LAW OFFICES
ROSE, SUNDSTROM & BENTLEY
A PARTNERSHIP INCLUDING PROFESSIONAL ASSOCIATIONS
2548 BLAIRSTONE PINES DRIVE
TALLAHASSEE, FLORIDA 32301
(904) 877-6555

CHRIS H. BENTLEY, P.A.
JENNIFER S. BRUBAKER
F. MARSHALL DETERDING
BRIAN L. DOSTER
MARTIN S. FRIEDMAN, P.A.
JOHN R. JENKINS, P.A.
STEVEN T. MINDLIN, P.A.
ROBERT M. C. ROSE
DAREN L. SHIPPY
WILLIAM E. SUNDSTROM, P.A.
DIANE D. TREMOR, P.A.
JOHN L. WHARTON

MAILING ADDRESS
POST OFFICE BOX 1567
TALLAHASSEE, FLORIDA 32302-1567
TELECOPIER (904) 656-4029

June 25, 1996

VIA HAND DELIVERY

Blanca S. Bayo, Director
Division of Records and Reporting
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, FL 32399-0850

ACK ✓
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LIN
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RCH
SEC ✓
WAS Golden
OTH

Drawings Forwarded to WAW

Re: Little Sumter Utility Company; Docket No. [redacted]
Application for Original Water and Wastewater Certificates
Our File No. 30059.01

Dear Ms. Bayo:

In response a letter of June 13, 1996, from Martha A. Golden, I am submitting additional information as requested by Ms. Golden and the Staff Engineering Analyst. This information generally follows the request of the Staff as outlined below:

1. Private Fire Protection Tariffs - Attached are two originals of the proposed tariff for private fire protection service and incorporating the rates for private fire protection outlined in our original application.

2. Engineering Plans - The Staff has asked for copies of engineering drawings and plans with the specifics for the treatment plant, water distribution and wastewater collection systems. The Utility does not have final plans in place for the distribution and collection systems. However, one copy of the preliminary drawings for Phase I of the distribution and collection facilities are attached. These, along with the Master Plan developed by CH2M Hill (including preliminary plant drawings) form the basis for the information provided in the application and Exhibit 8 of my May 3, 1996 letter. I trust that this detail will be sufficient to answer all the questions raised by the Staff in this regard. Five copies of the complete Master Plan document are enclosed.

The Staff should be aware that this Master Plan document was not in final form at the time of filing the application and was therefore not supplied at that time.

3. Financial and Rate Schedules - As noted above, the complete Master Plan is attached and does provide the detailed information that the Staff is requesting. In addition, I am attaching five copies of a detailed estimate of Phase I construction costs for water supply treatment and distribution system and for the wastewater treatment and collection systems. In addition, five copies of a detail of the operation and maintenance expenses for Phase I at 80% of capacity and comments concerning their derivation of same are attached hereto.

Should you have any further questions or need any additional information, please let me know.

Sincerely,

ROSE, SUNDSTROM & BENTLEY

F. Marshall Deterding
For The Firm

FMD/lts
Enclosures
cc: Ms. Martha Golden
James McRoy, P.E.
Raj Agarwal, Esquire
Mr. John Wise

NAME OF COMPANY LITTLE SUMTER UTILITY COMPANY

WATER TARIFF

PRIVATE FIRE PROTECTION CHARGES

AVAILABILITY - Available throughout the area served by the company.

APPLICABILITY - Applicable to all connections to the Utility's system for private fire protection facilities.

LIMITATIONS - Subject to all the rules and regulations of this tariff and general rules and regulations of the Commission.

RATES - (Monthly)

Meter Size	Base Facility Charge
2"	$ 3.51
3"	7.01
4"	10.96
6"	21.92
8"	35.07

TERMS OF PAYMENT Bills are due and payable when rendered. In accordance with Rule 25-30.320, Florida Administrative Code, if a customer is delinquent in paying the bill for water service, service may then be discontinued after five working days written notice, separate and apart from any bill for service.

EFFECTIVE DATE - 1996

TYPE OF FILING - Original Certificate

H.G. MORSE
ISSUING OFFICER

PRESIDENT
TITLE

Little Sumter Utility Company
Detail of Operation and Maintenance Expense for Phase I
when Utility Plants are Operating at 80% of Design Capacity

General Comments

As indicated in the Company's filing, Little Sumter Utility Company will be serving almost 3,000 customers and be a large Class B Utility within approximately six years of the commencement of operations. Therefore, the Commission Staff has ample information in its Annual Report data base and Commission Rate Orders on which to judge the reasonableness of the expense estimates used to develop initial rates.

As noted in every Original Certificate Order, the Commission states that it is not setting rate base or determining the actual level of operating expenses. Rather, the Orders generally state that the numbers contained in the Order are simply used as a means to set reasonable initial rates.

That the initial rates requested by Little Sumter are reasonable should be beyond dispute. The proposed water and sewer rates in this proceeding are among the lowest rates requested or approved by the Commission in recent years. As a result, it should be readily apparent that the estimates used to develop such rates are, therefore, reasonable.

Because the plant is not under construction, nor have construction permits been applied for or issued, the estimates for plant construction are based on the Master Plan prepared by CH2M Hill, which conceptualizes the future plant and plans to serve the proposed service area. Expenses related to operations were provided by CH2M Hill based primarily on their experience for similar sized utilities and the plant configurations outlined in the Master Plan. General and administrative expenses were estimated by Cronin, Jackson, Nixon & Wilson, CPA's, which has practiced before the Commission since 1979 and also reviewed the engineer's estimates for reasonableness, based on their experience with similar sized utilities.

As noted in the following schedules, a detailed line item estimate for all expenses used to develop initial rates is not possible to prepare, since the plants are not constructed, much less operational. Additionally, it will be approximately six years before the Company approaches design capacity. Hence, any detailed estimate of future expenses would not be worth the paper on which they are written. Rather, the Company believes the estimates are reasonable when compared to expenses for similar sized utilities and by the extremely low rates such estimates produce. As noted above, the Utility believes the Commission Staff has ample information on other utility systems of similar size for a basis of comparison on which to judge the reasonableness of the Company's expenses and requested rates.

Little Sumter Utility Company
Detail of Operation and Maintenance Expense for Phase I
when Utility Plants are Operating at 80% of Design Capacity

NARUC Account		Water	Sewer
615/715	<u>Purchased power</u> (1) <u>Water</u> 1 well pump @ 100 H.P. operating approximately 30% of the time = 193,433 KWH per year 2 high service pumps @ 150 H.P. operating approximately 14.5% of the time = 282,312 KWH per year Miscellaneous power @ 10 H.P. operating approximately 40% of the time = 26,140 KWH per year Total power = 501,885 KWH per year x $.06 per KWH = $30,113. say $30,000	$ 30,000	
	(2) <u>Sewer</u> 2 Anoxic mixers @ 2 H.P. operating 100% of the time = 26,140 KWH per year 2 Anoxic recycle pumps @ 10 H.P. operating approximately 80% of the time = 104,560 KWH per year 2 aeration blowers @ 75 H.P. operating approximately 40% of the time = 392,100 KWH per year 2 secondary clarifiers @ .75 H.P. operating 100% of the time = 9,800 KWH per year 1 RAS pump @ 5 H.P. operating 100% of the time = 32,675 KWH per year 1 WAS pump @ 3 H.P. operating approximately 25% of the time = 3,920 KWH per year 1 digester blower @ 30 H.P. operating 83% of the time = 130,175 KWH per year 1 effluent pump @ 75 H.P. operating approximately 25% of the time = 98,025 KWH per year Total power = 797,395 KWH per year @ $.06 per KWH = $47,844, say $48,000		$ 48,000
618/718	<u>Chemicals</u> (1) <u>Water</u> Chlorine: Average daily flow of 1.2 mgd @ dosage rate of 6 mg/L = 22,000 lbs per year = 22,000 lbs X $.30 lb = $6,600 per year, say $7,000	$ 7,000	
618/718	(2) <u>Sewer</u> Chlorine: Average flow of 0.36 mgd @ dosage rate of 12 mg/L = 13,160 lbs per year = $3,950, say $4,000		$ 4,000
620/720	<u>Materials and supplies</u> This account includes, but is not limited to, the following items: - parts, materials, lubricants, cleaners, rags, etc. related to routine maintenance of water treatment, distribution, sewer treatment, collection system and lift station plant performed by Utility personnel - all manner of office supplies used by field personnel (paper, pens, pencils, etc.)		

Little Sumter Utility Company
Detail of Operation and Maintenance Expense for Phase I
when Utility Plants are Operating at 80% of Design Capacity

NARUC Account		Water	Sewer
	Materials and supplies (con't.) - phone service at plant office - communications charges - lab supplies	$ 5,000	$ 10,000
	Note: See general comments on page 1. Although an exhaustive list and line item estimate for materials and supplies is impossible to prepare, the following should demonstrate that the above estimates are reasonable: 1. Cronin, Jackson, Nixon & Wilson, CPA's have prepared in excess of 30 Annual Reports each year since 1980 and participated in numerous rate cases. Based on this experience and the size of the Utility, the estimate is conservative and probably understated. 2. CH2M Hill originally provided the estimate based on their experience with similar sized utilities. 3. Staff has processed hundreds of Annual Reports, certificate and rate applications and is in the unique position to determine that the estimated amounts are fair and reasonable. 4. The amounts shown above equate to just $.18 and $.36 per month per ERC (2,345 ERC's @ 80% level of operation) for water and sewer, respectively.		
631/731	Contractual services - engineering This estimate was prepared by CH2M Hill and includes the following services: - Annual Reports required by FDEP - Permitting and regulatory compliance - Consulting/trouble shooting operational problems which occur 'from time to time - Consulting regarding maintenance problems - Review of commercial service agreements for estimated flows, engineering specifications, etc. The estimate is based on 40 hours annually for water and 80 hours annually for sewer at an average hourly rate of $75/hour	$ 3,000	$ 6,000
632/732	Contractual services - accounting These costs are for the services of Cronin, Jackson, Nixon & Wilson, CPA's, and include the following: - Preparation of adjusted year-end general ledger and PSC Annual Report - Annual index and pass-through adjustments - Miscellaneous management advisory services The estimate is based on 40 hours of work at an average hourly rate of $100. The total is allocated 50% to water and 50% to sewer.	$ 2,000	$ 2,000
633/733	Contractual services - legal These costs are the routine and recurring services of Rose, Sundstrom & Bentley and include the following: - Filing index and pass-through adjustments - Representation on rate and tariff matters		

Little Sumter Utility Company
Detail of Operation and Maintenance Expense for Phase I
when Utility Plants are Operating at 80% of Design Capacity

NARUC Account		Water	Sewer
	Contractual services - legal (con't.) - Review and filing of developer agreements - General corporate legal matters The estimate is based on approximately 25 hours @ $150 per hour, plus out-of-pocket expense. The estimated total is allocated 50% to water and 50% to sewer.	$ 2,000	$ 2,000
634/734	Contractual services - management fee The management fee requested is designed to cover all general and administrative (G&A) expenses as follows: 1. Billing & customer accounts 1.5 employees @ $15,000 = $22,500 2. Customer service Will handle customer service requests & new connects 1 employee @ $18,000 = 18,000 3. Accounting Run general ledger, receivables, and payables .5 employee @ $18,000 = 9,000 4. Bills & postage 28,140 bills @ $.22/bill (say) = 7,000 5. Rent, electricity, phone, janitorial Based on $300/month (say) = 3,500 Total $60,000 Allocated 50% water, 50% sewer	$ 30,000	$ 30,000
635/735	Contractual services - other (1) Outside maintenance These expenses include repairs & maintenance which are beyond the capability and daily routine maintenance performed by the Utility maintenance staff. Examples of such repairs would include pump and motor repairs, line breaks, major pump station maintenance, road work, etc. The estimate was provided by CH2M Hill based on judgement and experience with similar sized utilities. Cronin, Jackson, Nixon & Wilson, CPA's, reviewed the estimate and believe that the amounts are well within the level of outside maintenance incurred and approved by the PSC for similar sized utilities. See General Comments and note under materials and supplies which are equally applicable to outside maintenance.	$ 15,000	$ 20,000
	(2) Laboratory testing These expenses were estimated by CH2M Hill based on judgement, experience, and costs for similar sized utilities, as well as their knowledge of current testing requirements. A detailed line item summary of testing requirements and costs is not available at this		

Little Sumter Utility Company
Detail of Operation and Maintenance Expense for Phase I
when Utility Plants are Operating at 80% of Design Capacity

NARUC Account		Water	Sewer
	Laboratory testing (con't.) time, since permits and any special testing conditions are unknown. However, testing at a minimum is expected to include the following:		
	Water Bacteria, lead & copper, well chemical analysis, monitoring wells, organic & pesticides, THM's, secondary water quality, inorganic chemicals, drinking water analysis.		
	Sewer Effluent nitrate, bacteria coliform, primary & secondary tests, sludge analysis, monitoring wells.		
	A comparison of annual testing costs for similar sized utilities will demonstrate that the estimated costs are more than reasonable.	10,000	5,000
	Total estimated contractual services - other	$ 25,000	$ 25,000
657/757	Insurance This estimate was provided by CH2M Hill based on experience for similar sized utilities and costs of insurance for a utility (Sunbelt) formerly owned by the management of Little Sumter.		
	The estimate amounts to approximately $1.70 per thousand dollars of utilty plant.		
	A review of 1995 property and liability insurance costs for Hydratech, Royal, Holiday Pines, and St. Johns Service Co. indicates an average cost per thousand of $2.25. Thus, the Utility believes the estimates used to develop initial rates are reasonable.	$ 6,000	$ 11,000

Little Sumter Utility Company
Detailed Estimate of Phase I Construction Costs for
Water Supply, Treatment and Distribution System

NARUC Account	Description	Unit Cost	Quantity	Estimated Cost
	Supply and treatment			
307	Water supply wells - 16 in.	$ 195,000	2	$ 390,000
320	Chlorination system	80,000	1	80,000
311	High service pumps	66,667	3	200,000
330	Ground storage tank (1.0 mgd)	255,000	1	255,000
304	Site work (5% of construction subtotal)	64,000	Lump sum	64,000
304	Electrical instruments & controls (10% of construction subtotal)	129,000	Lump sum	129,000
309	Yard piping (10% of construction subtotal)	129,000	Lump sum	129,000
(Note 1)	Mobilization, bonding, insurance (3% of construction subtotal)	39,000	Lump sum	39,000
	Construction subtotal			1,286,000
(Note 1)	Construction contingency (15%)			193,000
	Total construction costs			1,479,000
(Note 1)	Engineering, legal & administration (15%)			222,000
	Total estimated supply & treatment costs			1,701,000
	Distribution system			
331	Distribution mains (Note 2)	9.15/L.ft.	141,300 L.ft.	1,293,000
331	Service mains	10.25/L.ft.	49,600 L.ft.	508,000
	Construction subtotal			1,801,000
	Engineering, legal & administration (7%)			126,000
	Total estimated distribution costs			1,927,000
	Total estimated Phase I construction costs before AFUDC			3,628,000
(Note 1)	Estimated AFUDC per Schedule No. 7, Exhibit L			71,071
	Total estimated plant costs			$ 3,699,071

Summary	
Total estimated construction costs	$ 3,699,071
Less allocated costs as follows:	
AFUDC	(71,071)
Engineering, legal & administration related to supply & treatment system	(222,000)
Construction contingency	(193,000)
Mobilization, bonding & insurance	(39,000)
Total costs, Column 1, Schedule No. 6, Exhibit L	$ 3,174,000

Notes: (1) These costs allocated to Accounts 304 through 330 on relative account values, as detailed on Schedule No. 6, Exhibit L.

(2) Average cost for piping includes cost of pipe, fittings, valves, and service connections.

(3) Estimated costs and quantities per the Master Plan prepared by CH2M Hill, previously filed in this proceeding

Little Sumter Utility Company
Detailed Estimate of Phase I Construction Costs for
Sewer Treatment, Disposal, and Collection System (3)

NARUC Account	Description	Unit Cost	Quantity	Total Estimated Cost
	Treatment & disposal plant			
380	Anoxic basins	$ 60,000	1	$ 60,000
380	Aeration basins (2 Train)	140,000	1	140,000
380	Anoxic recycle pumps	15,000	2	30,000
380	Secondary clarifiers	125,000	2	250,000
371	Return activated sludge/waste activated sludge pumps	15,000	4	60,000
380	Effluent filters, traveling bridge	137,500	2	275,000
380.4	Chlorinators	25,000	2	50,000
380.4	Chlorine contact basins	32,500	2	65,000
380	Aerobic digesters	55,000	2	110,000
380	Sludge loading facility	22,500	2	45,000
371	Plant recycle pump station	18,333	3	55,000
380	Blowers (aeration & digestion)	37,500	4	150,000
389	Emergency power generator	90,000	1	90,000
380	Percolation ponds	32,500	2	65,000
371	Effluent pumping	13,333	3	40,000
380	Effluent storage (ponds)	40,000	2	80,000
395	Sludge spray/spreader truck	25,000	1	25,000
354	Maintenance/lab building	25,000	1	25,000
354	Blower building	50,000	1	50,000
354	Chlorine building	13,000	1	13,000
354	Site work (5% of construction subtotal)	113,000	Lump sum	113,000
380	Electrical instruments & controls (10% of construction subtotal)	227,000	Lump sum	227,000
381	Plant sewers (8% of construction subtotal)	181,000	Lump sum	181,000
(Note 1)	Mobilization, bonding, insurance (3% of construction subtotal)	68,000	Lump sum	68,000
	Construction subtotal			2,267,000
	Construction contingency (15%)			340,000
	Total construction costs, excluding engineering			2,607,000
	Engineering & administration (15%)			391,000
	Total estimated construction costs for treatment and disposal system			2,998,000

Little Sumter Utility Company
Detailed Estimate of Phase I Construction Costs for
Sewer Treatment, Disposal, and Collection System (3)

NARUC Account	Description	Unit Cost	Quantity	Total Estimated Cost
	Collection system			
360	Collection sewers - force	5.90	18,800 L.ft.	111,000
361	Collection sewers - gravity	9.25	105,500 L.ft.	976,000
363	Service mains	8.15	60,800 L.ft.	496,000
360	Manholes	1,025	450	461,000
370	Lift stations	51,360	5	257,000
	Construction subtotal			2,301,000
(Note 2)	Engineering, legal, administration (7%)			161,000
	Total estimated construction costs for collection system			2,462,000
	Total estimated construction costs before AFUDC			5,460,000
(Note 1)	Estimated AFUDC per Schedule No. 7, Exhibit L			178,747
	Total estimated sewer plant costs			$ 5,638,747
	Summary			
	Total estimated construction costs			$ 5,638,747
	Less allocated costs as follows:			
	AFUDC			(178,747)
	Mobilization, bonding & insurance			(68,000)
	Construction contingency			(340,000)
	Engineering, legal & administration			(391,000)
	Total costs, Column 1, Schedule No. 6, Exhibit L			$ 4,661,000

Notes: (1) These costs allocated to Accounts 354 and 371 through 395 on relative account values, as detailed on Schedule No. 6, Exhibit L.

(2) These costs allocated to Accounts 360 through 370 on relative account values. Totals, including allocated costs, are in Column 1, Schedule No. 6, Exhibit L.

(3) Estimated costs and quantities per the Master Plan prepared by CH2M Hill, previously filed in this proceeding.

Water and Wastewater Master Plan

Prepared for

Little Sumter Utility Company

Prepared by

CH2M HILL

225 East Robinson Street, Suite 405
Orlando, Florida 32801

April 1996
114935.A0

Water and Wastewater Master Plan

Prepared for

Little Sumter Utility Company

Prepared by

CH2M HILL

225 East Robinson Street, Suite 405
Orlando, Florida 32801

April 1996
114935.A0

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Section

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Tables (continued)

Figures

Section 1
Summary

Purpose

In 1994, The Villages of Lake-Sumter, Inc. (The Villages) in Lady Lake, Florida received approval for the proposed development in Sumter County based on their Development of Regional Impact (DRI) Application for Development Approval (ADA). The land will be developed as an adult residential golfing community similar to the existing developments of The Villages of Lady Lake in Lake County and The Villages of Sumter in Sumter County. The Sumter County development will be served by two water and wastewater utilities. In the first phase of the Sumter County development, water and wastewater utilities will be provided by the existing water and wastewater system of the Village Center Community Development District (VCCDD). Water and wastewater utilities for all other Sumter County property will be provided by the newly formed Little Sumter Utility Company (LSU).

Water and wastewater service in the first phase will be provided by the VCCDD due to the close proximity to the VCCDD water and wastewater facilities. However, service to the Sumter County development beyond the first phase by the VCCDD was questionable. The area outside of the first phase of the Sumter County development is located in the northern and western portions of the Sumter County property while the water and wastewater facilities of the VCCDD are located in the southeastern portion of the Lake County property which is in the eastern portion of the development. In addition, the water and wastewater facilities of the VCCDD were designed to serve only the Villages of Lady Lake and the first phase of the Sumter County development. Thus, serving the western portion of the Sumter County development would be more difficult and costly than establishing LSU and constructing facilities located centrally within its service area.The master plan presents a water and wastewater capital improvements plan for development in the LSU service area. The phased plan covers the following time periods:

Phase 1: 1997 through 2002
Phase 2: 2003 through 2007
Phase 3: 2008 through 2015

Equivalent Residential Connections

The equivalent residential connections (ERC) for water demands and wastewater flows is required to be defined to assist in the Public Service Commission's review of LSU. As stated previously, water demands and wastewater flows were estimated based on a unit demand of 230 gpcd and 61gpcd, respectively for annual average conditions. The 230 gpcd unit water demand was based on total residential, commercial, development uses, and unaccounted-for water. To define an ERC, the commerical and a portion of the unaccounted-for water were subtracted from the total unit demand of 230 gpcd to determine the total estimated residential water demand of 216 gpcd (195 gpcd total residential demand, 11 gpcd unaccounted-for water, plus 10 gpcd development use). The estimated water demand for each category of water use was defined in the *Application for Water Use Permit and Water Conservation Plan (CH2M HILL, October 1995)*. For LSU, an ERC is defined as one dwelling unit with an annual average water demand of 410 gpd (216 gpcd multiplied by 1.9 persons per dwelling unit). The wastewater flow generated from an ERC is 109 gpd based on the wastewater unit flow of 61 gpcd, 1.9 persons per dwelling unit, and the percentage of total residential water demand compared to total water demand (216/230=0.939).

Future Water System

Water Supply and Treatment

The water supply and treatment facilities will be centrally located in the LSU service area to allow optimal water transmission piping and high service pumping. The water supply wells will be located adjacent to the wildlife preserve in the central portion of the LSU service area to minimize land usage to obtain adequate well spacing and minimize sanitary hazard set back requirements. The water supply wells are sized to meet MDD. Three 3.26 mgd wells plus one well to serve as standby will be required to meet buildout water demand conditions. High service pumps are sized to meet PHD or MDD plus fire flow, which ever demand is greater. At buildout conditions, four 3.5 mgd high service pumps plus one pump to serve as standby will be required. It is assumed that water will meet regulatory requirements by treating with chlorine and providing storage (2 million gallons at buildout). Future regulations may require treatment modifications.

Water Distribution System

A preliminary design of the major transmission lines and high service pumping was performed for the water distribution system for the LSU service area. The CYBERNET modeling program was used to assist in the design. The design criteria for sizing the system consisted of keeping a minimum pressure of 20 pounds per square inch (psi) at PHD or MDD plus fire flow. The criteria to provide MDD plus a 1,500 gpm fire flow anywhere in the system governed the sizing of transmission piping. The fire flow requirement was given to CH2M HILL by LSU. Friction factors used in the hydraulic calculations were a Hazen-Williams coefficient (C) of 120 for PVC pipe and 100 for ductile iron pipe.

Future Wastewater System

Wastewater Collection

The wastewater collection system consists of gravity collectors, force mains, service mains, and lift stations. The wastewater flow entering at different points in the system was estimated using 1,360 g/d/acre for PHD conditions based on the area of influence for each point. Manual calculations were performed to size the system. By dividing the system into three construction phases, a cost estimate was developed for the major components of the collection system. The WWTP will not be in operation until December 1998 when there are adequate wastewater flows to start up the facility. Until December 1998, wastewater from the LSU service area will be pumped to the VCCDD WWTP by interconnecting with the VCCDD collection system.

Wastewater Treatment

The WWTP will be located within the LSU service area (see Figure 5-1). The required MMADF buildout capacity of 1.3 mgd can be provided in three 0.45 mgd plant expansions. Wastewater treatment processes will be similar to those used at the WWTP which serves the VCCDD service area. The goal of the WWTP is to meet effluent criteria of 20 mg/l BOD, 5 mg/L TSS, and high level disinfection to produce effluent for reuse via golf course irrigation. During wet weather or when effluent does not meet criteria for public access reuse, effluent will be disposed of in percolation ponds. During these times, the WWTP must meet effluent criteria of 20 mg/L BOD, 20 mg/L TSS, and 12 mg/L nitrate.

Sludge Treatment

Waste activated sludge (WAS) and scum treatment will be achieved by aerobic digestion. Aerobic digesters will include basins and an aeration system with diffusers and blowers. The detention time used to size the digesters is 30 days for a sludge consisting of 1.5 percent solids. Aerobic digestion with a 30 day detention time is not an approved process to significantly reduce pathogens (PSRP) technology under the USEPA 40 CFR Part 503 Sludge Rules. However, the operation of The Villages WWTP aerobic digesters shows that a 30 day detention time is adequate to meet performance criteria for pathogen and vector attraction reduction. The construction of a sludge dewatering facility should be considered as flows increase in later phases of the development to minimize the operational costs of hauling large quantities of liquid sludge to the land application site.

Sludge Disposal

Sludge production volumes for each WWTP phase for ADF conditions for a 5-day SRT were used to estimate land requirements for sludge disposal. The estimated solids concentration of the liquid digested sludge is 1.5 percent. Land requirements were estimated for each phase based on an average total nitrogen content of 5.7 percent for liquid sludge with a total allowable nitrogen loading rate of 320 pounds per acre per year. The site life estimate was based on recent metals analyses performed on the digested sludge of the The Villages WWTP and the pollutant ceiling concentrations of 62-640 FAC, or CFR 40 Part 503 Sludge Rule, whichever were strictest. At buildout conditions, 138 acres will be required for sludge disposal. The estimated life of a site is 43 years with copper loading being the limiting factor. Land estimates calculated are in addition to land required for disposal of sludge from The Villages WWTP.

Effluent Management

As with The Villages WWTP, wastewater effluent for the LSU service area will be reused as much as possible via golf course irrigation. During wet weather or when effluent does not meet criteria for reuse, wastewater effluent will be disposed of in percolation ponds.

The effluent disposal capacity for the golf courses was estimated using the projected construction of golf courses described in the DRI-ADA for the LSU service area. An estimated six golf courses will be constructed in the LSU service area. Golf course V-4, a 60-acre, nine-hole course, will be incorporated into the existing Hacienda Hills course, which receives effluent from The Villages WWTP for irrigation. CH2M HILL used the assumption that nine holes of golf courses would be constructed every two years, starting in 1998.

The estimated average application rate of reuse water on golf courses is 0.68 inches per week, which was used to estimate the annual average day volume of required reuse water. The maximum daily application rate is 0.24 inches over a 10-hour period. These rates were obtained from the Water Conservation Plan (CH2M HILL, July 1994). The LSU WWTP will produce enough effluent to irrigate up to 400 acres of golf course at buildout conditions. The remaining golf courses will require irrigation water from another source (i.e., groundwater, stormwater, or effluent from another WWTP). Due to its distance from the LSU WWTP and the lack of available reuse water when it is constructed, it is assumed that the V-6 golf course (120 acres) will be irrigated by means other than wastewater effluent.

Implementation Plan

Table 1-1 summarizes the order-of-magnitude cost estimates presented in later sections. The costs for the reclaimed water system are not included in Table 1-1 because it is anticipated that these costs will be incurred by The Villages and not by LSU. The implementation plan includes a schedule for design, permitting, and construction of the water supply, water treatment, and wastewater treatment facilities (see Table 1-2). A more detailed proposed schedule of Phase 1 capital improvements is as follows:

- Water Supply and Treatment

Design	April 1996 to June 1996
Permitting	June 1996 to August 1996
Bidding/Award	August 1996
Construction	September 1996 to January 1997
Start up	January 1997

- Wastewater Treatment

Preliminary Design and Permitting	May 1996 to October 1996
Final Design	November 1996 to August 1997
Bidding/Award	September 1997 to November 1997
Construction	December 1997 to December 1998
Start up	December 1998

Table 1-1
Summary of Captial Cost Estimates by Phase
for LSU Water and Wastewater Facilities

Item	Cost ($) Phase 1 (1997 - 2002)	Phase 2 (2003 - 2007)	Phase 3 (2008 - 2015)
Water Distribution System	$1,927,000	$2,095,000	$2,246,000
Water Treatment Plant	$1,701,000	$2,159,000	$624,000
Wastewater Collection System	$2,462,000	$2,714,000	$2,883,000
Wastewater Treatment Plant	$2,998,000	$1,241,000	$1,472,000
Total	$9,088,000	$8,209,000	$7,225,000

Table 1-2
LSU
Implementation Schedule for the Water and Wastewater Treatment System

Equipment/ Facilities		Equipment Quantity/Size of Expansion														
		Year [a]														
		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Water Supply and Treatment	Water Supply Wells	2						1					1			
	High Service Pumps	3						1					1			
	Ground Storage Tank	1						1								
	Chlorination System	1														
Wastewater Treatment	Phase 1			+0.45 mgd												
	Phase 2							+0.45 mgd								
	Phase 3												+0.45 mgd			

mgd=million gallons per day
mg=million gallons
Notes: (a) Schedule reflects end of year startup of equipment or facilities.

Section 2

Purpose and Scope

Description of Development

In 1994, The Villages of Lake-Sumter, Inc. (The Villages) in Lady Lake, Florida received approval for the proposed development in Sumter County based on their Development of Regional Impact (DRI) Application for Development Approval (ADA). This development will later be expanded into property in Marion County. The land will be developed as an adult residential golfing community similar to the existing development of The Villages which consists of The Villages of Lady Lake in Lake County and The Villages of Sumter in Sumter County.

The Sumter County development is planned to occur in phases. Water and wastewater utilities for the initial phase will be provided by the existing water and wastewater system of the VCCDD. Water and wastewater utilities for later phases will be provided by LSU. Figure 2-1 outlines the service area for LSU and its proposed land use.

Recommendations for water and wastewater service needs for LSU are part of CH2M HILL's master planning effort. The master plan presents a phased water and wastewater capital improvements plan for development in the LSU service area. The phased construction covers the following time periods:

- Phase 1: 1997 through 2002
- Phase 2: 2003 through 2007
- Phase 3: 2008 through 2015

Purpose

This report summarizes CH2M HILL's evaluation of water and wastewater system needs for LSU, including water supply, water treatment, water distribution, wastewater collection, wastewater treatment, effluent management, and sludge disposal. The master plan presents projected water demands and wastewater flows and loads through buildout.

Scope

The scope of work for developing and preparing the master plan includes the following tasks:

- Develop water demands and wastewater flow projections through buildout by reviewing historical, current, and future data regarding dwelling units and population. Historical data from the development served by the VCCDD are used to determine unit water demands, unit wastewater flow, unit wastewater loadings, and peaking factors.

- Recommend water system needs by reviewing existing water quality data from the VCCDD water system, identifying potential well field and water treatment plant (WTP) locations, developing preliminary sizing of water treatment processes, laying out major water distribution system facilities (transmission lines 8-inches or greater, pumping, and storage), and developing a phased construction plan with an order-of-magnitude cost estimate.

- Determine future wastewater collection and treatment and disposal needs by sizing treatment facilities, laying out major collection and transmission lines, calculating effluent management requirements for percolation ponds and land application on golf courses, determining sludge treatment and land requirements for sludge disposal, and developing a phased construction plan with an order-of-magnitude cost estimate.

- Prepare an itemized list of recommended water and wastewater capital improvements along with a proposed implementation schedule through buildout.

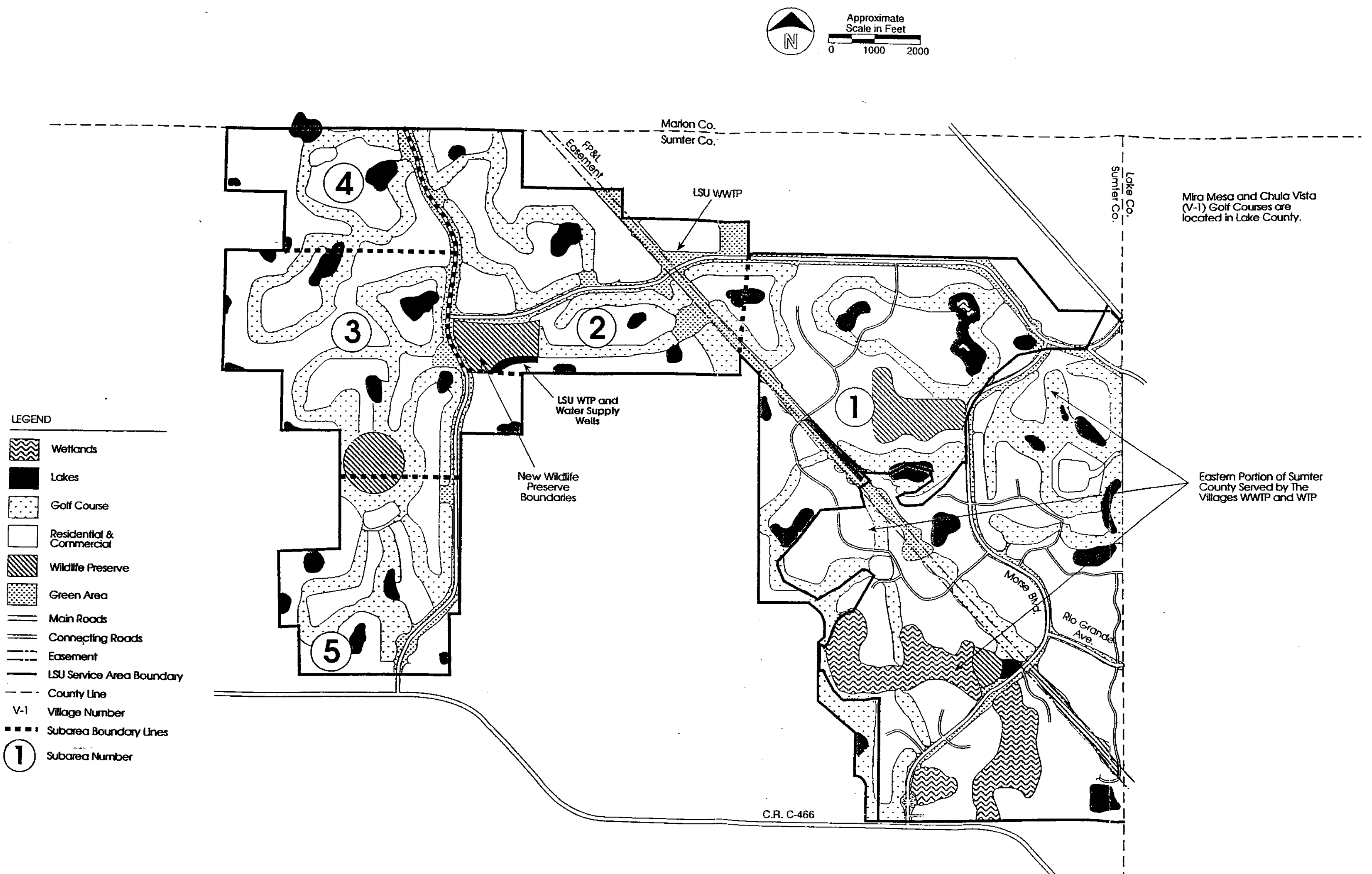

Figure 2-1. LSU Serviced Area Boundary Map.

Section 3
Population and Flow Projections

Population

To establish system sizing requirements in the master plan, population projections were used to estimate water demands and wastewater flows and loading. Population projections were based on a development rate of 600 dwelling units (DU) constructed per year with 1.9 persons per DU in all current development areas, including the LSU service area, and the VCCDD service area.

Table 3-1 shows population projections based on 1.9 persons per DU for the LSU service area. The growth rate of 600 DU per year and the value of 1.9 persons per DU were provided by The Villages and are based upon historical values and future marketing goals. It was assumed that residential construction in the service area would begin in 1997, and the buildout population of 17,013 would occur in year 2015. Buildout in the Sumter County portion of the VCCDD service area and the southern portion of The Villages of Lady Lake (population 10,439) was estimated to occur in year 2000. Figure 2-1 shows boundaries for the LSU service area.

Water Demand Projections

Table 3-2 presents estimated water demands for the LSU service area. Estimated average day flow demand (ADD) was based on 230 gallons per capita per day (g/c/d) as presented in the LSU water use permit application to the Southwest Florida Water Management District (SWFWMD) (CH2M HILL, October 1995). Maximum day demand (MDD) and peak hour demand (PHD) were based on peaking factors of 2.5 and 3.5, respectively, compared to the ADD as required by the Sumter County Comprehensive Plan.

Wastewater Flow and Load Projections

Table 3-3 presents estimated wastewater flows and loadings for the LSU service area. Wastewater flow projections were based on a historical annual average day flow (AADF) of 61 g/c/d. Peaking factors used in the flow projections were 1.25 multiplied by AADF for maximum month average day flow (MMADF) and 3.5 multiplied by AADF for peak hour flow (PHF). Loading projections were based on 0.18 pounds per capita per day (lb/c/d) for MMADF biochemical oxygen demand (BOD) and 0.17 lb/c/d for MMADF total suspended solids (TSS). Per capita flows and loading rates were based on historical data of The Villages WWTP which serves the VCCDD service area.

Table 3-1
Projected Growth Trends for LSU Service Area

	Area 1		Area 2		Area 3		Area 4		Area 5		Total	
Total Acres	974 Acres		627 Acres		586 Acres		200 Acres		312 Acres		2,699 Acres	
Buildout DU	3,168 DU		2,103 DU		1,966 DU		671 DU		1046 DU		8,954 DU	
Buildout Population	6,019 Persons		3,996 Persons		3735 Persons		1,275 Persons		1,987 Persons		17,013 Persons	
	Cumulative		**Cumulative**		**Cumulative**		**Cumulative**		**Cumulative**		**Cumulative**	
Year	DU	Residents	DU	Residents	DU	Residents	DU	Residents	DU	Residents	DU	Residents
1996												
1997	150	285									150	285
1998	500	950									500	950
1999	1,000	1,900									1,000	1,900
2000	1,550	2,945									1,550	2,945
2001	2,150	4,085									2,150	4,085
2002	2,750	5,225									2,750	5,225
2003	3,168	6,019	182								3,350	6,365
2004	3,168	6,019	782	1,486							3,950	7,505
2005	3,168	6,019	1,382	2,626							4,550	8,645
2006	3,168	6,019	1,806	3,431	176						5,150	9,785
2007	3,168	6,019	2,103	3,996	479	910					5,750	10,925
2008	3,168	6,019	2,103	3,996	803	1,526	276	524			6,350	12,065
2009	3,168	6,019	2,103	3,996	1,210	2,299	419	796			6,900	13,110
2010	3,168	6,019	2,103	3,996	1,504	2,858	600	1,140	25	48	7,400	14,060
2011	3,168	6,019	2,103	3,996	1,832	3,481	671	1,275	126	239	7,900	15,010
2012	3,168	6,019	2,103	3,996	1,966	3,735	671	1,275	392	745	8,300	15,770
2013	3,168	6,019	2,103	3,996	1,966	3,735	671	1,275	742	1,410	8,650	16,435
2014	3,168	6,019	2,103	3,996	1,966	3,735	671	1,275	992	1,885	8,900	16,910
2015	3,168	6,019	2,103	3,996	1,966	3,735	671	1,275	1,046	1,987	8,954	17,013

(a) Population projections based on 600 dwelling units (DU) constructed per year with an average of 1.9 persons per DU.

(b) Part of the 600 DU per year will be constructed in the VCCDD service area through the year 2000 with the remainder constructed in the LSU service area.

(c) In year 2009 and beyond, it is anticipated that part of the 600 DU per year will be constructed outside of the LSU service area.

(d) Buildout population determined based on an average of 3.318 DU/acre of land.

(e) Growth direction is assumed to occur in a general northwesterly direction.

Table 3-2
LSU
Projection of Water Demands

Year	Dwelling Units	Population @ 1.9/DU	ADD (mgd)	MDD (mgd)	PHD (mgd)	MDD Plus Fire Flow (mgd)
End-of-year Projections						
1997	150	285	0.07	0.16	0.23	2.32
1998	500	950	0.22	0.55	0.76	2.71
1999	1,000	1,900	0.44	1.09	1.53	3.25
2000	1,550	2,945	0.68	1.69	2.37	3.85
2001	2,150	4,085	0.94	2.35	3.29	4.51
2002	2,750	5,225	1.20	3.00	4.21	5.16
2003	3,350	6,365	1.46	3.66	5.12	5.82
2004	3,950	7,505	1.73	4.32	6.04	6.48
2005	4,550	8,645	1.99	4.97	6.96	7.13
2006	5,150	9,785	2.25	5.63	7.88	7.79
2007	5,750	10,925	2.51	6.28	8.79	8.44
2008	6,350	12,065	2.77	6.94	9.71	9.10
2009	6,900	13,110	3.02	7.54	10.55	9.70
2010	7,400	14,060	3.23	8.08	11.32	10.24
2011	7,900	15,010	3.45	8.63	12.08	10.79
2012	8,300	15,770	3.63	9.07	12.69	11.23
2013	8,650	16,435	3.78	9.45	13.23	11.61
2014	8,900	16,910	3.89	9.72	13.61	11.88
2015 (Buildout)	8,954	17,013	3.91	9.78	13.70	11.94

General Notes:

(a) Projections for Villages of Sumter from 1997 to 2000 based on figures provided by Villages of Lake-Sumter, Inc. and adjusted to reflect a total growth rate in the Villages of Lady Lake and Sumter of 600 DU/year.

(b) Projections after 2000 extrapolated at an average of 600 DU built/year all in the Villages of Sumter.

(c) Population estimated at 1.9 persons per dwelling unit (DU).

(d) ADD = Annual average day demand. Projected at 230 g/c/d (which includes residential, commercial, and development uses, and unaccounted-for water).

(e) MDD = Maximum Day Demand. Projected based on an estimated peaking factor of 2.5 as required by the Sumter County Comprehensive Plan.

(f) PHD = Peak Hour Demand. Projected based on an estimated peaking factor of 3.5 as required by the Sumter County Comprehensive Plan.

(g) Fire flow demand of 1,500 gpm (2.16 mgd) based on discussions with The Villages of Lake-Sumter, Inc.

Table 3-3
LSU
Projection of Wastewater Flows and Loads

Year	Dwelling Units	Population @ 1.9/DU	AADF (mgd)	MMADF (mgd)	PHF (mgd)	BOD (lb/d)	TSS (lb/d)
End-of-Year Projections							
1997	150	285	0.02	0.02	0.06	51	48
1998	500	950	0.06	0.07	0.20	171	162
1999	1000	1,900	0.12	0.14	0.41	342	323
2000	1550	2,945	0.18	0.22	0.63	530	501
2001	2,150	4,085	0.25	0.31	0.87	735	694
2002	2,750	5,225	0.32	0.40	1.12	941	888
2003	3,350	6,365	0.39	0.49	1.36	1,146	1,082
2004	3,950	7,505	0.46	0.57	1.60	1,351	1,276
2005	4,550	8,645	0.53	0.66	1.85	1,556	1,470
2006	5,150	9,785	0.60	0.75	2.09	1,761	1,663
2007	5,750	10,925	0.67	0.83	2.33	1,967	1,857
2008	6,350	12,065	0.74	0.92	2.58	2,172	2,051
2009	6,900	13,110	0.80	1.00	2.80	2,360	2,229
2010	7,400	14,060	0.86	1.07	3.00	2,531	2,390
2011	7,900	15,010	0.92	1.14	3.20	2,702	2,552
2012	8,300	15,770	0.96	1.20	3.37	2,839	2,681
2013	8,650	16,435	1.00	1.25	3.51	2,958	2,794
2014	8,900	16,910	1.03	1.29	3.61	3,044	2,875
2015 (buildout)	8,954	17,013	1.04	1.30	3.63	3,062	2,892

General Notes:

(a) AADF = Annual average day flow. Projected at 61 g/c/d, as derived from historical wastewater flows and includes residential and commercial flows.

(b) MMADF = Maximum Month Average Daily Flow. Projected at 1.25 x AADF, as derived from The Villages WWTP historical wastewater data.

(c) PHF = Peak Hour Flow. Projected at 3.5 x AADF (assumed).

(d) MMADF BOD projected at 0.18 lb/c/d, as derived from The Villages WWTP historical wastewater and population data.

(e) MMADF TSS projected at 0.17 lb/c/d, as derived from The Villages WWTP historical wastewater and population data.

(f) Projections for Villages of Sumter from 1997 to 2000 based on figures provided by Villages of Lake-Sumter, Inc. and adjusted to reflect a total growth rate in The Villages of Lady Lake and Sumter of 600 DU/year. Projections after 2000 extrapolated at an average of 600 DU built/year all in The Villages of Sumter.

(g) DU = Dwelling Unit.

Section 4
Future Water System

This section discusses water quality and regulatory issues concerning the proposed LSU service area, as well as the use of a consolidated water system versus the use of scattered wells. Based on the recommendations stemming from these discussions, information on water supply, treatment, storage, and distribution also are presented.

Water Quality Issues

As with the water system owned by the VCCDD, the LSU water system will use groundwater for its water supply. Historical water quality data from the VCCDD system were reviewed to determine potential impacts of future regulations, specifically the Disinfection By-Products (DBP) Rule and the Groundwater Rule. Although these rules are not currently in effect, they may eventually impact the LSU water system. Regardless of the community's size, the DBP Rule may require trihalomethane (THM) concentrations to be less than 40 micrograms per liter (µg/L) (current requirements are less than 80 µg/L) and haloacetic acid (HAA) concentrations to be less than 30 µg/L. These concentrations will be for an average of sample points at the plant after disinfection and in the distribution system.

Quarterly data on the VCCDD system show that the THM limit of 40 µg/L can be met if the LSU water system treats, stores, and distributes its water like the VCCDD system (pump and chlorinate for disinfection). THM levels for the VCCDD system have ranged from below the detection limit to 5 µg/L. Since THM concentrations have consistently been low for the VCCDD system, the Florida Department of Environmental Protection (FDEP) has granted permission to reduce the number of sample points. Therefore, if similar water quality is found in the new wells for the LSU system, adherence to future THM requirements should be met simply by pumping and chlorinating potable water before entry into the distribution system. Because no HAA data is available on the VCCDD system, no comment can be made on the potential impact of HAA monitoring requirements on the LSU water system.

The Groundwater Rule may require contact time (CT) values for certain types of wells; however, some systems may be able to prove that wells are naturally disinfected and would not have to meet the CT requirements. The Groundwater Rule is not expected to be in effect until 1997. At this time, it is unknown what the requirements will be for a well to achieve the status of naturally disinfected and what the required CT values will be.

Water System Alternatives

The following three alternatives were evaluated to determine the most efficient arrangement of the water supply wells and water storage for LSU:

- **Alternative 1.**
  Locate wells throughout the LSU service area like the system currently used by the VCCDD.

- **Alternative 2.**
  Consolidate water supply wells and treatment in one area. Have one elevated storage tank in the distribution system with the WTP located in the eastern portion of the LSU service area where development will begin.

- **Alternative 3.**
  Consolidate water supply wells and treatment in one area with no elevated storage tanks in the distribution system and with the WTP located in a central location within the LSU service area.

Alternative 1 is not recommended for LSU due mainly to the potential impact of future regulations, discussed previously. Although the VCCDD system has consistently low THM concentrations, the system has never been sampled and analyzed for HAAs, which will have monitoring limits under the future DBP Rule. It is anticipated that the Groundwater Rule will require a minimum contact time after disinfection for each entry point to the distribution system. If wells were scattered throughout the system, each well would be considered a single treatment plant and require its own storage tank, assuming that the well did not meet natural disinfection requirements. As discussed previously, the requirements for a well to achieve "naturally disinfected" status by the Groundwater Rule are unknown at this time.

Because of the unknown impact of future water regulations, CH2M HILL recommends the construction of a consolidated water supply and treatment system. This will allow more cost-effective treatment modifications if future regulations require changes in operation. A consolidated water supply and treatment system also will provide more efficient operation and maintenance, increased useful water storage, efficient land usage to meet well head protection requirements, and increased reliability and redundancy. Under the recommended system, wells will be sized to handle MDD and onsite storage will be used to make up the difference between MDD and PHD. The disadvantage of this system will be the costs associated with purchasing high service pumps to maintain supply and system pressure.

The WTP and distribution systems for Alternatives 2 and 3 were evaluated using the CYBERNET modeling software. The distribution system for each alternative was designed to provide MDD plus a fire flow of 1,500 gallons per minute (gpm) at a minimum pressure of 20 pounds per square inch (psi) anywhere in the system. The model of the distribution system for Alternative 2 showed that an elevated storage tank was not needed. More large-diameter pipe (>16 inches) was required for the distribution system in Alternative 2 (WTP located in the eastern portion of the development) to meet the fire flow criteria compared to Alternative 3 (WTP located in the central portion of the development). Therefore, a centrally located WTP is recommended. A more detailed discussion of the design of the water distribution system is presented later in this section.

Water Supply

Table 4-1 presents the design criteria and buildout requirements for the LSU water supply and treatment system. Two locations for water supply wells were considered: one adjacent to a wildlife preserve and one adjacent to the power easement. Both of these locations minimized land usage to obtain adequate well spacing and minimum sanitary hazard set back requirements. Figure 4-1 shows the recommended location of the water supply wells as adjacent to the wildlife preserve. This location is more centrally located in the LSU service area to allow optimal water transmission piping and high service pumping. The wells serving the LSU WTP will be located on the periphery of a kestrel nesting area. Based on discussions with CH2M HILL ecologists, installation of wells, appurtenances and pipelines adjacent to this area will likely be permittable (possibly with some construction-related constraints). Siting impact issues will likely be associated with potential long-term hydrologic effects (if any) caused by groundwater withdrawals, as opposed to short-term impacts due to construction.

The water supply wells are sized to meet MDD demands. To meet buildout requirements, a total of four wells with pumps having a capacity of 3.26-mgd each are recommended. Three wells will meet the buildout MDD demand of 9.78 mgd and one well will serve as a standby.

Operative wells would be spaced 300 to 400 feet apart in the siting areas. The wells will be completed into the upper Floridan aquifer, the principal regional groundwater source. It is likely that the new wells can be designed similarly to existing VCCDD water supply wells WS-3 and WS-5 with a casing diameter of about 20 inches and a completion depth of 300 to 350 feet below land surface. Based on Table 3-2 flow demands, each well will be designed for a pumping capacity of about 2,300 gpm. The new wells will be installed according to development phasing plans, projected water demands for the phases, and redundancy requirements.

Wellhead Vulnerability to Potential Contamination

A preliminary site assessment of the general development area was completed by Professional Service Industries, Inc., in March 1993. Results from that assessment indicated no artificial sources of potential contamination existing within several hundred feet of the proposed well siting areas. However, no additional field reconnaissance of the future well locations has been completed. The report indicates that the development area has historically been used as open pasture, farming operations, and occasional single-family residential use.

The development area generally lies in a high recharge area of the State of Florida, with approximately 10 to 20 inches of the annual rainfall entering the Floridan aquifer system. Surficial soils are typically well-drained, resulting in relatively low amounts of surface runoff and internal drainage. The potential for sinkhole development is relatively high in the regional area. These factors increase the vulnerability of the wellfield sites to potential contamination. This contamination potential increases as contaminants are released closer to well sites, and where higher volumes of contaminant releases occur in the capture zone of operating wells.

Regional and site-specific information obtained in The Villages of Lady Lake indicate that the upper Floridan aquifer is highly transmissive beneath the regional area. As a result, mobile contaminants that might enter the aquifer system would be expected to be rapidly diluted, especially with greater distances between the contaminant release and well sites. Other subsurface processes would also be expected to occur which would further attenuate contaminant levels.

The capture zones of the development water supply well system (not determined at this time) could include on-site and off-site development areas. Some considerations in this regard are summarized below:

- Land use in on-site areas immediately adjacent to the well sites will be controlled by the Sumter County Comprehensive Plan (see below).

- Projected development land use within other on-site portions of the capture zones will be residential, golf course, light commercial, and institutional activities. These types of land uses are typically considered "low impact" types of development, with respect to potential groundwater pollution potential.

- Existing and future land use within well capture zones outside the development area have not been evaluated as part of this effort. However, these areas will be situated further from the well sites, increasing the travel time of mobile contaminants that could enter the aquifer system from these areas. This affords greater opportunity for contaminant attenuation in the subsurface environment.

Impacts of Wellhead Protection Programs

Water supply well sites in the LSU service area are affected by the Sumter County Comprehensive Plan (latest version dated January 13, 1992). Policy 1.4.4 of the plan precludes construction activity within a 200-foot radius of each well. Additionally, the policy restricts specific kinds of land uses within a 500-foot radial zone around each well. The secondary land use controls may affect the design and installation of wastewater system piping within the 500-foot zone.

Installation of the new water supply wells require issuance of water use permits from the Southwest Florida Water Management District. For past water use permits, quantification (that is, groundwater modeling and monitoring programs) of development impacts resulting from groundwater withdrawals has not been a permitting requirement. This past position may change as the development expands and water demands increase.

Water Treatment

Based on the VCCDD water quality data, recommended water treatment consists of chlorination and storage (see Figure 4-2). Table 4-1 presents the design criteria for equipment sizing and buildout requirements. The ground storage tanks are sized to store the difference between MDD and PHD at buildout conditions for 8 hours. The disinfection system is sized to provide a chlorine dose of 3 milligrams per liter (mg/L) at MDD and 2 mg/L at PHD, with the ability to dose before and after storage. High service pumps are sized to meet PHD or MDD plus fire flow, whichever is greater. It is assumed that the water will meet regulatory requirements by treating with chlorine and providing storage. Future regulations may require treatment modifications, such as an increased storage volume or additional chemical additives. Table 4-2 presents an order of magnitude cost estimate per expansion phase, and Figure 4-3 presents a preliminary site plan for the recommended WTP location.

Distribution System

A preliminary design of the major transmission lines and high service pumps was performed for the water distribution system for the LSU service area. As discussed previously, it is recommended that the WTP be centrally located within the service area (see Figure 4-1). The CYBERNET modeling program was used to assist in the design. The design criteria for sizing the system consisted of keeping a minimum pressure of 20 pounds per square inch (psi) at PHD or MDD plus fire flow. The criteria to provide MDD plus a 1,500 gpm fire flow anywhere in the system governed the sizing of transmission piping. The fire flow requirement was given to CH2M HILL by LSU. It was assumed that piping 16 inches in diameter or smaller would be polyvinyl chloride (PVC) and that piping greater than 16 inches would be ductile iron. Friction factors used in the hydraulic calculations were Hazen-Williams coefficients (C) of 120 for PVC pipe and 100 for ductile iron pipe. Actual friction factors vary widely depending upon the age and condition of the pipe.

Figure 4-1 presents the preliminary design of major transmission piping for the water distribution system. Table 4-3 presents a summary of the quantity of pipe and an order of magnitude cost estimate for each phase. Unit piping costs include costs for pipes, fittings, valves, and service connections and were developed using historical costs to construct the water distribution system in the existing development.

Table 4-1
Summary of Design Criteria and Buildout Requirements for LSU Water System

Component	Design Criteria	Buildout Equipment Requirements
Water Supply Wells and Pumps	MDD; 1 standby well and pump.	3 - 3.26 mgd wells and pumps + 1 standby, total of 4
High Service Pumps	PHD or MDD + fire flow.	4 - 3.5 mgd pumps + 1 standby, total of 5
Ground Storage Tank	Store the difference between PHD and MDD, or MDD + fire flow and MDD, whichever is greater for 8 hours. Provide 30 minutes minimum chlorine contact time at MDD.	2 - 1.0 MG concrete tanks
Chlorinators	Provide 3 mg/L chlorine at MDD + 2 mg/L chlorine @ PHD.	2 - 500 lb/day chlorinators + 1 standby
Distribution System	Provide MDD + fire flow, at a min. pressure of 20 psi. Diameter ≤ 16", PVC Diameter > 16", Ductile Iron	

Note:
1. See Table 3-2 for water demand projections.

Table 4-2

Cost Opinion by Phase for Proposed LSU Water Supply and Treatment System[a]

	Estimated Cost			
Item	**Phase 1 (1997-2002)**	**Phase 2 (2003-2007)**	**Phase 3 (2008-2015)**	**Total**
Water Supply Wells[b]	$390,000	$420,000	$275,000	$1,085,000
Treatment & High Service Pumping				
Chlorination system	$80,000			$80,000
High Service Pumps[c]	$200,000	$200,000	$65,000	$465,000
Building[d]		$150,000		$150,000
Storage				
Ground Storage Tanks	$255,000	$255,000		$510,000
Emergency Power Generation[e]		$150,000		
Site Work (5% of Construction Subtotal)	$64,000	$82,000	$24,000	$170,000
Electrical & I&C (10% of Construction Subtotal)	$129,000	$163,000	$47,000	$339,000
Yard Piping (10% of Construction Subtotal)	$129,000	$163,000	$47,000	$339,000
Mobilization, Bonding, Insurance (3% of Construction Subtotal)	$39,000	$49,000	$14,000	$102,000
Subtotal Construction Costs	$1,286,000	$1,632,000	$472,000	$3,390,000
Construction Contingency (15%)	$193,000	$245,000	$71,000	$509,000
Total Construction Costs	$1,479,000	$1,877,000	$543,000	$3,899,000
Engineering, Legal, Admin. (15%)	$222,000	$282,000	$81,000	$585,000
Total Estimated Capital Costs per Phase	$1,701,000	$2,159,000	$624,000	$4,484,000

Notes:

[a]Cost estimate does not include land costs or administration/maintenance building. All costs are in January 1995 dollars.

[b]Wells constructed in Phase 1 will be located within the secured area of the WTP and will not require a well house. Well houses will be constructed in Phase 2 and 3.

[c]A hydropneumatic or surge protection system will be provided in Phase 2.

[d]High service pumps will be housed outside in Phase 1. A high service pump building will be constructed in Phase 2.

[e]An emergency generator will be provided in Phase 2. The VCCDD water system will provide backup water supply during Phase 1.

Table 4-3
Cost Opinion by Phase for Proposed LSU Water Distribution System

Item	Unit Cost (per LF)	Phase 1 (1997-2002)		Phase 2 (2003-2007)		Phase 3 (2008-2015)		Total
		Quantity	Total Cost	Quantity	Total Cost	Quantity	Total Cost	Total Cost
Distribution Mains	$9.15	141,300	$1,293,000	153,300	$1,403,000	164,700	$1,507,000	$ 4,203,000
Service Mains	$10.25	49,600	$508,000	54,100	$555,000	57,800	$592,000	$ 1,655,000
Total Construction Costs			$1,801,000		$1,958,000		$2,099,000	$ 5,858,000
Engineering, Legal, Admin. (7%)			$126,000		$137,000		$147,000	$ 410,000
Total Estimated Capital Costs per Phase			$1,927,000		$2,095,000		$2,246,000	$ 6,268,000

Notes:

Unit prices were developed from actual costs incurred by The Villages of Lake-Sumter, Inc. development and therefore include all contingencies.

An incremental cost equal to 7% of the construction cost was included in the total estimated capital costs for the engineering required to add water mains onto the contract documents.

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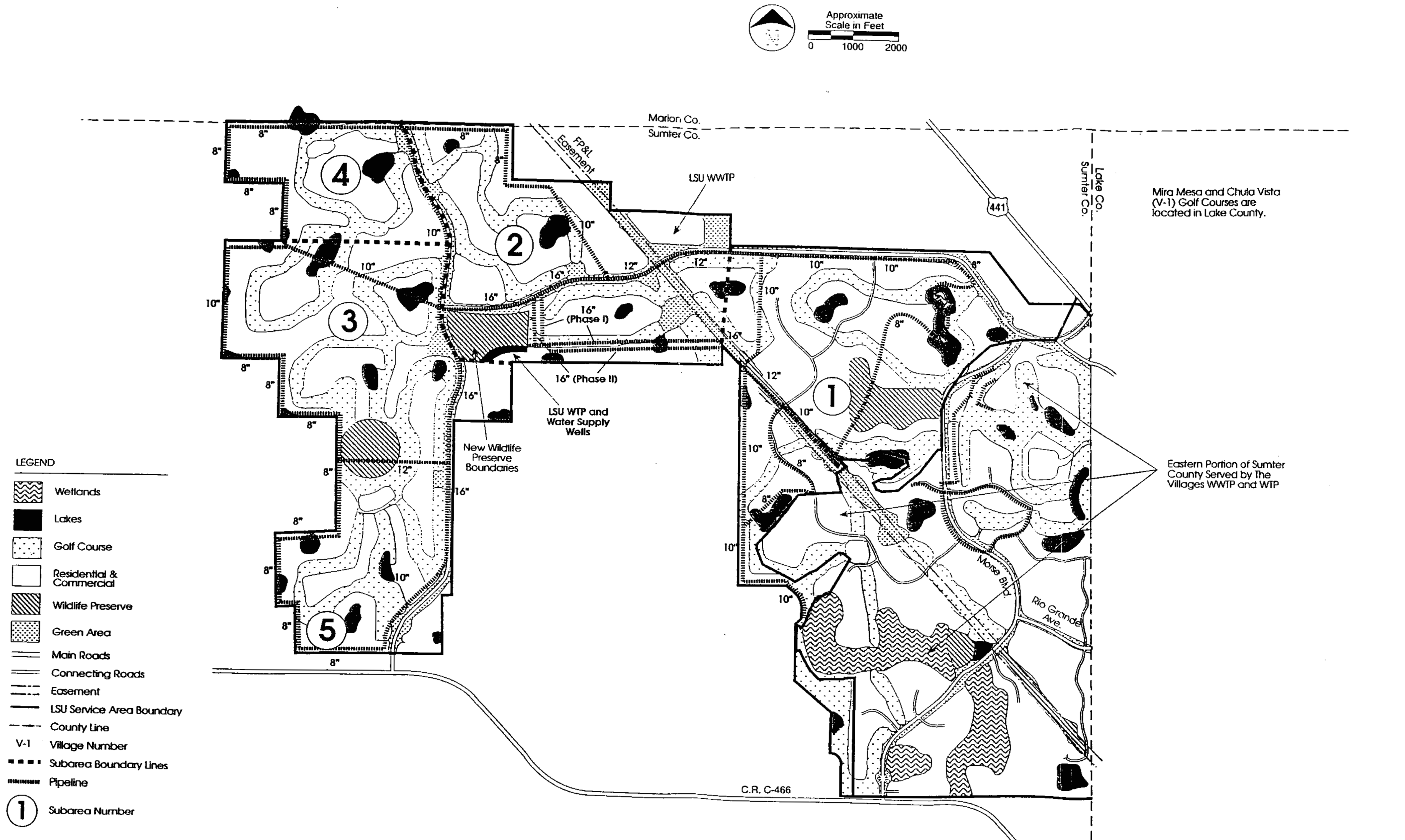

Figure 4-1. Location of LSU WTP and Distribution System.

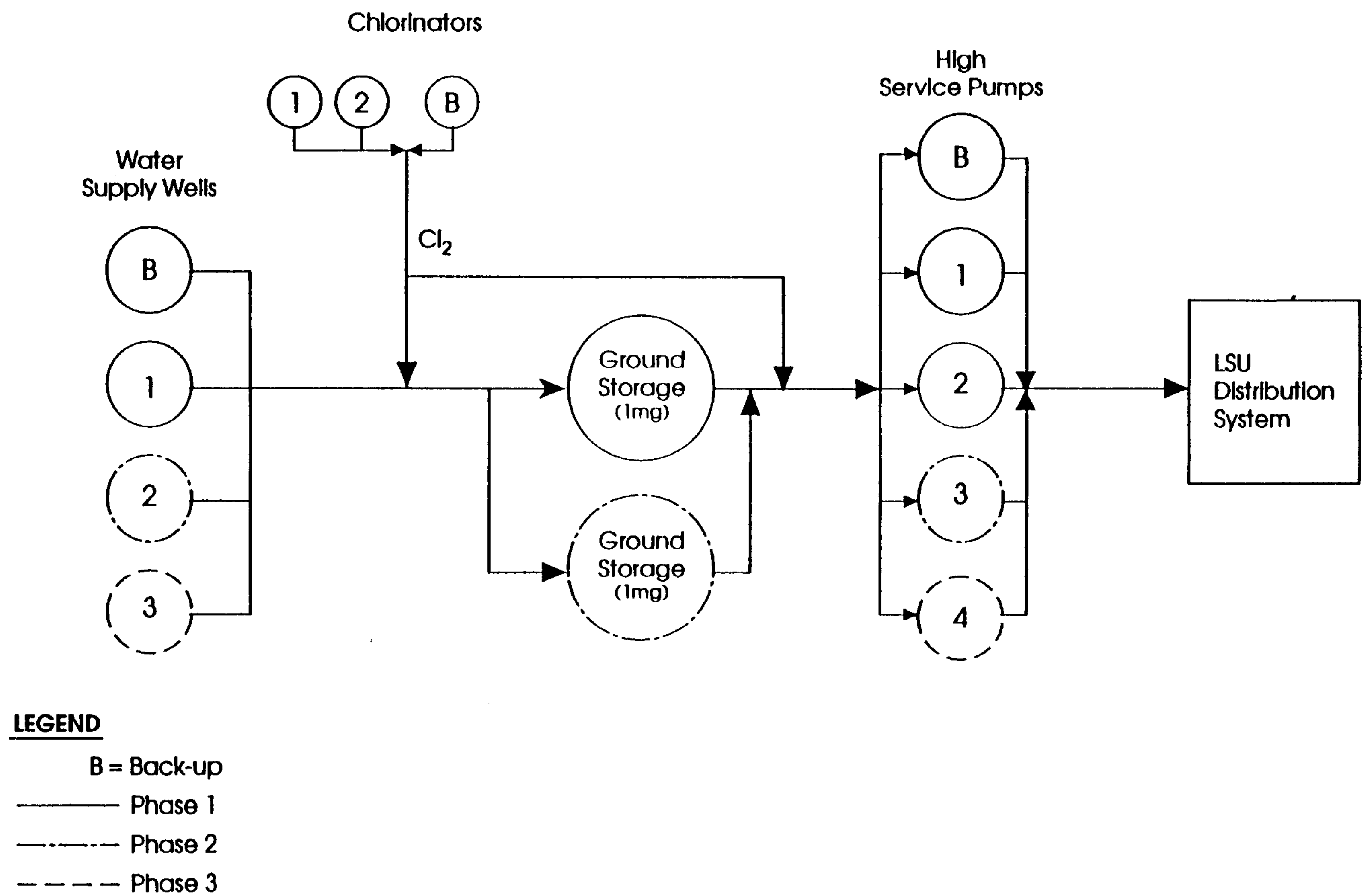

Figure 4-2. Flow Schematic for the LSU WTP.

CH2M HILL

Section 5

Future Wastewater System

This section discusses the proposed system to collect and treat wastewater and treat and dispose of sludge for the LSU service area. Phased expansion of the treatment and collection systems is recommended, and the requirements for sludge treatment and disposal are provided. Capital costs are presented for each of the three construction phases. The management of wastewater effluent is discussed in Section 6.

Wastewater Collection

Figure 5-1 shows the locations of the major wastewater collection and transmission system facilities, including major collection lines, pump stations, and force mains. Table 5-1 shows design criteria used in the preliminary sizing of gravity and force mains. The wastewater flow entering at different points in the system was estimated using 1,360 g/d/acre for PHF conditions based on the area of influence for each point. Manual calculations were performed to size the system. By dividing the system into the three construction phases, a cost estimate was developed for the major components of the collection system. Quantities for service laterals and collectors were based on 20.0 and 37.5 feet of pipe length per DU, respectively. Table 5-2 presents quantities and estimated capital costs. As will be discussed in the implementation plan in Section 7, the WWTP will not be in operation until December 1998 when there are adequate wastewater flows to start up the facility. Until December 1998, wastewater from the LSU service area will be pumped to The Villages WWTP by interconnecting with the VCCDD collection system.

Wastewater Treatment

The goal of the WWTP is to meet wastewater effluent criteria of 20 mg/l BOD, 5 mg/L TSS, and high level disinfection to produce effluent for disposal via golf course irrigation. During wet weather or when effluent does not meet criteria for public access reuse, effluent will be disposed of in percolation ponds. When effluent disposal is to the percolation ponds, the

WWTP must meet effluent criteria of 20 mg/L BOD, 20 mg/L TSS, and 12 mg/L nitrate. As shown in Figure 5-2, the new WWTP for the LSU service area will treat wastewater with the same processes used by The Villages WWTP, which treats a similar wastewater and must meet the same effluent criteria. These processes include:

- Screening
- Activated sludge with aeration basins for BOD and ammonia reduction, and anoxic basins for nitrate reduction
- Secondary clarification
- Filtration
- Disinfection by chlorination
- Effluent holding basin prior to golf course irrigation with percolation ponds as backup disposal method
- Sludge treatment by aerobic digestion
- Sludge disposal by land application

The WWTP will be located within the LSU service area (see Figure 5-1). The projection of wastewater flows indicates that the development will generate a MMADF of 1.3 mgd at buildout in the year 2015. The required buildout capacity of 1.3 mgd can be provided in three 0.45 mgd plant expansions.

Design calculations for the activated sludge system used a solids retention time (SRT) of 5 days and mixed liquor suspended solids (MLSS) concentrations ranging from 2,500 to 3,500 mg/L. Table 5-3 presents the preliminary design criteria and unit process sizing for each phase, and Figure 5-3 presents a preliminary site plan of the WWTP. Table 5-4 presents the order-of-magnitude cost estimate for each phase.

All major components of the WWTP facility will be constructed during Phase 1. Phase 2 will include expansion of anoxic and aeration systems, addition of a chlorine contact basin, additional aerobic digesters, an effluent storage pond, and an additional effluent pump. Phase 3 will include expansion of the anoxic and aeration systems, as well as addition of a third secondary clarifier, one traveling bridge filter, one chlorine contact basin, an additional aerobic digester, an effluent storage pond, one percolation pond, and an additional effluent pump. In addition, it is recommended that sludge dewatering be considered in Phase 2 to minimize the operational costs of hauling large quantities of liquid sludge to the land application sites.

Sludge Treatment

Waste activated sludge (WAS) treatment will be achieved by aerobic digestion. Digested sludge will be pumped into spray trucks via the sludge loading station for final disposal on agricultural land. Basin volume will be sized to provide a 30 day detention time for aerobic digestion of a 1.5 percent sludge. Aerobic digestion with a 30 day detention time is not an approved process to significantly reduce pathogens under the USEPA 40CFR Part 503 Sludge Rule. However, based on operation of The Villages WWTP, this detention time should be adequate to meet Class B sludge performance monitoring requirements for pathogen and vector attraction reduction.

Sludge Disposal

Land application of sludge in the State of Florida is regulated under Chapter 62-640 of the Florida Administrative Code (FAC). As part of the construction permit application for the LSU WWTP, an agricultural use plan will have to be submitted to the FDEP, describing how the sludge will be used as part of planned agricultural need of the crop considering the nutrient content of the sludge. It is assumed that any farmland used in the sludge land application program will be used for hay production. Normally the application area can be grazed by beef cattle after a 30-day waiting period following sludge application.

Table 5-5 presents estimated sludge production volumes for each WWTP phase for ADF conditions for a 5-day SRT. The estimated solids concentration of the liquid digested sludge is 1.5 percent. Land requirements were estimated for each phase based on an average total nitrogen content of 5.7 percent for liquid sludge with a total allowable nitrogen loading rate of 320 pounds per acre per year (lb/ac/yr). This loading is based on crop nitrogen demand as outlined in 62-640 FAC and the assumption that available nitrogen is 50 percent of total nitrogen. The site life estimate was based on recent metals analyses performed on the digested sludge of the The Villages WWTP and the pollutant ceiling concentrations of 62-640

FAC, or CFR 40 Part 503 Sludge Rule, whichever were strictest. Table 5-5 presents the land requirement for sludge produced by the LSU WWTP based upon the land application of liquid sludge. The estimated life of a site is 43 years with copper loading being the limiting factor. Land estimates calculated in Table 5-5 are in addition to land required for disposal of sludge from The Villages WWTP.

The following restrictions to sludge application are found in Chapter 62-640 FAC:

- No sludge can be applied during rain storms or during periods when surface soils are saturated.

- The water table must be greater than 2 feet below the ground surface for sludge to be applied.

Because the soils that are used for the sludge application are well-drained and the depth to the seasonal high water table is greater than 10 feet, the only time sludge application would be curtailed is during a rainfall event or equipment breakdown. In Phase 1, aerobic digesters provide 34 days of detention time. At buildout, the aerobic digesters should provide a minimum of 30 days of detention based on a 1.5 percent WAS concentration. Sludge may be dewatered and stockpiled if necessary. However, stockpiled sludge would require a front-end loader to transfer the sludge prior to land application.

Table 5-1
Design Criteria for Proposed Wastewater Collection and Transmission System

Item	Criteria
Force Mains	Minimum 4-inch diameter Velocity = 2.5 - 6 ft/sec PVC
Gravity Pipe	Minimum 8-inch diameter (excluding service laterals) Maintain the following minimum slopes: 8-inch .40 percent 10-inch .28 percent 12-inch .22 percent Minimum 2.0 fps @ PHF, following full or half full PVC Maximum 9 ft vertical drop
Manholes	Average spacing = 300 ft Maximum spacing = 400 ft
Flow	PHF - 3.5 x AADF AADF - 61 gal/cap/day, or PHF = 1,360 gal/day/acre
Pump Stations	Submersible, manifolded lift stations. Master lift station (B4) will feed into WWTP

Table 5-3
LSU WWTP
Preliminary Design Criteria and Unit Process Sizing

Process	**Phase 1 (1997-2002) (0.45 mgd)**	**Phase 2 (2003-2007) (+0.45 mgd)**	**Phase 3 (2008-2015) (+0.45 mgd)**	**Total (1.35 mgd)**	**Process Design Criteria**
Flows and Loads					
Wastewater Flows					
AADF, mgd	0.36	0.72	1.08	1.08	
MMADF, mgd	0.45	0.90	1.35	1.35	MMADF = 1.25 x AADF
PHF, mgd	1.26	2.50	3.80	3.80	PHF = 3.5 x AADF
MMADF Loading					
BOD, lb/d	1,062	2,125	3,187	3,187	BOD = 0.17 lb/cap/d
TSS, lb/d	1,003	2,007	3,010	3,010	TSS = 0.18 lb/cap/d
Estimated Population Served	5,902	11,803	17,705	17,705	
Screening	--	1 Manual	--	1 Manual	Phase 3 PHF
	--	1 Mechanical	--	1 Mechanical	Max Velocity (clean) = 4 fps
Width, ft	--	3	--	3	PHF = 3.8 mgd
Opening, in.	--	0.5	--	0.5	
Grit Removal	None	None	None	None	
Anoxic Zones					
Number	1	+1	+1	3	
Total Volume, MG	0.085	+0.085	+0.085	0.255	Denitrification Rate = 0.09 lb NO3/lb MLSS-day
Mixers, number per basin	2	+2	+2	6	Influent TKN = 53 mg/L
Anoxic Recycle Pumps					
Number	2	+1	+1	4	Recycle rate up to 5:1 based on MMADF
Type	Submersible	Submersible	Submersible	Submersible	
Capacity each, gpm	800	1,600	1,600	--	
Total Capacity, gpm	1,600	+1,600	+1,600	4,800	

Table 5-3
LSU WWTP
Preliminary Design Criteria and Unit Process Sizing

Process	Phase 1 (1997-2002) (0.45 mgd)	Phase 2 (2003-2007) (+0.45 mgd)	Phase 3 (2008-2015) (+0.45 mgd)	Total (1.35 mgd)	Process Design Criteria
Aeration Basins					
Number	1	+1	+1	3	
Trains per basin	2	+1	+1	4	
Total Volume, MG	0.224	+0.224	+0.224	0.672	SRT = 5 days
Sidewater Depth, ft (AOTR)	15	15	15	15	MLSS = 3,000 mg/L
Total O2 Required, lb/day	1,975	+1,975	+1,975	5,925	Diffuser Submergence = 14 feet
Air Required, cfm	1,640	+1,640	+1,640	4,920	Diffuser Type - Course Bubble
Secondary Clarifier					
Number	2	--	+1	3	SLR < 25 lb/sf/d @ MMADF
Type	RSR	--	RSR	RSR	HOR < 500 gal/sf/d @ MMADF
Diameter, ft	35	--	35	35	
SWD, ft	15	--	15	15	
Return Activated Sludge Pump					
Number	2	+1	+1	4	RAS @ 0.75 to 0.9% Solids
Type	Non-clog Centrifugals	Non-clog Centrifugals	Non-clog Centrifugals	Non-clog Centrifugals	SRT = 5 days Total Cap. = 100% MMADF
Capacity each, gpm	230	230	230	--	Firm Cap. = 75% MMADF
Firm Capacity, gpm	230	+230	+230	690	
Total Capacity, gpm	460	690	920	920	
Waste Activated Sludge Pumps					
Number	2	--	+1	3	WAS = 8,000 mg/L
Type	Non-clog Centrifugal	--	Non-clog Centrifugal	Non-clog Centrifugal	Min. pipe diam. = 4 inches
Capacity each, gpm	150	--	150	--	Min. pipe velocity = 2.5 ft/s
Total Capacity, gpm	300	--	450	450	

Table 5-3
LSU WWTP
Preliminary Design Criteria and Unit Process Sizing

Process	Phase 1 (1997-2002) (0.45 mgd)	Phase 2 (2003-2007) (+0.45 mgd)	Phase 3 (2008-2015) (+0.45 mgd)	Total (1.35 mgd)	Process Design Criteria
Filters					
Type	Traveling Bridge	--	Traveling Bridge	Traveling Bridge	Filtration rate < 2 gpm/sf @ MMADF
Number	2	--	+1	3	
Filter Area Each, sf	220	--	220	--	Filtration rate < 4 gpm/sf
Total Filter Area, sf	440	--	+220	660	@ PHF
Filter Rates, gpm/sf					
AADF	0.6	1.1	1.1	1.1	
MMADF	0.7	1.4	1.4	1.4	
PHF	2.0	4.0	4.0	4.0	
Disinfection					
Chlorine Contact Basins					
Number	2	+1	+1	4	
Volume Each, gal	6,500	13,000	13,000	--	15 minutes minimum at
Total Volume	13,000	+13,000	+13,000	39,000	PHF = 3.8 mgd to maintain
Detention Time					a CT of 50.
AADF, minutes	52	52	52	52	
PHF, minutes	15	15	15	15	
Chlorinators					
Number	2	+1	+1	4	(100 lb/day unit)
Demands:					
AADF, lb/d	18	37	55	70	6 mg/L dose at AADF
PHF, lb/d	85	170	255	255	8 mg/L dose at PHF
RAS/filter Chlorination	19	38	58	58	5 mg/L dose at MMADF for bulking or filter slime control

Table 5-3
LSU WWTP
Preliminary Design Criteria and Unit Process Sizing

Process	**Phase 1 (1997-2002) (0.45 mgd)**	**Phase 2 (2003-2007) (+0.45 mgd)**	**Phase 3 (2008-2015) (+0.45 mgd)**	**Total (1.35 mgd)**	**Process Design Criteria**
Effluent Storage					
Number of Ponds	1	+1	+1	3	Provide minimum storage volume of 3 days @ MMADF
Volume Each, MG	1.4	1.4	1.3	–	
Total Volume	1.4	1.4	1.3	4.10	Side Slope = 3:1
Active Water Depth, ft	7.5	7.5	7.5	7.5	
Total Water Depth, ft	9.5	9.5	9.5	9.5	
Free board, ft.	3	3	3	3	
Aerobic Digesters					
Number	2	+2	+1	5	WAS concentration of 1.5% TSS
Volume Each, gal	100,000	100,000	110,000	--	Detention time =30 days
Total Volume	200,000	200,000	110,000	510,000	
Side Water Depth, ft	14	14	14	14	
Total Air Required, cfm	870	870	870	2,610	
Aeration Blowers					
Number	2	+1	+1	4	
Capacity Each, cfm	1,650	1,650	1,650	–	
Firm Capacity, cfm	1,650	+1,650	+1,650	4,950	
Total Capacity, cfm	3,300	+1,650	+1,650	6,600	
Aerobic Digester Blowers					
Number	2	+1	+1	4	
Capacity Each, cfm	870	870	870	–	
Firm Capacity, cfm	870	1740	2,610	2,610	
Total Capacity, cfm	1,740	2,610	3,480	3,480	
Sludge Loading Facility					
Number of Pumps	2	–	–	2	Fill 3,500 gallon tank in 10-25 min.
Type	Recessed Impeller Centrifugal	–	–	Recessed Impeller Centrifugal	
Capacity Each, gpm	200	–	–	200	

Table 5-4
LSU WWTP
Estimated Capital Costs

Item	Estimated Cost Phase 1 (0.45 mgd)	Phase 2 (+0.45 mgd)	Phase 3 (+0.45 mgd)	Total (1.35 mgd)
Bar Screens		$83,000		$83,000
Anoxic Basins	$60,000	$46,000	$46,000	$152,000
Aeration Basins	$140,000	$135,000	$135,000	$410,000
Anoxic Recycle Pumps	$30,000	$13,000	$13,000	$56,000
Secondary Clarifiers	$250,000		$120,000	$370,000
RAS/WAS Pumps	$60,000	$10,000	$10,000	$80,000
Effluent Filters	$275,000		$135,000	$410,000
Chlorination System	$50,000	$13,000	$13,000	$76,000
Chlorine Contact Basin	$65,000	$55,000	$55,000	$175,000
Aerobic Digesters	$110,000	$110,000	$70,000	$290,000
Sludge Loading Facility	$45,000			$45,000
Plant Recycle Pump Station	$55,000			$55,000
Blowers (Aeration and Digestion)	$150,000	$80,000	$80,000	$310,000
Emergency Power Generation	$90,000			$90,000
Percolation Ponds	$65,000		$30,000	$95,000
Effluent Pumping	$40,000	$25,000	$25,000	$90,000
Effluent Storage	$80,000	$80,000	$70,000	$230,000
Sludge Spray/Spreader Truck	$25,000	$25,000		
Administration/Lab Building	$25,000			
Blower Building	$50,000			
Chlorine Building	$13,000			
Site Work (5% of Construction Subtotal)	$113,000	$47,000	$56,000	$216,000
Electrical and I&C (10% of Construction Subtotal)	$227,000	$94,000	$111,000	$432,000
Yard Piping (8% of Construction Subtotal)	$181,000	$94,000	$111,000	$432,000
Mobilization, Bonding, Insurance (3% of Construction Subtotal)	$68,000	$28,000	$33,000	$130,000
Construction Subtotal	$2,267,000	$938,000	$1,113,000	$4,318,000
Construction Contingency (15%)	$340,000	$141,000	$167,000	$648,000
				$0
Total Construction Cost	$2,607,000	$1,079,000	$1,280,000	$4,966,000
Engineering and Administration (15%)	$391,000	$162,000	$192,000	$745,000
Total Estimated Capital Cost	$2,998,000	$1,241,000	$1,472,000	$5,711,000

Notes:
mgd = million gallons per day
1. Costs in 1995 dollars
2. Costs do not include land cost.

Table 5-3
LSU WWTP
Preliminary Design Criteria and Unit Process Sizing

Process	Phase 1 (1997-2002) (0.45 mgd)	Phase 2 (2003-2007) (+0.45 mgd)	Phase 3 (2008-2015) (+0.45 mgd)	Total (1.35 mgd)	Process Design Criteria
Percolation Ponds					
Number	2	--	+1	3	Provide backup during wet
Area Each, sq. ft.	81,000	--	+81,000	--	weather and for out-of-
Total Area, sq. ft.	162,000	--	+81,000	243,000	compliance effluent.
					Max loading at 5.6 gal/d/sf
Effluent Pumps					
Number of Pumps	3	+1	+1	5	
Type	Vertical Turbine	Vertical Turbine	Vertical Turbine	Vertical Turbine	Apply 0.28 in/day of
Capacity Each, gpm	1,700	1,700	1,700	--	reuse to golf course
Firm Capacity, gpm	3,400	+1,700	+1,700	6,800	over 10 hour period.
Total Capacity, gpm	5,100	6,800	8,500	8,500	
Golf courses served, acres	268	402	537	537	
Plant Recycle Pumps					
Number of Pumps	3	--	--	3	
Type	Submersible	--	--	Submersible	Recycles supernatant from
Capacity Each, gpm	150	--	--	150	sludge holding basins and
Firm Capacity, gpm	300	--	--	300	backwash water from filters.
Total Capacity, gpm	450	--	--	450	

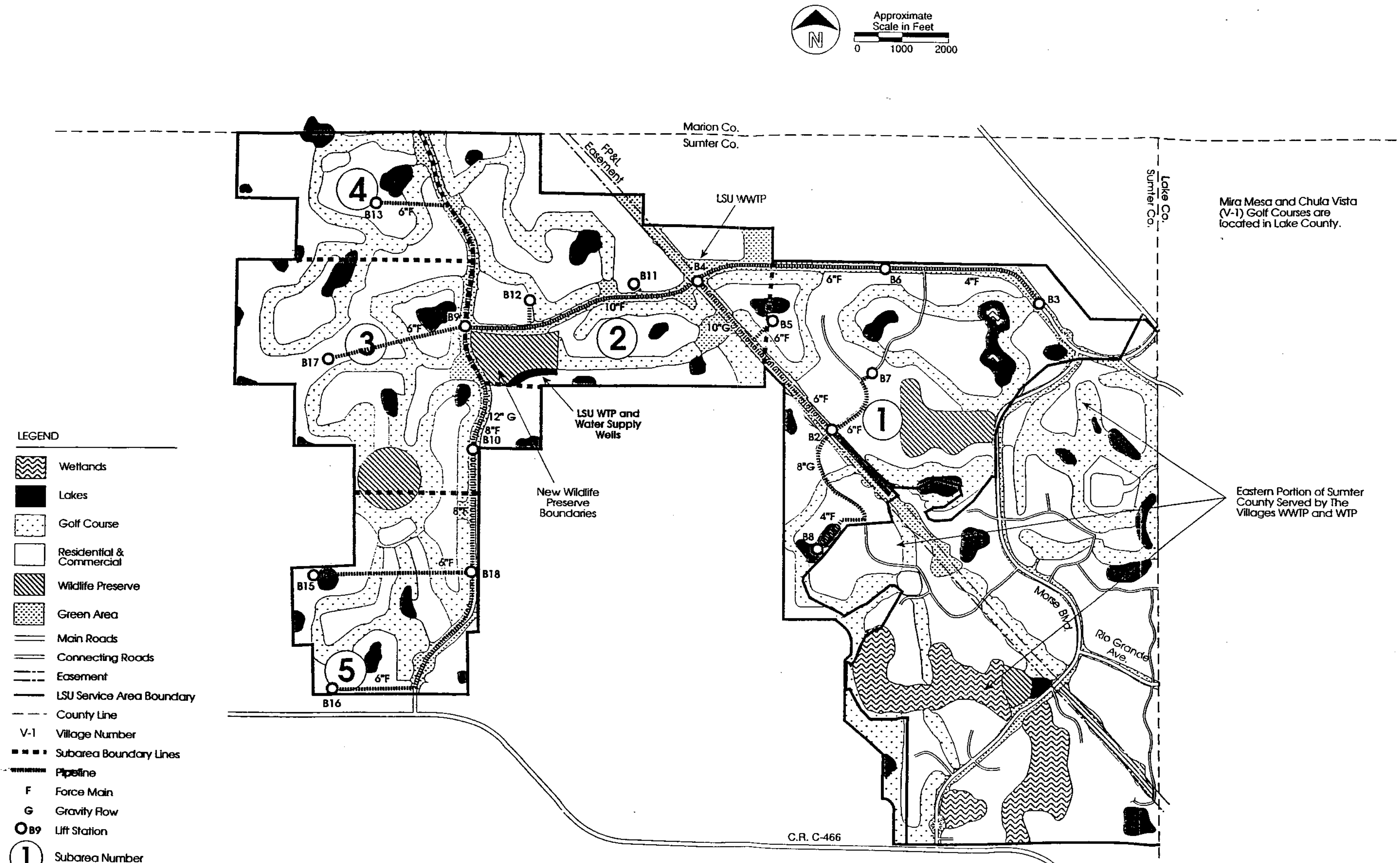

Figure 5-1. Location of LSU WWTP and Collection System.

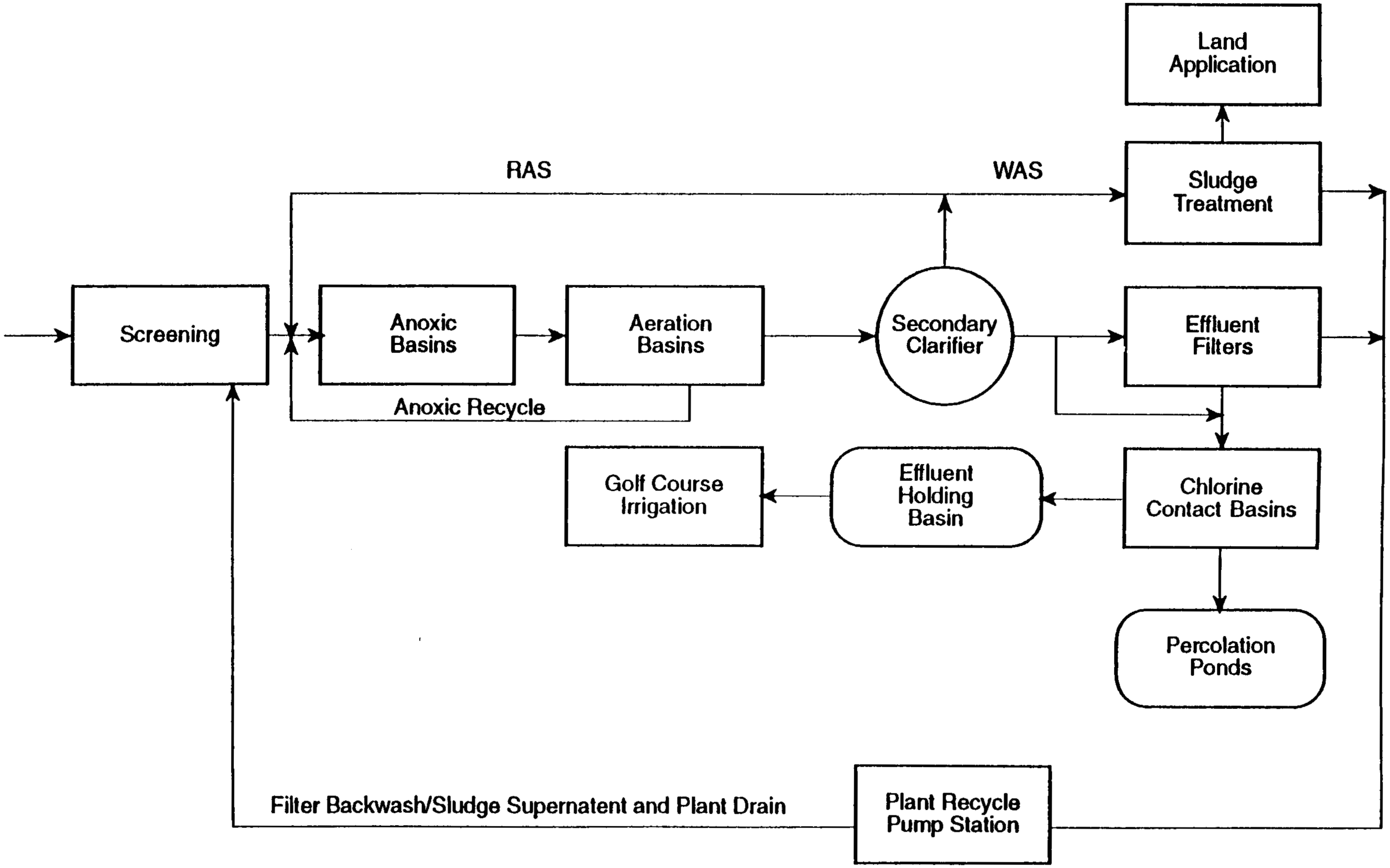

Figure 5-2. Flow Schematic for the LSU WWTP.

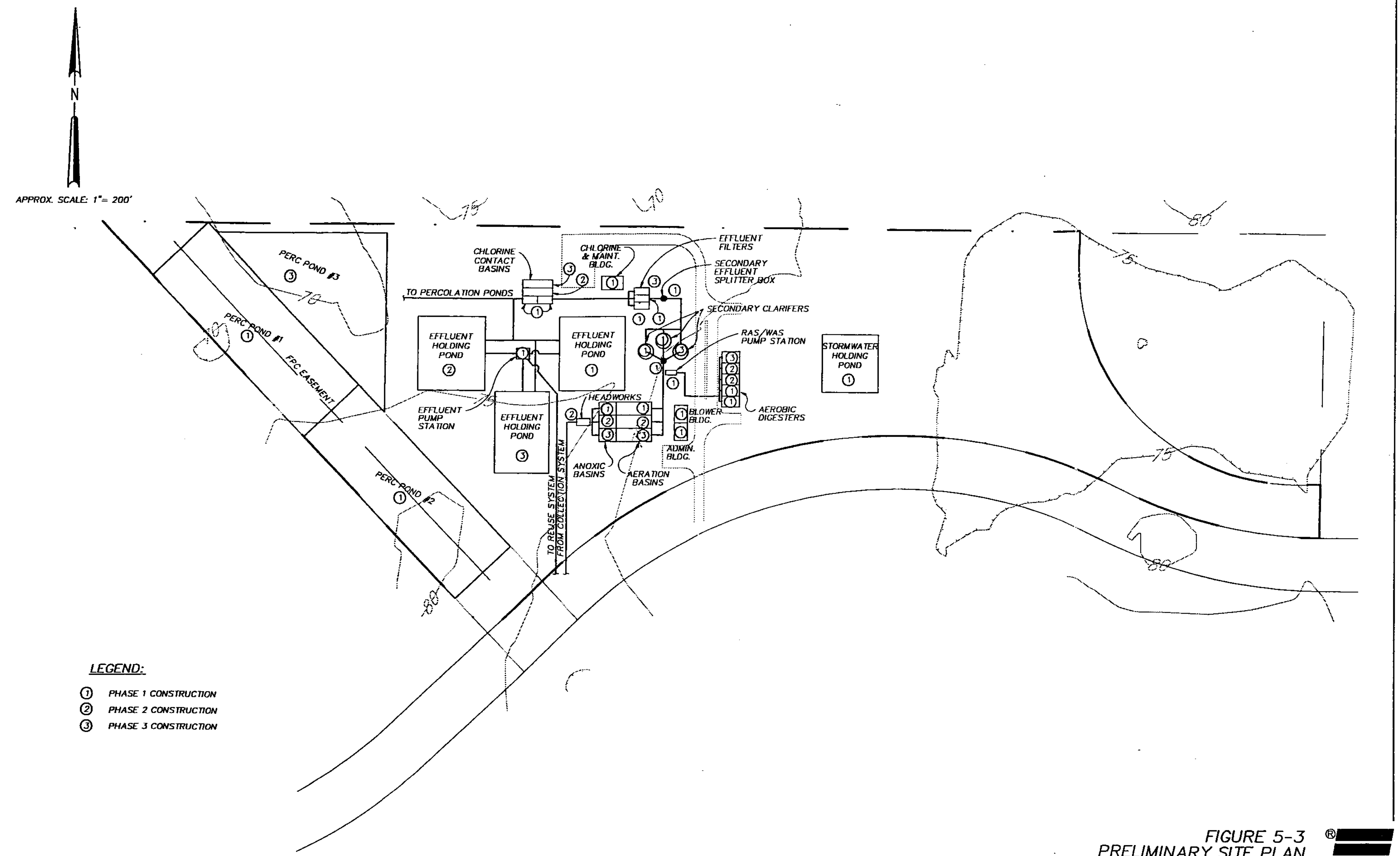

FIGURE 5-3
PRELIMINARY SITE PLAN
FOR LSU WWTP

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Section 6
Effluent Management

As with The Villages WWTP, wastewater effluent for the LSU service area will be reused as much as possible via golf course irrigation. The Southwest Florida Water Management District (SWFWMD) requires that WWTP effluent be reused to the maximum extent possible to minimize groundwater withdrawal. During wet weather or when effluent does not meet the criteria for public access reuse, wastewater effluent will be disposed of in percolation ponds.

Golf Course Irrigation

The effluent disposal capacity for the golf courses was estimated using the projected construction of golf courses described in the DRI-ADA for the LSU service area. An estimated six golf courses will be constructed in the LSU service area (see Table 6-1). Golf course V-4, a 60-acre, nine-hole course, will be incorporated into the existing Hacienda Hills course, which receives effluent from The Villages WWTP for irrigation. CH2M HILL used the assumption that nine holes of golf courses would be constructed every two years, starting in 1998.

The estimated average application rate of reuse water on golf courses is 0.68 inches per week, which was used to estimate the annual average day volume of required reuse water. The maximum daily application rate is 0.24 inches over a 10-hour period. These rates were obtained from the Water Conservation Plan (CH2M HILL, July 1994).

The golf courses located within the VCCDD service area are permitted for 1.75 inches per week by FDEP. Table 6-2 summarizes golf course irrigation requirements, available reuse water, and an estimated volume of groundwater used for irrigation. The estimated effluent pumping requirement shown in Table 6-2 is based on the maximum daily application rate of 0.24 inches per 10-hour period or the rate to drain the WWTP effluent holding basins in a 10 hour period, whichever is less.

The LSU WWTP will produce enough effluent to irrigate up to 400 acres of golf course at buildout conditions. The remaining golf courses will require irrigation water from another source (i.e., groundwater, stormwater, or effluent from another WWTP). Due to its distance from the LSU WWTP and the lack of available reuse water when it is constructed, it is assumed that the V-6 golf course (120 acres) will be irrigated by means other than wastewater effluent.

The preliminary design of the reclaimed water distribution system (see Figure 6-1), was based on keeping pipe velocities between 4 and 6 feet per second (fps). Table 6-3 summarizes quantities and an order-of-magnitude cost estimate per phase for the reclaimed water distribution system. Costs assume PVC or HDPE pipe material and exclude irrigation piping and associated appurtenances.

Percolation Ponds

As stated previously, percolation ponds will be used for wet weather disposal of effluent or for disposal of out-of-compliance effluent. A maximum loading rate of 5.6 gallons per day per square feet (gpd/sf) was used to size the percolation ponds for the LSU WWTP, based on the permitted loading rate of The Villages WWTP percolation ponds. Two 81,000-sf ponds will be constructed in Phase 1, and one additional pond will be constructed in Phase 3.

Table 6-1
LSU
Golf Course Construction Phasing

Village No.	No. of Holes	Type	Area (acres)
V-4 (Hacienda Hills)	9	Reg.	60
V-5	18	Par 3	60
V-6	9	Reg.	70
V-6	18	Reg.	120
V-7	18	Par 3	60
V-8	18	Par 3	100
V-9	18	Reg.	120

Note:
1. The proposed golf courses is based on the Land Use Phasing Schedule provided by Florida Planning Studios.

Table 6-2
Golf Course Irrigation

Golf Course	Total Acres	Cumulative Acres	Online Date	Cumulative Average Irrigation Demand (mgd)	Available Reclaimed Water (mgd)	Cumulative Required Pumping Rate (gpm)	Average Required Irrigation by Groundwater (mgd)
V-5	60	60	1998-1999	0.16	0.10	652	0.06
V-7	60	120	2000-2001	0.32	0.19	1303	0.13
V-6	120	180	2002-2003	0.47	0.28	1955	0.19
		240	2004-2005	0.63	0.39	2607	0.24
	70	310	2006-2007	0.82	0.53	3367	0.29
V-8	100	360	2008-2009	0.95	0.67	3910	0.28
		410	2010-2011	1.08	0.80	4453	0.28
V-9	120	470	2012-2013	1.24	0.94	5105	0.30
		530	2014-2015	1.40	1.04	5756	0.36

Notes:
Average irrigation rate = 0.68 inches/week
Design pumping rate= 0.24 inches per day based on 10 hours of pumping per day

Table 6-3
LSU
Estimated Cost for the Proposed Reclaimed Water Distribution System

Item	Type	Unit	Unit Cost	Phase 1 (1997-2002) Quantity	Phase 1 (1997-2002) Capital Cost	Phase 2 (2003-2007) Quantity	Phase 2 (2003-2007) Capital Cost	Phase 3 (2008-2015) Quantity	Phase 3 (2008-2015) Capital Cost	Total Capital Cost
Force Mains										
8-inch	PVC	Linear ft.	$6.50	10200	$66,000	0	$0	0	$0	$66,000
14-inch	PVC	Linear ft.	$21.00	0	$0	0	$0	0	$0	$0
16-inch	PVC	Linear ft.	$24.00	0	$0	3200	$77,000	0		$77,000
18-inch	PVC	Linear ft.	$27.00	6500	$176,000	0	$0	0	$0	$176,000
Piping Total					**$242,000**		**$77,000**		**$0**	**$320,000**
Contingency	15%				$36,000		$12,000		$0	$49,000
Total Construction Cost					**$278,000**		**$89,000**		**$0**	**$369,000**
Eng/Legal/Admin	15%				$42,000		$13,000		$0	$55,000
Total Capital Cost					**$320,000**		**$102,000**		**$0**	**$422,000**

Note:
1. Costs exclude onsite irrigation piping and associated appurtances. Unit prices were provided by The Villages and are based upon historical costs of similar construction in the VCCDD service area.

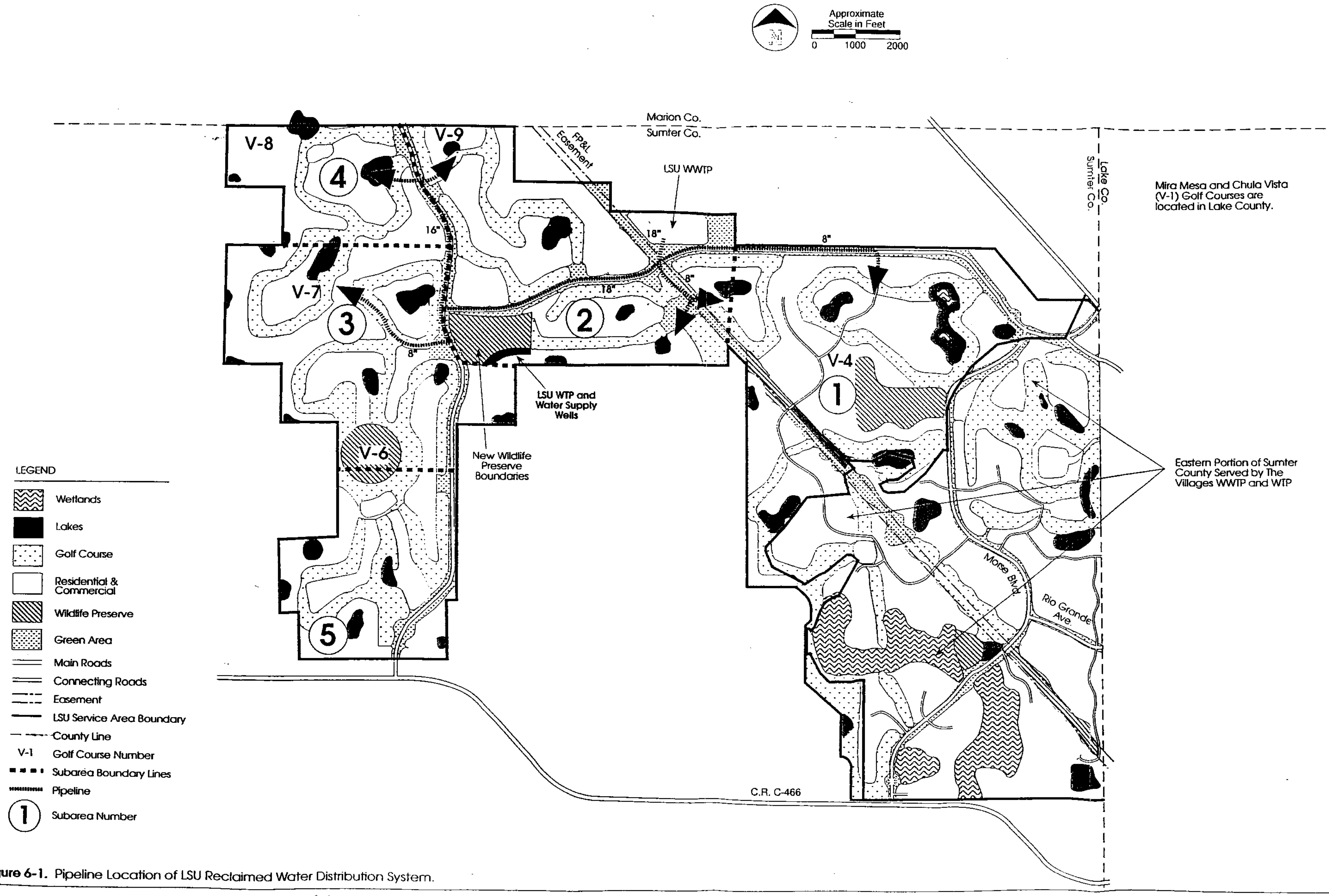

Figure 6-1. Pipeline Location of LSU Reclaimed Water Distribution System.

Section 7

Implementation Plan

This section presents the implementation plan for constructing the recommended water, wastewater, and effluent disposal systems described in this master plan. The following list summarizes the recommended LSU facilities in this master plan:

- Three 0.45 mgd expansions of the WWTP for a buildout treatment capacity of 1.35 mgd
- Four 3.26 mgd water supply wells with two constructed in Phase 1, one in Phase 2 , and one in Phase 3
- Water treatment, including storage and chlorination system construction in Phase 1, additional storage construction in Phase 2, and high service pumping construction in all three phases
- Phased construction of potable water and reclaimed water distribution systems and wastewater collection systems

Table 7-1 summarizes the order-of-magnitude cost estimates presented in previous sections. Costs for the reclaimed water system are not included in Table 7-1 since it is anticipated that these costs will be incurred by The Villages and not by LSU. The first phase in the implementation plan is for a period of 6 years; the second phase is for a period of 5 years; and the remaining phase is for a period of 8 years.

The implementation plan includes a schedule for design, permitting, and construction of the water supply, water treatment, and wastewater treatment facilities (see Table 7-2). A more detailed proposed schedule of Phase 1 capital improvements is as follows:

- Water Supply and Treatment

Design	April 1996 to June 1996
Permitting	June 1996 to August 1996
Bidding/Award	August 1996
Construction	September 1996 to January 1997
Start up	January 1997

- Wastewater Treatment

Preliminary Design and Permitting	May 1996 to October 1996
Final Design	November 1996 to August 1997
Bidding/Award	September 1997 to November 1997
Construction	December 1997 to December 1998
Start up	December 1998

Table 7-1
Summary of Captial Cost Estimates by Phase for LSU Water and Wastewater Facilities

	Cost ($)		
Item	**Phase 1 (1997 - 2002)**	**Phase 2 (2003 - 2007)**	**Phase 3 (2008 - 2015)**
Water Distribution System	$1,927,000	$2,095,000	$2,246,000
Water Treatment Plant	$1,701,000	$2,159,000	$624,000
Wastewater Collection System	$2,462,000	$2,714,000	$2,883,000
Wastewater Treatment Plant	$2,998,000	$1,241,000	$1,472,000
Total	$9,088,000	$8,209,000	$7,225,000

Table 7-2
LSU
Implementation Schedule for the Water and Wastewater Treatment System

Equipment/ Facilities		Equipment Quantity/Size of Expansion														
		Year [a]														
		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Water Supply and Treatment	Water Supply Wells	2						1					1			
	High Service Pumps	3						1					1			
	Ground Storage Tank	1						1								
	Chlorination System	1														
Wastewater Treatment	Phase 1			+0.45 mgd												
	Phase 2							+0.45 mgd								
	Phase 3												+0.45 mgd			

mgd=million gallons per day
mg=million gallons
Notes: (a) Schedule reflects end of year startup of equipment or facilities.