

DECENTRALIZED WASTEWATER MANAGEMENT FACILITY PLAN INTRODUCTION

FOR

CANAAN VALLEY, TUCKER COUNTY, WV



March 8, 2006

Submitted to:

Perot Systems Government Services, Inc.
8270 Willow Oaks Corporate Drive
Suite 300
Fairfax, VA 22031

Prepared by:

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

Table of Contents

1. BACKGROUND1
2. FEASIBILITY STUDY2
3. DECENTRALIZED WASTEWATER FACILITY PLAN7
4. EXISTING CONDITIONS8
 4.1. Soils8
 4.2. Water Quality9
 4.3. Existing Infrastructure.....11
 4.4. Development.....12
 4.4.1 Existing12
 4.4.2 Buildout13
REFERENCES21

List of Tables

Table 2-1: Canaan Valley Decentralized Wastewater Capital Improvement Plan5
Table 2-2: Cost Estimates – New Construction6
Table 4-1: Canaan Valley Soil Classifications9
Table 4-2: Canaan Valley Public Drinking Water Supply Data11
Table 4-3: Canaan Valley WWTFs12
Table 4-4: Canaan Valley Parcel Development13
Table 4-5: Summary of PKG Growth Scenarios for Canaan Valley17
Table 4-6: Canaan Valley Buildout Estimates18
Table 4-7: Onsite Area Parcel Developable Areas20

1. BACKGROUND

Lombardo Associates, Inc. (LAI) have been retained by Perot Systems Government Services to develop a Comprehensive Decentralized Wastewater Management Facility Plan for Canaan Valley, in Tucker County West Virginia, which meets the water quality standards and is protective of public health and safety.

Canaan Valley is an environmentally sensitive area in the Upper Blackwater River watershed overlaying karst geology with groundwater providing source water for residential and commercial needs. Canaan Valley wastewater planning has been a critical issue since the development and implementation of the Upper Blackwater Total Maximum Daily Load (TMDL) in 1998. The TMDL was developed in response to the level of dissolved oxygen falling below the water quality standards set by designated use for 'trout waters', the Upper Blackwater River was listed on the West Virginia impaired streams list (303d list).

The implementation of the TMDL calls for limits on waste load allocation by each of the owners of the Valley's package plants – small to medium sized wastewater treatment facilities (WWTFs), and the ancillary collection systems used to transport wastewater to the WWTFs. Most of these WWTFs were originally designed and built twenty or more years ago according to standards of the day. Since the implementation of the TMDL waste load allocations and the concurrent tightening of the effluent standards, WWTF operators have been struggling to achieve the effluent standards with outdated designs and facilities that are unable to meet those standards. Despite these efforts, the WVDEP has recently served almost all of these facilities with Consent Orders for noncompliance with their discharge permits. Review of the discharge monitoring reports (DMRs) indicates that the permit limits were not being met. Wastewater collection and treatment improvements are a first step in the restoration of the Upper Blackwater.

A Canaan Valley Wastewater Facility Plan in 2001 proposed sewerage and interconnection of the existing wastewater systems, termination in one large treatment system, and discharge to the Blackwater River near the Blackwater Center located off of the intersection of Rt. 32 and Timberline Road. This study was preliminary in nature. For the 2001 Plan to be viable all existing WWTFs had to connect. The estimated cost of the Plan was \$15.9 million in 2000 dollars. A 2005 Decentralized Treatment Feasibility Study determined that a decentralized approach to upgrading existing wastewater systems appears to be both technically viable and economically advantageous option to the 2001 Plan. The estimated cost of the decentralized approach was \$11.2 million. The Feasibility Study was primarily related to existing system upgrades and, like the 2001 Plan, did not include detailed evaluation of existing wastewater collection systems and the cost of upgrading them as necessary.

2. FEASIBILITY STUDY

In the Feasibility Study, LAI concluded 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 recommended 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.

LAI encouraged further discussions with CVI and other stakeholders in Canaan Valley to determine the most appropriate options for the Valley.

It was LAI's opinion that the rehabilitation of the existing wastewater treatment facilities in Canaan Valley could occur by use of the following options. However any rehabilitation program needs to be based upon a clear definition of wastewater needs. As only a very preliminary assessment was performed for the Feasibility Study, the options presented were necessarily preliminary and generic.

Equipment Repair/Replacement

WWTFs 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 was anticipated that the some of the existing WWTFs would 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.

Facility Expansion

It was 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 WWTF operator, LAI was of the opinion that flow equalization is needed at a number of the treatment systems and will result in improved wastewater treatment performance.

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

1. Each WWTF 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 WWTF malfunctioning. Most of the Canaan Valley WWTFs 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 WWTFs.
 - 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, 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.

Existing WWTFs out of compliance would be examined to determine the cause of non-compliance and develop a corrective action. Non-compliance was anticipated to be due to facilities being under-sized and/or equipment/facilities requiring replacement.

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

Based on the field visits and preliminary review of the existing conditions, Table 2-1 presents proposed improvements and **budgetary** estimates for anticipated needed wastewater improvements for the decentralized approach from the Feasibility Study. A Facility Plan was needed for each system to better define appropriate solutions and their associated costs.

TABLE 2-1: 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

Previously performed buildout analysis indicates that the maximum buildout of Canaan Valley that can occur is the population equivalent of approximately 6,000 people. This will result in 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 it was recommended in the Feasibility Study that individual septic systems or small cluster systems, i.e. serving multiple properties, could be implemented. For onsite systems in karst geology areas, pre-treatment systems would be required prior to subsurface dispersal. Numerous low-cost, simple to operate treatment systems are available for this type of application. Table 2-2 presents the cost estimates for onsite and cluster systems for new growth from the Feasibility Study.

TABLE 2-2: 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)

3. DECENTRALIZED WASTEWATER FACILITY PLAN

As a result of the Feasibility Study, a detailed 2005 Decentralized Wastewater Facility Plan was funded and initiated in late September 2005. This project builds upon the work performed for the Wastewater Management Feasibility Study (February, 2005) and consists of the following activities.

1. Comprehensive Decentralized Wastewater Management Facility Plan

- Wastewater Needs Definition
 - Data Collection
 - Existing Needs for WWTFs
 - Existing Needs for Unsewered Areas
 - Future Needs --based on 20 year projections
- Technology Alternatives Screening
- Management Alternatives Screening
- Identification of Technically Viable Scenarios
- Management Alternatives Evaluation
- Selection of Decentralized Preferred Plan

2. Public Participation

In collaboration with CVI, public input will be solicited to define the most probable solutions. Engineering expertise will interact with local concerns to describe potential project outcomes. Public participation is a key element of the Canaan Valley wastewater management planning process.

The web site will be an important tool to help disseminate information about the project. Additionally project and public meetings will be held to actively involve the public and stakeholders.

3. Comparative Summary of Decentralized Preferred Plan vs. 2000 Plan

A detailed comparative summary of the chosen decentralized management option and updated centralized sewer plan will be provided.

4. Final Recommended Plan

- Engineering description, cost (capital costs, O&M, retirement of existing debt), project funding plan, projected user rates, project schedule, land and easements required, and environmental benefits.
- Brief Environmental Assessment of Plan.

4. EXISTING CONDITIONS

Canaan Valley is a small, oval basin in rural Tucker County, West Virginia (Plate A1). 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.

Canaan Valley is 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 feet 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. Plate A2 shows the relation of the Upper Blackwater River watershed in the Cheat River basin. Plates A3 and A4 show the digital elevation model and 40 foot contour intervals for the Valley and provide a feel for the slopes.

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. Plate A5 depicts the wetland regions of the Canaan Valley. Wetlands comprise approximately 18 percent of the Canaan Valley's total area. The floodplain regions of Canaan Valley are also shown on Plate A5.

4.1. Soils

The Canaan Valley soils are primarily described as poorly drained soils derived from the erosion of the Blackwater Anticline. A summary of the US Department of Agriculture (USDA) soil types and classifications found within the Valley is presented in Table 4-1.

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. Plate A6 shows the results of a soil screening analysis, which shows the distribution of the soils most likely to be suited for onsite systems. However, it should be noted that soils in the Valley are highly variable and the USDA Soil Survey information cannot be relied upon for site characterization. Site evaluations need to be performed to determine the dispersal capacity of the site and properly site the onsite system.

TABLE 4-1: CANAAN VALLEY SOIL CLASSIFICATIONS

Soil Type	Acres	Percent of Watershed	Permeability (mp)		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%	30	95	*	*	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%	30	95	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%								

* not applicable

4.2. Water Quality

The Upper Blackwater River was listed on West Virginia's 303(d) list of impaired waters in 1996 because its dissolved oxygen (DO) was below the state standard minimum of 6 mg/L and thus the river was not meeting its designated use. The designation for the Upper Blackwater River is "Aquatic Life B2 Trout Waters", which is the propagation and maintenance of fish and other aquatic life in streams or stream segments that sustain

year-round trout populations. Streams or stream segments which receive annual stockings of trout but which do not support year-round trout populations are excluded from the trout water designation.

The low DO was a result of too much organic carbon and ammonia nitrogen and organic nitrogen during low flow periods. The problem was attributed to wastewater treatment plants. There are also natural conditions including beaver dams and wetlands that impact the DO. The organic and ammonia nitrogen and organic carbon contribute to the DO problem as bacteria convert them to different chemical forms, consuming oxygen in the process.

A total of 23.4 miles of the river from its headwaters to the mouth of Yellow Creek was listed as impaired in 1996 and 1998. In 1998 a TMDL was developed for the Upper Blackwater River. The river was then moved to Supplemental Table B - Previously Listed Waters - TMDL Developed on the 303(d) list. Under the existing 40 CFR 130 regulations, TMDL development allows for the removal from the 303(d) list. Further, EPA's Integrated Water Quality Monitoring and Assessment Report Guidance recommends classification of impaired waters for which a TMDL has been developed in a category that is clearly distinguished from the formal 303(d) list. To facilitate future transition to the "integrated" process and format, WVDEP developed this supplement. Waters included in this supplement have had TMDLs developed, but water quality improvements are not yet complete and/or documented.

The integrated reporting system provides a consistent way for states to categorize the water quality of streams and lakes across the nation. EPA has developed five main categories and three subcategories for an overall rating of each segment or assessment unit. All stream segments or assessment units fall into one the following categories:

- Category 1 - fully supporting all designated uses
- Category 2 - fully supporting some designated uses, but no or insufficient information exists to assess the other designated uses
- Category 3 - insufficient or no information exists to determine if any of the uses are being met
- Category 4 - waters that are impaired or threatened but do not need a Total Maximum Daily Load (TMDL)
 - Category 4a - waters that already have an approved TMDL but are still not meeting standards
 - Category 4b - waters that have other control mechanisms in place which are reasonably expected to return the water to meeting designated uses
 - Category 4c - waters that have been determined to be impaired by pollution or other natural factors
- Category 5 - waters that have been assessed as impaired and are expected to need a TMDL

The Upper Blackwater River falls under Category 4a.

Freeland Run in Canaan Valley was identified as impaired on the 2004 303(d) list as a Category 5 water due to benthic macroinvertebrates. Benthic macroinvertebrate sampling is conducted in 303(d) listed streams having aquatic life impairments. Streams

are listed as biologically impaired based on a survey of their benthic macroinvertebrate community. Benthic macroinvertebrate communities are rated using a multimetric index developed for use in wadeable streams of West Virginia. The West Virginia Stream Condition Index (WVSCI) is composed of six metrics that were selected to maximize discrimination between streams with known impairments and reference streams. Streams with WVSCI scores of 60.6 or less are considered biologically impaired and included on the 303(d) list.

4.3. Existing Infrastructure

The Canaan Valley State Park water supply is from surface waters. The remainder of the public water supplies in the Valley rely on groundwater for their water source. Table 4-2 shows the population served and water production data for the other public drinking water supplies in the Valley. Plate A8 shows the locations of the water supply protection areas within the project study area.

TABLE 4-2: CANAAN VALLEY PUBLIC DRINKING WATER SUPPLY DATA

Canaan Valley Public Drinking Water Supply Data		
Facility Name	Population Served	Water Produced (GPD)*
Timberline Four Season Resort Management	789	78,900
Canaan Valley State Park	1580	158,000
WV Resorts	50	5,000
Canaan Valley National Wildlife Reserve	25	2,500
Canaan Village Inc.	400	40,000
Blackwater Center	60	6,000
Black Bear Woods	283	28,300
Beaver Ridge Resort	300	30,000
Land of Canaan Vacation	60	6,000
Canaan Valley Stores	25	2,500
Deerfield Village	150	15,000
White Grass Ski Touring Center	50	5,000
North Point Subdivision	240	24,000
Canaan Valley State Park	1580	158,000
Canaan Vistas	25	2,500
Total	5,617	561,700

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

The existing wastewater management practices in the Valley include the following sectors:

1. Individual onsite systems – 474 systems
2. Wastewater treatment facilities (WWTFs) – 17 systems

Table 4-3 presents the existing WWTFs in the Valley, their estimated ages, description of their service area, and permitted flows. The location of the WWTFs and their service areas is shown on Plate B1.

TABLE 4-3: CANAAN VALLEY WWTFs

No.	WWTF	Estimated Date Installed	Permits		Description of Served Area	Flow (gpd)
			NPDES Permit No.	Bureau of Health Cert. of Approval		
1	Beaver Ridge Resort	1984	WVG550795	9183	60 condos, 8 houses	30,000
2	Black Bear Resort	1986	WVG550641	8620	Pedestal home resort	20,000
3	Blackwater Center Association	1985	WVG550802.	9308	Restaurant, shops, bank, 14 apts.	6,000
4	Canaan Village, Inc	1985	WVG550794	9399	Motel, rental units	40,000
5	Canaan Valley National Wildlife Refuge	1976	WVG550918	5444	Headquarters	7,000
6A	CVSP - Cabins	1978	WV0081124	6086	Park cabins	5,000
6B	CVSP - Ski Area	1978	WV0081125	6086	Ski area	10,000
6C	CVSP - Lodge	1978	WV0081126	6086	Park lodge	100,000
6D	CVSP - Ski Maintenance Building	1978	WV0081127			450
6E	CVSP - Campground	1978	WV0081128	6086	Campsites	5,000
6F	CVSP - Golf Clubhouse	1978	WV0081129	6086	Clubhouse	5,000
7	Deerfield Village Development, Inc	1984	WVG550715	9001	Town houses, restaurant, shops	30,000
8	Lochoa Industries	1981, 1985	WVG550906	8441, 9341	42 condos, 30 houses	24,000
9A	Canaan Mtn Resort - North Point		WVG550906		Subdivision	18,760
9B	Canaan Mtn Resort - North Lake		WVG550906		Subdivision	21,490
10	Timberline Four Seasons Resort		WV0089826		Recreational facility & subdivision	66,000, 120,000
11	Windwood and Talheim Village	1973	WV0082775	4162	Subdivision	55,000

4.4. Development

The Tucker County 2003 Assessor's database was joined with the Tucker County parcels provided by CVI – understood to be accurate as of May 2004. All parcels within the Canaan Valley study area were selected from the County parcel dataset to create a project parcel dataset.

4.4.1 Existing

The development status of the parcels was determined based on the assessed building value. If the assessed building value is greater than, \$1,000 it was assumed that the parcel was developed. Otherwise it was considered undeveloped. The development status was refined for select parcels based on feedback received from the advisory

committee and other stakeholders and review of aerial photography. Analysis indicates that 956 (54 percent) out of the 1,759 parcels that fall within Canaan Valley are developed.

CVI also provided information regarding the wastewater service area for parcels in the sewerred areas. This information was used with the assigned development status to determine the number of developed and undeveloped parcels within the service area for each of the WWTFs and the unsewerred areas. Approximately, 50 percent of the developed parcels are served by WWTFs. The remainder are served by onsite septic systems. Table 4-4 presents the parcel development by service area.

TABLE 4-4: CANAAN VALLEY PARCEL DEVELOPMENT

No.	No. WWTFs	WWTF	Developed Parcels	Undeveloped Parcels	Total Parcels
1	1	Beaver Ridge Resort	3	1	4
2	1	Black Bear Resort	83	24	107
3	1	Blackwater Center Association	5	0	5
4	1	Canaan Village, Inc	17	25	42
5	1	Canaan Valley National Wildlife Refuge	4	0	4
6	6	CVSP	21	39	60
7	1	Deerfield Village Development, Inc	7	2	9
8	1	Lochoa Industries	11	35	46
9	2	Canaan Mtn Resort - North Point/North Lake	67	60	127
10	1	Timberline Four Seasons Resort	237	115	352
11	1	Windwood and Talheim Village	27	33	60
Sewered Subtotal			482	334	816
Unsewered Subtotal			474	469	943
Total			956	803	1,759

4.4.2 Buildout

4.4.2.1 Zoning Ordinance

The Canaan Valley Zoning Ordinance is effective July 31, 1998 provides regulations for the development of land within Canaan Valley. Included are provisions that control development with respect to natural features, maximum density, and open space requirements. The following sections are applicable when evaluating buildout potential and wastewater management.

Steep Slopes (303.B.)

If the lot involves a new principal building on land areas with a natural slope over 25 percent, then a minimum lot area of 3 acres shall be required. If the lot involves a new principal building on land areas with a natural slope over 35 percent, then a minimum lot area of 5 acres shall be required.

Landscaping and Buffer Yards (307.D.)

Substantial landscaping shall be provided to buffer sewage lagoons, sewage treatment plants and stormwater detention basins/pond from views of homes and roads.

Maximum Density (404)

A minimum lot area of 1 acre shall apply for any lot recorded after the effective date of the Ordinance, and a maximum density of one dwelling unit per acre shall apply except as provided:

- A: within a "Planned Development" approved under Section 405, or
- B: under Section 303 for lots involving steep slopes over 25 percent

Planned Developments (405)

If a "Planned Development" is approved, it is possible to obtain increased density and great flexibility in site layout.

B. As part of a subdivision, the density of a "Planned Development" may be increased as provided in Section 405.C. and no minimum lot area shall apply for each individual dwelling, provided all of the following standards are met:

1. Any dwelling on a lot of less than 1 acre shall be served by a central water and central sewage system meeting State and County requirements.
2. The owners shall agree to establish a long-term operation and maintenance contract for the central water and sewage systems with a qualified individual or firm, unless the systems will be operated by incorporated Town, City or Public Service District.
3. The maximum density shall be determined based upon total lot area of the tract, minus the following: a) land within the right of way of existing public roads, and b) land propose for commercial and industrial buildings and related parking. The resulting acreage shall then be multiplied by the maximum average density (see below) to determine the maximum number of dwelling units or hotel/motel rental units.
 - a. In determining the maximum density, portions of a Planned Development involving golf courses, ski trails, wetlands, steep slopes, open space and proposed roads may be included in the acreage to determine the maximum density.

4. The applicant shall prove that proposed layout of lots, buildings and roads will fully consider slopes over 35 percent, waterways, scenic ridgelines and wetlands, and hold their disturbance to a reasonable minimum.
 5. A minimum amount of land areas as provided in Section 405.C shall be in preserved open space, through one or more of the following methods:
 - a. Through setting aside land owned by the applicant through one of the methods provided in Section 406; or
 - b. Through counting lands that are occupied by existing or to-be donated publicly-owned open space, existing ski trails or an existing golf course within a 2,000 feet wide radius of the boundaries of the Planned Development as the open space. Such lands are not required to be owned by the applicant for the Planned Development.
 6. The steep slope provisions of Section 303 shall not apply within an approved Planned Development.
 9. The tract shall include a minimum of 5 acres of land.
- C. The following maximum average density shall apply within a Planned Development if land area equal to the following minimum percentage of the total land area of the Planned Development are set aside as open space (as provided in Section 406.B)

Maximum Average Density Per Acre		Minimum Land Area Preserved in Public Semi-Public or Private Open Space
Dwelling Units	Motel/Hotel Units*	
2	5	20%**
3	6	30%
4	7	40%
5	8	50%
6	9	60%
7	10	70%
8	11	80%
9	12	90%

*The maximum density for motel or hotel rental units provided shall be increased to 20 units per acre, with 20 percent open space, if a use is within 1,000 feet of the centerline of WV Route 32 or Courtland Road

**Absolute minimum to qualify as a Planned Development

4.4.2.2 Data Analysis

An analysis of current and buildout conditions was performed to determine the sustainable wastewater management strategy for Canaan Valley that would serve current and buildout conditions.

Buildout conditions were initially determined as part of the PKG Consultant's 1998 Land Use Capacity Forecast (buildout scenarios subcontracted by Thrasher 2001). Table 4-5 presents the buildout estimates in Thrasher 2001.

CVI revised the Thrasher 2001 estimates and found material differences in the amount of land available to develop. Most of the difference was associated with the recent purchase of developable lands by the USFWS for inclusion in the Canaan Valley National Wildlife Refuge. Since the Thrasher 2001 report was published, 3,424 acres of developable land identified by PKG have since been converted to conservation land owned by USFWS. That change represents a 56 percent decrease in the available developable lands. Eleven of the 31 Potential Development Areas identified by PKG are no longer viable sites for development. After reviewing and revising the PKG estimates to reflect current conditions, CVI completed an independent analysis to determine the locations of large tracts of land potentially available and suitable for development in Canaan Valley. The CVI analysis factored into account natural impediments to growth, such as water/wetland features, to determine the maximum number of one acre lots that might be developed on a parcel-by-parcel basis. Table 4-6 presents the results of CVI's buildout analysis as presented in the 2005 Feasibility Study.

TABLE 4-5: SUMMARY OF PKG GROWTH SCENARIOS FOR CANAAN VALLEY

Scenario 1						
Holding Capacity of 31 Potential Development Areas						
No.	Site	Acres	Minus 20% ⁽¹⁾	Land Use	Units/sf ⁽²⁾	Persons
1	Canaan Heights property	315	252	Residential	252	655
2	Black Bear Resort	54	43	Resort Res.	20	52
3	Ratliff Property	24	19	Residential	19	49
4	Bonner Property	112	90	Residential	90	234
5	North Point Resort	7	6	Resort Res.	40	104
6	Beaver Ridge Resort	23	18	Resort Res.	30	78
7	Jefferson Property	92	74	Residential	74	192
8	Cooper Property (east)	299	239	Residential	239	621
9	Cooper Property (west)	36	29	Residential	29	75
10	Beall Property	118	94	Residential	94	244
11	Miller Property	102	82	Residential	82	213
12	Route 32 Property	70	56	Residential	56	146
12a	Route 32 Property	70	56	Commercial	80,000 sf	267
13	Miller Property	42	34	Residential	34	88
14	Cortland Road Property	125	100	Residential	100	260
15	Peat Farm Property	387	310	Residential	310	806
16	Oriskany Inn Property	22	18	Commercial	10,000 sf	33
17	Gas Well Property	10.5	8	Residential	8	21
17a	Gas Well Property	10.5	8	Commercial	10,000 sf	33
18	Timberline Resort - Golf Course	407	326	Resort Res.	60	156
19	Timberline Resort - Mid Mountain	46	37	Resort Res.	40	104
20	Timberline Resort - Hillside	153	122	Resort Res.	40	104
21	Freeland Road Property	298	238	Residential	238	619
22	Dial Property	27	22	Residential	22	57
23	Reed Property	307	246	Residential	246	640
24	Cabin Mountain Plateau 1	16	13	Residential	13	34
25	Cabin Mountain Plateau 2	23	18	Residential	18	47
26	Cabin Mountain Plateau 3	21	17	Residential	17	44
27	Cabin Mountain Hillside	785	628	Residential	628	1,633
28	Allegheny Power Property 1	695	556	Residential	213	554
29	Allegheny Power Property 2	2,068	1,654	Residential	264	686
30	Allegheny Power Property 3	469	375	Residential	375	975
31	Allegheny Power Property 4	438	350	Residential	350	910
Totals ⁽³⁾		7,592	6,073		4,001	10,434
Totals from Pflum, Klausmeier & Gehrum Table		6,919	5,535		3,399	9,170
<i>Difference</i>		673	538		602	1,264
<p>(1) Twenty percent of every potential development area is set aside to account for natural feature restraints, right-of-way and infrastructure improvements to the site at time of development.</p> <p>(2) For commercial areas, the number of persons yielded was calculated by using 300 sf of commercial space per employee.</p> <p>(3) Totals do not include Rows 12a and 17a (duplicates) and Units/sf Total Calculates Row 16 as 0.22 acres.</p>						

(Thrasher 2001)

TABLE 4-6: CANAAN VALLEY BUILDOUT ESTIMATES

NO	SITE	ACRES	MINUS		LAND USE	UNITS	PERSONS
			20%				
1	Canaan Heights Property	315	252		Residential	252	655
2	Black Bear Property	54	43		Resort Residential	20	52
4	Bonner Property	112	90		Residential	90	234
5	Northpoint Resort	7	6		Resort Residential	40	104
6	Beaver Ridge Resort	23	18		Resort Residential	30	78
7	Jefferson Property	92	74		Residential	74	192
9	Cooper Property (west)	36	29		Residential	29	75
10	Beall Property	118	94		Residential	94	244
11	Miller Property	102	82		Residential	82	213
12	Route 32 Property	70	56		Residential	56	146
	Route 32 Property				Commercial		
13	Miller Property	42	34		Residential	34	88
14	Cortland Road Property	125	100		Residential	100	260
15	Peat Farm Property	387	310		Residential	310	806
19	Timberline Resort - Mid Mo	46	37		Resort Residential	40	104
21	Freeland Road Property	298	238		Residential	238	619
22	Dial Property	27	22		Residential	22	57
23	Reed Property	307	246		Residential	246	640
24	Cabin Mountain Plateau 1	16	13		Residential	13	34
28	Allegheny Power Property	695	556		Residential	213	554
31	Allegheny Power Property	438	350		Residential	350	910
		3,310	2,650			2,333	6,065
		at gpcd	70			Flow (gpcd)	424,550
*Note that Site 12 and 17 have alternate uses. Be careful when summing the columns.							
EXCLUDED SITES							
NO	SITE	ACRES	MINUS		LAND USE	UNITS	PERSONS
			20%				
3	Ratliff Property				Residential		
8	Cooper Property (east)				Residential		
16	Oriskany Inn Property		18		Commercial		
17	Gas Well Property		8		Residential		
	Gas Well Property		8		Commercial		
18	Timberline Resort - Golf Course		326		Resort Residential		
20	Timberline Resort - Hillside				Resort Residential		
25	Cabin Mountain Plateau 2				Residential		
26	Cabin Mountain Plateau 3				Residential		
27	Cabin Mountain Hillside				Residential		
29	Allegheny Power Property 2				Residential		
30	Allegheny Power Property 3				Residential		

(Lombardo Associates 2005)

LAI conducted an independent analysis of the development potential in the Valley as part of this project. Similar to CVI's 2004 effort, LAI subtracted the area of the water bodies and wetlands from the total parcel area within the onsite area to determine the

area of developable land on each parcel. Land owned by the US Fish and Wildlife Service (USFWS), US Forest Service (USFS), and WV Department of Natural Resources (WVDNR) was then excluded from the total area of developable land. This resulted in a total acreage of developable land of approximately 6,000. Further subtracting the 3 large parcels in the north of the Valley, since they were not included in the CVI estimates, results in 3,493 developable acres which is comparable to the 3,310 estimated by CVI. Table 4-7 presents the parcel area, wetland/waterbody area, and net developable area for the parcels with the 50 largest developable areas. Those parcels account for about 70 percent of the total developable land in the Valley in onsite areas.

Assuming that only 80 percent of each parcel is developable due to roads, common areas, slopes and other constraints, leaves 2,794 acres for development in the Valley. At a development density of one equivalent dwelling unit (EDU) per acre and 2.6 capita (ca) per EDU, the buildout population would be 7,264. From Title 64 Series 47 the estimated wastewater flow is 70 gpcd and the total additional wastewater flow in the Valley is approximately 508,480 gpd.

Under the Planned Development provision of the zoning ordinance, it may be possible to have greater development density on some of the lots. However, the buildout analysis above is consistent with previous estimates and for planning purposes is considered sufficient.

It was assumed that the undeveloped parcels within sewer service areas will be served by the WWTFs.

TABLE 4-7: ONSITE AREA PARCEL DEVELOPABLE AREAS

PIN	Name	Parcel Area (ac)	Wetland/Waterbody Area (ac)	Net Developable Area (ac)	Cumulative Developable Area (ac)	% of Cumulative Total
05-311-1	W VA POWER & TRANS CO	392	39	353.2	353.2	10%
05-370-25	REED RANDALL R	313	1	312.6	665.8	19%
03-291-2	W VA POWER & TRANS CO	161	33	127.5	1,109.0	32%
05-310-15	W VA POWER & TRANS CO	143	21	122.5	1,231.6	35%
05-330-3	W VA POWER & TRANS CO	120	10	109.9	775.7	22%
05-310-6	W VA POWER & TRANS COMPANY	152	46	105.1	981.6	28%
05-310-7	W VA POWER & TRANS COMPANY	115	14	100.8	876.4	25%
05-310-16	W VA POWER & TRANS CO	110	12	98.7	1,343.5	38%
05-350-8	THOMPSON BARBRA DOROTHY ET AL	382	286	96.1	1,439.6	41%
05-330-12	W VA POWER & TRANS CO	87	20	67.7	1,507.2	43%
05-330-16	MILLER GLENN	57	0	56.7	1,563.9	45%
05-390-8	REED RANDALL R	56	-	56.4	1,620.3	46%
05-330-2	W VA POWER & TRANS CO	76	24	52.0	1,672.3	48%
03-291-3	W VA POWER & TRANS CO	50	2	48.3	1,720.6	49%
05-350-8.49	THOMPSON DOROTHY	56	12	43.5	1,764.1	51%
05-370-11	PARSONS VIRGINIA	141	97	43.5	1,807.5	52%
05-330-16	MILLER GLENN	41	-	40.9	1,848.4	53%
05-330-11	W VA POWER & TRANS CO	64	29	35.2	1,883.7	54%
05-350-2.1	TETER FREDERICK WILLIAM &	38	3	34.7	1,918.4	55%
05-330-8	MONONGAHELA POWER CO	53	19	33.5	1,951.9	56%
05-330-19	MONONGAHELA POWER CO	30	1	28.9	1,980.8	57%
05-390-7	REED RANDALL R	28	-	28.1	2,008.9	58%
05-330-9	ALLMAN RUTH COOPER	27	-	27.4	2,036.3	58%
05-310-10	MONONGAHELA POWER	37	14	23.4	2,059.7	59%
05-350-39	TIMBERLINE ASSOCIATION INC	24	1	22.8	2,082.5	60%
03-290-12	PETERSON WILLIAM M JR &	22	-	22.4	2,104.9	60%
05-330-1.61	JEFFERSON MARTIN &	22	-	21.6	2,126.4	61%
05-330-20.1	BEALL ROSCOE C III	21	-	20.7	2,147.2	61%
05-390-8A	REED RANDALL R	20	-	20.1	2,167.3	62%
05-331-121	GEARY JAMES PAUL	19	-	19.2	2,186.5	63%
03-310-21	BONNER HOWARD & JOYCE	17	-	17.2	2,203.8	63%
05-350-1	STURM KENNETH G & SUE ELLEN	17	-	16.8	2,220.5	64%
05-350-2.2	GAMPONIA HERMONIO & PHOEBE J	15	0	14.5	2,235.0	64%
05-330-10.1	MONONGAHELA POWER CO	16	2	13.8	2,248.8	64%
05-350B-52	THOMPSON BARBRA DOROTHY	19	5	13.6	2,262.5	65%
05-310-18	W VA POWER & TRANS CO	15	2	13.2	1,244.8	36%
05-350-1	STURM KENNETH G & SUE ELLEN	12	-	12.5	2,274.9	65%
05-330-1	COOPER FAY & ST JOHN'S	12	-	12.0	2,287.0	65%
03-290-38.6	BOSLEY THOMAS V	12	-	11.6	2,298.5	66%
03-290-39.1	PAINI WILLIAM J & SUELLA J	8	-	8.3	2,306.8	66%
05-350A-9999.2		8	0.2	8.2	2,315.0	66%
03-290-33.4	MCDANIEL DUKE A & LINDA	8	-	7.9	2,322.9	67%
05-330-1.76	COOPER MARTIN L ESTATE	8	-	7.7	2,330.6	67%
05-331-110	COOPER RICHARD C &	7	-	7.2	2,337.8	67%
05-331-108	VOORHEES EDWIN JR &	7	-	7.1	2,345.0	67%
05-350-12	MINEAR SARAH	7	-	7.1	2,352.0	67%
05-330-1.75	COOPER MARTIN L ESTATE	7	-	6.9	2,358.9	68%
	Subtotal	3,051	692	2,359	2,359	
	Others				1,134	
	Total				3,493	

REFERENCES

- Canaan Valley Zoning Committee (1998) *Canaan Valley Zoning Ordinance, Tucker County, West Virginia, 92543*, Adopted by the Tucker County Commission on June 24, 1998, with an Effective Date of July 31, 1998.
- Lombardo Associates (2005). *Canaan Valley Tucker County, West Virginia, Wastewater Management Feasibility Study*, February 8, 2005.
- 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.
- USEPA (1997) *Upper Blackwater River: Total Maximum Daily Load for Dissolved Oxygen*, US EPA, in cooperation with the WV DEP, October 22, 1997.