemont	11119 SAGECANYON	1/4/03	38	Collection system temporary blockage	
10495-075	Sagemont	11227 FUQUA	5/27/04	40	Collection system temporary blockage	
10495-075	Sagemont	10422 KIRKHALL	4/30/04	48	Collection system temporary blockage	
10495-075	Sagemont	10922 OVERLEA	6/6/04	50	Collection system temporary blockage	
10495-075	Sagemont	12118 Ryewater	6/23/04	51	Collection system temporary blockage	
10495-075	Sagemont	11923 POMPTON	3/22/03	56	Collection system temporary blockage	
10495-075	Sagemont	10506 Kirkhall	3/27/00	58	Collection system temporary blockage	

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TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
10495-075	Sagemont	12722 WHITE PLAINS	8/9/04	60	Collection system temporary blockage	
10495-075	Sagemont	11103 Sage Willow	2/10/01	63	Collection system temporary blockage	
10495-075	Sagemont	12807 gotham	12/2/02	64	Collection system temporary blockage	
10495-075	Sagemont	11810 ALGONQUIN	8/24/04	70	Collection system temporary blockage	
10495-075	Sagemont	11700 Sagearbor	5/20/02	75	WWTP hydraulic overload	
10495-075	Sagemont	11218 SAGECANYON	4/26/04	75	Collection system structural blockage	
10495-075	Sagemont	11800 TEANECK	7/6/04	77	Collection system temporary blockage	
10495-075	Sagemont	12719 Chaumont	3/20/00	78	Collection system temporary blockage	
10495-075	Sagemont	12707 Corning	8/29/00	80	Collection system temporary blockage	
10495-075	Sagemont	10910 SAGETRAIL	6/21/04	85	Collection system temporary blockage	
10495-075	Sagemont	11107 Sageview	3/16/00	113	Collection system temporary blockage	
10495-075	Sagemont	6500 Beamer	2/25/00	120	Collection system temporary blockage	
10495-075	Sagemont	14705 GULF FRWY	8/4/04	120	Pump/lift station mechanical failure	
10495-075	Sagemont	12526 RAVENA COURT	8/9/04	120	Collection system temporary blockage	
10495-075	Sagemont	12114 RHINEBECK	6/7/04	122	Collection system temporary blockage	
10495-075	Sagemont	12223 Pompton	3/22/00	127	Collection system temporary blockage	
10495-075	Sagemont	12722 WHITE PLAINS	1/20/03	129	Collection system temporary blockage	
10495-075	Sagemont	10927 SAGEVALE	7/9/04	130	Collection system temporary blockage	
10495-075	Sagemont	10202 Kirklane	3/22/00	155	Collection system temporary blockage	
10495-075	Sagemont	11750 TEANECK	5/31/03	174	Collection system temporary blockage	
10495-075	CLEAR BROOK CITY MUD	11426 WOODVIOLET	07/14/04	200	CONTRACTOR ERROR	STREET
10495-075	Sagemont	10802 SAGEBLUFF	7/26/04	210	Collection system temporary blockage	
10495-075	Sagemont	12015 New Brunswick	10/25/00	240	Collection system temporary blockage	
10495-075	Sagemont	10506 Kirkhall	9/22/00	250	Collection system temporary blockage	
10495-075	Sagemont	11807 Sagecliff	2/8/00	294	Collection system temporary blockage	
10495-075	Sagemont	10422 KIRKHALL	7/16/04	296	Collection system structural blockage	
10495-075	Sagemont	11901 HIGHLAND MEADOWS	6/28/01	300	Pump/lift station mechanical failure	
10495-075	Sagemont	12211 Fairbury	2/28/00	392	Collection system temporary blockage	
10495-075	Sagemont	11031 Sage Heather	10/10/00	400	Collection system temporary blockage	
10495-075	Sagemont	11822 RYEWATER	12/9/02	411	Collection system temporary blockage	
10495-075	Sagemont	10816 HUGHES	7/14/03	420	Collection system temporary blockage	
10495-075	Sagemont	12306 FAIRBURY	5/28/01	444	Collection system temporary blockage	
10495-075	Sagemont	12006 POMPTON	4/20/04	462	Collection system grease blockage	
10495-075	Sagemont	11901 Highland Meadow	7/5/00	500	Pump/lift station mechanical failure	
10495-075	CLEAR BROOK CITY MUD	11710 MEADOW BROOK	05/08/01	500	BLOCKAGE IN LINE	STRET
10495-075	Sagemont	11041 Fuqua	4/26/00	540	Collection system temporary blockage	
10495-075	Sagemont	10700 FUQUA	7/6/04	565	Collection system temporary blockage	
10495-075	Sagemont	10716 SABO RD	12/3/02	635	Collection system temporary blockage	
10495-075	Sagemont	11203 Sagevalley	11/14/00	910	Collection system temporary blockage	
10495-075	Sagemont	12501 Scarsdale	1/23/01	1000	Collection system temporary blockage	
10495-075	CLEAR BROOK CITY MUD	LIFT STATION	03/29/03	1000	TEST PLUGS STUCK	STREET
10495-075	Sagemont	11101 Fuqua	5/13/00	1015	Collection system temporary blockage	
10495-075	Sagemont	10806 SAGETRAIL DR	5/2/01	1120	Collection system temporary blockage	
10495-075	Sagemont	11901 Highland Meadow	2/6/01	1200	Pump/lift station mechanical failure	

TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
10495-075	Sagemont	10800 BEAMER	10/10/01	1339	Collection system temporary blockage	
10495-075	Sagemont	10590 FUQUA	8/22/01	1410	Collection system structural blockage	
10495-075	Sagemont	12710 Chaumont	2/28/00	1500	Collection system temporary blockage	
10495-075	Sagemont	12014 RHINEBECK	2/20/03	1816	Collection system structural blockage	
10495-075	Sagemont	12375 Scarsdale	7/24/01	2000	Pump/lift station mechanical failure	
10495-075	CLEAR BROOK CITY MUD	LIFT STATION	08/14/04	2,500	CONTRACTOR ERROR	STREET
10495-075	Sagemont	11203 Sagevalley	6/12/00	2602	Collection system temporary blockage	
10495-075	Sagemont	10906 Sagemeadow	3/1/00	3144	Collection system temporary blockage	
10495-075	Sagemont	11123 Sagetrail	10/17/00	4000	Collection system temporary blockage	
10495-075	Sagemont	12000 TEANEAK	5/20/02	4137	Collection system temporary blockage	
10495-075	Sagemont	11806 Sagedowne	11/12/00	4590	Collection system temporary blockage	
10495-075	Sagemont		1/21/00	5000	Pump/lift station mechanical failure	
10495-075	Sagemont	11014 SAGEHEATHER	1/17/03	5625	Collection system temporary blockage	
10495-075	Sagemont	11203 SAGEVALLEY	4/25/01	5815	Collection system temporary blockage	
10495-075	Sagemont	11203 Sagevalley	12/5/00	6400	Collection system temporary blockage	
10495-075	Sagemont	10906 SAGETRAIL	6/26/01	8070	Collection system temporary blockage	
10495-075	Sagemont	10614 SAGEDOWNE	6/10/01	11830	Collection system temporary blockage	
10495-075	Sagemont	11022 Sage Leaf	11/14/00	26465	Collection system temporary blockage	
10495-075	Sagemont	12734 Saranac	11/26/00	147050	Collection system temporary blockage	
10495-075	Sagemont	11700 SAGEARBOR	6/6/01		WWTP effluent violation	
10495-075	Sagemont	10910 SAGETRAIL			Collection system temporary blockage	
10495-075	Sagemont	14705 GULF FREEWAY			Pump/lift station mechanical failure	
10495-079	SAGEMEADOW UD	9831 SAGE LEE	07/19/05	5	UNKNOWN	GROUND
10495-079	SAGEMEADOW UD	10510 SAGE CANYOU	07/14/03	10	GREASE	GROUND
10495-079	SAGEMEADOW UD	11015 SAGEYORK	06/03/02	10	GREASE	CLEAN OUT
10495-079	SAGEMEADOW UD	11114 SAGE ORCHARD	08/23/04	15	GREASE	GROUND
10495-079	SAGEMEADOW UD	10730 SAGE BLUFF	12/20/03	20	GREASE	BACKYARD
10495-079	SAGEMEADOW UD	9835 SAGE ROYAL	04/19/03	25	GREASE BLOCKAGE	GROUND
10495-079	SAGEMEADOW UD	9842 SAGE BEND	04/19/03	25	GREASE BLOCKAGE	GROUND
10495-079	Southeast	10802 LONGREN	5/15/04	27	Collection system temporary blockage	
10495-079	Southeast	9963 MANGO	8/23/03	30	Collection system temporary blockage	
10495-079	Southeast	8435 LETTIE	6/23/04	36	Collection system temporary blockage	
10495-079	Southeast	7734 FOLKESTONE	7/21/04	46	Collection system temporary blockage	
10495-079	Southeast	11566 Gulf Frwy	10/14/00	50	Collection system temporary blockage	
10495-079	SAGEMEADOW UD	10507 SAGE BLUFF	03/23/05	50	GREASE	CUSTOMER YARD
10495-079	KIRKMONT MUD	8706 KIRKMONT	04/04/03	50	GREASE	GROUND
10495-079	Southeast	10018 KIRKGLEN	8/18/04	58	Collection system temporary blockage	
10495-079	Southeast	7807 FUQUA	7/13/04	66	Collection system temporary blockage	
10495-079	Southeast	7829 FUQUA	7/13/04	66	Collection system temporary blockage	
10495-079	Southeast	10400 ALTA LOMA WAY	4/30/02	70	Collection system temporary blockage	
10495-079	Southeast	9999 FUQUA	5/24/04	72	Collection system temporary blockage	
10495-079	Southeast	11715 KIRKHOLLOW	8/12/04	80	Collection system temporary blockage	
10495-079	SAGEMEADOW UD	10806 KIRKBEND	11/12/04	90	GREASE	STORM SEWER
10495-079	Southeast	10325 Almeda Genoa	8/27/00	102	Collection system temporary blockage	

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TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
10495-079	SAGEMEADOW UD	1503 SAGE TRAIL	07/15/03	105	GREASE	GROUND
10495-079	Southeast	10214 Buena Park	3/7/00	112	Collection system temporary blockage	
10495-079	Southeast	10307 BUENA PARK DR	5/2/04	119	Collection system structural blockage	
10495-079	Southeast	10511 Thornlea	4/23/04	124	Collection system temporary blockage	
10495-079	Southeast	9611 KINGSVALLEY	3/4/04	140	Collection system temporary blockage	
10495-079	Southeast	10018 KIRKGLEN	6/7/03	154	Collection system temporary blockage	
10495-079	Southeast	10235 GULF MEADOWS	6/26/03	159	Collection system temporary blockage	
10495-079	Southeast	9826 TELEPHONE	5/1/04	160	Collection system temporary blockage	
10495-079	Southeast	10311 BUENA PARK	10/27/02	180	Collection system temporary blockage	
10495-079	Southeast	10315 BUENA PARK	9/15/03	184	Collection system temporary blockage	
10495-079	Southeast	9611 KINGSVALLEY	7/7/04	195	Collection system temporary blockage	
10495-079	Southeast	10901 Telephone	7/28/00	196	Collection system temporary blockage	
10495-079	Southeast	11715 Kirkhollow	3/10/00	199	Collection system grease blockage	
10495-079	Southeast	6919 LEADER	5/21/01	234	Collection system temporary blockage	
10495-079	SAGEMEADOW UD	11406 SAGE KING	01/17/04	305	HEAVY RAINFALL	STORM SEWER
10495-079	Southeast	8403 LETTIE	5/18/01	336	Collection system temporary blockage	
10495-079	Southeast	10115 Glenmawr	1/7/00	352	Collection system temporary blockage	
10495-079	Southeast	#NULL# Almeda Genoa @ Rowlett	6/1/00	390	Collection system temporary blockage	
10495-079	SAGEMEADOW UD	11403 SAGEKING	06/02/02	460	TOILET PAPER & GREASE	STORM DRAIN
10495-079	Southeast	9610 KINGSPOINT	3/28/01	500	WWTP hydraulic overload	
10495-079	Southeast	10210 Kirkdale	1/16/01	520	Collection system temporary blockage	
10495-079	Southeast	9918 EBB	9/4/01	536	Collection system temporary blockage	
10495-079	Southeast	10231 Palm Shadow	1/24/00	538	Collection system temporary blockage	
10495-079	Southeast	10231 PALM SHADOW	1/24/00	538	Collection system temporary blockage	
10495-079	SAGEMEADOW UD	10807 KIRKBEND	12/06/03	562	GREASE	STORM SEWER
10495-079	Southeast	7829 Fuqua	12/15/00	582	Collection system temporary blockage	
10495-079	Southeast	10200 Almeda Genoa rd	3/10/02	720	Collection system temporary blockage	
10495-079	SAGEMEADOW UD	11403 SAGE KING	06/25/02	720	GREASE	STORM SEWER
10495-079	Southeast	9813 caffrey	4/26/02	966	Collection system temporary blockage	
10495-079	Southeast	10817 Telephone	8/17/00	976	Collection system temporary blockage	
10495-079	Southeast	9610 Kingspoint	11/12/01	1200	WWTP hydraulic overload	
10495-079	Southeast	9606 mango	1/7/02	1257	Collection system temporary blockage	
10495-079	Southeast	10901 TELEPHONE	9/18/01	1290	Collection system temporary blockage	
10495-079	Southeast	11210 NEWTON	4/16/04	1351	Collection system structural blockage	
10495-079	Southeast	9938 MANGO	6/22/02	1464	Collection system temporary blockage	
10495-079	Southeast	9610 Kingspoint	1/10/01	1500	Collection system temporary blockage	
10495-079	Southeast	7803 Fuqua	1/25/01	1515	Collection system temporary blockage	
10495-079	Southeast	10002 Kirkglen	12/16/01	1560	Collection system temporary blockage	
10495-079	Southeast	10607 Rambling Trail	12/8/00	1880	Collection system temporary blockage	
10495-079	Southeast	12348 GULF FRWY	10/30/01	2040	Collection system temporary blockage	
10495-079	Southeast	10901 TELEPHONE	6/13/01	2112	Collection system structural blockage	
10495-079	Southeast	10950 Cayman Mist	7/3/00	3040	Collection system temporary blockage	
10495-079	Southeast	10103 OLENTANGY	5/23/01	4085	Collection system temporary blockage	
10495-079	Southeast	10141 ALMEDA GENOA	9/27/02	4320	Collection system temporary blockage	

Sanitary Sewer Overflow Data Summary - 2000 to 2005

TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
10495-079	Southeast	10200 ALMEDA GENOA	3/10/02	4800	Collection system temporary blockage	
10495-079	Southeast	12348 GULF FRWY	10/15/01	5455	Collection system temporary blockage	
10495-079	Southeast	11106 TELEPHONE	3/19/01	5642	Collection system temporary blockage	
10495-079	Southeast	10519 RAMBLING TRAIL DR	3/5/01	5730	Collection system temporary blockage	
10495-079	Southeast	8010 Fuqua	1/1/01	5978	Collection system temporary blockage	
10495-079	Southeast	8402 COASTWAY	3/19/01	6685	Collection system temporary blockage	
10495-079	Southeast	10235 ALMEDA GENOA	2/3/02	8445	Collection system temporary blockage	
10495-079	SAGEMEADOW UD	9823 SAGE LEE	01/11/04	14,400	TRASH IN LINE	STORM SEWER
10495-079	Southeast	9938 Mango	10/16/02	19780	Collection system temporary blockage	
10495-079	Southeast	10901 telephone	9/10/01	25240	Collection system temporary blockage	
10495-079	Southeast	9610 Kingspoint	6/9/01		WWTP effluent violation	
10495-079	Southeast	9610 KINGSPOINT	8/31/01		WWTP effluent violation	
10495-079	Southeast	9610 KINGSPOINT	8/31/01		WWTP effluent violation	
10495-079	Southeast	9610 KINGSPOINT	9/1/01		WWTP effluent violation	
10495-079	Southeast	9610 KINGSPOINT	9/2/01		WWTP effluent violation	
10495-079	Southeast	9610 Kingspoint	12/13/01		WWTP hydraulic overload	
10495-079	Southeast	9610 Kingspoint	12/16/01		WWTP hydraulic overload	
10495-079	Southeast	9610 KINGSPOINT			WWTP hydraulic overload	
+	Southeast	9611 KINGSVALLEY			Collection system temporary blockage	
10520-001	WEBSTER, CITY OF	MAGNOLIA and TEXAS AVE	11/24/02		CONTRACTOR ERROR	STORM DRAIN
10526-001	NASSAU BAY, CITY OF	UPPER BAY and PARK ROAD	12/13/01	200	HEAVY RAIN	STORM SEWER
10526-001	NASSAU BAY, CITY OF	140 SURF COURT	06/28/04	400	VANDALISM	CLEAR LAKE
10526-001	NASSAU BAY, CITY OF	UPPER BAY and PARK ROAD #23	01/29/02	500	PUMPS LEFT OFF	STORM DRAIN
10526-001	NASSAU BAY, CITY OF		06/09/01		HEAVY RAINS	CLEAR CREEK
10568-005	LEAGUE CITY, CITY OF	1251 LINK ROAD	05/08/01	50	VANDALISM	DRAINAGE DITCH
10568-005	LEAGUE CITY, CITY OF	301 S GULF FRWY	05/05/01	50	ELECTRICAL PROBLEM	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	4412 FIELD GLEN CT	03/04/01	100	LINE STOPPAGE	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	451 CONSTELLATION	08/14/00	100	GREASE IN LINE	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	321 EMPRESS and 321 LAYFAYE	10/08/03	100	ELECTRICAL PROBLEMS	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	814 DAVIS	09/12/04	150	POWER FAILURE	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	2448 FAIRWAY POINTE	12/21/01	200	CS BACK UP	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	NORTH OF UHAUL	01/04/01	200	LIFT STATION PROBLEMS	GROUND
10568-005	LEAGUE CITY, CITY OF	380 AMBER LANE	05/10/05	250	ELECTRICAL FAILURE	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	2815 HICKORY LIMB	03/03/01	250	LS FLOAT FAILURE	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	2811 SUGARWOOD	03/03/01	250	LS FLOAT FAILURE	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	2823 FOREST POINT	03/03/01	250	LS FLOAT FAILURE	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	2448 FAIRWAY POINT	12/03/02	250	RAIN FALL	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	FM 518 and FM 270	12/12/02	250	CRACKED PIPE JOINT	DRAINAGE DITCH
10568-005	LEAGUE CITY, CITY OF	2316 COLONIAL CT N	02/11/04	500	COLLAPSED LINE	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	321 LAFAYETTE	03/19/05	500	LIGHTNING STRIKE AT L/S	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	2517 WOOD HALL	11/03/03	500	VANDALISM	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	2508 FM 518	02/24/03	500	H2S DAMAGE TO LINE	DRAINAGE DITCH
10568-005	LEAGUE CITY, CITY OF	2130 SAVANNAH CT N	02/11/04	600	COLLAPSED LINE	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	321 LAFAYETTE	12/26/03	800	BLOCKAGE IN LINE	STORM DRAIN

APPENDIX F
Sanitary Sewer Overflow Data Summary - 2000 to 2005

TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
10568-005	LEAGUE CITY, CITY OF	321 EMPRESS LANE	12/26/03	800	BLOCKAGE IN LINE	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	2517 MASTERS DRIVE	10/25/01	800	POWER FAILURE	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	4412 FIELD GLEN CT	03/01/01	1000	BACKED UP MAIN	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	KNOLLWOOD and COVE	05/27/01	1000	ELECTRICAL PROBLEM	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	S. SHORE 800' S. OF 518	05/13/04	1200	HEAVY RAIN	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	1009 NEWPORT	02/11/04	1,500	COLLAPSED LINE	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	2448 FAIRWAY POINTE	12/04/02	1500	HEAVY RAINFALL	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	2651 FM 2094	06/05/01	1500	AIR RELEASE VALVE FAILED	DRAINAGE DITCH
10568-005	LEAGUE CITY	321 LAFAYETTE LANE	07/11/02	1800	POWER OUTAGE	STORM SEWER
10568-005	LEAGUE CITY	323 EMPRESS LANE	07/11/02	1800	POWER OUTAGE	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	2500 BLK OF 2094	03/01/02	2000	ELECTRICAL FAILURE	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	2448 FAIRWAY POINTE	08/15/02	2500	HEAVY RAIN	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	2155 COVE PARK	09/14/00	5000	LIFT STATION FAILED	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	2448 FAIRWAY POINT DR	09/13/00	8000	ELECTRICAL FAILURE	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	2448 FAIRWAY POINT	06/05/01	8500	HEAVY RAINS	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	2000 BLOCK OF 518	12/19/00	9500	BROKEN FORCE MAIN	DRAINAGE DITCH
10568-005	LEAGUE CITY, CITY OF	CALDER and WALNUT	04/04/01	480000	COLLAPSED 54' LINE	DRAINAGE DITCH
10568-005	LEAGUE CITY, CITY OF	1499 7TH ST	08/30/03		RAINFALL/TS GRACE	STORM SEWER
10568-005	LEAGUE CITY, CITY OF	1411 FM 518	06/09/01		HEAVY RAINS	STORM DRAIN
10568-005	LEAGUE CITY, CITY OF	CORNER OF 518 and 270	06/09/01		HEAVY RAINS	STORM DRAIN
11571-001	BLACKHAWK/FRIENDSWOOD	WWTP	05/04/05	30	BELT PRESS FAILURE	CLEAR CREEK
11571-001	FRIENDSWOOD, CITY OF	1902 EAGLE COVE	04/03/03	50	BROKEN BEND IN LINE	CHIGGER CREEK
11571-001	BLACKHAWK/FRIENDSWOOD	B'HAWKandSHADY OAKS	03/15/04	60	BLOCKAGE	MARY'S CREEK
11571-001	BLACKHAWK/FRIENDSWOOD	2831 EARLY TURN	03/15/04	75	BLOCKAGE	MARY'S CREEK
11571-001	FRIENDSWOOD, CITY OF	115 OAK DRIVE	04/03/03	100	CONTRACTOR ERROR	CHIGGER CREEK
11571-001	FRIENDSWOOD, CITY OF	N SHADOWBEND and MARY'S CT	09/05/03	100	MAIN STOPPAGE	MARY'S CREEK
11571-001	BLACKHAWK/FRIENDSWOOD	WWTP	05/05/05	100	RAS PUMP OVERFLOW	CLEAR CREEK
11571-001	FRIENDWOOD, CITY OF	4411 FRIENDSWOOD LINK	08/07/03	150	POWER GLITCH	GROUND
11571-001	BLACKHAWK/FRIENDSWOOD	SUNSET and W.C'WOOD	03/15/04	180	BLOCKAGE	MARY'S CREEK
11571-001	FRIENDSWOOD, CITY OF	1810 BAY AREA BLVD	05/20/01	200	BROKEN AIR RELIEF	
11571-001	FRIENDSWOOD, CITY OF	N SHADOWBEND and MARY'S CT	09/04/03	200	LINE SURCHARGE	MARY'S CREEK
11571-001	BLACKHAWK REGIONAL	TANGLEWOOD and FM 528	05/08/03	200	CLOGGED LINE	
11571-001	FRIENDSWOOD, CITY OF	WINDING RD and MARY COURT	10/17/03	300	GREASE	STORM SEWER
11571-001	BLACKHAWK/FRIENDSWOOD	WWTP	07/22/05	400	BROKEN RAS LINE	GROUND
11571-001	BLACKHAWK REGIONAL	400 BLK OF WOODLAWN	05/09/03	500	CLOGGED LINE	DRAINAGE CREEK
11571-001	FRIENDSWOOD, CITY OF	205 E EDGEWOOD	03/19/03	500	SEWER MAIN STOPPAGE	MARY'S CREEK
11571-001	BLACKHAWK/FRIENDSWOOD	803 TANGLEWOOD	07/22/05	500	GREASE	MARY'S CREEK
11571-001	FRIENDSWOOD, CITY OF	FM 518 and ANNETTE	11/15/00	500	BROKE FORCE MAIN	STORM SEWER
11571-001	HARRIS CO MUD 55	2710 SAILORS MOON	01/31/02	800	STOPPAGE IN LINE	STORM DRAIN
11571-001	HARRIS CO MUD 55	15919 CAMPFIRE	03/21/03	800	BLOCKAGE IN LINE	STORM SEWER
11571-001	FRIENDSWOOD, CITY OF	2007 SOUTH MISSION	04/21/01	900	MAIN STOPPAGE	STORM DRAIN
11571-001	FRIENDSWOOD, CITY OF	2003 SAN MIGUEL	02/18/02	1000	CAP REMOVED FROM CO	RETENTION POND
11571-001	FRIENDSWOOD, CITY OF	502 COLONIAL	09/11/02	1000	SEWER MAIN STOPPAGE	STORM DRAIN
11571-001	BLACKHAWK WWTP	WWTP	01/15/04	1000	CONTRACTOR ERROR	STORM DRAIN
11571-001	BLACKHAWK/FRIENDSWOOD	CLEARVIEW and 518	02/11/04	1,020		MARY'S CREEK

APPENDIX F
Sanitary Sewer Overflow Data Summary - 2000 to 2005

TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
11571-001	FRIENDSWOOD, CITY OF	1016 APPLEWOOD	12/18/03	1050	GREASE IN LINE	STORM SEWER
11571-001	BLACKHAWK STP	15908 BLUE MESA RIDGE	08/19/02	1200	PUMPS OUT	STORM DRAIN
11571-001	BLACKHAWK/FRIENDSWOOD	APPLEBLOSSOM/ROYAL	02/11/04	1,440	RAINFALL	MARY'S CREEK
11571-001	BLACKHAWK STP	15919 CAMP FIRE ROAD	05/26/02	1500	BLOCKAGE IN LINE	DOWNSTREAM
11571-001	FRIENDSWOOD, CITY OF	APPLEBLOSSOM and ROYAL	10/10/03	1800	UNKNOWN	CLEAR CREEK
11571-001	FRIENDSWOOD, CITY OF	2003 SAN MIGUEL	02/12/02	2000		DITCH
11571-001	FRIENDSWOOD, CITY OF	203 and 205 WINDSONG	09/11/03	2900	MAIN STOPPAGE	MARY'S CREEK
11571-001	FRIENDSWOOD, CITY OF	EDENVALE and PENNYSTONE	01/17/02	3000	SEWER MAIN STOPPAGE	STORM DRAIN
11571-001	BLACKHAWK/FRIENDSWOOD	MH AT FALLING LEAF CT	06/25/04	3000	LIFT STATION FAILURE	CLEAR CREEK
11571-001	BLACKHAWK/FRIENDSWOOD	134 MOSS POINT	10/04/04	3,300	LIFT STATION FAILURE	CLEAR CREEK
11571-001	FRIENDSWOOD, CITY OF	207 E EDGEWOOD	02/08/01	3500	LIFT STATION FAILURE	MARY'S CREEK
11571-001	FRIENDSWOOD, CITY OF	MARY'S CROSSING	09/12/03	3800	HEAVY RAINFALL	MARY'S CREEK
11571-001	FRIENDSWOOD, CITY OF	207 E EDGEWOOD	01/05/01	4000	MAIN LINE STOPPAGE	MARY'S CREEK
11571-001	BLACKHAWK/FRIENDSWOOD	E.CASTLEWOOD/QUAKER BEND	02/05/04	5000	UNDETERMINED	MARY'S CREEK
11571-001	BLACKHAWK/FRIENDSWOOD	1 PENN CIRCLE	06/25/04	6000	HEAVY RAIN	CLEAR CREEK
11571-001	BLACKHAWK/FRIENDSWOOD	WWTP	06/20/04	7000	FORCE MAIN LEAK	CLEAR CREEK
11571-001	BLACKHAWK/FRIENDSWOOD	222 SHADWELL	05/11/04	9000	MISALIGNED MANHOLE	COWARDS CREEK
11571-001	FRIENDSWOOD, CITY OF	605 N CLEAR CREEK	01/16/01	10000	HEAVY RAINS	COWARDS CREEK
11571-001	FRIENDSWOOD, CITY OF	203 SUNNYVIEW	01/16/01	10000	HEAVY RAINS	MARY'S CREEK
11571-001	FRIENDSWOOD, CITY OF	313 LIVEOAK	01/16/01	10000	HEAVY RAINS	COWARDS CREEK
11571-001	FRIENDSWOOD, CITY OF	411 SCENIC VIEW	01/16/01	10000	HEAVY RAINS	COWARDS CREEK
11571-001	FRIENDSWOOD, CITY OF	FALLING LEAF	01/16/01	10000	HEAVY RAINS	MARY'S CREEK
11571-001	BLACKHAWK/FRIENDSWOOD	110 CENTURY	10/05/04	15,000	LIFT STATION FAILURE	CLEAR CREEK
11571-001	BLACKHAWK/FRIENDSWOOD	222 SHADWELL	01/30/04	30000	CAR HIT MANHOLE	COWARD'S CREEK
11571-001	FRIENDSWOOD, CITY OF	S OF RUNWAY ON POLLY RANC	12/26/00	30000	BROKE FORCE MAIN	CLEAR CREEK
11571-001	FRIENDSWOOD, CITY OF	2600 AIRLINE DR	11/03/02	450000	18" FORCE MAIN RUPTURED	CLEAR CREEK
11571-001	FRIENDSWOOD, CITY OF	MARY'S CROSSING	09/21/03		MAY HAVE OVERFLOWED	MARY'S CREEK
11572-001	PILCHERS PROPERTY	WWTP	03/13/02	20000	UNKNOWN AIR PUMP	RECEIVING STREAM
12295-001	BRAZORIA CO MUD 5	1303 CRYSTAL LAKE CR W	03/31/03	30	POWER FAILURE TO LS	STREET
12295-001	BRAZORIA CO MUD 5	1307 CRYSTAL LAKE CIR W	04/12/03	80	ELECTRICAL PROBLEMS AT LS	STORM SEWER
12295-001	BRAZORIA CO MUD 5	1002 OXFORD DR	01/07/01	200	BLOCKAGE	STORM SEWER
12332-001	BRAZORIA CO MUD 2	2419 COVINGTON	07/21/03	75	GREASE IN LATERAL	STORM INLET
12332-001	BRAZORIA CO MUD 1	4903 CARRINGTON CT	11/09/01	100	MAIN LINE BACKUP	
12332-001	BRAZORIA CO MUD 1	2740 AMBERLY COURT	01/05/02	150	BLOCKAGE IN LINE	STORM INLET
12332-001	BRAZORIA CO MUD 1	4935 PECAN GROVE	10/31/00	250	SEWER LINE STOPPAGE	STORM DRAIN
12332-001	BRAZORIA CO MUD 2	3622 SENOVA DR	12/15/01	350	POWER LOSS TO LS 2	STORM DRAIN
12332-001	BRAZORIA CO MUD 2	3900 NORTHFORK	11/19/00	500	SYSTEMWIDE BACKUP	DRAINAGE DITCH
12332-001	BRAZORIA CO MUD 1	4019 LOTUS DR	12/26/02	500	BLOCKAGE IN SYSTEM	STORM SEWER
12332-001	BRAZORIA CO MUD 1	4103 S WEBBER DRIVE	01/25/02	500	POWER FAILURE AT LS	STORM SEWER
12332-001	BRAZORIA CO MUD 1	4130 WEBBER DRIVE N	01/19/02	500	STOPPAGE IN LINE	STORM SEWER
12332-001	BRAZORIA CO MUD 1	WWTP	09/18/04	500	BLOCKAGE	GROUND
12332-001	BRAZORIA CO MUD 2	3900 NORTHFORK	11/14/00	1000	HEAVY RAINS	DRAINAGE DITCH
12332-001	BRAZORIA CO MUD 1	WWTP	04/13/03	1000	VANDALISM	GROUND
12332-001	BRAZORIA CO MUD 2	2442 ARROWSMITH	01/21/03	2100	GREASE	
12332-001	BRAZORIA CO MUD 1	3111 1/2 SOUTH DOWN	09/09/01	8000	LS POWER FAILURE	STORM DRAIN

APPENDIX F
Sanitary Sewer Overflow Data Summary - 2000 to 2005

TPDES Number	Name	Address	Event Date	Total Volume (Gallons)	Excursion Cause	Location
12332-001	BRAZORIA CO MUD 1	WWTP	12/12/03	10000	HEAVY RAINFALL	GROUND
12332-001	BRAZORIA CO MUD 2	3900 NORTHFORK	06/17/03	18000	RAINFALL	MARY'S CREEK
14135-001	BRAZORIA CO MUD 19	WWTP	12/10/01	2000	LEAK ON FORCE MAIN	CONTAINED
14135-001	BRAZORIA CO MUD 19	WWTP	12/30/02	3000	HIGH FLOW AND AIR	GROUND
14135-001	BRAZORIA CO MUD 19	WWTP	04/08/02	20000	HEAVY RAINS	GROUND

APPENDIX G
STORM WATER SAMPLING RESULTS – 2006

APPENDIX G
Storm Water Sampling Results – 2006

Table G-1 Storm Event #1

WQM Station ID	Sample Date	TSS (mg/l)	Flow (cfs)	E-Coli (MPN/100ml)	Enterococci (MPN/100ml)
11425	5/29/2006	29.6	42.042	9525	N/A
11425 dup	5/29/2006	29.2	42.042	11440	N/A
11425	5/29/2006	348	25.410	3305	N/A
11425	5/30/2006	199	5.051	1369	N/A
16473	5/29/2006	202	122.536	19015	N/A
16473	5/29/2006	70.8	100.562	6638	N/A
16473	5/30/2006	30.4	25.090	1724	N/A
16486	5/29/2006	160	11.918	N/A	7710
16486	5/29/2006	70.4	4.992	N/A	12250
16486	5/30/2006	23.2	1.250	N/A	14920
16493	5/29/2006	11.6	1.304	13340	N/A
16493	5/29/2006	12.8	0.452	2969	N/A
16493	5/30/2006	6.8	2.715	457	N/A
16611	5/29/2006	286	14.171	N/A	35150
16611	5/29/2006	134	7.045	N/A	31770
16611	5/30/2006	56.4	2.323	N/A	2356
17068	5/29/2006	586	18.251	77010	N/A
17068	5/29/2006	82.4	6.017	47860	N/A
17068	5/30/2006	22.8	1.360	4742	N/A
17068 dup	5/30/2006	24.8	1.360	3742	N/A
18818	5/29/2006	< 4.0	0.013	N/A	64880
18818	5/29/2006	< 4.0	< 0.002228	N/A	32430
18818	5/30/2006	16.8	< 0.000139	N/A	N/A
F1	5/29/2006	83.2	105.000	25375	N/A
F1	5/29/2006	61.2	79.152	26360	N/A
F1	5/30/2006	49.6	51.677	4113	N/A
F1 dup	5/30/2006	51.2	51.677	3873	N/A
R1	5/29/2006	12.8	0.016	89	N/A
R1	5/29/2006	10.8	0.002	403	N/A
R1	5/30/2006	4	0.002	281	N/A

N/A = Not Sampled

APPENDIX G
Storm Water Sampling Results – 2006

Table G-2 Storm Event #2

WQM Station ID	Sample Date	TSS (mg/l)	Flow (cfs)	E-Coli (MPN/100ml)	Enterococci (MPN/100ml)
11425	7/18/2006	160	N/A	29240	N/A
11425	7/18/2006	260	N/A	32535	N/A
11425	7/19/2006	109	99.23	5442	N/A
16473	7/18/2006	128	277.72	41060	N/A
16473 dup	7/18/2006	133	277.72	41325	N/A
16473	7/18/2006	83	249.74	36540	N/A
16473	7/19/2006	61.2	53.90	4006	N/A
16486	7/18/2006	122	91.88	N/A	11070
16486	7/18/2006	49.2	26.69	N/A	9097
16486 dup	7/18/2006	52	26.69	N/A	9230
16486	7/19/2006	23.2	4.59	N/A	1130
16493	7/18/2006	84.4	N/A	31030	N/A
16493	7/18/2006	108	N/A	36805	N/A
16493	7/19/2006	53.2	142.35	6147	N/A
16611	7/18/2006	248	105.30	N/A	135665
16611	7/18/2006	247	28.96	N/A	105015
16611	7/19/2006	34	6.83	N/A	9330
17068	7/18/2006	139	20.54	41125	N/A
17068	7/18/2006	51.6	18.23	14780	N/A
17068	7/19/2006	14.4	5.07	452	N/A
17068 dup	7/19/2006	13.2	5.07	803	N/A
18818	7/18/2006	5.2	1.45	N/A	51720
18818	7/18/2006	< 4.0	0.16	N/A	23030
18818	7/19/2006	N/A	0.02	N/A	1788
F1	7/18/2006	24	551.59	20235	N/A
F1	7/18/2006	29.6	440.74	32620	N/A
F1	7/19/2006	25.6	58.37	4699	N/A
R1	7/18/2006	64.4	3.72	41125	N/A
R1	7/18/2006	46	0.43	31740	N/A
R1	7/19/2006	26	0.71	2679	N/A

N/A = Not Sampled

APPENDIX H
GENERAL METHODS FOR ESTIMATING FLOW AT TMDL WQM STATIONS

Appendix H
General Methods for Estimating Flow at WQM Stations

Flow duration curve analysis looks at the cumulative frequency of historic flow data over a specified period (USEPA 2007). Because stream flow conditions on any given day can be highly variable, depending on watershed characteristics and weather patterns, flow duration curves are a useful tool for characterizing the percentage of days in a year when given flows occur (USEPA 2007). To support the development of bacteria TMDLs, flow duration curves can be developed using existing USGS measured flow where the data exist at the same location as the WQM station, or by estimating flow for WQM stations with no corresponding flow record. Flow data are derived and synthesized to support preparation of flow duration curves and load duration curves for each WQM station in this report in the following priority.

USGS Gage Coincides with WQM Station

In cases where a USGS flow gage coincides with, or occurs within one-half mile upstream or downstream of the WQM station the following protocols will be employed:

a. If simultaneous daily flow data matching the water quality sample date are available, these flow measurements will be used to prepare flow exceedance percentiles.
b. If flow measurements at the coincident gage are missing for some dates on which water quality samples were collected, the gaps in the flow record will be filled, or the record will be extended, by estimating flow based on measured streamflows at a nearby gages. First, the most appropriate nearby stream gages are identified as those within a 150 km radius that have at least 300 coincident daily flow measurements. For all identified gages, four regression equations are calculated on the coincident data. The calculated regressions include a linear regression, log-linear regression, logarithmic regression and a power curve regression. For each regression, the root mean square error (RMSE) is calculated and the equation with the best fit or lowest RMSE is chosen to represent that gage. The gages are ranked in order of best fit or increasing RMSE. As many data points requiring filling as possible are filled with the best fit gage (lowest RMSE). If dates remain to be filled, the process is repeated in an iterative fashion with the second best fit gage and so forth until all dates requiring filling have been filled.

No USGS Gage Coincides with WQM Station

Where no coincident flow data are available for a WQM station, but flow gage(s) are present upstream and/or downstream, flows will be estimated for the WQM station from an upstream or downstream gage using a watershed area ratio method that includes a modification utilizing the NRCS Curve number (CN) to account for differences in watersheds (Wurbs & Sisson, 1999; Wurbs 2006). In coastal watersheds, where the choice of using an upstream or downstream station may be severely limited, it may be necessary to use a gage station from an adjacent watershed that has similar characteristics. These recent studies have demonstrated that, while flow predictions for a specific time with any flow distribution method are not highly accurate, RMSE, means and others flow characteristics can be estimated with an acceptable degree of accuracy. Since many of the flow frequencies important to a load duration curve involve the low end of the frequency range and the NRCS Curve method involves inherent limitations as flows approach the initial abstraction limit, another modification was applied to this method.

The Furness method (Furness 1959) employed by the USGS in Kansas (Studley 2000) estimates flow duration curves by estimating several descriptive statistics that describe the curve. The adaptation was included to utilize the existing period of record to calculate the flow frequency curve for an individual USGS gage, which completely describes the shape of the curve. The mean flow is then projected to the ungaged location utilizing the modified NRCS Curve method, which operates best around the mean of a distribution. Individual flow measurements and flow frequencies can then be projected to the ungaged location by normalizing them to the percent of the mean flow and multiplying the result by the newly projected mean flow for the ungaged location.

Drainage subbasins will first be delineated for all impaired 303(d)-listed WQM stations, along with all USGS flow stations located in the 8-digit HUCs with impaired streams. All the USGS gage stations will be identified that have a continuous period of record upstream and downstream of the subwatersheds with 303(d) listed WQM stations.

a. Watershed delineations are performed using ESRI Arc Hydro with a 30 m resolution National Elevation Dataset (NED) digital elevation model, and National Hydrography Dataset (NHD) streams. The area of each watershed will be calculated following watershed delineation.
b. The watershed average curve number is calculated from soil properties and land cover as described in the U.S. Department of Agriculture (USDA) Publication TR-55: Urban Hydrology for Small Watersheds. The soil hydrologic group is extracted from NRCS STATSGO soil data, and land use category from the NOAA Coastal Change Analysis Program (C-CAP). Based on land use and the hydrologic soil group, SCS curve numbers are estimated at the 30-meter resolution of the C-CAP grid as shown in Table H-1.
c. The average curve number is then calculated from all the grid cells within the delineated watershed.
d. The average rainfall is calculated for each watershed from gridded average annual precipitation datasets for the period 1971-2000 (Spatial Climate Analysis Service, Oregon State University, http://www.ocs.oregonstate.edu/prism/, created 20 Feb 2004).

Table H-1 Runoff Curve Numbers for Various Land Use Categories and Hydrologic Soil Groups

C-CAP Value	C-CAP Class	Group A	Group B	Group C	Group D
2	High-Intensity Developed	89	92	94	95
3	Medium-Intensity Developed	77	85	90	92
4	Low-Intensity Developed	61	75	83	87
5	Open-Space Developed	39	61	74	80
6	Cultivated Land	67	78	85	89
7	Pasture/Hay	35	56	70	77
8	Grassland/Herbaceous	39	61	74	80
9	Deciduous Forest	30	55	70	77
10	Evergreen Forest	30	55	70	77
11	Mixed Forest	30	55	70	77
12	Scrub/Shrub	30	48	65	73
13	Palustrine Forested Wetland	0	0	0	0
14	Palustrine Scrub/Shrub Wetland	0	0	0	0
15	Palustrine Emergent Wetland	0	0	0	0
16	Estuarine Forested Wetland	0	0	0	0
17	Estuarine Scrub/Shrub Wetland	0	0	0	0
18	Estuarine Emergent Wetland	0	0	0	0
19	Unconsolidated Shore	0	0	0	0
20	Bare Land	77	86	91	94
21	Water	0	0	0	0
22	Palustrine Aquatic Bed	0	0	0	0
23	Estuarine Aquatic Bed	0	0	0	0

e. The mean flow at the ungaged site is calculated from the gaged site utilizing the modified NRCS Curve Number method (Wurbs & Sisson, 1999). The NRCS runoff curve number equation is:

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S} \qquad (1)$$

where:

Q = runoff (inches)

P = rainfall (inches)

S = potential maximum retention after runoff begins (inches)

I_a = initial abstraction (inches)

If $P < 0.2$, $Q = 0$. Initial abstraction has been found to be empirically related to S by the equation

$$I_a = 0.2*S \qquad (2)$$

Thus, the runoff curve number equation can be rewritten:

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} \qquad (3)$$

S is related to the curve number (CN) by:

$$S = \frac{1000}{CN} - 10 \qquad (4)$$

f. First, S is calculated from the average curve number for the gaged watershed. Next, the historic mean flow at the gage is converted to depth basis (as used in equations 1 and 3) by dividing by its drainage area, then converted to inches. Equation 3 is then solved for daily precipitation depth of the gaged site, P_{gaged}. The daily precipitation depth for the ungaged site is then calculated as the precipitation depth of the gaged site multiplied by the ratio of the long-term average precipitation in the watersheds of the ungaged and gaged sites:

$$P_{ungaged} = P_{gaged}\left(\frac{M_{ungaged}}{M_{gaged}}\right) \qquad (5)$$

where M is the mean annual precipitation of the watershed in inches. The daily precipitation depth for the ungaged watershed, along with the average curve number of the ungaged watershed, are then used to calculate the depth equivalent daily flow Q of the ungaged site. Finally, the volumetric flow rate at the ungaged site is calculated by multiplying by the area of the watershed of the ungaged site and converting the value to cubic feet.

g. If wastewater treatment facilities (WWTF) are located within the drainage area of the USGS gage, a base flow for the USGS gage should be calculated before projecting flow to an ungaged site. The base flow for the USGS gage is calculated by deducting the sum of the Average Monthly WWTF flow for all outfalls in the drainage area from the measured USGS flow record. The Average Monthly WWTF flows are applied for each day (1-31) of a given month.

$$Q_{baseflow} = Q_{USGSgage} - \sum_{\#wwtf}^{1} Q_{Avg.MonthlyWWTF}$$

If the base flow results in a negative value, that value is then set to zero.

h. After flow has been estimated for the ungaged site, average monthly flows from WWTFs that drain into the ungaged watershed are then added to the flow estimates.

In the rare case where no coincident flow data are available for a WQM station and no gages are present upstream or downstream, flows will be estimated for the WQM station from a gage on an adjacent watershed of similar size and properties, via the same procedure described above for upstream or downstream gages.

USEPA 2007. An Approach for Using Load Duration Curves in the Development of TMDLs. EPA 841-B-07-006 August 2007. http://www.epa.gov/owow/tmdl/techsupp.html

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Furness, L.W. 1959. Kansas streamflow characteristics- part 1, Flow duration: Kansas Water Resources Board Technical Report No. 1, 213 p.

Wurbs, R. A. 2006. Methods for Developing Naturalized Monthly Flows at Gaged and Ungaged Sites. Journal of Hydrologic Engineering, Vol. 11, No. 1, January 1, 2006.

APPENDIX I
FLOW EXCEEDANCE PERCENTILES FOR TMDL WQM STATIONS

APPENDIX I
Flow Exceedance Percentiles for TMDL WQM Stations

WQ Station	16493	14229	16477	16473	17068	17069	17071	
	Chigger Creek	Clear Creek Above Tidal	Cowart Creek	Marys Creek	Hickory Slough	Turkey Creek	Mud Gully	Sims Bayou at Hiram Clarke St, Houston, TX*
Segment	1101B	1102	1102A	1102B	1102C	1102D	1102E	
USGS Gage Reference	08075400	08075400	08075400	08075400	08075400	08075400	08075400	**08075400**
Watershed Area (sq. mile)	14.9	57.8	19.3	16.2	7.7	10.1	9.4	20.7
NRCS Curve Number	75.4	73.3	77.7	83.7	78.0	74.4	82.6	83.2
Average Annual Rainfall (inch)	53.1	51.8	52.7	52.4	52.2	53.3	53.0	50.3
Percentile	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**
0	527	447	1,456	4,617	599	240	2,288	4,641
1	80	77	220	700	90	40	350	701
2	47	50	130	417	54	27	210	416
3	29	34	81	259	33	18	132	257
4	21	27	58	184	24	14	94	184
5	16	23	44	141	18	12	73	140
6	11	19	31	101	13	10	54	100
7	9.3	18	26	84	11	8.9	45	82
8	7.8	16	22	71	9.0	8.4	39	69
9	6.6	15	18	60	7.6	7.9	34	58
10	5.6	14	16	53	6.5	7.5	30	50
11	4.8	14	13	45	5.6	7.3	26	43
12	4.1	13	11	39	4.7	7.1	23	37
13	3.6	13	10	35	4.2	6.9	21	32
14	3.2	13	8.8	30	3.6	6.8	19	28
15	2.9	12	7.9	27	3.3	6.6	17	26
16	2.6	12	7.1	25	2.9	6.4	16	23
17	2.3	12	6.3	23	2.6	6.3	15	20
18	2.1	12	5.8	21	2.4	6.1	14	19
19	1.9	12	5.3	20	2.2	6.0	13	17
20	1.8	12	5.0	19	2.1	6.0	13	16
21	1.7	12	4.7	17	2.0	5.9	12	15
22	1.6	12	4.4	16	1.8	5.8	12	14
23	1.4	11	4.0	15	1.7	5.8	11	13
24	1.3	11	3.8	14	1.6	5.7	11	12
25	1.3	11	3.6	14	1.5	5.7	10	12
26	1.2	11	3.4	13	1.4	5.6	10	11
27	1.1	11	3.2	13	1.4	5.6	9.9	10
28	1.1	11	3.0	12	1.3	5.5	9.7	10
29	1.0	11	2.9	12	1.2	5.5	9.5	9.4
30	1.0	11	2.7	11	1.2	5.4	9.3	9.0

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WQ Station	16493 Chigger Creek	14229 Clear Creek Above Tidal	16477 Cowart Creek	16473 Marys Creek	17068 Hickory Slough	17069 Turkey Creek	17071 Mud Gully	Sims Bayou at Hiram Clarke St, Houston, TX*
Segment	1101B	1102	1102A	1102B	1102C	1102D	1102E	
USGS Gage Reference	08075400	08075400	08075400	08075400	08075400	08075400	08075400	**08075400**
Watershed Area (sq. mile)	14.9	57.8	19.3	16.2	7.7	10.1	9.4	20.7
NRCS Curve Number	75.4	73.3	77.7	83.7	78.0	74.4	82.6	83.2
Average Annual Rainfall (inch)	53.1	51.8	52.7	52.4	52.2	53.3	53.0	50.3
Percentile	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**
31	1.0	11	2.7	11	1.1	5.4	9.1	8.8
32	0.91	11	2.6	11	1.1	5.3	9.0	8.4
33	0.88	11	2.5	10	1.1	5.3	8.8	8.1
34	0.85	11	2.4	10	1.0	5.3	8.7	7.9
35	0.83	11	2.3	9.8	1.0	5.2	8.5	7.7
36	0.80	10	2.3	9.5	1.0	5.2	8.4	7.4
37	0.76	10	2.2	9.3	0.92	5.2	8.2	7.1
38	0.74	10	2.1	9.1	0.89	5.1	8.1	6.9
39	0.72	10	2.0	9.0	0.87	5.1	8.0	6.7
40	0.69	10	1.9	8.8	0.84	5.1	7.9	6.4
41	0.66	10	1.9	8.6	0.81	5.1	7.8	6.2
42	0.64	10	1.8	8.2	0.79	5.0	7.7	6.0
43	0.63	10	1.8	8.1	0.77	5.0	7.6	5.9
44	0.62	10	1.7	8.0	0.76	5.0	7.5	5.8
45	0.60	10	1.7	7.9	0.74	5.0	7.4	5.7
46	0.58	10	1.7	7.8	0.72	5.0	7.4	5.5
47	0.57	9.9	1.6	7.7	0.70	4.9	7.3	5.4
48	0.55	9.9	1.6	7.6	0.68	4.9	7.2	5.3
49	0.53	9.8	1.5	7.4	0.66	4.9	7.1	5.1
50	0.51	9.8	1.5	7.2	0.64	4.9	7.0	4.9
51	0.50	9.8	1.4	7.1	0.63	4.8	7.0	4.8
52	0.49	9.7	1.4	7.0	0.62	4.8	6.9	4.7
53	0.48	9.7	1.4	6.8	0.60	4.8	6.9	4.6
54	0.47	9.7	1.3	6.7	0.59	4.8	6.8	4.5
55	0.46	9.7	1.3	6.6	0.58	4.7	6.8	4.4
56	0.45	9.6	1.3	6.4	0.57	4.7	6.7	4.4
57	0.44	9.6	1.3	6.3	0.56	4.7	6.6	4.3
58	0.44	9.6	1.2	6.2	0.55	4.7	6.6	4.2
59	0.43	9.5	1.2	6.1	0.54	4.6	6.5	4.2
60	0.42	9.5	1.2	6.0	0.53	4.6	6.5	4.1

APPENDIX I
Flow Exceedance Percentiles for TMDL WQM Stations

WQ Station	16493 Chigger Creek	14229 Clear Creek Above Tidal	16477 Cowart Creek	16473 Marys Creek	17068 Hickory Slough	17069 Turkey Creek	17071 Mud Gully	Sims Bayou at Hiram Clarke St, Houston, TX*
Segment	1101B	1102	1102A	1102B	1102C	1102D	1102E	
USGS Gage Reference	08075400	08075400	08075400	08075400	08075400	08075400	08075400	**08075400**
Watershed Area (sq. mile)	14.9	57.8	19.3	16.2	7.7	10.1	9.4	20.7
NRCS Curve Number	75.4	73.3	77.7	83.7	78.0	74.4	82.6	83.2
Average Annual Rainfall (inch)	53.1	51.8	52.7	52.4	52.2	53.3	53.0	50.3
Percentile	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**
61	0.41	9.5	1.2	5.9	0.52	4.6	6.4	4.0
62	0.40	9.5	1.1	5.7	0.51	4.6	6.4	3.9
63	0.39	9.4	1.1	5.6	0.50	4.5	6.3	3.8
64	0.38	9.4	1.1	5.5	0.49	4.5	6.2	3.7
65	0.37	9.4	1.0	5.4	0.48	4.5	6.2	3.7
66	0.36	9.3	1.0	5.2	0.47	4.4	6.1	3.6
67	0.35	9.3	1.0	5.2	0.46	4.4	6.1	3.5
68	0.34	9.3	1.0	5.0	0.45	4.4	6.0	3.4
69	0.33	9.3	0.93	5.0	0.44	4.3	6.0	3.3
70	0.32	9.3	0.91	4.9	0.42	4.2	5.9	3.2
71	0.31	9.2	0.88	4.8	0.41	4.2	5.9	3.1
72	0.30	9.2	0.87	4.7	0.40	4.1	5.8	3.0
73	0.29	9.2	0.84	4.7	0.39	4.1	5.8	2.9
74	0.28	9.2	0.81	4.6	0.38	4.0	5.7	2.8
75	0.27	9.1	0.78	4.5	0.37	4.0	5.7	2.8
76	0.26	9.1	0.76	4.4	0.36	3.9	5.7	2.7
77	0.25	9.1	0.73	4.4	0.34	3.9	5.6	2.6
78	0.24	9.1	0.70	4.3	0.33	3.9	5.6	2.5
79	0.23	9.1	0.68	4.2	0.32	3.8	5.5	2.4
80	0.22	9.0	0.65	4.1	0.31	3.6	5.5	2.3
81	0.21	9.0	0.62	4.1	0.29	3.6	5.4	2.2
82	0.20	9.0	0.59	4.0	0.28	3.5	5.3	2.1
83	0.19	9.0	0.57	3.9	0.27	3.4	5.3	2.1
84	0.18	8.9	0.54	3.8	0.26	3.4	5.2	2.0
85	0.17	8.9	0.51	3.8	0.25	3.4	5.2	1.9
86	0.16	8.8	0.48	3.7	0.23	3.3	5.2	1.8
87	0.15	8.8	0.46	3.6	0.22	3.3	5.1	1.7
88	0.14	8.7	0.44	3.5	0.21	3.3	5.0	1.6
89	0.13	8.7	0.42	3.4	0.20	3.2	4.9	1.6
90	0.12	8.6	0.39	3.3	0.19	3.2	4.9	1.5

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WQ Station	16493	14229	16477	16473	17068	17069	17071	
	Chigger Creek	**Clear Creek Above Tidal**	**Cowart Creek**	**Marys Creek**	**Hickory Slough**	**Turkey Creek**	**Mud Gully**	**Sims Bayou at Hiram Clarke St, Houston, TX***
Segment	1101B	1102	1102A	1102B	1102C	1102D	1102E	
USGS Gage Reference	08075400	08075400	08075400	08075400	08075400	08075400	08075400	**08075400**
Watershed Area (sq. mile)	14.9	57.8	19.3	16.2	7.7	10.1	9.4	20.7
NRCS Curve Number	75.4	73.3	77.7	83.7	78.0	74.4	82.6	83.2
Average Annual Rainfall (inch)	53.1	51.8	52.7	52.4	52.2	53.3	53.0	50.3
Percentile	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**	**Q (cfs)**
91	0.11	8.5	0.36	3.2	0.18	3.2	4.8	1.4
92	0.10	8.5	0.33	3.1	0.16	3.2	4.7	1.3
93	0.09	8.5	0.29	2.9	0.14	3.1	4.6	1.2
94	0.07	8.4	0.24	2.8	0.12	3.1	4.5	1.0
95	0.05	8.3	0.19	2.6	0.11	3.1	4.4	0.82
96	0.03	8.2	0.14	2.4	0.08	3.0	4.3	0.62
97	0	8.1	0.10	2.2	0.07	3.0	4.1	0.34
98	0	8.0	0.06	1.7	0.05	2.8	3.8	0.09
99	0	7.9	0.04	1.1	0.04	2.7	3.5	0
100	0	7.6	0	0.12	0	2.5	2.9	0

***USGS Gage Used to Estimate Flows for Ungaged Stations**

APPENDICES J – N*

**** See attached CD***

APPENDIX O
METHOD FOR ESTIMATING FUTURE WWTF PERMITTED FLOWS

Appendix O - Methodology to Project Permitted Flows for WWTFs Discharging to the Clear Creek Watershed

This methodology is intended to estimate future permitted WWTF flows on a watershed basis. The growth in wastewater flow is assumed to be the result of increases in population. A projected flow is initially determined for each WWTF and the flows are subsequently summed by watershed to allow a calculation of additional assimilative capacity and additional capacity for future waste load allocations that may me associated with expanding or new WWTFs. The steps followed for the flow projection are summarized below.

1. Projection of flows from municipal/residential mobile home discharges

- Find population estimates from TWDB for municipalities and county facilities (Table O-1).
- For residential mobile home parks, determine the city where they are located
- Find all the municipal/home park outfalls for a given city and find the total permitted flow (Table O-2).
- Find gallons/capita/day (GPCD) by city by dividing the total permitted flow per city by the population in 2010 (Table O-3).
- Determine the fraction of flow that a given outfall corresponds to respect to the total permitted flow for the city it falls in (Table O-4).
- Calculate projected flow for 2050 by multiplying the GPAD for the city by the fraction of flow for the given facility by the population for 2050 for the city where the facility is located (Table O-4).

2. Projection of flows from industrial discharges

- Determine the percent increase in water demand from manufacturing facilities between 2010 and 2050 by county (from the TWDB projections).
- Multiply the current permitted flow for the facility by the expected percent increase in manufacturing industry water demand for the county in which the facility is located. This is the projected flow for 2050 (Table O-4).
- The Gulf Coast Waste Disposal Authority facility (Blackhawk Regional WWTF) treats a combination of the municipal sewage from the city of Friendswood and effluent from manufacturing industries. Thus, the projected flow in 2050 was calculated as the sum of the projected flow from the city (calculated as outlined in the municipal/residential mobile homes category) and the projected increase in flow using the percent increase in water demand for the manufacturing industry in Harris County (Table O-4).

3. Calculation of flows by watershed

- Add up the flows discharging to a given water body (Table O-5).
- Use the projected flow to recalculate LDCs or to re-run the tidal prism model for future conditions.

Table O-1 TWDB Population Projections

Water User Group	County Name	P2000	P2010	P2020	P2030	P2040	P2050
Alvin	Brazoria	21,413	23,231	25,123	26,935	28,605	30,375
Brazoria County MUD #1	Brazoria	4,110	7,517	11,063	14,458	17,587	20,904
Pearland	Brazoria	35,696	63,685	80,689	96,167	110,461	125,585
League City	Galveston	45,306	53,403	60,392	64,532	66,207	67,454
Friendswood	Galveston	21,237	24,553	27,415	29,110	29,796	30,307
Harris County WCID #89	Harris	2,430	2,475	2,519	2,562	2,605	2,648
Houston	Harris	1,919,813	2,199,988	2,472,783	2,741,099	3,006,695	3,270,641
Nassau Bay	Harris	4,170	4,170	4,170	4,170	4,170	4,170
Webster	Harris	9,083	13,076	16,964	20,788	24,573	28,334

Table O-2 Total Permitted Flows by City

Permit	Permittee	Segment	Use Population Projection For	Permitted Flow (MGD)
12332-001	Brazoria County MUD 1	1102	Brazoria County MUD 1	2.4
10005-001	City of Alvin	2432	City of Alvin	5
14440-001	R. West Development Co Inc	1104	City of Alvin	0.24
12935-001	K C Utilities	1104	City of Alvin	0.05
12822-001	Walker Water Works Inc	1102	City of Alvin	0.035
14039-001	Walker Water Works Inc	2432	City of Alvin	0.056
10134-002	City of Pearland	1102	City of Pearland	4.5
10134-007	City of Pearland	1102	City of Pearland	2
10134-008	City of Pearland	1102	City of Pearland	2
10134-010	City of Pearland	1102	City of Pearland	2.5
10134-007	City of Pearland	1102	City of Pearland	2.5
12849-001	CMH Parks Inc	1102	City of Pearland	0.075
13865-001	TIKI Leasing Co Ltd	1102	City of Pearland	0.049
12680-001	H & R Realty Investments	1102	City of Pearland	0.012
13864-001	Fresno Manufacturing LLC	1102	N/A Used Manufacturing % Increase for Fort Bend County	0.0084
10568-003	City of League City	1101	City of League City	0.66
10568-005	City of League City	1101	City of League City	7.5
10495-002	City of Houston	1007	City of Houston	25
10495-003	City of Houston	1007	City of Houston	28
10495-009	City of Houston	1007	City of Houston	7
10495-010	City of Houston	1007	City of Houston	2

Permit	Permittee	Segment	Use Population Projection For	Permitted Flow (MGD)
10495-016	City of Houston	1006	City of Houston	7
10495-030	City of Houston	1014	City of Houston	26.4
10495-037	City of Houston	1007	City of Houston	60
10495-050	City of Houston	1007	City of Houston	3.75
10495-053	City of Houston	1007	City of Houston	4
10495-065	City of Houston	1007	City of Houston	3
10495-075	City of Houston	1102	City of Houston	6.14
10495-076	City of Houston	1017	City of Houston	21
10495-077	City of Houston	1006	City of Houston	7.25
10495-078	City of Houston	1016	City of Houston	8
10495-079	City of Houston	1102	City of Houston	5.33
10495-090	City of Houston	1007	City of Houston	200
10495-095	City of Houston	1007	City of Houston	7.2
10495-099	City of Houston	1017	City of Houston	4
10495-100	City of Houston	1016	City of Houston	3.7
10495-101	City of Houston	1016	City of Houston	4
10495-109	City of Houston	1014	City of Houston	12
10495-111	City of Houston	1007	City of Houston	13.3
10495-112	City of Houston	902	City of Houston	0.82
10495-115	City of Houston	1016	City of Houston	3
10495-116	City of Houston	1007	City of Houston	18
10495-119	City of Houston	1007	City of Houston	23
10495-122	City of Houston	1016	City of Houston	5
10495-126	City of Houston	1016	City of Houston	2
10495-133	City of Houston	1016	City of Houston	3
10495-135	City of Houston	1014	City of Houston	3.5
10495-136	City of Houston	1113	City of Houston	5
10495-139	City of Houston	1017	City of Houston	0.995
10495-146	City of Houston	1002	City of Houston	6.6
10495-148	City of Houston	1016	City of Houston	0.49
10495-149	City of Houston	1002	City of Houston	0.95
10495-150	City of Houston	1016	City of Houston	0.7
10495-151	City of Houston	1006	City of Houston	0.75
10526-001	City of Nassau Bay	1101	City of Nassau Bay	1.33
10520-001	City of Webster	1101	City of Webster	3.3

Permit	Permittee	Segment	Use Population Projection For	Permitted Flow (MGD)
11571-001	Gulf Coast WDA & City of Friendswood	1101	City of Friendswood and % Increase Manufacturing for Harris County	9.25
12939-001	Harris County WCID #89	1102	Harris County WCID #84	0.95

Table O-3 GPCD by City

Municipality/County MUD	Total Permitted Flow (MGD)[A]	Population 2010[b]	GPCD Year 2010[c]
Brazoria County MUD 1	2.4	7,517	319
City of Alvin	5.381	23,231	232
City of Friendswood	9.25	24,553	377
City of Houston	532.026	2,199,988	242
City of League City	8.16	53,403	153
City of Nassau Bay	1.33	4,170	319
City of Pearland	13.636	63,685	214
City of Webster	3.3	13,076	252
Harris County WCID #84	0.95	2,475	384

[a] *Sum of permitted flows in Table O-2 for each city*
[b] *From Table O-1*
[c] *Total permitted flow*10^6/Population 2010*

Table O-4 Flow Projections

Permitted Flow (MGD)	Receiving Water	Use Pop Projection From	GPCD[a]	Pop 2050[b]	% Flow In City[c]	Flow 2050[d] (MGD)	Adj Flow 2050[e] (MGD)
1.33	Clear Creek Tidal	City of Nassau Bay	319	4,170	100%	1.33	1.33
7.5	Clear Creek Tidal	City of League City	153	67,454	91.9%	9.473	9.473
9.25	Clear Creek Tidal	City of Friendswood And % Increase Manufacturing	377	30,307	100.0%	11.418	13.546
6.14	Turkey Creek	City of Houston	242	3,270,641	1.20%	9.128	9.128
5.33	Mud Gully	City of Houston	242	3,270,641	1.0%	7.924	7.924
4.5	Clear Creek Above Tidal	City of Pearland	214	125,585	33.0%	8.874	8.874
4	Mary's Creek	City of Pearland	214	125,585	29.3%	7.888	7.888
3.3	Clear Creek Tidal	City of Webster	252	28,334	100%	7.151	7.151
2.5	Clear Creek Above Tidal	City of Pearland	214	125,585	18.30%	4.93	4.93
2.4	Mary's Creek	Brazoria County MUD 1	319	24,368	100%	7.78	7.78
2	Clear Creek Above Tidal	City of Pearland	214	125,585	14.7%	3.944	3.944
2	Clear Creek Above Tidal	City of Pearland	214	125,585	14.7%	3.944	3.944
0.95	Clear Creek Above Tidal	City of Pearland	214	125,585	7.00%	1.873	1.873
0.95	Clear Creek Above Tidal	Harris County WCID #84	384	2648	100%	1.016	1.016
0.66	Clear Creek Tidal	City of League City	153	67454	8.10%	0.834	0.834
0.075	Hickory Slough	City of Pearland	214	125,585	0.60%	0.148	0.148
0.049	Cowart Creek	City of Pearland	214	125,585	0.40%	0.097	0.097
0.035	Cowart Creek	City of Alvin	232	30,375	0.70%	0.046	0.046
0.012	Mary's Creek	City of Pearland	214	125,585	0.10%	0.024	0.024
0.0084	Clear Creek Above Tidal	Manufacturing % Increase	NA	NA	NA	0.0084	0.01

[a] *From Table O-3*
[b] *From Table O-1*
[c] *Permitted flow for facility/total permitted flow for the city in which the facility is located*
[d] *GPCD*Population 2050*%flow in city*
[e] *Flow 2050+Permitted Flow*% increase of manufacturing industry water demand by county (Harris 23% and Fort Bend 14%)*

Table O-5 Projected Flows by Watershed

Watershed	Segment	Projected Permitted Flow (MGD)
Clear Creek Tidal	1101	36.4
Chigger Creek	1101B	0.011[a]
Robinson Bayou	1101D	1.6[b]
Clear Creek Above Tidal	1102	24.6
Cowart Creek	1102A	0.1
Mary's Creek	1102B	15.7
Hickory Slough	1102C	0.1
Turkey Creek	1102D	9.1
Mud Gully	1102E	7.9

[a] *There are currently no WWTFs discharging to Chigger Creek, so the projected increase in permitted flow for the closest WWTF (12822-001) was assigned to this watershed and subtracted for the total permitted flow projected to be discharged to segment 1102A.*

[b] *There are currently no WWTFs discharging to Robinson Bayou, so half of the projected increase in permitted flow for the closest WWTF (10568-005) was assigned to this watershed and subtracted for the total permitted flow projected to be discharged to segment 1101.*