EAST TEXAS REGION
(REGION I)

SPECIAL STUDY NO. 5

LNG AND REFINERY EXPANSIONS
JEFFERSON COUNTY

Prepared for
East Texas Regional Water Planning Group

Submitted by
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FINAL REPORT
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TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Lower Neches Valley Authority (LNVA) provides water supply for the majority of industrial users in Jefferson County. Near the end of the planning cycle for the 2006 East Texas Regional Water Plan a number of significant industrial expansions were expected to develop in the near future. The impact of these expansions on water supply could not be defined prior to completion of the 2006 Plan. The purpose of this study was to identify the impact of these expansions on water sources and major strategies required to meet the demands. The results of the study indicate the major industrial growth identified in this report will consume approximately 80% of the remaining available supply, as identified in Chapter 4A, Appendix B of the 2006 Water Plan, by the end of the planning period in 2060. The majority of the usage is associated with LNG facilities. This increase should warrant a closer review of LNVA supply and demands in future planning cycles.

WATER DEMANDS FOR REFINERY EXPANSIONS AND LNG FACILITY

The 2006 East Texas Regional Water Plan (Chapter 4A, Appendix B) projected the Jefferson County manufacturing demands being met by the LNVA. The demands are provided in Table 1.

Table 1. LNVA supplied Jefferson County Manufacturing Demands – 2006 Water Plan

Year	2010	2020	2030	2040	2050	2060
Annual Demand, Ac-Ft.	211,779	241,259	266,696	291,954	314,844	339,461

The LNVA provided data regarding demands for existing facilities and demands expected by expansion or new facilities. Table 2 provides a projection of the demands by current status of the facility, classification by type of use and the number in each category. The following is the basis on which the demands were derived for each status category. The demands also include projection for system loss (which declines from 10% to 6% during the planning period).

Existing Facilities: Usage is based on current contracts.

Under Construction/Announced Facilities: Usage is based on contract quantities.

Future Anticipated Demands: LNVA has received inquiry for water supply to projects that have not received finance commitment. The LNG facility, the largest user, has received FERC licensing but a commitment to fund the project has not been announced.

Beyond the identified specific projects, there is normal growth in demand other than major expansions. Growth demands in the 2006 Water Plan were moved into the decade 2040 and beyond, along with the previously discussed system losses, to account for unidentified growth.

Table 2. Projected Industrial Water Demand for Jefferson County based on Identified Expansions

Facility Classification			Projected Industrial Demand in Jefferson County					
Status	Type	No.	2010	2020	2030	2040	2050	2060
Existing Facilities	Petrochemical	16	138,120	136,875	135,631	134,387	133,142	131,898
Under Construction	Petrochemical	3		43,104	42,712	42,320	41,928	41.536
	Storage	3	21,756	21,560	21,634	21,168	20,972	20,776
	LNG	1		197,148	195,355	193,563	191,771	189,979
Announced Facilities	Petrochemical	1		14,787	14,653	14,518	14,384	14,250
Future Anticipated Demands	Petrochemical	1		30,807	30,527	30,246	29,966	29,686
	Storage	2		11,990	11,881	11,772	11,663	11,554
	LNB	1			293,036	290,347	287,659	284,970
Total Demands Based on Identified Major Expansions			**159,876**	**456,270**	**745,158**	**738,321**	**731,485**	**724,649**
Decadal Growth Projected in 2006 Water Plan						**27,000**	**53,500**	**79,500**
Total Projected Demand			**159,876**	**456,270**	**745,158**	**765,321**	**784,985**	**804,149**

The variation from the projections for the demands in the 2006 Water Plan (Table 1) and the current projections (Table 2) is presented in Table 3. The reduction in the year 2010 is mainly attributed to the use of contract amounts as opposed to the maximum historical usage.

Table 3. Change in LNVA Supplied Jefferson County Manufacturing Demands

Year	2010	2020	2030	2040	2050	2060
Change in Annual Demand, Ac-Ft.	-51,903	215,011	478,462	473,367	470,141	464,688

CAPACITY OF INFRASTRUCTURE TO MEET NEEDS

The majority of the impact to the LNVA system is from the demand for LNG. The LNVA indicates the existing canals are adequate to deliver the required demand to the end of the existing system located approximately nine miles from the LNG site. LNVA indicates some improvements will be required at a minimal number of crossings that have been constructed on the system. The strategy to meet the demand was limited to evaluating facilities needed to deliver water from the end of the LNVA canal to the location of the LNG facility.

WATER MANAGEMENT STRATEGIES

The available supply to meet the change in manufacturing demands is derived from Chapter 4A, Appendix B of the 2006 Water Plan for the LNVA system. Table 4 addresses the impact of the increase in industrial demands on the available supplies.

Table 4. Impact of Revised Manufacturing Demands on Balance of Available Supply

Year	2010	2020	2030	2040	2050	2060
Available Supply, Ac-Ft.	705,264	671,774	643,154	615,156	589,886	564,046
Annual Demand, Ac-Ft.	-51,903	215,011	478,462	473,367	470,141	464,688
Supply Balance	757,167	456,763	464,692	141,789	128,745	99,358

The new demands can be met by the available supplies. However, the demands significantly reduce the available supplies in the later portion of the planning period. A review of the full demands on the LNVA system as presented in Chapter 4A, Appendix B of the 2006 Water Plan may be warranted in light of the information generated from this report.

The only major strategy related to this study is the supply from the LNVA canal system to the LNG facility that is under construction. Subtracting the system delivery losses, the infrastructure need for this strategy was based on 179,200 acre-feet/year. This yield remains constant from 2020 to 2060. The route from the end of the existing LNVA facilities to the LNG facility is difficult because of existing industrial development, wetlands and waterways. Evaluation of two different route options and three pipeline size scenarios indicates the best option to be a single 96” diameter pipeline with a length of some 8.9 miles. A total of five pumps, one 22,200 gpm/600 horsepower low flow pump and four 37,000 gpm/600 horsepower high flow pumps were selected for developing the cost of the

strategy. The cost summary for the strategy is provided in the Table 5.

Table 5. Strategy to Supply water for LNG Facility from End of LNVA System

Strategy	Yield (ac-ft/yr)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
LNVAI-1: Supply to LNG in Jefferson County	179,200	$48,252,088	$14,716,771	$81	$0.25

A detailed summary of the cost is provided in Appendix A.

EVALUATION OF STRATEGY IMPACT

Water management strategies were evaluated for certain impacts. The evaluation is based on a numeric evaluation and is provided in the following Table 6.

Table 6. Evaluation of Impact

Strategy Key	Reliability	Impacts on the Following				Political Feasibility
		Environmental	Agricultural Resources	Other Natural Resources	Key Water Quality Parameters	
LNVAI-1	1	3	1	1	1	1

Five of the impact areas receive a minimal impact ranking. The proposed strategy provides a reliable means of transporting water to the facility. There is adequate supply to meet the demand of the strategy without impact to agricultural resources. There are no known major impacts to other natural resources or water quality. Environmental impacts are temporary disturbance to possible wetland areas and re-warming of water prior to discharge. The fresh water may have an environmental benefit for re-use in supply to wetlands.

Appendix A

LNVA Supply to new LNG Facility North to Sabine Pass

LNVA Supply (from its own Gulf States Canal west of Port Arthur on SP RR south of Highway 73) to new LNG facility N of Sabine Pass

	2000	2010	2020	2030	2040	2050	2060
Required water, af/y		179200	179200	179200	179200	179200	179200
Distribution Design, gpm (1.2*Reqd)		133307	133307	133307	133307	133307	133307
Supplied water, MGD		160	160	160	160	160	160
Distribution Cost							
Length Dist. Pipe, feet		47100					
Pumping Rate, gpm		133307					
Pipe Diameter, in		96					
Head Loss/100 feet		0.0987					
Depth to Water Surface, feet		25					
Head Loss in Lift Station, feet		10					
Total Head Required, feet		81.4877					
Total Horsepower, hp		3918.685524					
Cost of Pipeline by footages:							
39100 feet @ $595/lf		$23,264,500					
6900 feet @ $695/lf		$4,795,500					
1100 feet @ $993/lf		$1,092,300					
Pump Station and Intake		$5,100,000					
Total Capital Cost		$34,252,300	0	0	0	$0	0
Engineering & Cont. (30%)		$10,275,690	$0	$0	$0	$0	$0
Interest During Construction		$1,855,348	$0	$0	$0	$0	$0
Total Cost		$46,383,338	$0	$0	$0	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		($4,043,911)	$0	$0	$0	$0	$0
New Plus Existing Debt Service		($4,043,911)	($4,043,911)	($4,043,911)	($4,043,911)	($4,043,911)	($4,043,911)
O&M Cost							
Electricity		(1,763,897)	(1,763,897)	(1,763,897)	(1,763,897)	(1,763,897)	(1,763,897)
O&M		($127,500)	($127,500)	($127,500)	($127,500)	($127,500)	($127,500)
Transmission Line		($291,523)	($291,523)	($291,523)	($291,523)	($291,523)	($291,523)
Raw Water		($5,838,852)	($5,838,852)	($5,838,852)	($5,838,852)	($5,838,852)	($5,838,852)
Total Annual Cost		($6,226,830)	($6,226,830)	($6,226,830)	($6,226,830)	($6,226,830)	($6,226,830)
Unit Cost, $/1000 gallons		($0.11)	($0.11)	($0.11)	($0.11)	($0.11)	($0.11)