

Canaan Valley Tucker County, West Virginia

Wastewater Management Feasibility Study Executive Summary

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Submitted to:

Canaan Valley Institute
Front Street Circle
B&L Building, 3rd Floor
Thomas, WV 26292

Submitted by:

Environmental Engineers/Consultants
LOMBARDO ASSOCIATES, INC.
49 Edge Hill Road
Newton, Massachusetts 02467

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1. INTRODUCTION

Lombardo Associates, Inc. (LAI) was retained by the Canaan Valley Institute (CVI) to evaluate a proposed centralized wastewater treatment option (Thrasher Engineering 2001) and identify possible alternative wastewater management solutions for Canaan Valley. The goal was to identify and develop a sustainable, cost-effective wastewater management strategy that is protective of public health and environmental resources.

As part of this effort, LAI prepared a Community Profile, which compiled information on:

- Population and demographics
- Land Use
- Natural Resources
- Existing Infrastructure
- Regulatory Issues
- Legal and Institutional Issues

in Canaan Valley to assess the existing conditions.

That Community Profile was used to identify the wastewater needs in the Valley. The needs of both the existing development and future buildout were considered. Then LAI identified and screened technological, management, and financial options suitable to meet the wastewater needs of the Valley. Centralized, cluster, and on-site wastewater management options are discussed in this report. Information is also provided on various treatment technologies that are available.

It is LAI's opinion that the Thrasher 2001 plan is not a viable wastewater solution for Canaan Valley for the following reasons:

- It does not demonstrate that water quality standards will be met with the centralized system.
- It relies on 100 percent participation of the existing wastewater treatment facilities without providing them with compensation.
- It overestimates the future development of the Valley and will likely facilitate rural sprawl and high density development.

Instead, LAI recommends Canaan Valley pursue a decentralized approach to wastewater management. There are several advantages of this approach:

- It assures that the water quality goals are achieved.
- It promotes salvaging, retrofitting, and/or rehabilitating existing decentralized systems.
- It allows for "smart growth" consistent with the Valley's unique character.
- It is more cost effective than a fully centralized system.

Based on discussions with CVI, LAI prepared an Implementation Plan for a decentralized approach to wastewater management. Management, financial, and ownership options are presented. LAI encourages further discussions with CVI and other stakeholders in Canaan Valley to determine the most appropriate options for the Valley.

Once the Facility Plan is complete for those study areas, Wastewater Management Facility Plans for the remaining areas in the Valley will be developed.

1.1. GENERAL PROJECT AREA DESCRIPTION

Canaan Valley is a small, oval basin in rural Tucker County, West Virginia (Figures 1-1, 1-2 and Plate 1). The northern half of the valley contains large tracts of undeveloped wetlands, and the southern half is devoted largely to recreation and tourism. According to a variety of sources, state parks and ski resorts

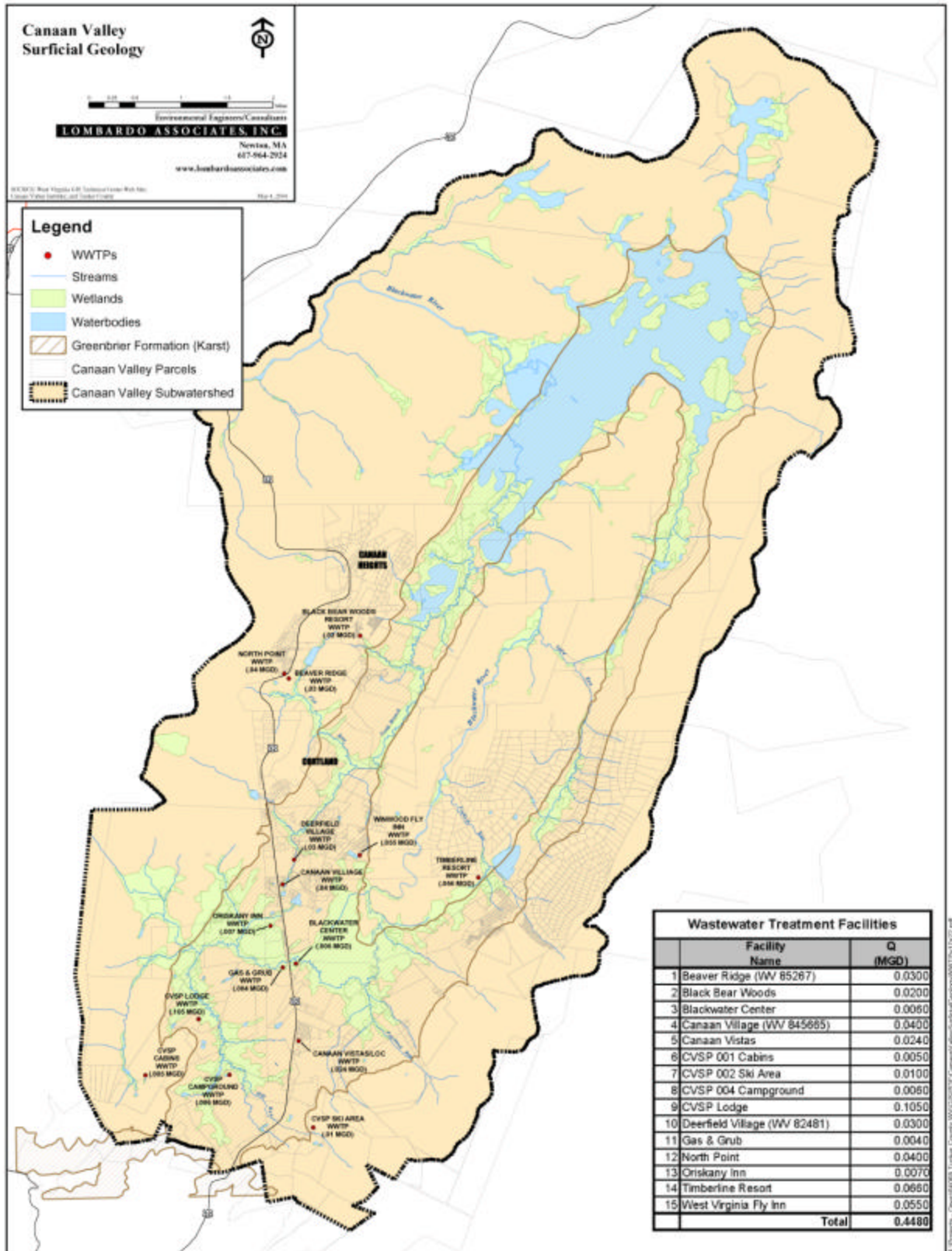
attract 1.2 million visitors to Canaan Valley each year. The area is also a popular site for vacation and retirement homes.

Types of land cover in Canaan Valley have changed considerably over time. High density forest that covered the valley was logged in the early 1900's. Such activities exposed the large sphagnum bogs, which caught fire several times thereafter. More recently, recreation and tourism have become a large part of the Canaan Valley economy and developed much of the southern half of the valley.

1.1.1 SURFICIAL GEOLOGY

Canaan Valley is an elongated, oval-shaped valley located in the Allegheny Mountains of northern West Virginia. It is the highest valley of its size east of the Rocky Mountains, with an average elevation of 3,200 ft. above sea level. The valley is flanked by Canaan, Cabin, and Brown Mountains, and is drained by the Blackwater River, a tributary of the Cheat River, northwestwardly through a narrow water gap. The surficial geology herein was described by the U.S. Geological Survey (USGS) water quality report dated 1996 and is illustrated on Figure 1-1.

FIGURE 1-1: SURFICIAL GEOLOGY OF CANAAN VALLEY, WV



1.1.2 SOILS

The Canaan Valley soils are primarily described as poorly drained soils derived from the erosion of the Blackwater Anticline. A summary of the NRCS types and classifications found within the valley is presented in Table 1-1.

TABLE 1-1: SUMMARY OF NRCS SOILS & NRCS SOILS CLASSIFICATIONS

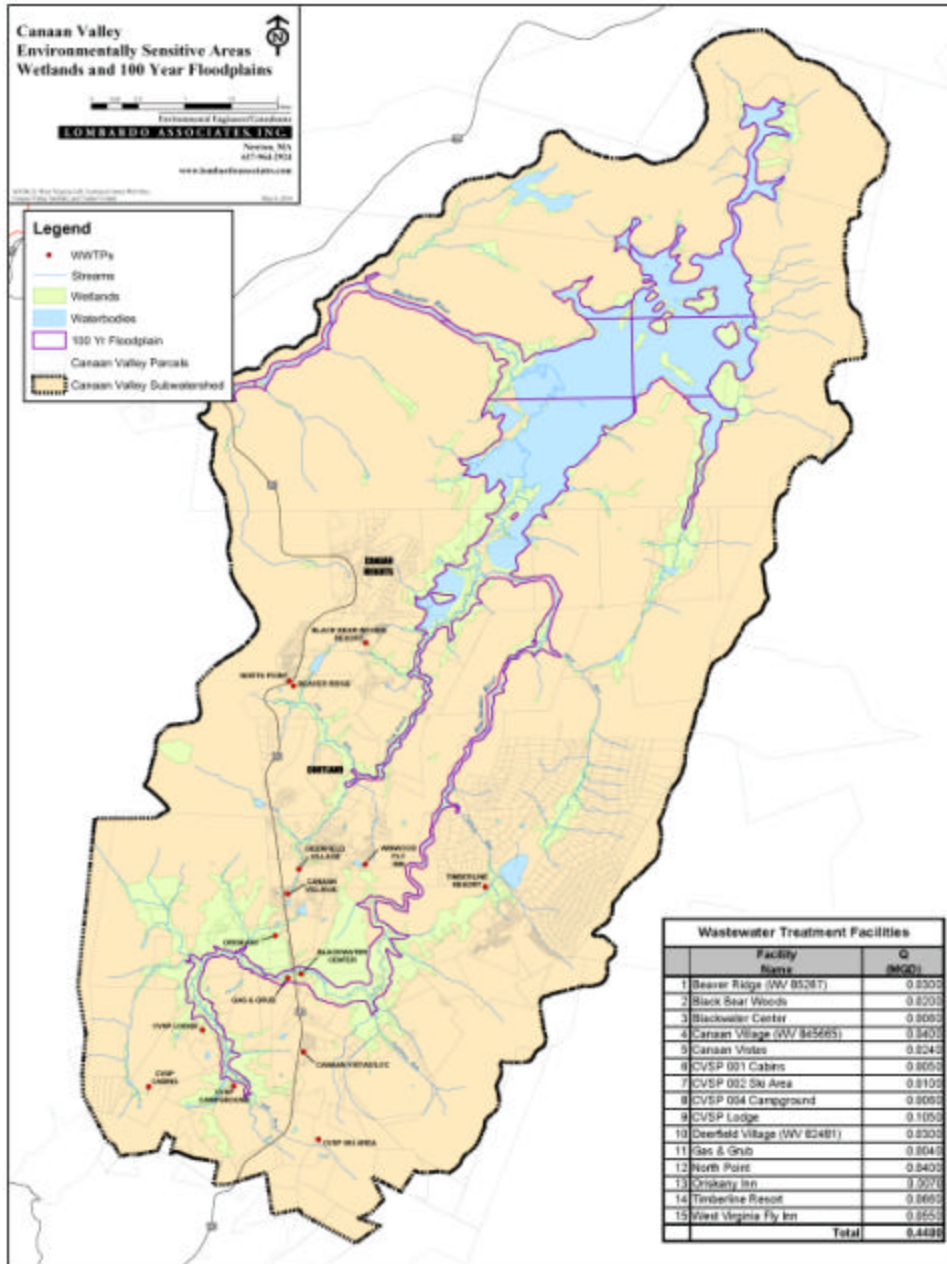
Soil Type	Acres	Percent of Watershed	Permeability (mpi)		Depth to Groundwater (ft)		Depth to Bedrock (ft)		Leachfield Limitations	
			min	max	min	max	min	max		
Bb/Bd	Barbour and Pope	10.46	0.03%				3	6	10	slight, possible pollution hazard to nearby streams, springs on shallow wells
Bm/Bn	Belmont	1,328.93	3.35%	30	95	*	*	2	4	severe, slopes
Ch/Cn	Calvin	7,966.03	20.09%	95	300	*	*	2	4	severe, slopes
Da/Dk/Dm	Dekalb	8,892.29	22.43%	10	30	*	*	2	4	severe, depth to bedrock
Lc	Leetonia	609.82	1.54%	10	30	*	*	1	4	severe, depth to bedrock
Ph	Philo	5.94	0.01%	95	300	1	2	4	10	severe, high water table, flood hazard
Ab	Albrights	1,002.43	2.53%	95	300	1	2	4	12	severe, slow permeability in subsoil, slopes
Al	Alluvial	11.34	0.03%	95	300	0	1	3	+	on-site investigation required
At	Atkins	1,255.96	3.17%	95	300	0	1	4	+	severe, high water table, flood hazard
Bo/Bp	Blago	3,704.97	9.35%	95	300	0	1	4	12	severe, high water table
Br	Brinkerton	404.59	1.02%		>300	0	1	3	10	severe, high water table
Bs	Brinkerton and Nolo	1,096.35	2.77%							severe, high water table
Co	Cookport	130.71	0.33%	95	300	1	2	2	4	severe, slow permeability in subsoil
En/Er	Ernest	821.00	2.07%	95	300	1.5	2	4	10	severe, slow permeability in subsoil
H2	water	167.73	0.42%							
Ld/Ls	Lickdale	1,231.77	3.11%		>300	0	1	4	12	severe, high water table
Mc/Mk	Meckesville	2,085.34	5.26%	95	300		4	4	12	severe, slow permeability in subsoil, slopes
Mp	Muck and peat	699.16	1.76%		variable	0	2	5	15	severe, high water table
No	Nolo	494.62	1.25%	95	300	0.5	1.5	2	3	severe, high water table
Sa	Sandstone	600.48	1.51%			no estimates made				severe, rubble material
Sm	Strip mine	19.56	0.05%			no estimates made				on-site investigation required
Vb	Very stony land - Brinkerton-Lickdale association	956.33	2.41%			variable				severe, high water table, slow permeability, many stones and boulders
Vd	Very stony land-Dekalb complex	927.23	2.34%			variable				severe, slopes, many stones and boulders
Ve	Very stony land-Ernest complex	520.15	1.31%			variable				severe, slow permeability, many stones and boulders
Vl	Very stony land-Leetonia complex	2,250.52	5.68%			variable				severe, many stones and boulders
Vw	Very stony land-wet land complex	90.88	0.23%			variable				severe, slow permeability, many stones and boulders
Wt	Wet terrace land	2,356.80	5.94%			variable				severe, high water table, slow permeability
Unknown	Unknown or unclassified	3.07	0.01%							
Totals		39,644.46	100%							

The most well drained soils are shown in the top six highlighted rows. These have permeabilities that are moderately rapid to rapid. Calvin soils have drainfield limitations due to slope and both the Calvin and Dekalb soils have very shallow (2 to 4 feet) depth to bedrock. Drainfields in these soils will need to address /overcome these severe soil limitations. The Calvin and Dekalb soils account for approximately 42 percent of the entire watershed and 90 percent of the high permeability soils.

1.1.3 WETLANDS AND FLOODPLAINS

The Canaan Valley contains the largest wetlands complex in West Virginia and consists of bogs, marshes, and streams, many of which are in the northern half of the valley. Figure 1-10 depict the wetland regions of the Canaan Valley. Wetlands comprise approximately 18% of the Canaan Valley's total area. Figure 1-2 also depicts the floodplain regions of Canaan Valley.

FIGURE 1-2: ENVIRONMENTALLY SENSITIVE AND FLOOD PLAIN REGIONS FOR CANAAN VALLEY, WV VICINITY



1.2. EXISTING INFRASTRUCTURE

1.2.1 EXISTING WASTEWATER INFRASTRUCTURE

Most facilities in the valley release treated wastewater into polishing ponds that discharge into a receiving stream by overflowing. During the summer low-flow period, water loss by evaporation from the polishing ponds frequently exceeds inputs, so there is very little discharge into the streams.

Thrasher (2001) stated that the WVDEP was contacted regarding the fifteen (15) privately or state owned and operated wastewater treatment systems in the Valley. Thrasher (2001) stated that, according to DEP personnel, discharges from the facilities in the Valley generally are in compliance with permit limits. However, six of the fifteen facilities were considered to be in poor condition, while some are undersized. Also it is understood that recently (approximately January 2005) WVDEP issued compliance orders to a number of Canaan Valley wastewater treatment plants.

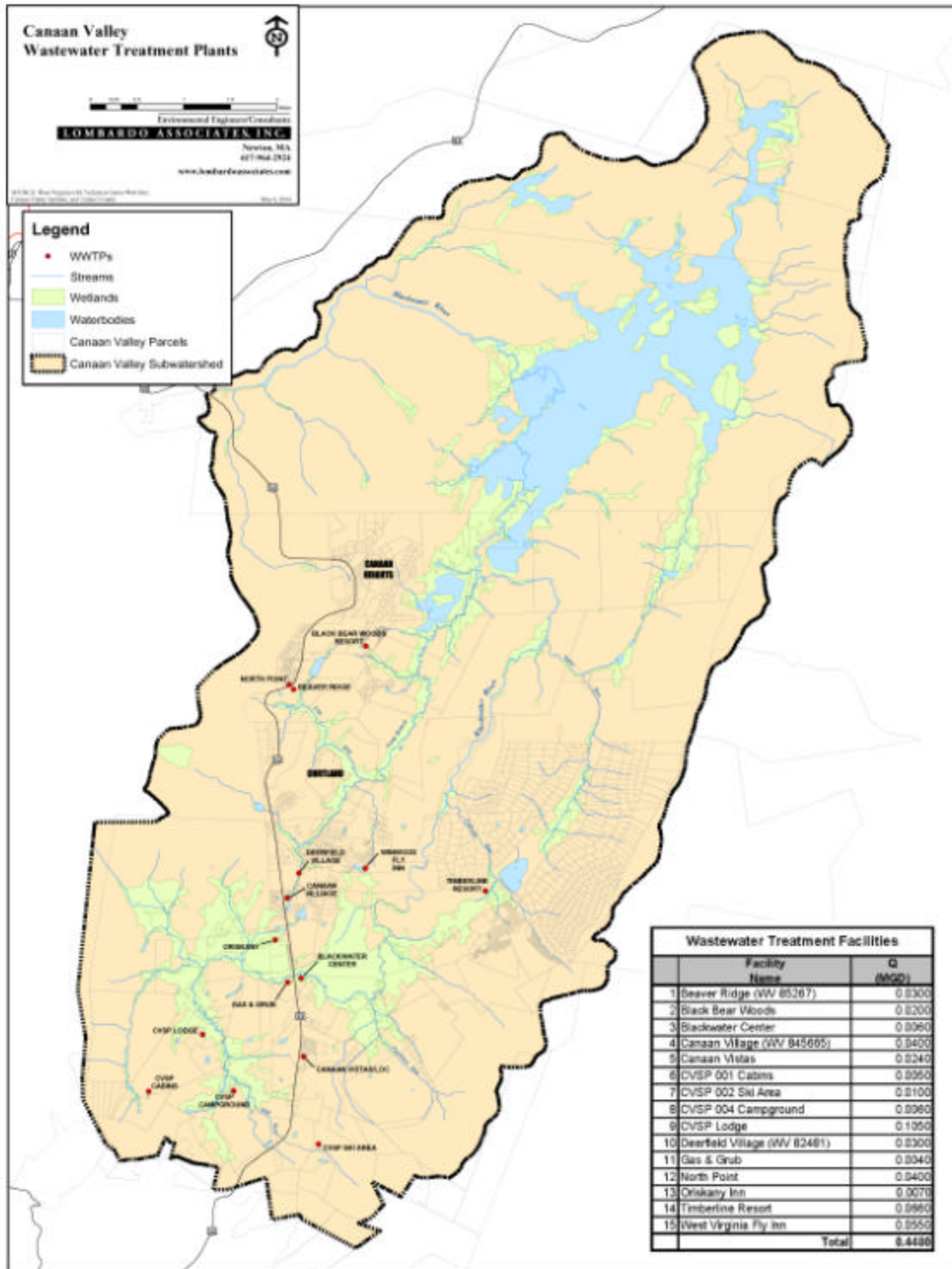
All basic treatment systems will be required to obtain a minimum standard effluent of:

- 10 mg/l BOD₅
- 3 mg/l NH₃N,
- 30 mg/l TSS

regardless of discharge location.

The locations of the wastewater treatment facilities in the Canaan Valley are illustrated in Figure 1-3.

FIGURE 1-3: MAP OF CANAAN VALLEY WASTEWATER TREATMENT FACILITIES



1.2.2 EXISTING WATER SUPPLY INFRASTRUCTURE

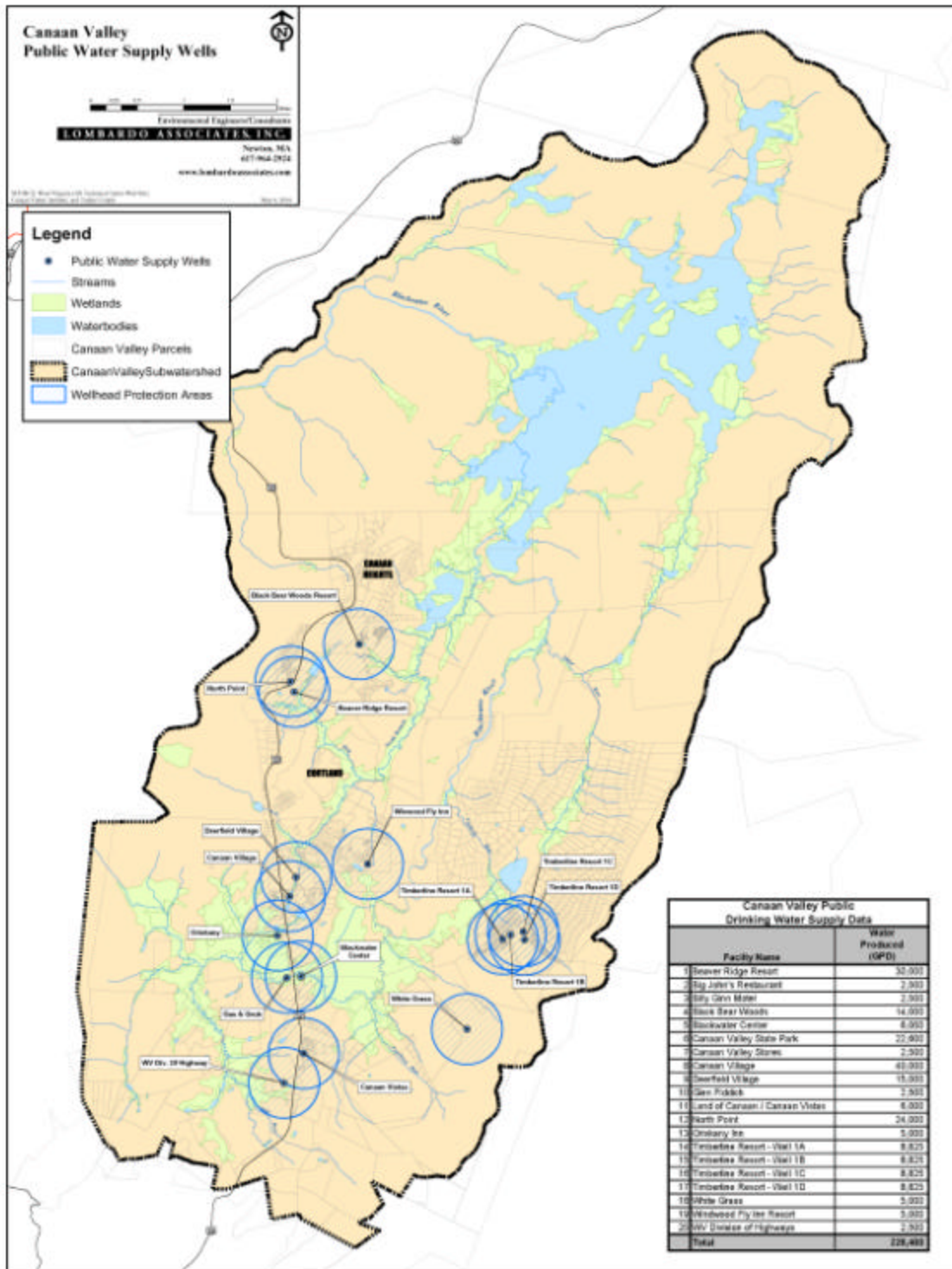
The water treatment plant in Canaan Valley State Park has a capacity of 0.126 MGD. Table 1-2 shows the population served and water production data for the other public drinking water supplies in the Valley. Figure 1-4 presents the locations of the existing wells within the project study area.

TABLE 1-2: CANAAN VALLEY PUBLIC DRINKING WATER SUPPLY DATA

	Facility Name	Population Served	Water Produced (GPD)*
1	Beaver Ridge Resort	300	30,000
2	Big John's Restaurant	25	2,500
3	Billy Ginn Motel	25	2,500
4	Black Bear Woods	140	14,000
5	Blackwater Center	60	6,000
6	Canaan Valley State Park	226	22,600
7	Canaan Valley Stores	25	2,500
8	Canaan Village	400	40,000
9	Deerfield Village	150	15,000
10	Glen Fiddich	25	2,500
11	Land of Canaan / Canaan Vistas	60	6,000
12	North Point	240	24,000
13	Oriskany Inn	50	5,000
14	Timberline Resort - 1A	88	8,825
15	Timberline Resort - 1B	88	8,825
16	Timberline Resort - 1C	88	8,825
17	Timberline Resort - 1D	88	8,825
18	White Grass	50	5,000
19	Windwood Fly Inn Resort	50	5,000
20	WV Division of Highways	25	2,500
	Total	2,204	220,400

* WVDHHR uses 100 gpd/person for water production estimates
 Source: West Virginia Dept. of Health and Human Resources

FIGURE 1-4: CANAAN VALLEY PUBLIC WATER SUPPLY WELLS



1.3. LEGAL AND INSTITUTIONAL ISSUES

There are three types of public wastewater management entities that can be established in West Virginia. They are listed along with the mechanisms to form the entities in Table 1-3 below.

TABLE 1-3: TYPES OF PUBLIC WASTEWATER MANAGEMENT ENTITIES

Public Wastewater Entity	Mechanism for Establishing
Sewage Management Districts	Petition of the public
	County Commission
Public Sewage District (PSD)	County Commission Resolution
Municipality	Town Council and mayor
	Town charter

The Hamrick Public Service District is an example of an existing wastewater management entity in Tucker County.

Information was not available on water and sewer rates in each development, as well as, how use fees are collected.

1.4. THRASHER ENGINEERING 2001 PROPOSED WASTEWATER MANAGEMENT FACILITIES

Thrasher Engineering (2001) proposed the following:

1. Abandonment of 15 existing wastewater treatment plants
2. Conversion of existing wastewater treatment plants to pump stations
3. Wastewater collection system interconnecting new pump stations to new wastewater treatment plant – consisting of 9 large pump stations and 24 small grinder type stations with gravity collection
4. New 0.75 MGD wastewater treatment plant at Timberline - orbal ditch treatment system with UV disinfection and pumped discharge to a single Blackwater River location
5. Force main to discharge location at river mile point 1.2 of the Blackwater River – 12 inch diameter
6. Discharge facilities

for a total project cost of \$15,850,000 in 2001 dollars as presented on Table 1-4.

The estimated Annual O&M costs are presented in Table 1-5. Proposed Debt for Project Bonding is presented in Table 1-6. Proposed User Charges are presented in Table 1-7.

The basis of the Thrasher Plan is:

- Increase capacity for future growth.
- Reduce impacts of wastewater on violation of water quality standards.

Issues of concern associated with the Thrasher Plan are:

- All 15 wastewater systems need to agree to participate for the Plan to be viable. No preliminary assessments of willingness to participate are indicated.
- Sludge disposal still needs to be addressed.
- The wastewater collection for CVSP and Timberline Resorts will stay in private operation.

- The amount of infiltration in each collection system needs to be quantified for assessing this issue and ability of wastewater systems to properly treat wastewater flow.
- The Financing Plan requests \$11 million in grants (69.4% of project costs) and \$4.85 million in a 40 year no-interest loan.
- It appears that the annual electric cost was underestimated by almost \$20,000 per year. Original estimates were calculated based on a 60 HP requirement rather than the 90 HP requirement stated in the design and efficiency miscalculation.

TABLE 1-4: THRASHER PLAN ESTIMATED PROJECT COSTS

Wastewater Discharge System (Blackwater River)		
Project Costs	Price	Total Price
<i>Engineering</i>		
Engineering Design	\$ 875,000	
Engineering During Construction	\$ 125,000	
Engineering Inspection	\$ 500,000	
Engineering Subtotal		\$ 1,500,000
<i>Special Services</i>		
Design Surveying	\$ 150,000	
Preparation of Applications	\$ 5,000	
Land and R/W Surveying	\$ 50,000	
Subsurface Investigation /		
Compaction Testing	\$ 40,000	
Construction Stakeout	\$ 75,000	
O&M Manual	\$ 30,000	
Warranty and Start-Up	\$ 5,000	
One-Year Certification	\$ 5,000	
Special Services Subtotal		\$ 360,000
<i>General</i>		
Legal	\$ 75,000	
Administration	\$ 150,000	
Bond Counsel	\$ 50,000	
Lands and Right-of-Way	\$ 200,000	
Accounting	\$ 5,000	
Electrical Service	\$ 55,000	
WVDOH Fees	\$ 45,000	
Permits	\$ 10,000	
General Subtotal		\$ 590,000
<i>Project Costs Subtotal</i>		\$ 2,450,000
Construction Costs		
Collection System	\$ 6,262,000	
Treatment System	\$ 5,182,850	
Discharge System	\$ 809,250	
<i>Construction Subtotals</i>		\$ 12,254,100
Contingency		\$ 1,145,900
Total Project Costs		\$ 15,850,000

TABLE 1-5: ESTIMATED ANNUAL O&M COSTS

Item	Cost
Collection	\$ 34,600
Pumping	175,068
Treatment and Disposal	107,425
Billing and Collection	15,000
Administration and General	55,000
Total Proposed O&M Costs	\$ 387,093

TABLE 1-6: PROPOSED DEBT FOR PROJECT BONDING

Loan/Grant Breakdown	
Proposed Grant	\$ 11,000,000
WV IJDC Loan (P/A, 0%, 40-Year)	4,850,000
= Annual Loan Payment	121,250
+ 15% Coverage	18,188
Total Annual Expense	\$ 139,438
Total Loan Expense (40 Years)	\$ 5,577,520

TABLE 1-7: PROPOSED USER CHARGES

Capacity	Rate (per 1,000 gallons)
First 5,000 gallons	\$ 8.00
Next 5,000 gallons	\$ 7.50
Next 40,000 gallons	\$ 7.00
Next 50,000 gallons	\$ 6.50
All over 100,000 gallons	\$ 6.00

Notes:

- Minimum Charge Meter User
No bill will be rendered for less than 4,500 gallons or \$36.00 per month
- Minimum Charge (No meter – Residential Well Customers)
No bill will be rendered for less than \$36.00 per month
- Service Connection
A service connection fee of \$250.00 to all applicants applying for sewer service

2. WASTEWATER MANAGEMENT NEEDS DEFINITION

The areas of investigation for the Needs Definition are:

- An understanding of each of the seventeen small wastewater systems in Canaan Valley
- Location of individual septic systems, their age, functionality and expected useful life
- Proposed sewerage, if any, for future growth

2.1. EXISTING WASTEWATER SYSTEMS

Table 2-1 presents a brief description of each wastewater system. Aerial photos of each of the WWTP are presented in Appendix B, along with a layout of the sewer system associated with each wastewater treatment plant.

TABLE 2-1: CANAAN VALLEY WASTEWATER SYSTEMS

Canaan Valley Wastewater Treatment Systems

	Receiving Stream	Facility Name	Q (MGD)	Treatment Plant Process
1	Blackwater River	Beaver Ridge (WV 85267)	0.0300	activated sludge, sand filter, direct discharge
2	N. Branch	Black Bear Woods	0.0200	activated sludge, sand filter, UV, direct discharge
3	Blackwater River	Blackwater Center	0.0060	activated sludge, sand filter, direct discharge
4	N. Branch	Canaan Village (WV 845665)	0.0400	activated sludge, sand filter, direct discharge
5	Freeland Run	Canaan Vistas	0.0240	activated sludge, sand filter, direct discharge
6	Club Run	CVSP 001 Cabins	0.0050	activated sludge, sand filter, direct discharge
7	Mill Run	CVSP 002 Ski Area	0.0100	activated sludge, sand filter, direct discharge
8	Mill Run	CVSP 004 Campground	0.0060	activated sludge, sand filter, direct discharge
9	Blackwater River	CVSP Lodge	0.1050	activated sludge, sand filter, direct discharge
10	N. Branch	Deerfield Village (WV 82481)	0.0300	activated sludge, sand filter, direct discharge
11	Blackwater River	Gas & Grub	0.0040	activated sludge, sand filter, direct discharge
12	N. Branch	North Point	0.0400	activated sludge, sand filter, direct discharge
13	Coon Run	Oriskany Inn	0.0070	activated sludge, sand filter, direct discharge
14	Yaokum Run	Timberline Resort	0.0660	aerated lagoon
15	N. Branch	West Virginia Fly Inn	0.0550	activated sludge, sand filter, direct discharge
		Total	0.4480	

Values for Q from permit files.

One of the most important considerations in defining the wastewater needs is to assess the capacity and performance of the existing wastewater treatment plants. Table 2-2 analyzes the capacity of the seventeen wastewater treatment plants. It shows that a majority of the plants are currently operating under capacity. This excess capacity can help accommodate future growth in the Valley.

TABLE 2-2: CAPACITY ANALYSIS FOR CANAAN VALLEY WWTPS

Facility Name:	Permit MAX (MGD)	Actual MAX (1)	ACTUAL MAX / Permit MAX	Actual MAX as % of Total Max	Cum Actual MAX as % of Total Max	Avg of Monthly Daily MAX (2)
Windwood and Thalheim Resort WV 0082775	0.055	0.021	38%	9%	9%	0.009
Timberline Four Seasons Resort WV 0089852	0.120	0.107	89%	46%	55%	0.066
Northpoint/Canaan Mtn Resort/ North WVG550887 (see note Below)	0.040	0.005	13%	2%	57%	0.003
Note: this facility was sold from American Aeries to Northpoint et al						
American Aeries WV0103420 (see note below)	0.032	0.002	6%	1%	58%	0.002
Lochoa Industries WV 0103110	0.032	0.007	22%	3%	61%	0.003
Canaan Heights (?)						
Deerfield Village Development, Inc WV 0103110/wvg550715	0.030	0.012	40%	5%	66%	0.006
Canaan Village, Inc WV 0103110/WVG550420	0.040	0.003	8%	1%	67%	0.002
Canaan Vistas ?						
Canaan Valley National Wildlife Refuge WV0103110/WVG550918	0.0070	0.001	14%	0%	68%	0.000
Blackwater Center Association WV0103110/WVG550802	0.006	0.002	33%	1%	69%	0.001
Black Bear Resort WV0103110/WVG550641	0.020	0.008	40%	3%	72%	0.004
Beaver Ridge Resort WV0103110/WVG550795	0.030	0.004	13%	2%	74%	0.002
Subtotal	0.412	0.172	42%			0.100
Canaan Valley State Park - Cabins WV0081124 #1	0.005	0.007	140%	3%	77%	0.003
CVSP Ski Area WV0081124 #2	0.010	0.006	60%	3%	79%	0.003
CVSP - Lodge WV0081124 #3	0.100	0.044	44%	19%	98%	0.019
CVSP - Ski Maintenance Building WV0081124 #2-01	0.0005	0.001	222%	0%	99%	0.000
CVSP - Campground WV 0081124 #4	0.006	0.002	33%	1%	100%	0.001
CVSP - Golf Clubhouse WV 0081124 #5	0.006	0.001	17%	0%	100%	0.000
CVSP Subtotal	0.127	0.061				0.027
TOTAL	0.5395	0.2330	43%	100%	100%	0.1265
1) Maximum values for period of record						
2) Average of maximum is average of daily maximums per month for period of record						

Table 2-3 shows the number of exceedences for BOD₅, TSS, Ammonia-N, pH, and fecal coliform for each facility. The maximum value over the permit limit was also recorded. Note that five of the facilities had no permit violations. The CVSP - Cabins and CVSP – Ski Maintenance Area facilities had the most exceedences. From Table 2-4, those facilities were the facilities with the highest actual max to permit max flow ratios. BOD₅ and ammonia-N were the first and second most commonly violated parameters, respectively.

TABLE 2-3: EFFLUENT VIOLATIONS

Facility Name: Permit Number:	BOD5		TSS		Ammonia-N		pH		Fecal Coliform	
	# Exceed	Max Value	# Exceed	Max Value	# Exceed	Max Value	# Exceed	Max Value	# Exceed	Max Value
Windwood and Thalheim Resort WV 0082775	5	57.7			1	3.95	1	9.2	2	380
Timberline Four Seasons Resort WV 0089852	8	24.2			1	15.2	2	9.6		
Northpoint/Canaan Mtn Resort/ North Lake WVG550887 (see note Below) <i>Note: this facility was sold from American Aeries to Northpoint et al</i>										
American Aeries WV0103420 (see note below)										
Lochoa Industries WV 0103110	2	10.5			2	11.2			1	16,000
Deerfield Village Development, Inc WV 0103110/wvg550715	2	21								
Canaan Village, Inc WV 0103110/WVG550420										
Canaan Valley National Wildlife Refuge WV0103110/WVG550918	1	11.2					1	10.4		
Blackwater Center Association WV0103110/WVG550802										
Black Bear Resort WV0103110/WVg550641										
Beaver Ridge Resort WV0103110/WVG550795										
Canaan Valley State Park - Cabins WV0081124 #1	15	22.5	1	70	1	7.99			3	2,000
CVSP Ski Area WV0081124 #2	8	36			4	49	1	9.1		
CVSP - Lodge WV0081124 #3	7	14.1					1	9.1	2	45,000
CVSP - Ski Maintenance Building WV0081124 #2-01	13	307	12	620	11	2,780				
CVSP - Campground WV 0081124 #4	2	11.8								
CVSP - Golf Clubhouse WV 0081124 #5	1	6.7								
TOTAL	47		13		16		3		5	

2.2. PROPOSED SEWERING, IF ANY, FOR POTENTIAL GROWTH

Maximum buildout of Canaan Valley, based upon the latest information, suggests that the population equivalent of approximately 6,000 people can occur. This buildout could occur:

- Within existing sewer areas
- Areas near sewer systems whereby connection to the existing system would be practical
- Areas that could implement their own decentralized cluster system
- Areas that could implement individual on-site systems

and obviously will occur over some time period.

Based upon the existing excess capacity, as illustrated in Table 2-2, it appears that much of the future build out could be accommodated within the service areas of existing wastewater treatment facilities: Approximately 50 percent of existing capacity is available, which is slightly greater than the 250,000 gpd provided by the Thrasher Plan for future growth.

Based upon US Natural Resource Conservation Service (NRCS) data, approximately 50 percent of the soils of Canaan Valley are conducive to subsurface dispersal, albeit some soils have shallow depth to groundwater or bedrock and would require advanced pretreatment. Although one must be sensitive to the karst geology that will provide little additional purification, post treatment and dispersal by subsurface systems appears to an important mechanism for effluent dispersal in Canaan Valley. Thus, it appears that a decentralized approach to wastewater management in the Valley is technically feasible and sewerage solely for potential growth is not necessary throughout Canaan Valley.

On-site and clustered systems can accommodate growth and development even in a maximum build out scenario, and offer safe wastewater treatment and aquifer recharge given the suitability of Canaan Valley's soils. If, upon detailed site assessment, environmentally sensitive areas are encountered (e.g. karst), then clustered systems can be utilized to treat waste water in nearby appropriate soils. Lastly, on-site and clustered decentralized systems are scalable and can be designed to meet growth demands "just-in-time" and in various combinations depending upon site conditions, economics, and the nature of proposed development.

2.3. REHABILITATION OF EXISTING WASTEWATER SYSTEMS

It is Lombardo Associates, Inc.'s opinion that the rehabilitation of the seventeen existing wastewater treatment facilities in Canaan Valley could occur by use of the following technology options. However any rehabilitation program needs to be based upon a clear definition of wastewater needs. As only a very preliminary assessment has been performed, the discussion in this section is necessarily preliminary and generic.

Equipment Repair - Replacement

Wastewater Management Facilities may be in need of ordinary equipment repair – replacement to address faulty operational issues.

It is expected that the following issues need to be addressed:

- Electrical Systems upgrade
- Addition of monitoring equipment and telemetry (internet connection)
- System automation
- Concrete, building and fence repair

Technology Replacement - Enhancement

It is anticipated that the some of the existing wastewater treatment facilities will need technology replacement and/or enhancement. Replacement could be changing of treatment processes to one of a variety of fixed film processes.

Enhancement could be conversion of activated sludge systems to Integrated Fixed Film/Activated Sludge Systems (IFAS) systems by addition of media. Several types of media are available for IFAS systems and they fall into two categories:

Facility Expansion

It is anticipated and understood that the treatment processes at some sites are undersized and therefore will require expansion. A detailed facility analysis is needed to identify these needs.

Flow Equalization

Based upon a field visit and discussions with the treatment plant operator, LAI is of the opinion that flow equalization is needed at a number of the treatment systems and will result in improved wastewater treatment performance.

Institutional Options for Unsewered Areas

The institutional management options for unsewered areas are:

- Private individual as currently practiced;
- Placing all wastewater systems in an utility management program administered by the County PSD and/or the private sector

TABLE 2-4: WASTEWATER COLLECTION, TREATMENT AND DISPERSAL SUMMARY OF OPTIONS

System Component	Options
Service	Determined by Defined Wastewater Needs and Community Choice
Collection	Gravity Grinder Pump (GP) Septic Tank Effluent (STE) – Septic Tank Effluent Gravity (STEG) – Pressurized (STEP) Vacuum
Treatment Technology	<u>Fixed Film Process</u> – Recirculating Media Filters (RMF) – Intermittent Media Filters – Constructed Wetlands – Rotating Biological Contactor (RBC) <u>Suspended Growth Processes</u> – Activated Sludge – Sequencing Batch Reactor (SBR) – Membrane Bio-Reactor <u>Integrated Fixed Film & Suspended Growth</u> – Media & Activated Sludge
Disinfection	Chlorine UV Ozone
Treatment Location	Determined by Dispersal Site, Land Availability, Community Choice
Dispersal Technology	Subsurface Leaching Field / Bed Subsurface Drip Irrigation System Water Reuse Surface Discharge
Dispersal Location	Determined by Technical Requirements of Dispersal Technology, Environmental Considerations, Land Availability, Community Choice

2.4. COMPLIANT EXISTING SYSTEMS

It is proposed that existing plants that are in compliance and recently built would be maintained and enhanced as follows:

1. **Each plant would be examined** to identify mechanisms to improve its performance and reliability. Mechanisms are expected to include:
 - a. Increase influent storage for dampening flow variations and for improved solids removal. Surge flow wash out of solids is a common cause of treatment plant malfunctioning. Most of the Canaan Valley treatment plants appear to have little to no equalization storage capacity.
 - b. Addition of fixed media to supplement the activated sludge treatment plants. Addition of fixed media is a mechanism (and one of the simplest) to increase the capacity of existing wastewater treatment plants.
 - c. Membrane processes will be examined, as well, for applicability to Canaan Valley as new membrane systems have recently been developed for small flow applications.
 - d. Replacement of the treatment process may make technical and economic sense.
2. **The effluent dispersal options** of subsurface systems (such as drip dispersal or trench system) would be examined to replace the current practice of surface water discharge. Alternately, subsurface constructed wetlands could be used for effluent polishing prior to direct discharge. The constructed wetlands could potentially replace the existing lagoons. Major benefits of subsurface dispersal or constructed wetlands options are:
 - a. Groundwater recharge and maintenance of stream base flows. Direct discharge options are known to increase the peaks and decrease the minimum flows of streams.
 - b. When used for reuse, such as irrigation, demands on the water supply aquifer are reduced and stream flows protected.
3. **Use of automated, electronic data collection systems** that can advise management agencies, in a pro-active manner, of issues that need to be addressed so that corrective actions can be implemented prior to permit violations. Many causes of malfunctions are excess flow related, which may be due to illegal stormwater connections, broken pipes, etc.

Major benefits of salvaging existing wastewater treatment plants are the reduction of proposed capital expenditure and enabling an existing private owner to continue to depreciate any remaining investment.

2.5. NON-COMPLIANT EXISTING SYSTEMS

Existing plants out of compliance would be examined to determine the cause of non-compliance and develop a corrective action. Non-compliance is anticipated to be due to facilities being under-sized and/or equipment/facilities requiring replacement. Based upon LAI's limited field review, it appears that needs for equipment replacement and rehabilitation of existing facilities to extend their longevity are modest.

The process described above for enhancement would be used for rehab/replacement, as well as:

1. Add influent storage
2. Change/modify treatment process
3. Add fixed media, consider membrane processes
4. Consider effluent dispersal via subsurface methods – focus on drip dispersal for beneficial reuse, recognizing needed care in karst geology
5. Consider constructed wetlands for effluent dispersal

2.6. RECOMMENDED CAPITAL IMPROVEMENTS

Based on the field visits and review of the existing conditions, Table 3-3 presents proposed improvements and **budgetary** estimates for anticipated needed wastewater improvements for the decentralized approach. Facility Plans need to be performed for each system to better define appropriate solutions and their associated costs.

The maximum buildout of Canaan Valley suggests that the population equivalent of approximately 6,000 people can occur. Clearly there will be some areas that will be too distant from existing sewer systems to make the use of existing systems option technically or economically feasible. For those areas, individual septic systems or small cluster systems, i.e. serving multiple properties, could be implemented. For karst geology areas, those wastewater would be required to install pre-treatment systems prior to subsurface dispersal. Numerous low-cost, simple to operate treatment systems are available for this type of application. Table 2-5 presents cost estimates for on-site and decentralized systems for new growth.

TABLE 2-5: COST ESTIMATES – NEW CONSTRUCTION

	Construction Cost	Engineering, Surveying, Permitting, etc.	Total Capital Costs
On-Site			
1. Conventional Septic System	\$6,000 - \$10,000	\$2,000 - \$3,000	\$8,000 - \$13,000
2. Advanced Treatment Unit – for Environmentally Sensitive Areas	\$12,500 - \$18,000	\$2,500 - \$4,000	\$15,000 - \$22,000
Clustered (Costs per Property)			
1. Conventional Septic System (extent of required sewerage will significantly affect costs)	\$6,000 - \$12,000	\$3,000 - \$4,000	\$9,000 - \$16,000
2. Advanced Treatment Unit – for Environmentally Sensitive Areas	\$12,000 - \$16,000	\$3,000 - \$5,000	\$15,000 - \$21,000

(Costs are Considered Maximum & are per Residential Property)

TABLE 2-6: CANAAN VALLEY DECENTRALIZED WASTEWATER CAPITAL IMPROVEMENT PLAN

Group	Facility Name	Proposed Improvements	Construction Budget	Capitol Budget
Group I	Timberline Four Seasons Resort	Upgrades to existing plant - Flow EQ, media & automation/telemetry, subsurface discharge	\$1,500,000	\$2,535,000
	Lochoa Industries	Upgrades to existing plant - Flow EQ, media & automation/telemetry, replacement of equipment & facility expansion subsurface discharge	\$700,000	\$1,183,000
	Blackwater Center Association	Replace existing plant, due to location surface discharge	\$150,000	\$253,500
	Canaan Valley State Park - Cabins	Upgrades to existing plant - Flow EQ, media & automation/telemetry, subsurface discharge	\$60,000	\$101,400
	CVSP Ski Area	Upgrades to existing plant - Flow EQ, media & automation/telemetry, subsurface discharge	\$150,000	\$253,500
	CVSP - Lodge	Upgrades to existing plant - Flow EQ, media & automation/telemetry, subsurface discharge	\$750,000	\$1,267,500
	CVSP - Ski Maintenance Building	Upgrades to existing plant - Flow EQ, media & automation/telemetry, subsurface discharge	\$25,000	\$42,250
	CVSP - Campground	Upgrades to existing plant - Flow EQ, media & automation/telemetry, subsurface discharge	\$100,000	\$169,000
	CVSP - Golf Clubhouse	Upgrades to existing plant - Flow EQ, media & automation/telemetry, subsurface discharge	\$100,000	\$169,000
	Subtotal			\$3,535,000
Group II	Windwood and Thalheim Resort	Upgrades to existing plant - Flow EQ, media & automation/telemetry, subsurface discharge	\$550,000	\$929,500
	Northpoint/Canaan Mtn Resort/ North Lake	Upgrades to existing plant - Flow EQ, media & automation/telemetry, subsurface discharge	\$400,000	\$676,000
	American Aeries			\$0
	Deerfield Village Development, Inc		\$400,000	\$676,000
	Canaan Village, Inc		\$500,000	\$845,000
	Canaan Valley National Wildlife Refuge		\$70,000	\$118,300
	Black Bear Resort	Make improvements of flow EQ, effluent wetland & automation/telemetry	\$200,000	\$338,000
	Beaver Ridge Resort	Upgrades to existing plant - Flow EQ, media & automation/telemetry, subsurface discharge	\$200,000	\$338,000
	Allowance for Treatment of On-Site & Cluster Systems		\$750,000	\$1,267,500
	Subtotal			\$3,070,000
MISCELLANEOUS (10%)			\$660,500	
CONTINGENCY (20%)			\$1,321,000	
CONSTRUCTION COST TOTAL			\$8,586,500	
ENGINEERING & OTHER DEVELOPMENT COSTS (30%)			\$2,575,950	
TOTAL PROJECT COSTS			\$11,163,000	\$11,163,000

3. RECOMMENDED PREFERRED PLAN

A Recommended Preferred Wastewater Management Plan that integrates the desired solutions into an optimized plan was developed. The recommended Preferred Wastewater Management Plan consists of the following two phases:

1. Upper Watershed Wastewater Facility Plan
2. Lower Watershed Wastewater Facility Plan including on-site areas.

LAI recommends pursuit and implementation of a decentralized wastewater management approach for Canaan Valley based on our field visits, data collected, GIS analysis, and reports reviewed.

LAI found several weaknesses in the centralized wastewater project proposed by Thrasher. Foremost, it appears to be not economically viable. Among other things, it required 100 percent volunteer participation from existing wastewater facilities. The Thrasher plan proposes discharging a waste load allocation (WLA) of 750,000 gpd, which is less restrictive than the WLA set in the TMDL, in the most sensitive area for dissolved oxygen in the upper reaches of the Blackwater River.

Moreover, the environmental sensitivity and dispersed development of the area lends itself to a more decentralized approach. Canaan Valley has extensive wetlands and surface waters that need to be protected. Streams in the Valley are considered trout waters and most support native trout reproduction. However, due to low levels of dissolved oxygen resulting from too much organic carbon, ammonia nitrogen, and organic nitrogen from wastewater point sources, the WVDEP in conjunction with USEPA, developed TMDLs for dissolved oxygen. Thus, it is important that the wastewater option pursued meet the WLA specified in the TMDLs.

A decentralized wastewater management plan also allows for “smart” future growth. The excess capacity in the existing wastewater treatment systems can be utilized. The implementation of drip irrigation or beneficial reuse systems can help reduce the pollutant load from additional wastewater from new growth.

In summary, LAI feels that decentralized systems are technically viable, economically competitive and thereby are the most appropriate approach for Canaan Valley. Also, the decentralized approach allows maximum flexibility in planning for future growth. Especially with new technologies, on-site systems are obtaining higher treatment levels, greater reliability, and more flexibility.

Specific recommendations on a lot-by-lot basis cannot be made in this Feasibility Analysis, as that would be performed in a Wastewater Facility Plan. A more detailed analysis is required before LAI can propose solutions for individual situations/properties. This would be done in the next phase of the analysis and requires review of specific site parameters and limitations. Additional field visits will be required to gather the necessary information.

It is recommended that a Wastewater Management Facility Plan for four study areas in the upper watershed: Canaan Valley State Park, Lochoa, Timberline Resort, and Blackwater Center be prepared. Once the Facility Plan is complete for those study areas, a Wastewater Management Facility Plan for the remaining areas in the Valley should be developed.

3.1. IMPLEMENTATION PLAN

Based on discussion with CVI, a two phase Implementation Plan was developed for wastewater management in Canaan Valley. During the first phase a Wastewater Management Facility Plan would be prepared for four study areas in the upper watershed: Canaan Valley State Park, Lochoa, Timberline Resort, and Blackwater Center be prepared. The major activities of this phase of the project would consist of preparing Wastewater Facility Planning level details on:

1. Existing Conditions Assessment

2. Planning Period Projections
3. Needs Analysis
4. Alternatives Identification and Evaluation
5. Definition of Preferred Plan
6. Management, Legal, and Institutional Issues
7. Capital Budget and User Charges

The four study areas indicated by DO levels in the TMDL modelling are:

1. Timberline Resort
2. Lochoa (Canaan Vistas)
3. Blackwater Center
4. Canaan Valley State Park

The following phase of the Implementation Plan would then involve the development of Wastewater Management Facility Plans for the remaining areas in the Valley.

REFERENCES

Thrasher Engineering (2001) *Amendment #1 to the Facilities Plan of the Proposed Wastewater Collection and Treatment System Project for the Tucker County Commission and the Hamrick Public Service District*, November 2001.