

**Gulf Coast Region Water and Wastewater
Needs Assessment
2007**

“To promote the preservation, protection, and enhancement of ground water and surface water quality through coordination and integration of water quality programs in the 13-county Gulf Coast Region.”

– Houston--Galveston Area Council
Water Quality Management Program Mission Statement

August 21, 2007

**PREPARED IN COOPERATION WITH THE
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY AND
U.S. ENVIRONMENTAL PROTECTION AGENCY**

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H-GAC Region Forecast for Water and Wastewater Needs - 2035

Introduction

The Gulf Coast Water Quality Management Planning Region follows the southeast Texas coastline from Bolivar Island to Palacios, reaching inland to the piney woods of Huntsville and Lake Livingston to the north, westward through Columbus to Weimar, and eastward through Anahuac to Winnie. The region encompasses approximately 12,500 square miles in 13 counties including Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Harris, Liberty, Matagorda, Montgomery, Walker, Waller, and Wharton. According to the 2000 Census, the region's population was 4,854,454, an increase of 957,312 people (25%) since 1990 (U.S. Census Bureau 2000 Census). The Houston-Galveston Area Council (H-GAC) forecasts project an increase in population of 40% over the next twenty years with the greatest growth expected in Harris, Brazoria, Fort Bend, Galveston, and Montgomery Counties (Houston-Galveston Area Council. 2035 Regional Growth Forecast. 2006).

The 2007 Regional Water and Wastewater Needs (RWWN) examines population forecasts, projected water needs, and projected wastewater treatment plant cost needs in 2035 for watersheds in eight counties—Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller. Thus, it is a companion piece to the Regional Growth Forecast developed to assess transportation needs and economic growth in the 8-county area rather than an assessment of the entire H-GAC 13-county region. The RWWN - 2035 is useful as a planning guide for implementation measures that conserve water use, plus control and/or prevent water quality problems.

The purpose of this document is to present data reflecting the overall need for water in the region in million gallons per day (MGD) and the cost of wastewater treatment facility construction, either new or expansion, to meet the resultant wastewater treatment needs

Forecast Model

Overview. The Houston-Galveston Area Council (H-GAC) compiles the wastewater facility information in this report to assist the Water Quality and Technical Analysis Division of the TCEQ. Additionally, domestic wastewater facility financing decisions made by the Texas Water Development Board (TWDB) under the State Revolving Loan Fund (SRF) program must be consistent with the certified and approved Water Quality Management Plan (WQMP) developed by H-GAC for its region and TCEQ for the entire state.

Forecast Methodology. There are two major phases in the forecasting process. In phase I, H-GAC develops county-level control totals for population, households and employment. In phase II, H-GAC allocates these control totals to specific areas within each county. To this is added a Phase III, or using the forecast model to project water needs, and by analogy wastewater needs plus underlying cost.

Phase I The development of county-level totals for population, number of households, and number of jobs for future years (from 2005 through 2035) is a multi-step process. H-GAC starts by forecasting the total population in the region (eight counties—Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, Waller—combined) using a National population projection from the U.S. Bureau of the Census and applying to it our projection of the region's share in the total U.S. population. In the next step, H-GAC allocates the regional population forecast to the counties using the shares from the two projections (known as “0.5” and “1.0” scenarios) of the county population growth developed by the Texas State Data Center and the Office of the State Demographer. Then, H-GAC derives the forecast for the number of households in each county from the ethnic and age compositions (drawn from the scenarios) of the forecasted county populations and demographic statistical relationships obtained from the 2000 Census data. H-GAC's regional employment forecast is driven by the available future population in the working age labor force. The regional employment forecast is then allocated to the counties using projected shares in the regional employment.

Phase II. For small area allocation H-GAC uses the UrbanSim Land Use Forecasting and Simulation Model. The model breaks the region up into very small, regularly spaced squares where each square has an area of one million square feet, or approximately 23 acres. UrbanSim then analyzes land use dynamics, and determines statistical relationships between different types of land uses and various factors, such as proximity to population and employment, land values, and accessibility over the transportation network. Based on that information, the model makes predictions about the likelihood of certain type of development in certain parts of the region. The model works by “creating” housing units and job slots (non-residential square footage) and then allocating population and employment growth (defined by county control totals) into available housing and job locations.

Forecast Data Sources. A very important part of the modeling process is the preparation of the “base year” data, which describes the existing conditions in the UrbanSim grid cells. The three major data sources for the base year are appraisal data (from county appraisal districts), demographic data (from the U.S. Bureau of the Census), and employment data (company-level data from a proprietary Info-USA database).

Forecast Results. While the elementary geographic unit of the forecast is the UrbanSim grid cell, the forecast results are available for different geographic units (Regional Analysis Zones, Transportation Analysis Zones, Census Tracts, Cities, Zip codes). Forecast for these standard areas is derived by aggregating (summing up) results for individual UrbanSim grid cells located within each standard area. Upon request, H-GAC's staff will generate a forecast for a user-

defined area. Although the H-GAC's Forecasting staff strives to ensure the best data quality possible, we cannot offer an unqualified guarantee or warranty for the data. Due to statistical properties of error propagation, higher levels of aggregation will necessarily contain less error than the lower ones. Therefore, H-GAC's Forecasting staff suggests and recommends the use of the largest possible geographic units.

The source of the population forecast data is H-GAC's Regional Growth Forecast, which was formulated in 2005. The forecast model divided the entire region into about a quarter million grid cells (square blocks 1000 feet to a side). For every grid cell, the forecast model predicts the number of people who will be residing in it in a given forecast year (2005 through 2035). To determine the population, people are "poured" into the respective service area boundaries. The aggregation (summing up) of the population from the grid cells that fall into a larger a real unit, the SAB allows for the needs determination. The forecast model gives planners a reasonable prediction for future population and wastewater treatment needs in different parts of the region.

Water Needs Forecasts.

The following Table 1 contains the updated information for population and water needs in the 8-county region. The Table includes the following:

1. Stream Segment - The classified stream segment into which any recommended facility may discharge existing or projected wastewater. In the case of no-discharge facilities, this is a classified stream segment drainage area in which the facilities are located.
2. Watershed - Area in square miles and percentage covered by utility districts and/or cities.
3. Population in 2005 - H-GAC base forecast year. The year is the first year in our simulation model using UrbanSim, which uses a disaggregate agent-based land use simulation model. This is the state-of-the-art in its field application. The model doesn't track individual buildings or distinguish between single-family and multi-family units. It's useful in situations when a prediction about the spatial distribution of population and employment in the future is needed. H-GAC has applied the model to water and wastewater needs in the 8-county region.
4. Population in 2035 - From H-GAC Regional Forecast. See methodology above.
5. Forecast Water Demand (MGD) in 2005 - Calculated by multiplying the 2005 forecast population by 175 gallons/person/day. This number is based on the average gallons/per/person/day for the region calculated using EPA PCS data in 2005 as part of the Water Quality Management Plan wasteload determinations.

6. Forecast Water Demand in (MGD) in 2035 - Calculated by multiplying the 2035 forecast population by 175 gallons/person/day.

Table 1: Water Needs Forecast for 2035 by Stream Segment

Stream Segment	Watershed	Watershed Area (square miles)	Area Covered by Utility Districts & Cities (%)	Population in 2005* (thousands)	Population in 2035* (thousands)	Water Demand in 2005* (MGD)	Water Demand in 2035* (MGD)
901	Cedar Bayou Tidal	68.3	10%	6.9	13.2	1.0	1.9
902	Cedar Bayou Above Tidal	104.7	1%	0.3	0.7	0.0	0.1
1001	San Jacinto River Tidal	62.6	10%	13.4	28.9	2.0	3.9
1002	Lake Houston	291.9	6%	26.0	70.4	3.7	9.1
1003	East Fork San Jacinto River	403.5	1%	3.9	6.1	0.5	0.8
1004	West Fork San Jacinto River	215.8	29%	63.5	142.0	9.9	21.6
1005	HSC	123.1	16%	87.9	113.0	12.3	14.8
1006	HSC/Buffalo Bayou	278.7	75%	1174.3	1435.3	177.0	214.5
1007	Houston Ship Channel/San Jacinto River	48.7	36%	29.1	51.2	4.1	7.1
1008	Spring Creek	452.9	19%	179.0	306.4	25.6	42.2
1009	Cypress Creek	305.5	23%	243.5	388.0	30.3	44.6
1010	Caney Creek	222.0	8%	12.8	30.4	2.0	4.6
1011	Peach Creek	150.7	3%	3.6	7.5	0.6	1.1
1012	Lake Conroe	455.8	3%	14.7	28.0	1.8	3.7
1013	Buffalo Bayou Tidal	6.7	18%	5.0	6.7	0.8	1.0
1014	Buffalo Bayou Above Tidal	357.9	30%	496.2	636.0	71.2	88.3
1015	Lake Creek	327.2	No Permit	.	.	.	.
1016	Greens Bayou	138.7	48%	174.6	306.5	22.8	39.5
1017	White Oak Bayou Above Tidal	108.8	14%	67.9	90.8	8.6	11.2
1101	Clear Creek Tidal	44.6	34%	25.3	45.7	3.7	6.9
1102	Clear Creek Above Tidal	112.0	63%	141.8	213.0	21.0	30.9
1103	Dickinson Bayou Tidal	60.2	50%	35.1	54.7	5.5	8.6
1104	Dickinson Bayou Above Tidal	45.0	17%	10.0	13.0	1.6	2.0
1105	Bastrop Bayou Tidal	217.4	5%	24.1	27.3	3.6	4.1
1107	Chocolate Bayou Tidal	36.7	No Permit	.	.	.	.
1108	Chocolate Bayou Above Tidal	110.8	5%	4.7	10.3	0.7	1.3
1109	Oyster Creek Tidal	32.1	21%	13.1	15.3	2.0	2.3
1110	Oyster Creek Above Tidal	154.1	3%	10.5	22.1	1.5	2.9

Stream Segment	Watershed	Watershed Area (square miles)	Area Covered by Utility Districts & Cities (%)	Population in 2005* (thousands)	Population in 2035* (thousands)	Water Demand in 2005* (MGD)	Water Demand in 2035* (MGD)
1111	Old Brazos River Channel	5.3	No Permit	.	.	.	.
1113	Armand Bayou Tidal	64.5	65%	112.9	174.9	18.1	27.4
1301	San Bernard River Tidal	131.3	No Permit	.	.	.	.
1302	San Bernard River Above Tidal	864.5	No Permit	.	.	.	.
2421	Upper Galveston Bay	143.6	29%	70.9	116.6	10.7	17.7
2423	East Bay	98.2	No Permit	.	.	.	.
2424	West Bay	505.0	12%	86.9	131.1	13.3	19.9
2425	Clear Lake	7.7	35%	5.0	7.4	0.7	1.0
2426	Tabbs Bay	34.1	47%	21.3	36.5	3.3	5.6
2431	Moses Lake	32.4	100%	21.0	32.9	3.4	5.3
2437	Texas City Ship Channel	6.9	97%	4.5	7.2	0.7	1.2
2439	Lower Galveston Bay	194.8	11%	46.9	67.5	7.7	11.1
Totals		7024.7		3236.7	4636.8	471.7	658.1

* H-GAC Forecast

** Assumes 175 gallons/day/person

Wastewater Treatment Needs and Costs

The following Table 2 contains the updated information for wastewater treatment needs water in the 8-county region. The Table includes the following:

1. *Stream Segment* - The classified stream segment into which any recommended facility may discharge existing or projected wastewater. In the case of no-discharge facilities, this is a classified stream segment drainage area in which the facilities are located.
2. *Watershed* - Area in square miles.
3. *Permitted Wastewater Treatment Capacity -2005* - Obtained from wastewater permits in the region.
4. *Wastewater Treatment Capacity Forecast for 2035 (110%)*- Once the population for an area is determined by aggregating population from the grid cells or the elementary units, it is multiplied by 175 gallons per person per day. The water use figure is the average value determined from data in H-GAC's Regional Water Quality Management Plan Update. A 10% contingency is included in the figure.
5. *Wastewater Treatment Capacity Deficit* - Gallons of wastewater needing treatment less the capacity available in million gallons per day.
6. *Forecast Cost of the Wastewater Treatment Capacity Needed in 2035* - Calculated by multiplying the 2035 forecast capacity deficit by \$3.50 and shown in millions of dollars. Wastewater treatment facility construction costs, including collection lines, were obtained from two reputable consulting firms that are well experienced in designing wastewater collection and treatment facilities. Costs covered a range of \$3-4 per gallon. H-GAC averaged the two estimates for planning purposes. Collection System costs for planning are estimated at \$20,000/acre based on the cost of linear foot of pipe. These costs are subject to change depending upon situational needs and types of systems (gravity vs. force main collection systems; how many lift stations needed, etc.) and, as stated, are for planning purposes only.

Table 2: Wastewater Treatment Capacity Deficit and Cost for Supply in 2035

Stream Segment	Watershed	Watershed Area (square miles)	Area Covered by MUDs (%)	2005 Treatment Permitted Capacity* (MGD)	2035 Capacity Need (70%) (MGD)	2035 Capacity Deficit (MGD)	Cost of Capacity Deficit ** (\$ million)
901	Cedar Bayou Tidal	68.3	10%	2.0	1.3	0	0
902	Cedar Bayou Above Tidal	104.7	1%	0.8	0.1	0	0
1001	San Jacinto River Tidal	62.6	10%	2.6	2.8	0.1	0.45
1002	Lake Houston	291.9	6%	16.0	6.4	0	0
1003	East Fork San Jacinto River	403.5	1%	0.8	0.5	0	0
1004	West Fork San Jacinto River	215.8	29%	14.7	15.1	0.4	1.24
1005	Houston Ship Channel (HSC)	123.1	16%	13.6	10.4	0	0
1006	HSC/Buffalo Bayou	278.7	75%	171.2	150.2	0	0
1007	HSC/San Jacinto River	48.7	36%	5.9	5.0	0	0
1008	Spring Creek	452.9	19%	20.4	29.5	9.1	31.88
1009	Cypress Creek	305.5	23%	63.6	31.2	0	0
1010	Caney Creek	222.0	8%	0.7	3.2	2.5	8.80
1011	Peach Creek	150.7	3%	1.1	0.8	0	0
1012	Lake Conroe	455.8	3%	3.5	2.6	0	0
1013	Buffalo Bayou Tidal	6.7	18%	0.5	0.7	0.2	0.82
1014	Buffalo Bayou Above Tidal	357.9	30%	101.7	61.8	0	0
1015	Lake Creek	327.2	No Permts	.	0.0	0.0	0
1016	Greens Bayou	138.7	48%	44.4	27.7	0	0
1017	White Oak Bayou Above Tidal	108.8	14%	10.1	7.8	0	0
1101	Clear Creek Tidal	44.6	34%	4.2	4.8	0.7	2.29
1102	Clear Creek Above Tidal	112.0	63%	27.6	21.7	0	0
1103	Dickinson Bayou Tidal	60.2	50%	7.5	6.0	0	0
1104	Dickinson Bayou Above Tidal	45.0	17%	1.7	1.4	0	0
1105	Bastrop Bayou Tidal	217.4	5%	4.5	2.8	0	0
1107	Chocolate Bayou Tidal	36.7	No Permits	.	0.0	0.0	0
1108	Chocolate Bayou Above Tidal	110.8	5%	3.2	0.9	0	0
1109	Oyster Creek Tidal	32.1	21%	3.3	1.6	0	0

Table 2: Wastewater Treatment Capacity Deficit and Cost for Supply in 2035 (Continued)

Stream Segment	Watershed	Watershed Area (square miles)	Area Covered by MUDs (%)	2005 Treatment Permitted Capacity* (MGD)	2035 Capacity Need (70%) (MGD)	2035 Capacity Deficit (MGD)	Cost of Capacity Deficit ** (\$ million)
1110	Oyster Creek Above Tidal	154.1	3%	1.8	2.0	0.2	0.76
1111	Old Brazos River Channel	5.3	No Permits	.	0.0	0.0	0
1113	Armand Bayou Tidal	64.5	65%	16.5	19.2	2.7	9.35
1301	San Bernard River Tidal	131.3	No Permits	.	0.0	0.0	0
1302	San Bernard River Above Tidal	864.5	No Permits	.	0.0	0.0	0
2421	Upper Galveston Bay	143.6	29%	11.8	12.4	0.6	2.26
2423	East Bay	98.2	No Permits	.	0.0	0.0	0
2424	West Bay	505.0	12%	23.4	13.9	0	0
2425	Clear Lake	7.7	35%	4.7	0.7	0	0
2426	Tabbs Bay	34.1	47%	3.6	3.9	0.3	1.16
2431	Moses Lake	32.4	100%	5.6	3.7	0	0
2437	Texas City Ship Channel	6.9	97%	1.2	0.8	0	0
2439	Lower Galveston Bay	194.8	11%	11.1	7.7	0	0
	Total	7024.7		605.4	460.7	19.4	59.01

* H-GAC Forecast

** Assumes 175 gallons/day/person and at a cost of \$3.50 per gallon

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