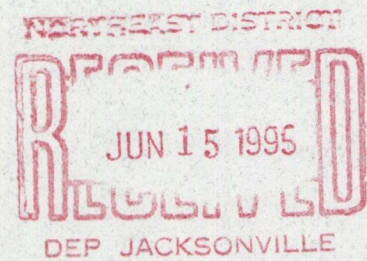


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**TRAIL RIDGE LANDFILL**  
**MITIGATION MONITORING REPORT NO. 5**  
**DER PERMITS 161821182 AND SC16-184444**

**2 May 1995**

**PREPARED FOR:**

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**MITIGATION MONITORING REPORT NO. 5  
FOR  
TRAIL RIDGE LANDFILL**

**A. INTRODUCTION**

On 7 April 1995, Environmental Services, Inc. conducted the fifth monitoring of the forested wetland creation effort located at the Trail Ridge Landfill site in Duval County (see Drawing 1). Pursuant to Conditions 6, 11, 12 13 and 14 of Permit # 12-031-055 (see Appendix A) this evaluation was undertaken to document the success of the creation area at the beginning of its third growing season. This report will discuss the status of the project in terms of the following:

- . Percent survival and density of planted species
- . Recruitment density and composition
- . Percent cover of herbaceous species
- . Recorded growth via established parameters for trees and shrubs
- . Hydrological conditions
- . Wildlife utilization

The earthwork phase of construction was completed during the summer of 1992. The mitigation area was over-excavated approximately 0.5 foot below the existing grade of the adjacent wetlands. The area was then backfilled with mulch consisting of the upper soil layer from impacted wetlands on-site to promote natural revegetation by herbaceous recruits. Planting of the forested creation area was completed on 16 November 1992. A mixture of 3-gallon trees and 1-gallon shrubs were planted on 10-foot centers throughout the mitigation area. A total of 2,095 native wetland trees and 125 native wetland shrubs were installed. A completion report of the species planted was submitted on 10 December 1992. Planted tree and shrub species included:

**Native Wetland Trees**

<u>Species</u>	<u>Size</u>	<u>Number</u>
Bald cypress ( <i>Taxodium distichum</i> )	3-gallon	419
Red Maple ( <i>Acer rubrum</i> )	3-gallon	419
Sweetgum ( <i>Liquidambar styraciflua</i> )	3-gallon	419
Black gum ( <i>Nyssa sylvatica</i> var. <i>biflora</i> )	3-gallon	95
Sweet bay ( <i>Magnolia virginiana</i> )	3-gallon	295
Water Tupelo ( <i>Nyssa aquatica</i> )	3-gallon	448



### Native Wetland Shrubs

<u>Species</u>	<u>Size</u>	<u>Number</u>
Wax myrtle ( <i>Myrica cerifera</i> )	1-gallon	31
Fetterbush ( <i>Lyonia lucida</i> )	1-gallon	46
Buttonbush ( <i>Cephalanthus occidentalis</i> )	1-gallon	31
Virginia willow ( <i>Itea virginica</i> )	1-gallon	17

#### B. ANALYTICAL TECHNIQUES

A total of eight (8) permanent belt transects were established within the forested mitigation area (Figure 2) and marked with 4-foot PVC stakes for reference. Four transects were orientated north-south, and four were orientated east-west to capture a uniform cross-section of the entire creation area. Each transect is 10 feet in width. All tree specimens within each transect were counted, and the health of each specimen was observed by noting new twig and leaf growth.

A total of ten (10) square meter plots were also permanently installed at each point of intersection between the various transects. The herbaceous density and growth parameters were noted by visual estimation. Recruitment of nuisance and non-nuisance species were noted throughout the mitigation area. Any observed wildlife in the vicinity of the mitigation area was also noted.

The methodology used in assessing growth and survivorship of planted trees and shrubs was as follows:

1. **Survivorship.** All trees and shrubs growing within each transect were counted. This number was divided by the total number of trees or shrubs originally planted within that belt transect to obtain the percent survivorship of planted species.
2. **Growth.** Two (2) trees in each transect were permanently marked with an identifying numbered tag.
  - a. **Caliper.** The width of tree trunks was measured six (6) inches from the ground.
3. **Recruitment.** The natural recruitment of wetland trees, shrubs and herbs in each transect was determined by visual assessment.

The methodology used in assessing growth and coverage of herbaceous vegetation was as follows:



- a. **Growth and Coverage.** The percent cover by wetland species of the total area of each square meter plot was determined and recorded.
- b. **Recruitment.** The natural recruitment of herbaceous wetland species within each plot was determined by visual assessment. Any recruited herbs observed throughout the mitigation area were also noted.

## C. RESULTS

**Survivorship.** The creation area at Trail Ridge has shown excellent survivorship since it was initially planted. The overall survivorship for all of the transects is approximately 92 percent. This high survival rate is indicative of excellent growing conditions within the creation area. All of the trees and shrubs were exhibiting new twig and leaf growth. No signs of stress were observed and all specimens appeared healthy. Please refer to Table 1 for the data on the survivorship.

**Growth.** The marked trees were measured for changes in diameter at a height of 6 inches above ground level. The majority of the specimens have grown slightly since the previous iteration. All species were healthy and normal leaf growth was observed. Growth data are also provided in Table 1.

**Coverage.** The coverage of the mitigation area by natural recruits has given the area a natural appearance. The percent coverage by the recruits in the area is approximately 50 percent. This also is a very good indicator of the overall success of the creation area, since all of the coverage is a result of natural recruitment. Data from the sample quadrats are provided in Table 2. The diversity of the herbaceous species is very good for a site of this type.

**Recruitment.** A large variety of herbaceous species have naturally recruited into the mitigation area, contributing to the formation of a diverse and thickly vegetated community. Notable recruits include beak rushes (*Rhynchospora* spp.), sphagnum moss (*Sphagnum* sp.), various sedges (*Cyperus* sp.), rush (*Juncus* sp.), pennywort (*Hydrocotyle umbellata*), bamboo briar (*Smilax laurifolia*), spikerush (*Eleocharis* sp.), red root (*Lachnanthes caroliniana*), low panicum (*Panicum* sp.), St. Johns wort (*Hypericum fasciculatum*), yellow-eyed grass (*Xyris* sp.), blue maidencane (*Amphicarpum muhlenbergianum*), red ludwigia (*Ludwigia repens*), bladderwort (*Utricularia* spp.), Asiatic coinwort (*Centella asiatica*), and fetterbush. Several tree species have also started to recruit into the creation area. These include red maple, sweetgum, loblolly bay (*Gordonia lasianthus*), and tupelo. The adjacent wetland system is apparently providing the seeds for these specimens.

**Nuisance Species.** No nuisance species were observed within the mitigation area. Historically tenacious nuisance species such as cattails (*Typha* sp.) were notably absent from the area.



**Hydrologic Conditions.** The data collected from the piezometers revealed that the water table was very close to the surface. Levels ranged from +0.2 feet to -1.5 feet. Rain gauge data from Trail Ridge Landfill indicates that March was a very wet month with 7.6 inches of rain falling. The average rainfall for March is only 5.4 inches. This above average rainfall has helped the water table to rise and remain high for extended periods. As of March 31, 1995 a total of 12.6 inches of rain has fallen at Trail Ridge Landfill. The average rainfall for these 3 months is 13.6, which is 1 inch more than has fallen. All piezometer data are provided in Table 3.

**Wildlife Utilization.** During the site visit various species of minnows (*Fundulus* sp.), mosquito fish (*Gambusia* sp.), frogs and tadpoles were observed in the areas of standing water within the creation area. These organisms represent pioneer species which would be expected to colonize developing wetlands, indicating the emergence of a stable ecosystem. Evidence of armadillo (*Dasypus novemcinctus*) and deer (*Odocoileus virginianus*) were also observed. Crayfish burrows were observed indicating inundation and saturation at the surface since the previous iteration. A red-shouldered hawk (*Buteo lineatus*) was observed flying over the wetland creation area.

#### D. CONCLUSION

The wetland creation area at the Trail Ridge Landfill is continuing to exhibit signs of success at the beginning of its third growing season. Planted trees and shrubs appear to be healthy and growing as evidenced by new leaf and twig growth. Percent cover by herbaceous species has been excellent thus far, with herbaceous natural recruits accounting for approximately 50 percent coverage of the creation area. No nuisance species have been observed within the project site. Evidence of proper hydrology and the presence of pioneer faunal species indicate the early successional development of a healthy, viable wetland ecosystem.

(JH\cc\MITT-181.01\91-297.04\91-297.MR5)

Attachments



**TABLE 1**  
**Percent Survival & Growth Data of Planted Trees**

Transect Number	No of Planted Trees	No of Trees Living						Percent Survival						Tree Number - Species	Spring 1993 Caliper (Inches)	Fall 1993 Caliper (Inches)	Spring 1994 Caliper (Inches)	Fall 1994 Caliper (Inches)	Spring 1995 Caliper (Inches)	Fall 1995 Caliper (Inches)
		M <sup>1</sup>	M <sup>2</sup>	M <sup>3</sup>	M <sup>4</sup>	M <sup>5</sup>	M <sup>6</sup>	M <sup>1</sup>	M <sup>2</sup>	M <sup>3</sup>	M <sup>4</sup>	M <sup>5</sup>	M <sup>6</sup>							
1	37	37	36	35	35	33		*	97	95	95	89		T1-1 ( <i>Taxodium distichum</i> ) T1-2 ( <i>Liquidambar styraciflua</i> )	0.4 0.5	0.4 0.5	0.5 0.5	0.9 0.6	1.2 0.9	
2	40	40	37	37	36	36		*	93	93	90	90		T2-1 ( <i>Taxodium distichum</i> ) T2-2 ( <i>Nyssa sylvatica</i> var. <i>biflora</i> )	0.5 0.3	0.6 0.4	0.6 0.5	1.0 0.5	1.2 0.6	
3	45	45	44	44	44	43		*	98	98	98	96		T3-1 ( <i>Taxodium distichum</i> ) T3-2 ( <i>Magnolia virginiana</i> )	0.6 0.5	0.6 0.5	0.7 0.7	0.9 0.7	1.2 0.8	
4	31	31	31	31	30	30		*	100	100	97	97		T4-1 ( <i>Acer rubrum</i> ) T4-2 ( <i>Acer rubrum</i> )	0.5 0.3	0.5 0.4	0.6 0.4	0.7 0.6	1.0 0.9	
5	91	91	91	91	88	85		*	100	100	97	93		T5-1 ( <i>Acer rubrum</i> ) T5-2 ( <i>Acer rubrum</i> )	0.4 0.5	0.4 0.5	0.4 0.5	0.7 0.7	1.0 0.7	
6	80	80	80	79	78	75		*	100	99	98	94		T6-1 ( <i>Magnolia virginiana</i> ) T6-2 ( <i>Magnolia virginiana</i> )	0.7 0.8	0.8 0.8	0.8 0.9	0.8 **	0.9 **	
7	46	46	46	46	46	44		*	100	100	100	96		T7-1 ( <i>Acer rubrum</i> ) T7-2 ( <i>Liquidambar styraciflua</i> )	0.4 0.6	0.6 0.6	0.6 0.7	0.8 0.8	0.9 **	
8	44	44	36	36	36	36		*	82	82	82	82		T8-1 ( <i>Acer rubrum</i> ) T8-2 ( <i>Taxodium distichum</i> )	0.4 0.7	0.5 0.7	0.5 0.7	0.7 1.0	0.8 1.3	

Note: M<sup>1</sup> designates the first monitoring iteration, M<sup>2</sup> the second, etc.

\* Since no previous survivorship data has been taken, data from the first iteration will serve as background for future comparison.

\*\* Dead.



**TABLE 2**  
**Data From Sample Quadrats at Trail Ridge Landfill**

Quadrat #	Species	Percent Coverage					
		M1	M2	M3	M4	M5	M6
Q-1	<i>Eleocharis</i> sp.	3	15	30	15	2	
	<i>Panicum</i> sp.			15	15	2	
	<i>Lachnanthes caroliniana</i>		5		10		
	<i>Rhynchospora</i> spp.				5		
	<i>Juncus elliotti</i>					2	
	<i>Xyris</i> sp.					2	
Q-2	<i>Panicum</i> sp.	3	2	50	35	40	
	<i>Rhynchospora</i> sp.	5	5	10	10		
	<i>Iris virginica</i>			5			
	<i>Ludwigia repens</i>	3					
	<i>Hypericum fasciculatum</i>	4	2		1		
	<i>Lachnanthes caroliniana</i>	5	5		10	8	
	<i>Eleocharis</i> sp.	40	40		20	20	
	<i>Centella asiatica</i>					10	
	<i>Iris virginica</i>					8	
Q-3	<i>Panicum</i> sp.	40	50	70	70	50	
	<i>Eleocharis</i> sp.	30	20	10	8		
	<i>Rhynchospora</i> sp.	10	10	10	8	2	
	<i>Utricularia</i> spp.					4	
Q-4	<i>Panicum</i> sp.	20	10	40	35	35	
	<i>Eleocharis</i> sp.	60	80	35	25	7	
	<i>Rhynchospora</i> sp.	5	5	5	10		
	<i>Xyris</i> sp.		2	2	5	8	
	<i>Lachnanthes caroliniana</i>		2		8	2	
	<i>Ludwigia repens</i>	5					
	<i>N. sylvatica</i> v. <i>biflora</i>				2		
	<i>Centella asiatica</i>					5	
	<i>Hypericum</i> spp.					5	
	<i>Eriocaulon</i> spp.					6	
Q-5	<i>Rhynchospora</i> sp.			2	5		
	<i>Iris virginica</i>			1			
	<i>Ludwigia repens</i>	2					
	<i>Panicum</i> spp.				10	7	
	<i>Utricularia</i> spp.					3	
Q-6	<i>Panicum</i> sp.			8	10	5	
	<i>Eleocharis</i> sp.		2	10	5	5	
	<i>Andropogon virginicus</i>			5	2		
	<i>Rhynchospora</i> spp.				3	5	
	<i>Utricularia</i> spp.					3	



**TABLE 2 (Continued)**  
**Data From Sample Quadrats at Trail Ridge Landfill**

Quadrat #	Species	Percent Coverage					
		M1	M2	M3	M4	M5	M6
Q-7	<i>Panicum</i> sp.			25	25	30	
	<i>Eleocharis</i> sp.	5	20	20	15	5	
	<i>Rhynchospora</i> sp.		20	20	25	10	
	<i>Juncus elliotii</i>				10	5	
	<i>Xyris</i> spp.					7	
Q-8	<i>Panicum</i> sp.	20	5	30	30	20	
	<i>Rhynchospora</i> sp.	20	35	40	20	10	
	<i>Eleocharis</i> sp.	30	35		20	8	
Q-9	<i>Panicum</i> sp.	10	5	10	15	20	
	<i>Eleocharis</i> sp.	60	60	35	30	10	
	<i>Rhynchospora</i> sp.			5	5	5	
	<i>Cyperus</i> spp.	5	5				
	<i>Fuirena squarrosa</i>				5		
	<i>Xyris</i> spp.					8	
	<i>Utricularia</i> spp.					7	
Q-10	<i>Ilex glabra</i>					2	
	<i>Panicum</i> sp.	10	20	50	40	25	
	<i>Rhynchospora</i> sp.	10	5	35	15	30	
	<i>Eleocharis</i> sp.	55	50	3	10	10	
	<i>Iris virginica</i>			2			
	<i>Juncus effusus</i>	10	15				
	<i>Juncus elliotii</i>				20		
	<i>Lachnanthes caroliniana</i>				10	5	
	<i>Baccharis halimifolia</i>					5	



Table 3. Piezometer Data From Wetland Creation Area

Piez.#	Depth of Water Table(feet)			
	Fall 1993	Spring 1994	Fall 1994	Spring 1995
1	-3.0	-1.3	-2.5	-1.5
2	-1.3	-1.7	-1.2	0.0
3	-1.1	-0.6	-0.5	-0.1
4	-1.5	-1.1	-1.7	-0.2
5	0.0	0.0	-1.1	0.1
6	-1.0	-1.0	-1.3	0.0
7	-1.7	-1.7	-2.3	-0.5
8	-2.5	-0.5	-1.7	-0.1
9	0.2	0.0	-2.1	-0.1
10	-0.9	0.4	0.0	0.2
11	*	-0.5	-1.6	0.0

Note: \* indicates no record.



## APPENDIX A

### PROJECT INFORMATION

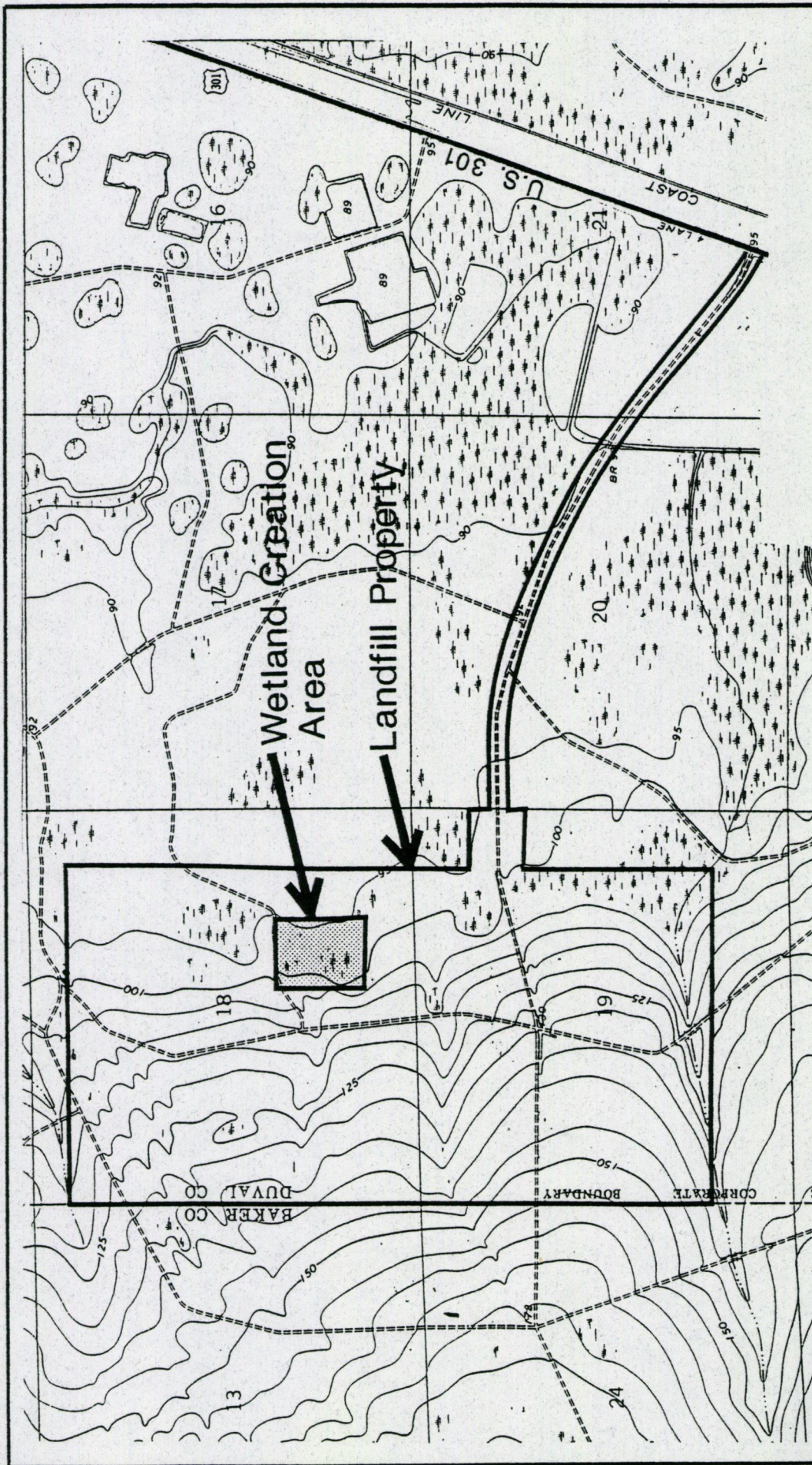
Date: 2 May 1995	
Project Name: Trail Ridge Landfill	Project No: 91-297.3
Monitoring Period: Spring 1995	Monitoring Rep: 5 of 6
Permit No: <u>161821182 and SC16-184444</u>	
Total Wetlands Created: <u>± 4.76 acres</u>	
Monitoring Conditions: <u>Permit No. 161821182 - Specific Conditions 6, 11, 12, 13 and 14 (46, 51, 52, 53 and 54 for Permit No. SC16-184444).</u>	
6(46).	The mitigation plan, "Trail Ridge Landfill Wetland Impacts and Mitigation Plan," submitted on June 18, 1990, shall be appended as a Specific Condition of this permit. Any specific condition requirements listed herein, shall supersede or modify any requirements contained in the appended mitigation plan.
11(51).	<p>The permittee shall furnish the Department with monitoring reports on the wetland creation areas describing:</p> <ul style="list-style-type: none"><li>a. Percent survival and diversity of planted species within each stratum;</li><li>b. Recruitment density and composition within each stratum;</li><li>c. Recorded growth via established parameters for planted trees and shrubs;</li><li>d. Percent cover of herbaceous species;</li><li>e. Surface water elevations referenced to N.G.V.D., or if surface water is not present, groundwater elevation referenced to N.G.V.D.</li></ul> <p>The first monitoring year shall start as of the planting date and data shall be collected and submitted in accordance with Specific Condition Number 6. Reports to the Department must also include photographs, descriptions of problems encountered and solutions undertaken.</p>



**Monitoring Conditions 6, 11, 12, 13 and 14 (46, 51, 52, 53 and 54) Continued**

- 12(52). Within the wetland creation areas, non-native vegetation and nuisance vegetation such as *Typha* sp. shall be controlled by hand clearing or other methods approved by the Department so that they constitute no more than 10% of the areal cover at any monitoring period.
- 13(53). Successful establishment of the wetland creation shall occur when:
- a. On an annual basis at least 80 percent of the planted individuals in each stratum have survived and are showing signs of normal annual growth, based on standard growth parameters such as height and base diameter, or canopy circumference; and
  - b. The above criteria has been achieved and maintained for a three (3) year period following initial planting.
- 14(54). In the event that the success criteria as stated in Specific Condition Number 13 are not achieved by the expiration date of this permit, the permittee shall enter into a long term agreement with the Department so as to insure the success of the mitigation plan.





**Figure 1**  
Location Map

Source: U.S.G.S. Topographical Survey,  
Maxville, FL., Quadrangle. (1970)



ENVIRONMENTAL  
SERVICES, INC.

## Trail Ridge Landfill Mitigation Monitoring

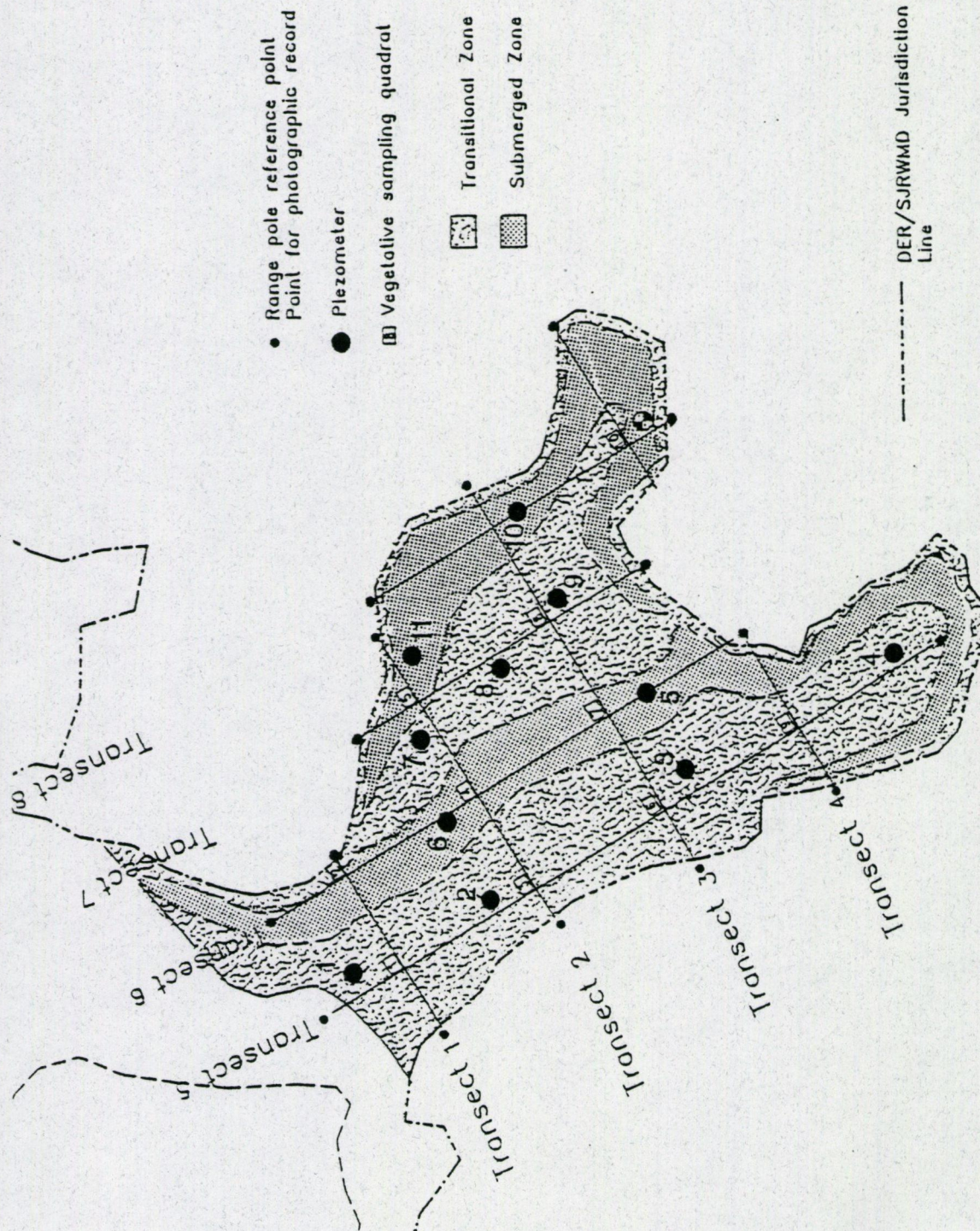
Project No. 91-297.3

Date 5/26/93

Scale 1"=2000'

Drawing No. 1 of 2





ENVIRONMENTAL  
SERVICES, INC.

# Trail Ridge Landfill Mitigation Plan 4.76 Acres

Project No.	91-297.3
Date	5/26/93
Scale	1"=150'
Drawing No.	2 of 2



TRAIL RIDGE LANDFILL  
SPRING 1995



Transect 1 - Panoramic Views



TRAIL RIDGE LANDFILL  
SPRING 1995



Transect 2 - Panoramic Views



TRAIL RIDGE LANDFILL  
SPRING 1995



Transect 3 - Panoramic Views



TRAIL RIDGE LANDFILL  
SPRING 1995



Transect 4 - Panoramic Views



TRAIL RIDGE LANDFILL  
SPRING 1995



Transect 5 - Panoramic Views



TRAIL RIDGE LANDFILL  
SPRING 1995



Transect 6 - Panoramic Views



TRAIL RIDGE LANDFILL  
SPRING 1995



Transect 7 - Panoramic Views



TRAIL RIDGE LANDFILL  
SPRING 1995



Transect 8 - Panoramic Views



TRAIL RIDGE LANDFILL  
SPRING 1995



Sample Quadrats



TRAIL RIDGE LANDFILL  
SPRING 1995



Sample Quadrats



TRAIL RIDGE LANDFILL  
SPRING 1995



Sample Quadrats



TRAIL RIDGE LANDFILL  
SPRING 1995



Sample Quadrats