DNERR Comprehensive Site Description

Phase I - *Description/Analysis of Dominant Vegetation/ Cover Types*

PREPARED FOR

Delaware National Estuarine Research Reserve
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Executive Summary

The Delaware National Estuarine Research Reserve (DNERR) system has been established as described in the *Delaware National Estuarine Research Reserve - Final Environmental Impact Statement/Draft Management Plan* (NOAA/DE DNREC, 1992) and the *Delaware National Estuarine Research Reserve* - Final Management Plan (NOAA/DE DNREC, 1993). The DNERR was designated by the National Oceanic and Atmospheric Administration in July, 1993 as the 22nd site in the National Estuarine Research Reserve System (NERRS). Two estuarine reserve components have been designated: Upper Blackbird Creek, New Castle County and Lower St. Jones River, Kent County.

The objectives and goals of the program center on the elements of resource protection, estuarine research, and environmental education. Resource protection will be afforded through acquisition of key property holdings that include marshland and upland buffer areas and through cooperative agreements with watershed landowners. Additionally, program recognition, research, and education activities will promote resource protection through landscape value awareness and supplemental stewardship programs.

The primary objective of Phase I characterization is to initiate watershed/ estuarine characterizations through the mapping and description of dominant vegetation/ cover types within the boundaries and adjacent lands of the two estuary reserve sites. This characterization work will serve as a baseline for long-term DNERR monitoring activities.

The majority of the field effort during the first half of the 1993 summer was expended on mapping dominant plant communities within the boundaries and selected adjacent lands of each DNERR component site, using tidal wetlands maps. The vegetation map categories reflect the dominant vegetation types. Mapping information was copied from field maps to new State coastal wetland maps (1:200), and submitted to the DNREC Geographic Information System (GIS) staff for input into the Department GIS system. Final GIS maps are included as Appendix B.

The plant species list developed during the summer included 113 species in the Blackbird marshes and 66 species in the St. Jones marshes. Transects were established for quantitative vegetation sampling for each estuary. Along each transect, horizontal distance and relative elevation (referenced to each transect's upland origin) were recorded at plant community edges, at ditch and creek banks, and at 80-100 foot intervals. Dominant and subdominant species were identified for each plant community. Data for aboveground biomass, plant community height, average DBH, and salinity were also collected at selected sampling points.

The brief review of the 1993 data provide an initial overview of the vegetation data base. These data may be integrated with the GIS mapping data, and supplemented by focused efforts in following years of the Delaware National Estuarine Research Reserve monitoring project.

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1.Introduction

The Delaware National Estuarine Research Reserve (DNERR) system has been established as described in the *Delaware National Estuarine Research Reserve - Final Environmental Impact Statement/Draft Management Plan* (NOAA/DE DNREC, 1992) and the *Delaware National Estuarine Research Reserve* - Final Management Plan (NOAA/DE DNREC, 1993). The DNERR was designated by the National Oceanic and Atmospheric Administration in July, 1993 as the 22nd site in the National Estuarine Research Reserve System (NERRS). Two estuarine reserve components have been designated: Upper Blackbird Creek, New Castle County and Lower St. Jones River, Kent County. Figures 1 and 2 show the maximum proposed size and boundaries of each component with participation by landowners within each site on a voluntary and cooperative basis. The objectives and goals of the program center on the elements of resource protection, estuarine research, and environmental education. Resource protection will be afforded through acquisition of key property holdings that include marshland and upland buffer areas and through cooperative agreements with watershed landowners. Additionally, program recognition, research, and education activities will promote resource protection through landscape value awareness and supplemental stewardship programs.

2.Objectives, Materials and Methods of Phase I, 1993-94

The primary objective of Phase I characterization is to initiate watershed/ estuarine characterizations through the mapping and description of dominant vegetation/ cover types within the boundaries and adjacent lands of the two estuary reserve sites. This characterization work will serve as a baseline for long-term DNERR monitoring

activities. During the next few years of the program, it is anticipated that subsequent characterization phases will focus on fishes, aquatic macroinvertebrates and avifauna, water quality and hydrology, and land use/watershed relations. In keeping with program objectives of both education and research, an agreement was made to employ two interns from Wesley College, Dover DE to assist in the summer fieldwork portion of Phase I activity.

Start up/Orientation

Ms. Sue Mrugal and Dr. Kurt Philipp of Wetlands Research Associates (WRA) worked with the two Wesley interns, Doug Potts and Avery Dalton, and their advisor, Dr. Terry Higgins. During their internship, the Wesley students were also seasonal employees of the DNREC's Division of Fish and Wildlife. Dr. William Meredith of the Division of Fish and Wildlife, also the DNERR Research Coordinator, provided overall project guidance and review. Field activities began on May 24, 1993 with a general overview of the project goals and sampling procedures. Aerial photos of the study area were obtained for copying from the Wetlands and Aquatic Protection Branch of DNREC and copies of tidal wetlands maps were requested from Donovan Associates, Dover, DE. WRA staff held weekly meetings with the Wesley interns to review progress, problems and planning.

Facilities and equipment were provided throughout the field data collection period. Working space was provided at DNREC Division of Fish and Wildlife (DFW) facilities at the Biological Field Office in Little Creek, and the Aquatic Education Resources Center near Woodland Beach. A DFW vehicle was most often used by the interns for travel within and between the reserves when transporting small boats. DNREC provided a power boat and trailer on occasion for sampling the lower open

reaches of St. Jones River. A light-weight canoe was provided by WRA for the majority of field data collection in the reserves. The canoe and light equipment were stored at the Little Creek Wildlife Area and the Aquatic Education Resources Center or on the property of Corbit Collins, Townsend. Access points to open water for sampling by canoe and to areas for foot surveys were through public access points and over private property as approved by local land owners. The access points on the Upper Blackbird Creek were: Taylors Bridge and Blackbird Landing bridges and the properties of Corbit Collins, Rusty Harvey, and Mr. Unruh. On the Lower St. Jones River the access points were: Barker's Landing and the Wilson farm. Access points for the sampling are shown in Figures 1 and 2.

3.Task Area One - Study Area Orientation and Land Use Mapping Revision

As a form of further orientation to the two estuary systems, the Wesley interns spent the first week of field work driving and walking throughout the estuary watersheds and mapping current land use types on USGS topographic maps. These maps may serve as baseline resources for changes in the watersheds to be revised annually as the DNERR program proceeds. In addition to providing updated information beyond the most recent land use maps for the watersheds, they may prove useful in water quality and wildlife area tasks to be conducted in the next few years. These maps may also prove useful in planning for land acquisition/agreements and later watershed/water quality phases of the program.

4.Task Area Two - Mapping of Dominant Marsh Vegetation

The majority of the field effort during the first half of the 1993 summer was expended on mapping dominant plant communities within the boundaries and selected adjacent lands of each DNERR component site, using tidal wetlands maps.

Specifically, the Logan Lane off-site area was included in the survey of the St. Jones site, while the survey at the Blackbird site essentially kept within site boundaries. Wetland community types used were generally as described in the Atlas of Delaware's Wetlands and Estuarine Resources (Daiber *et al.*,1976), although some classes were further subdivided. Co-dominants were noted as in the New Jersey tidelands mapping. The acreage (Table 1) and per cent composition (Table 2) of plant community and land use cover types for the Upper Blackbird Creek and Lower St. Jones River were:

Table 1 - Mapping Unit Acreages

Upper Blackbird Creek		Lower St. Jones River	
Map Unit	Acres	Map Unit	Acres
Impoundment	2.7	*Atriplex triangularis*	0.4
Marsh Shrub - Low Salinity	32.6	Beach	16.7
Nuphar lutea	0.4	Cropland	310.4
Open Water (Not impounded)	127.3	Impoundment - Logan Lane	275.9
Peltandra virginica	8.6	Marsh Shrub - High Salinity	132.8
Phragmites australis	99.0	Marsh Shrub - Low Salinity	15.8
Pontederia cordata	3.9	Open Water (Not impounded)	257.1
Scirpus americanus	0.1	*Peltandra virginica*	0.4
Spartina alterniflora	256.6	*Phragmites australis*	489.4
Spartina alterniflora Mix	42.5	Salt hay (*Spartina patens/ Distichlis spicata*)	86.8
Spartina cynosuroides	24.4	*Scirpus americanus*	0.6
Tidal Flat	236.9	*Spartina alterniflora*	2276.7
Tidal Swamp Forest	37.6	*Spartina cynosuroides*	61.3
Typha (*latifolia/angustifolia*)	13.7	Tidal Flat	26.2
Upland Forest	275.9	Tidal Swamp Forest	33.7
Zizania aquatica	9.8	*Typha* (*latifolia/angustifolia*)	1.6
		Upland Forest	647.1

Table 2 - Mapping Unit Per Cent Composition-Wetlands Only

Upper Blackbird Creek		Lower St. Jones River	
Map Unit	Acres	Map Unit	Acres
Impoundment	0.30	*Atriplex triangularis*	0.01
Marsh Shrub - Low Salinity	3.64	Beach	
Nuphar lutea	0.04	Cropland	
Open Water (Not impounded)	14.21	Impoundment - Logan Lane	7.54
Peltandra virginica	0.96	Marsh Shrub - High Salinity	3.63
Phragmites australis	11.05	Marsh Shrub - Low Salinity	0.43
Pontederia cordata	0.44	Open Water (Not impounded)	7.03
Scirpus americanus	0.01	*Peltandra virginica*	0.01
Spartina alterniflora	28.64	*Phragmites australis*	13.38
Spartina alterniflora Mix	4.74	Salt hay (*Spartina patens/ Distichlis spicata*)	2.37
Spartina cynosuroides	2.72	*Scirpus americanus*	0.02
Tidal Flat	26.44	*Spartina alterniflora*	62.23
Tidal Swamp Forest	4.2	*Spartina cynosuroides*	1.68
Typha (*latifolia/angustifolia*)	1.53	Tidal Flat	0.72
Upland Forest		Tidal Swamp Forest	0.92
Zizania aquatica	1.09	*Typha* (*latifolia/angustifolia*)	0.04
		Upland Forest	

The vegetation map categories reflect the dominant vegetation types. Other nondominant species may be found within these categories. For example, the *Spartina alterniflora* category indicates a dominance of this species, but there may be pockets or scatterings of *Phragmites australis* within the *S. alterniflora* community. Brief descriptions of the dominant plant community or land use cover types are given below:

Atriplex triangularis

Community dominated by the herbaceous annual orache in brackish to salty high marshes.

Beach

Sandy and/or rocky shoreline, mostly free of vegetation.

Cropland

Tilled or grazed uplands.

Impoundment

An artificially dammed or gated wetland area often containing expanses of shallow open water surrounded in part by earthen levees or dikes and often bordering on upland edges. Interactions with contiguous tidal water may or may not be controllable.

Marsh Shrub - Low Salinity

This category includes the fresher tidally-influenced scrub/shrub communities dominated by woody plants such as buttonbush (*Cephalanthus occidentalis*), dogwoods (*Cornus* spp.), smooth alder (*Alnus serrulata*), sweet pepperbush (*Clethra alnifolia*), and winterberry (*Ilex verticillata*).

Marsh Shrub - High Salinity

Includes the brackish scrub/shrub communities dominated by groundselbush (*Baccharis halimifolia*), marsh elder (*Iva frutescens*), and red cedar (*Juniperus virginiana).*

Nuphar lutea

Community of the herbaceous perennial yellow pondweed, found in fresh to slightly brackish creeks and ponds. Can form dense monospecific stands in one to three feet of water.

Open Water (unimpounded)

Includes creeks, rivers, and ponds that are not formed or controlled by artificial structures.

Peltandra virginica

Community dominated by the perennial herbaceous emergent arrow arum along the shores of fresh to moderately brackish creeks and ponds. This category also includes some small skunk cabbage (*Symplocarpus foetidus*) communities in the upper portions of the Blackbird Creek watershed.

Phragmites austalis

Coarse tall grass known as common reed, found in fresh to brackish marshes. The *P. australis* community can include many other species, such as salt marsh cordgrass (*Spartina alterniflora*), big cordgrass (*Spartina cynosuroides*), red cedar *(J. virgini*ana), salt grass (*D. spicata*), arrow arum (*P. virginica*), pickerelweed (*P. cordata*), American three-square (*Scirpus americanus*), and marsh elder (*I. frutescens*). The common reed often forms dense monospecific

stands on disturbed soils and has also become increasingly common in undisturbed wetland areas.

Pontederia cordata

The herbaceous perennial pickerelweed found along shores of creeks and ponds in fresh to moderately brackish water.

Salt Hay

The dominant species in this brackish to salty marsh community are salt meadow cordgrass (*Spartina patens*) and salt grass (*Distichlis spicata*) in varying proportions.

Scirpus americanus

The herbaceous perennial American or Three-square is found along brackish shorelines. Generally forms small monospecific stands interspersed with other emergents. Occasionally co-dominant with salt meadow cordgrass (*S. patens*). Subdominants include salt marsh cordgrass (*S. alterniflora*) and salt grass (*D. spicata*).

Spartina alterniflora

The perennial grass salt marsh cordgrass grows in brackish to salty marshes. Forms extensive communities, often virtually monspecific and in recognized tall and short forms. This community can contain significant amounts of *P. australis*. Sudominants include swamp rose mallow (*Hibiscus palustris*), marshpepper smartweed (*Polygonum hydropiper*), and pickerelweed (*P. cordata*).

Spartina alterniflora Mix

Salt marsh cordgrass mixed with other brackish marsh emergents such as arrow arum (*P. virginica*), pickerelweed (P. *cordata*), rice cutgrass (*Leersia oryzoides*), giant bulrush (*Scirpus validus*), and wild rice (*Zizania aquatica*). There is often no clear dominance by a single species. This is a transition community between the brackish and fresh water areas.

Spartina cynosuroides

The perennial grass big cordgrass found in fresh to brackish high marshes. Often mixes with *S. alterniflora.*

Tidal Flat

Area of exposed mud, either at low tides or as a marsh panne.

Tidal Swamp Forest

Forest with tidally-influenced hydrology. Species include willows (*Salix* spp.), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanicus*), red cedar (*J. virginiana*), black or sour gum (*Nyssa sylvatica*), and sweet gum (*Liquidambar styraciflua*).

Typha

Community composed of one or both cattail species (broad-leaf cattail, *Typha latifolia* and narrow-leaf cattail, *T. angustifolia*). May be monospecific or include other species. It can be codominant with nodding bur-marigold (*Bidens cernua*) or include subdominants such as sensitive fern (*Onoclea sensibilis*), saltmarsh waterhemp (*Acnida cannabina*), rice cutgrass (*Leersia oryzoides*), or saltmarsh cordgrass (*S. alterniflora*).

Upland Forest

Upland communities of trees or trees and shrubs, including tulip tree (*Liriodendron tulipifera*), black cherry (*Prunus serotina*), American beech (*Fagus grandifolia*), white oak (*Quercus alba*), southern red oak (*Quercus falcata*), hickory (*Carya* sp.), American holly (*Ilex opaca*), sassafras (*Sassafras albidum*), and black haw (*Viburnum prunifolium*).

Zizania aquatica

The tall annual grass wild rice, found in fresh to slightly brackish marshes. Can form extensive monospecific stands.

The areas of vegetation mapping are shown in Figures 3 and 4. As noted earlier, Figure 4 the southern half of the off-site Logan Lane area was also included in the mapping. During systematic ground traverse of the marshes, unit sizes were chosen as discernible from corresponding patterns on the DNREC tidal wetlands maps . Map units were drawn directly on field copies of tidal wetlands maps. Mapping was assisted with the use of color aerial photo copies and both black- and blue-line copies of the Delaware coastal wetlands maps. Community mapping was nearly completed for both estuaries by the second week of July, 1993. Voucher plant specimens were collected and preserved in a plant press. Selected areas such as Trunk Branch (Lower St. Jones River) and some small headwater areas were completed in late summer, 1993. Continued work throughout the marshes allowed for the confirmation of plant community types as species composition changed, reflecting more annual plant species. Journals were maintained by both interns, recording daily activities, data sets, and observational notes.

The DNREC Natural Heritage Inventory staff (Keith Clancy and William McAvoy) provided verification of questionable species identification and greatly assisted in overall plant identification. The plant species list developed during the summer included 113 species in the Blackbird marshes and 66 species in the St. Jones marshes (Tables 3 and 4).

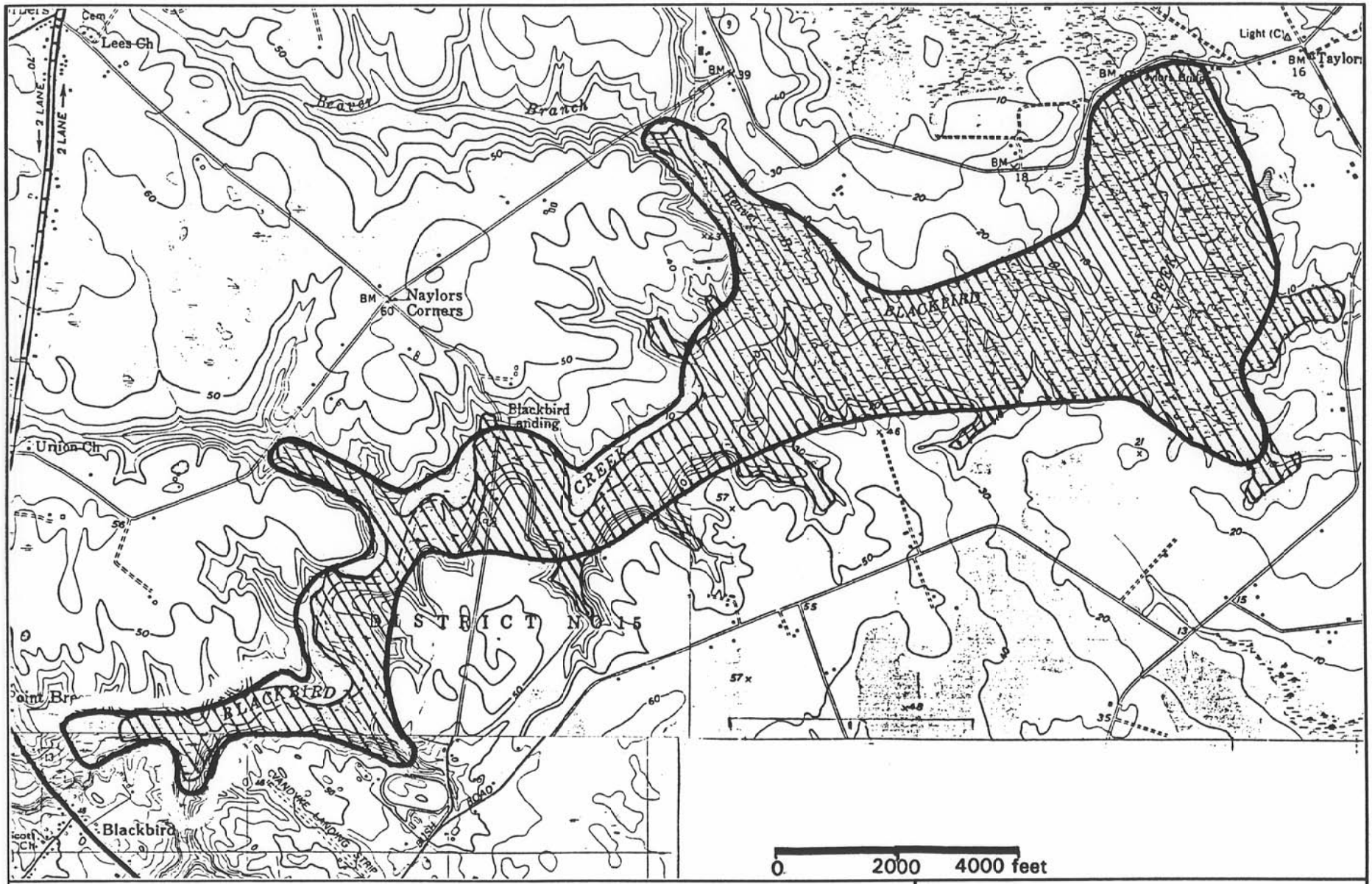

Figure 3. Vegetation Mapping Coverage
Upper Blackbird Creek DNERR Component
USGS topographic map

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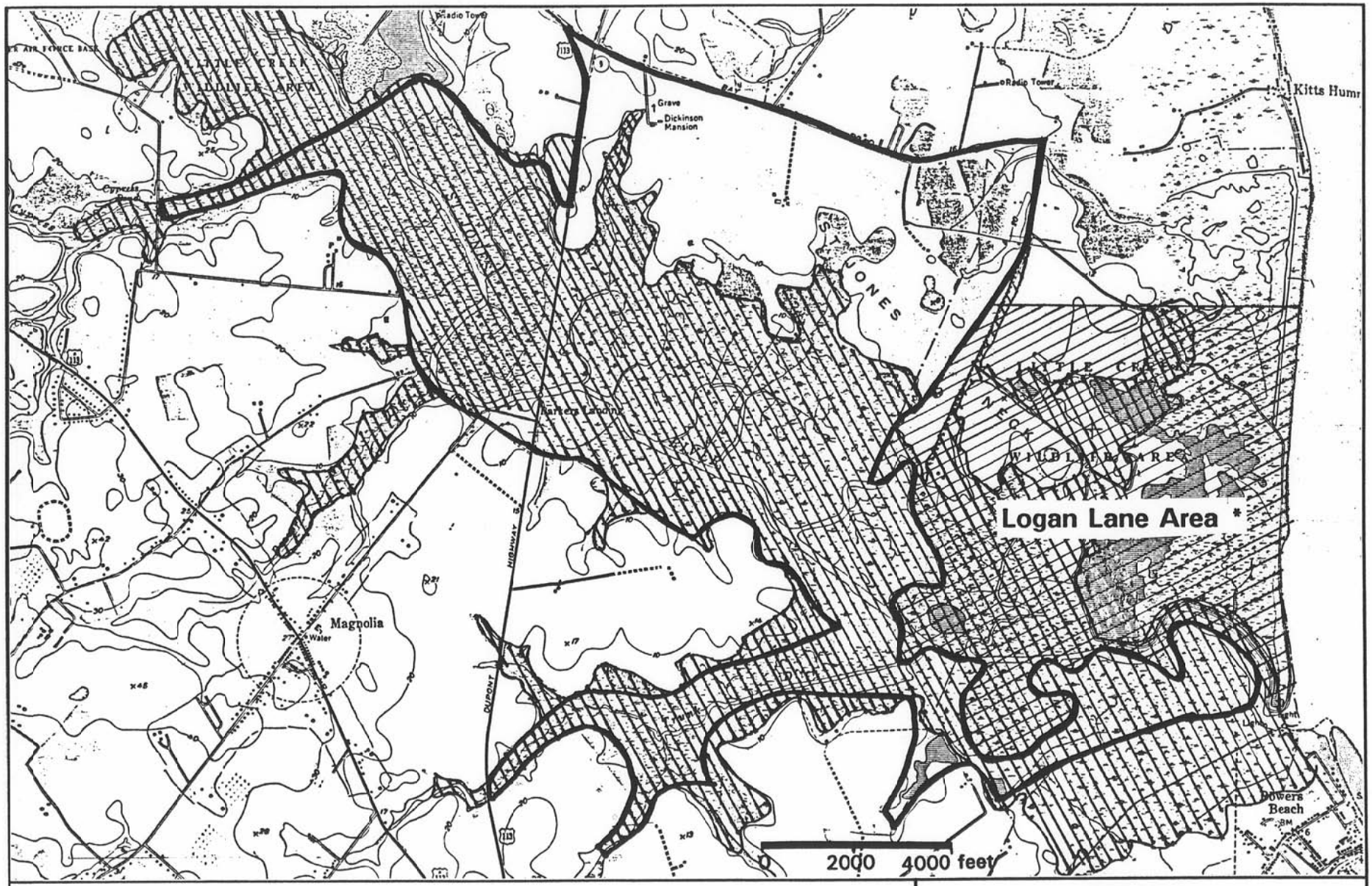

Figure 4. Vegetation Mapping Coverage
Lower St. Jones River DNERR Component
USGS topographic map

* Logan Lane area was surveyed and mapped (on GIS maps) for vegetation cover.

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Table 3

Plant Species List - Upper Blackbird Creek Estuary

Species Name	Common Name
Acer rubrum	red maple
Acnida cannabina	saltmarsh water hemp
Acorus calamus	sweet flag
Alnus serrulata	smooth alder
Apios americana	groundnut
Arisaema triphyllum	jack-in-the-pulpit
Aronia arbutifolia	chokeberry
Asclepias incarnata	swamp milkweed
Aster vimineus	white aster
Athryium filix-femina	lady fern
Bidens cernua	nodding bur-marigold
Boehmeria cylindrica	false nettle
Calamagrostis canadensis	bluejoint
Caltha palustris	marsh marigold
Campsis radicans	trumpet creeper
Carex comosa	bearded carex
Carex gigantia	large sedge

Table 3

Plant Species List - Upper Blackbird Creek Estuary

Species Name	Common Name
Carex lurida	lurid carex
Carex straminea	straw carex
Carex stricta	uptight sedge
Carex vinata	a sedge
Carpinus caroliniana	ironweed
Carya tomentosa	mockernut hickory
Cephalanthus occidentalis	buttonbush
Cicuta maculata	water hemlock
Clematis virginiana	virgin's bower
Clethra alnifolia	sweet pepperbush
Cornus amomum	silky dogwood
Cornus florida	flowering dogwood
Cornus racemosa	gray dogwood
Cyperus strigosus	umbrella sedge
Decodon verticillatus	water willow
Echinochloa Walteri	water millet
Eleocharis ambigens	a spike-rush

Table 3

Plant Species List - Upper Blackbird Creek Estuary

Species Name	Common Name
Eleocharis palustris	marsh spike-rush
Elymus virginicus	Virginia wild-rye
Eupatorium fistulosum	joe-pye-weed
Fagus grandifolia	American beech
Fragaria virginia	wild strawberry
Fraxinus pennsylvanica	green ash
Galium tinctorium	common madder
Geum virginiana	rough avens
Hamamelis virginiana	witch hazel
Hibiscus palustris	swamp rose mallow
Hydrocotyl sibthorpioides	a water penny-wort
Ilex opaca	American holly
Ilex verticillata	winterberry
Impatiens capensis	jewelweed
Iris pseudacorus	yellow flag
Iris versicolor	blue flag
Itea virginica	Virginia willow

Table 3

Plant Species List - Upper Blackbird Creek Estuary

Species Name	Common Name
Juglans nigra	black walnut
Juniperus virginiana	red cedar
Kosteletzya virginica	seashore mallow
Leersia oryzoides	rice cutgrass
Lilium canadense	Canada lily
Lindera benzoin	spicebush
Liquidambar styraciflua	sweet gum
Liriodendron tulipifera	tulip tree
Lobelia cardinalis	cardinal flower
Mikania scandens	climbing hempweed
Nuphar luteum	yellow pond lily
Onoclea sensibilis	sensitive fern
Osmunda regalis	royal fern
Panicum laniterinum	a panic grass
Parthenocissus quinquefolia	Virginia creeper
Peltandra virginica	arrow arum
Phragmites australis	common reed

Table 3

Plant Species List - Upper Blackbird Creek Estuary

Species Name	Common Name
Phytolacca americana	pokeweed
Podophyllum peltatum	mayapple
Polygonum arifolium	halberd-leaved tearthumb
Polygonum hydropiper	marshpepper smartweed
Polygonum sagittatum	arrow-leaved tearthumb
Ponderia cordata	pickerelweed
Prunus cf. Avium	mazzard
Prunus serotina	black cherry
Ptilimnium capillaceum	mock bishopweed
Quercus alba	white oak
Quercus falcata	southern red oak
Quercus rubra	red oak
Ranunculus longirostris	white water-crowfoot
Rhododendron viscosum	swamp honeysuckle
Rhus copallina	winged sumac
Rorippa palustris	marsh yellow cress
Rosa palustris	swamp rose

Table 3

Plant Species List - Upper Blackbird Creek Estuary

Species Name	Common Name
Rubus phoenicolasius	wineberry
Rubus sp.	blackberry
Rumex verticillatus	swamp dock
Sagittaria australis	long-beaked arrowhead
Sagittaria latifolia	broadleaf arrowhead
Sassafras albidum	sassafras
Saururus cernuus	lizard's tail
Scirpus americanus	American three-square
Scirpus polyphyllus	leafy bulrush
Scirpus robustus	saltmarsh bulrush
Scirpus validus	giant bulrush
Sisyrinchium graminoides	blue-eyed grass
Sium suave	water parsnip
Smilax glauca	sawbriar
Smilax rotundifolia	common greenbriar
Spartina alterniflora	saltmarsh cordgrass
Spartina cynosuroides	big cordgrass

Table 3

Plant Species List - Upper Blackbird Creek Estuary

Species Name	Common Name
Spartina patens	saltmeadow cordgrass
Stachys hispidus	smooth hedge nettle
Symplocarpus foetidus	skunk cabbage
Thalictrum pubescens	tall meadow-rue
Toxicodendron radicans	poison ivy
Typha angustifolia	narrow-leaf cattail
Typha latifolia	broad-leaf cattail
Ulmus rubra	slippery elm
Vaccinium corymbosum	highbush blueberry
Viburnum prunifolium	black haw
Viburnum recognitum	northern arrowwood
Viburnum rufidulum	rusty black haw
Xanthium strumarium	common cocklebur
Zizania aquatica	wild rice

Table 4

Plant Species List - Lower St. Jones River Estuary

Species Name	Common Name
Acer rubrum	red maple
Apios americana	ground nut
Atriplex patula	orach
Baccharis halimifolia	groundsel bush
Calystegia sepium	hedge bindweed
Carex alata	winged sedge
Carex albolutescens	greenish-white sedge
Carex lonchocarpa	long sedge
Carex lurida	lurid sedge
Carex stricta	uptight sedge
Carya cordiformis	bitternut hickory
Cephalanthus occidentalis	buttonbush
Cicuta maculata	water hemlock or spotted cowbane
Clethra alnifolia	sweet pepperbush
Coptis trifolia	canker root
Diospyros virginiana	persimmon tree
Distichlis spicata	salt grass

Table 4

Plant Species List - Lower St. Jones River Estuary

Species Name	Common Name
Eleocharis ambigens	a spikerush
Fagus grandifolia	American beech
Fraxinus pennsylvanica	green ash
Galium tinctorium	common madder
Glyceria stricta	manna grass
Hibiscus palustris	swamp rose mallow
Hydrocotyle umbellata	many-flowered pennywort
Ilex glabra	inkberry
Ilex opaca	American holly
Ilex verticillatus	winterberry
Impatiens capensis	jewelweed
Iva frutescens	marsh elder
Juglans nigra	black walnut
Juniperus virginiana	red cedar
Leersia oryzoides	rice cutgrass
Liquidambar styraciflua	sweet gum
Lonicera japonica	Japanese honeysuckle

Table 4

Plant Species List - Lower St. Jones River Estuary

Species Name	Common Name
Magnolia virginiana	sweet bay magnolia
Nuphar luteum	yellow pond lily
Nyssa sylvatica	black or sour gum
Osmunda cinnamomea	cinnamon fern
Osmunda regalis	royal fern
Peltandra virginica	arrow arum
Phragmites australis	common reed
Polygonum convolvulus	black bindweed
Prunus serotina	black cherry
Ptilimnium capillaceum	mock bishopweed
Quercus phellos	willow oak
Rhododendron viscosum	swamp honeysuckle
Rosa multiflora	multiflora rose
Rosa palustris	swamp rose
Rumex verticillatus	swampdock
Salsola kali	saltwort
Sambucus canadensis	common elderberry

Table 4

Plant Species List - Lower St. Jones River Estuary

Species Name	Common Name
Scirpus americanus	American three-square
Scirpus robustus	saltmarsh bulrush
Scirpus validus	giant bulrush
Smilax glauca	sawbriar
Spartina alterniflora	saltmarsh cordgrass
Spartina cynosuroides	big cordgrass
Spartina patens	saltmeadow cordgrass
Symplocarpus foetides	skunk cabbage
Thalictrum pubescens	tall meadow-rue
Toxicodendron radicans	poison ivy
Typha angustifolia	narrow-leaf cattail
Typha latifolia	broad-leaf cattail
Vaccinium corumbosum	highbush blueberry
Viburnum recognitum	northern arrowwood
Viburnum prunifolium	black haw

During the fall of 1993 and early winter of 1994, the mapping information was copied from field maps to new State coastal wetland maps (1:200), reviewed by WRA staff, and submitted to the DNREC Geographic Information System (GIS) staff for input into the Department GIS system. GIS system maps with vegetation mapping information for each DNERR site were reviewed by WRA staff and the 1993 Wesley interns. Final GIS maps are included as Appendix B,found at the back of this report in two enclosure folders.

5.Task Area Three - Marsh Transect Data Collection and Analysis

During mid-July 1993, transects were established for quantitative vegetation sampling. Three transect locations were selected for each estuary. Transect sampling locations are shown in the Figures 5 and 6. Transect locations were selected to be representative of each marsh and to provide a high diversity of plant community types. Along each transect, horizontal distance and relative elevation (referenced to each transect's upland origin) were recorded at plant community edges, at ditch and creek banks, and at 80-100 foot intervals. Dominant and subdominant species were identified for each plant community.

Additional data were collected at community center points and some community boundaries in large plant communities. Aboveground biomass was collected in late August at these sample points, as well as data on plant density, per cent areal cover, and plant height. Depending on the community types, either 1.0 m^2 or 0.1 m^2 size sample plots were used. All samples were sorted to species and dry weights obtained for each species/sample. Biomass samples were oven dried at 50^0 C until constant weight was obtained. In forest and scrub/shrub communities, woody plants within 10 m of the sample point were recorded by species and diameter at breast height. All

three transects were completed in the Blackbird Creek area, but only transect #1 was completed in the St. Jones area. Transect # 2 in the St. Jones was established and examined during mid-summer, 1993. The Trunk Branch transect (Transect #3) was established during the last week of the summer work period and examined during two separate days in October and November, 1993. Only qualitative data on plant species composition were collected along Transects #2 and #3 (i.e. no data for relative elevations, biomass, densities, per cent cover, or height). Data from these two uncompleted transects have been recorded in field notebooks and some summaries have been produced in data tables. Time and manpower limitations prevented completion of these two transects.

Community and individual sampling plot data from the established transects are provided in Tables 5 and 6. Elevational data are consistent within each transect. Elevational data remain to be referenced to both Delaware coordinate reference monuments (NGVD) and to tidal elevations on each transect. This may be accomplished in the 1995 field season. Relative elevation data were set to upland reference markers. Observations of creek bank elevation above apparent low tide elevation where the Blackbird Creek transects met main creek channels gave an average elevation difference of 3.0 feet. Therefore in order to present transects within the Blackbird Creek site, elevations were adjusted by setting an elevation of three feet below the last tidal creek measurement as 0.0 for each transect. Sustained recordings of tidal cycles at each of these transect locations on the tidal creeks will provide an adequate relationship between marsh elevations and tidal inundation.

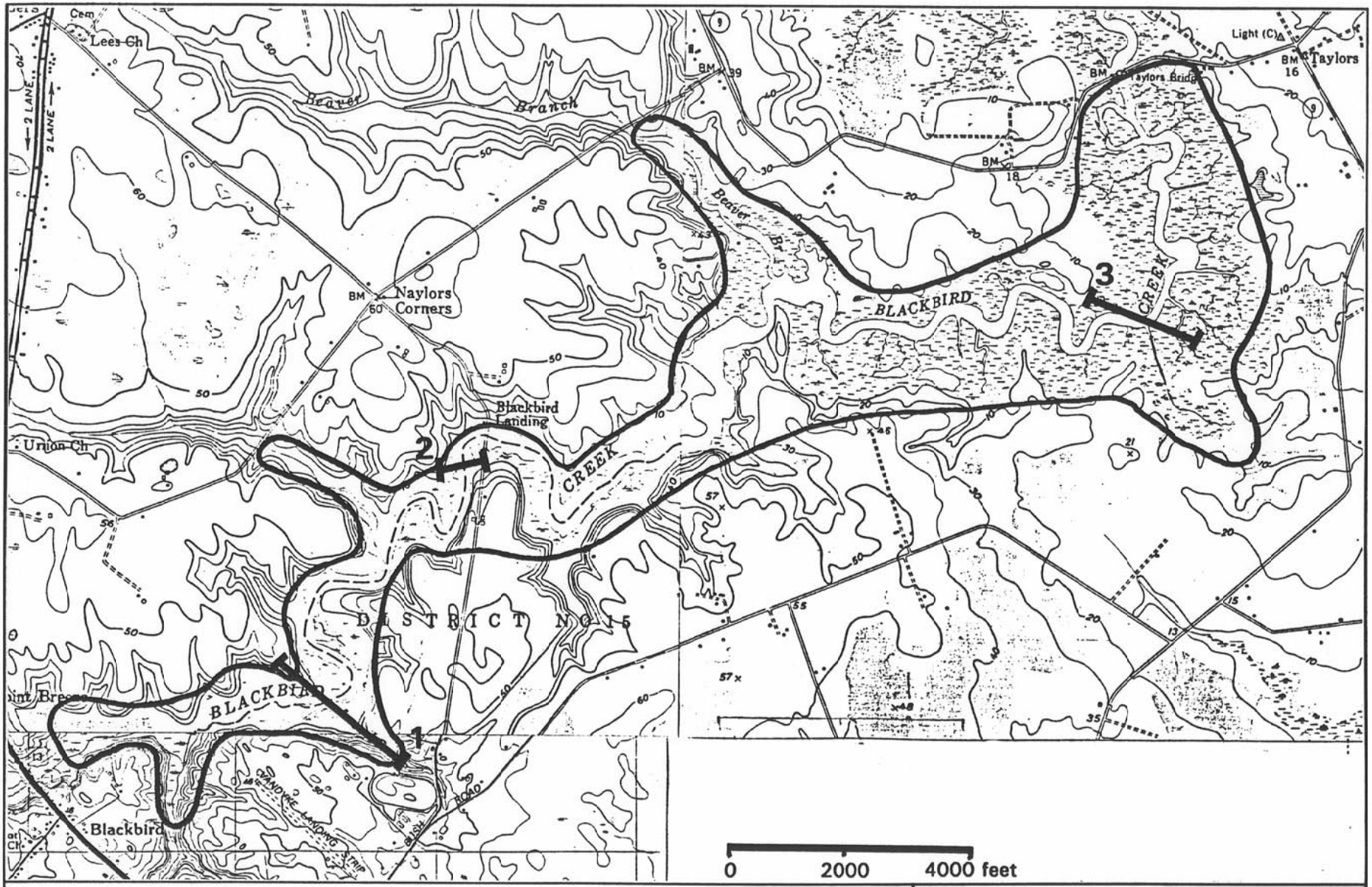

Figure 5. Transect Locations
Upper Blackbird Creek DNERR Component
USGS topographic map

Wetlands Research Associates, Inc.

Figure 6. Transect Locations
Lower St. Jones River DNERR Component
USGS topographic map

Wetlands Research Associates, Inc.

Table 5

Transect and Vegetation Data

Transect #	Sample Point #	Community Type	Distance from Forest Edge Feet	Elevation Feet	Plant Community Width Feet
SJ-1	Stake A	Forested Upland	122.5	0.00	122.5
SJ-1	B	Phragmites australis	0.0		0.0
		(Upland border)		-3.50	0.0
SJ-1	C	Phragmites australis	31.1	-3.50	31.1
SJ-1	1	Mixed Marsh - St. Jones	51.3	-4.35	83.3
SJ-1	2	Spartina alterniflora	114.3	-4.55	273.0
SJ-1	3	Spartina alterniflora	344.5	-4.55	273.0
SJ-1	4	Spartina alterniflora	457.7	-4.25	1047.8
SJ-1	5	Spartina alterniflora	549.6	-4.35	1047.8
SJ-1	6	Spartina alterniflora	695.5	-4.55	1047.8
SJ-1	7	Spartina alterniflora	867.6	-4.65	1047.8
SJ-1	8	Spartina alterniflora	994.1	-4.55	1047.8
SJ-1	9	Spartina alterniflora	1143.1	-4.95	1047.8
SJ-1	10	Spartina alterniflora	1230.1	-4.75	1047.8
SJ-1	11	Spartina alterniflora	1357.2	-4.55	1047.8
SJ-1	12	Spartina alterniflora	1420.0	-4.95	67.4
SJ-1	13	Spartina alterniflora	1466.8	-4.15	67.4
SJ-1		(Creek bank)	1478.0	-4.15	11.1
SJ-1		Spartina cynosuroides	1525.0	-4.15	23.9
SJ-1	14	Spartina alterniflora	1623.7	-4.30	237.1
SJ-1	15	Spartina alterniflora	1697.3	-4.70	237.1
SJ-1	16	Spartina alterniflora	1785.4	-4.55	237.1
SJ-1	17	Distichlis spicata	1841.1	-4.35	55.5
SJ-1	18	Spartina alterniflora	1908.3	-4.65	887.8
SJ-1	19	Spartina alterniflora	1968.0	-4.65	887.8
SJ-1	20	Spartina alterniflora	2040.3	-4.85	887.8
SJ-1	21	Spartina alterniflora	2123.3	-4.95	887.8
SJ-1	22	Spartina alterniflora	2221.3	-4.95	887.8
SJ-1	23	Spartina alterniflora	2311.5	-5.15	887.8
SJ-1	24	Spartina alterniflora	2401.8	-4.95	887.8
SJ-1	25	Spartina alterniflora	2483.0	-5.05	887.8
SJ-1	26	Spartina alterniflora	2547.6	-5.20	887.8
SJ-1	27	Spartina alterniflora	2627.4	-5.00	887.8
SJ-1	28	Spartina alterniflora	2721.3	-4.60	297.4
SJ-1	29	Spartina alterniflora	2798.6	-5.30	297.4
SJ-1	30	Spartina alterniflora	2885.5	-5.00	297.4
SJ-1	31	Spartina alterniflora	2974.1	-4.75	259.6
SJ-1	32	Spartina alterniflora	3055.0	-4.80	259.6
SJ-1	33	Spartina alterniflora	3097.1	-4.90	259.6
SJ-1	34	Spartina alterniflora	3189.0	-5.00	259.6
SJ-1	35	Spartina alterniflora	3286.5	-4.60	259.6
SJ-1	36	Spartina alterniflora	3344.8	-4.50	259.6

Table 5

Transect and Vegetation Data

Transect #	Sample Point #	Community Type	Distance from Forest Edge Feet	Elevation Feet	Plant Community Width Feet
SJ-1		Phragmites australis (River bank)	3362.3	-4.50	17.4
SJ-1		Iva frutescens (River bank)	3373.4	-4.50	11.8
BB-1	A	Forested Upland	125.8	0.00	125.8
BB-1	B	(Upland/Marsh border)		-1.75	
BB-1	1	Mixed Marsh - Blackbird	50.0	-2.20	170.3
BB-1	2	Mixed Marsh - Blackbird	100.0	-2.90	170.3
BB-1	3	Mixed Marsh - Blackbird	150.0	-2.80	170.3
BB-1	4	Mixed Marsh - Blackbird	170.3	-2.95	170.3
BB-1	5	(Creek)	417.5	-2.85	247.2
BB-1	6	Scrub Marsh	467.5	-2.65	150.0
BB-1	7	Scrub Marsh	517.5	-2.55	150.0
BB-1	8	Scrub Marsh	567.5	-2.70	150.0
BB-1	9	Scrub Forest	617.5	-2.50	165.5
BB-1	10	Scrub Forest	667.5	-1.55	165.5
BB-1	11	Scrub Forest	717.5	-2.05	165.5
		Forested Upland	733.2		0.0
BB-2	A	(Marsh edge/Road)		5.30	
BB-2	1	Mixed Marsh - Blackbird	101.3	6.10	201.2
BB-2	2	Mixed Marsh - Blackbird	144.7	7.10	201.2
BB-2	3	Mixed Marsh - Blackbird	184.5	7.20	201.2
BB-2	4	(Creek Bank)	201.2		201.2
BB-2		(Creek)	552.0		350.7
BB-2	5	Spartina alterniflora	630.0	7.10	228.7
BB-2	6	Spartina alterniflora	688.0	8.20	228.7
BB-2	7	Spartina alterniflora	727.0	7.40	228.7
BB-2	8	Phragmites australis	780.7	7.40	64.3
BB-2	9	Phragmites australis	805.5	7.40	64.3
BB-2	10	Phragmites australis	827.6	7.30	64.3
BB-2	11	Phragmites australis (Upland edge)	844.5	7.00	64.3
BB-3	A	Forested Upland	-33.3		34.7
BB-3	B	Phragmites australis (Upland edge)		-0.70	
BB-3	1	Phragmites australis	100.0	-2.40	86.0
BB-3	2	Phragmites australis	200.0	-1.95	178.0
BB-3	3	Spartina alterniflora	300.0	2.20	178.0
BB-3	4	Spartina alterniflora	400.0	2.10	719.0

Table 5

Transect and Vegetation Data

Transect #	Sample Point #	Community Type	Distance from Forest Edge Feet	Elevation Feet	Plant Community Width Feet
BB-3	5	Spartina alterniflora	500.0	2.30	719.0
BB-3	6	Spartina alterniflora	600.0	2.30	719.0
BB-3	7	Spartina alterniflora	700.0	2.45	719.0
BB-3	8	Spartina alterniflora	800.0	-1.85	719.0
BB-3	9	Spartina alterniflora	900.0	-2.30	719.0
BB-3	10	Spartina alterniflora	1000.0	-1.75	719.0
BB-3	11	Spartina cynosuroides (Creek bank)	1097.0	-2.05	39.0
BB-3		(Creek)	1097.0		235.0
BB-3	12	Spartina alterniflora (Creek bank)	1332.0	-2.05	181.0
BB-3	13	Spartina alterniflora	1432.0	-2.60	181.0
BB-3	14	Spartina cynosuroides	1532.0	-2.45	70.0
BB-3	15	Spartina cynosuroides (Stream bank)	1583.0	-2.75	70.0
BB-3		(Stream)	1583.0		29.0
BB-3	16	Spartina alterniflora (Stream bank)	1612.0	-2.55	293.0
BB-3	17	Spartina alterniflora	1712.0	-2.55	293.0
BB-3	18	Spartina alterniflora	1812.0	-2.50	293.0
BB-3	19	Spartina alterniflora	1907.0	-2.75	293.0
BB-3	20	(Mud flat)	2007.0	-6.50	269.0
BB-3	21	(Mud flat)	2102.0	-3.80	269.0
BB-3	22	(Mud flat/Isl. edge)	2182.0	-3.50	49.0
BB-3	23	Spartina alterniflora			
BB-3		(Island)	2202.0	-3.50	49.0
BB-3	24	(Mud flat/Isl. edge)	2231.0	-2.40	732.0
BB-3	25	(Mud flat)	2313.0	-3.40	732.0
BB-3	26	(Mud flat)	2463.0	-3.60	732.0
BB-3	27	(Mud flat)	2563.0	-3.40	732.0
BB-3	28	(Mud flat)	2663.0	-3.80	732.0
BB-3	29	(Mud flat)	2763.0	-3.50	732.0
BB-3	30	(Mud flat)	2863.0	-3.70	732.0
BB-3	31	(Mud flat)	2963.0	-2.60	732.0
BB-3	32	Spartina alterniflora	3057.5	-2.70	94.5
BB-3	33	(Marsh/Upland edge)	3086.5	-1.70	29.0

Table 6

Biomass Data for Transects on the Blackbird Creek and St. Jones River

Site Community Type #	Plant Species	Distance from Upland: (Feet)	Elevation (Feet)	# of Individuals	Dry Weight (g/m2)	DBH (Inches)	Height (Inches)	Total % Cover	Sample Date
SJ-T1-Upland	Carya cordiformis	0.0	0	1		14.5			08/19/93
SJ-T1-Upland	Liquidambar styraciflua	0.0	0	1		11.25			08/19/93
SJ-T1-Upland	Liquidambar styraciflua	0.0	0	1		18			08/19/93
SJ-T1-Upland	Juglans nigra	0.0	0	1		12.5			08/19/93
SJ-T1-Upland	Juglans nigra	0.0	0	1		9.75			08/19/93
SJ-T1-Upland	Carya cordiformis	0.0	0	1		11.75			08/19/93
SJ-T1-Upland	Carya cordiformis	0.0	0	1		11.75			08/19/93
SJ-T1-Upland	Carya cordiformis	0.0	0	1		4			08/19/93
SJ-T1-Upland	Viburnum prunifolium	0.0	0	1		1.25			08/19/93
SJ-T1-Upland	Viburnum prunifolium	0.0	0	1		2.75			08/19/93
SJ-T1-Upland	Viburnum prunifolium	0.0	0	1		4			08/19/93
SJ-T1-Upland	Liquidambar styraciflua	0.0	0	1		6.25			08/19/93
SJ-T1-Upland	Carya cordiformis	0.0	0	1		3			08/19/93
SJ-T1-Upland	Carya cordiformis	0.0	0	1		12.75			08/19/93
SJ-T1-Upland	Carya cordiformis	0.0	0	1		3.75			08/19/93
SJ-T1-Upland	Liquidambar styraciflua	0.0	0	1		16			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		5.75			08/19/93
SJ-T1-Upland	Ilex opaca	0.0	0	1		3.5			08/19/93
SJ-T1-Upland	Liquidambar styraciflua	0.0	0	1		5.5			08/19/93
SJ-T1-Upland	Liquidambar styraciflua	0.0	0	1		8.5			08/19/93
SJ-T1-Upland	Liquidambar styraciflua	0.0	0	1		11.75			08/19/93
SJ-T1-Upland	Liquidambar styraciflua	0.0	0	1		11			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		1			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		5.25			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		4.75			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		1.8			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		4			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		6			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		3.5			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		4.5			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		5			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		6.5			08/19/93
SJ-T1-Upland	Diospyros virginiana	0.0	0	1		6			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		2.25			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		4.25			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		3.5			08/19/93
SJ-T1-Upland	Diospyros virginiana	0.0	0	1		3.75			08/19/93
SJ-T1-Upland	Ilex opaca	0.0	0	1		2			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		6			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		7.25			08/19/93
SJ-T1-Upland	Ilex opaca	0.0	0	1		1.5			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		4.75			08/19/93
SJ-T1-Upland	Diospyros virginiana	0.0	0	1		3			08/19/93
SJ-T1-Upland	Liquidambar styraciflua	0.0	0	1		21.5			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		10.5			08/19/93
SJ-T1-Upland	Ilex opaca	0.0	0	1		4.75			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		4			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		3			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		7			08/19/93
SJ-T1-Upland	Ilex opaca	0.0	0	1		4			08/19/93
SJ-T1-Upland	Juniperus virginiana	0.0	0	1		7.5			08/19/93
SJ-T1-Upland	Quercus phellos	0.0	0	1		8.5			08/19/93
SJ-T1-Upland	Nyssa sylvatica	0.0	0	1		10.25			08/19/93
SJ-T1-Upland	Nyssa sylvatica	0.0	0	1		2			08/19/93
SJ-T1-Upland	Viburnum prunifolium	0.0	0	1		4			08/19/93
SJ-T1-Upland	Prunus (serotina)	0.0	0	1		9.25			08/19/93
SJ-T1-Upland	Prunus (serotina)	0.0	0	1		4.5			08/19/93
SJ-T1-Upland	Viburnum prunifolium	0.0	0	1		3.5			08/19/93
SJ-T1-Upland	Prunus (serotina)	0.0	0	1		8.75			08/19/93
SJ-T1-Upland	Prunus (serotina)	0.0	0	1		13.25			08/19/93

Table 6

Biomass Data for Transects on the Blackbird Creek and St. Jones River

Site Community Type #	Plant Species	Distance from Upland: (Feet)	Elevation (Feet)	# of Individuals	Dry Weight (g/m2)	DBH (Inches)	Height (Inches)	Total % Cover	Sample Date
SJ-T1-Upland	Prunus (serotina)	0.0	0	1		15.75			08/19/93
SJ-T1-Upland	Prunus (serotina)	0.0	0	1		7.75			08/19/93
SJ-T1-Upland	Carya cordiformis	0.0	0	1		7.25			08/19/93
SJ-T1-Upland	Liquidambar styraciflua	0.0	0	1		5			08/19/93
SJ-T1-Upland	Carya cordiformis	0.0	0	1		5.5			08/19/93
SJ-T1-Upland	Carya cordiformis	0.0	0	1		7			08/19/93
SJ-T1-Upland	Carya cordiformis	0.0	0	1		12			08/19/93
SJ-T1-Upland	Liquidambar styraciflua	0.0	0	1		17.25			08/19/93
SJ-T1-C1	Phragmites australis	31.1	-3.5	42	800.7		103		08/19/93
SJ-T1-C1	Scirpus americanus	31.1	-3.5		10.6				08/19/93
SJ-T1-C1	Distichlis spicata	31.1	-3.5		11.8				08/19/93
SJ-T1-C1	Spartina alterniflora	31.1	-3.5		1.2				08/19/93
SJ-T1-C2	Spartina alterniflora	83.3	-4.35	55	15.9		20		08/19/93
SJ-T1-C2	Phragmites australis	83.3	-4.35	6					08/19/93
SJ-T1-C2	Spartina patens	83.3	-4.35	1732	32.2		24		08/19/93
SJ-T1-C2	Distichlis spicata	83.3	-4.35	166	12.4		24		08/19/93
SJ-T1-C2	Scirpus americanus	83.3	-4.35	122	39.2		24		08/19/93
SJ-T1-C3	Spartina alterniflora	273.0	-4.55	1312	514.7		23	85	08/19/93
SJ-T1-C4	Spartina alterniflora	457.7	-4.25	1252	649.1		20	98	08/19/93
SJ-T1-C4	Distichlis spicata	457.7	-4.25	25			20		08/19/93
SJ-T1-C4	Spartina patens	457.7	-4.25	4195			20		08/19/93
SJ-T1-C5	Distichlis spicata	1420.2	-4.55	2680	39.1		16		08/19/93
SJ-T1-C5	Spartina patens	1420.2	-4.55	16	1.6		16		08/19/93
SJ-T1-C6	Spartina alterniflora	1466.2	-4.15	296	788.2		25	95	08/19/93
SJ-T1-C7	Spartina alterniflora	1525.0	-4.3	160	1105		40	90	08/19/93
SJ-T1-C8	Spartina alterniflora	1623.7	-4.3	1740	790.5		22	87	08/19/93
SJ-T1-C9	Spartina patens	1785.4	-4.55	738	56.4		14		08/19/93
SJ-T1-C9	Distichlis spicata	1785.4	-4.55	175	29		14		08/19/93
SJ-T1-C10	Spartina alterniflora	1841.1	-4.35	1300	500.5		30	95	08/19/93
SJ-T1-C11	Spartina alterniflora	2721.3	-4.6	1040	741.4		21	92	08/19/93
SJ-T1-C12	Spartina alterniflora	2974.1	-4.75	1264	520.4		22	92	08/19/93
SJ-T1-C13	Phragmites australis	3344.8	-4.5	165	836		101		08/19/93
SJ-T1-C13	Scirpus americanus	3344.8	-4.5	6					08/19/93
SJ-T1-C14	Baccharis halimifolia	3362.3	-4.5	6					08/19/93
SJ-T1-C14	Atriplex patula	3362.3	-4.5	130					08/19/93
SJ-T1-C14	Phragmites australis	3362.3	-4.5	2					08/19/93
SJ-T1-C14	Spartina patens	3362.3	-4.5	8					08/19/93
BB-T1-Upland	Viburnum prunifolium	0.0	0	1		2			08/12/93
BB-T1-Upland	Viburnum prunifolium	0.0	0	1		2			08/12/93
BB-T1-Upland	Viburnum prunifolium	0.0	0	1		4.5			08/12/93
BB-T1-Upland	Quercus rubra	0.0	0	1		6			08/12/93
BB-T1-Upland	Cornus (florida)	0.0	0	1		2.75			08/12/93
BB-T1-Upland	Quercus rubra	0.0	0	1		10			08/12/93
BB-T1-Upland	Cornus (florida)	0.0	0	1		3			08/12/93
BB-T1-Upland	Cornus (florida)	0.0	0	1		2			08/12/93
BB-T1-Upland	Cornus (florida)	0.0	0	1		5			08/12/93
BB-T1-Upland	Liriodendron tulipifera	0.0	0	1		12			08/12/93
BB-T1-Upland	Liriodendron tulipifera	0.0	0	1		9.75			08/12/93
BB-T1-Upland	Liriodendron tulipifera	0.0	0	1		8			08/12/93
BB-T1-Upland	Quercus rubra	0.0	0	1		14.75			08/12/93
BB-T1-Upland	Quercus rubra	0.0	0	1		11			08/12/93
BB-T1-Upland	Carya tomentosa	0.0	0	1		4			08/12/93
BB-T1-Upland	Liquidambar styraciflua	0.0	0	1		4.25			08/12/93
BB-T1-Upland	Carya tomentosa	0.0	0	1		7.5			08/12/93
BB-T1-Upland	Juglans nigra	0.0	0	1		7			08/12/93
BB-T1-Upland	Liquidambar styraciflua	0.0	0	1		4.5			08/12/93
BB-T1-Upland	Carya tomentosa	0.0	0	1		5.75			08/12/93
BB-T1-C1	Peltandra virginica	0.0	-1.75	11				25	08/12/93

Table 6

Biomass Data for Transects on the Blackbird Creek and St. Jones River

Site Community Type #	Plant Species	Distance from Upland: (Feet)	Elevation (Feet)	# of Individuals	Dry Weight (g/m2)	DBH (Inches)	Height (Inches)	Total % Cover	Sample Date
BB-T1-C1	Phragmites australis	0.0	-1.75	12				25	08/12/93
BB-T1-C1	Toxicodendron radicans	0.0	-1.75	1				25	08/12/93
BB-T1-C1	Impatiens capensis	0.0	-1.75	6	1.6		52	25	08/12/93
BB-T1-C1	Typha latifolia	0.0	-1.75	18	2024.8		124	85	08/12/93
BB-T1-C1	Onoclea sensibilis	100.0	-2.9	50	182.1		38	85	08/12/93
BB-T1-C1	Acnida cannabina	100.0	-2.9	4	118.9		38	85	08/12/93
BB-T1-C1	Polygonum arifolium	100.0	-2.9	2	51.8			85	08/12/93
BB-T1-C1	Peltandra virginica	100.0	-2.9	22	0.7			85	08/12/93
BB-T1-C1	Mikania scandens	100.0	-2.9	2	32.5			85	08/12/93
BB-T1-C1	Pontederia cordata	100.0	-2.9	6				85	08/12/93
BB-T1-C1	Zizania aquatica	150.0	-2.9	18				60	08/12/93
BB-T1-C1	Polygonum hydropiper	150.0	-2.8	16	28.8			60	08/12/93
BB-T1-C1	Leersia oryzoides	150.0	-2.8	9	3			60	08/12/93
BB-T1-C1	Cicuta maculata	150.0	-2.8	2				60	08/12/93
BB-T1-C1	Aster vimineus	150.0	-2.8	2				60	08/12/93
BB-T1-C1	Sagittaria latifolia	150.0	-2.8	3				60	08/12/93
BB-T1-C1	Echinochloa walteri	150.0	-2.8		6.2				08/12/93
BB-T1-C1	Caltha palustris	150.0	-2.8		106.6				08/12/93
BB-T1-C2	Zizania aquatica	417.5	-2.85	99	336		98	90	08/12/93
BB-T1-C2	Asclepias incarnata	417.5	-2.85	25				90	08/12/93
BB-T1-C2	Peltandra virginica	417.5	-2.85	29	9.9			90	08/12/93
BB-T1-C2	Leersia oryzoides	417.5	-2.85	4	576.7			90	08/12/93
BB-T1-C2	Pontederia cordata	417.5	-2.85	1	1.5			90	08/12/93
BB-T1-C2	Sagittaria latifolia	417.5	-2.85	2				90	08/12/93
BB-T1-C2	Typha latifolia	417.5	-2.85	16	1111.1		98	90	08/12/93
BB-T1-C2	Spartina alterniflora	417.5	-2.85		576.7			80	08/12/93
BB-T1-C2	Polygonum arifolium	517.5	-2.35	8	6.6		61	80	08/12/93
BB-T1-C2	Aster vimineus	517.5	-2.55	1				80	08/12/93
BB-T1-C2	Polygonum hydropiper	517.5	-2.55	19	38			80	08/12/93
BB-T1-C2	Bidens cernua	517.5	-2.55	58	1601.3		64	80	08/12/93
BB-T1-C2	Impatiens capensis	567.5	-2.55	2				95	08/12/93
BB-T1-C2	Apios americana	567.5	-2.55	2				95	08/12/93
BB-T1-C2	Acnida cannabina	567.5	-2.55		44.5			95	08/12/93
BB-T1-C2	Cicuta maculata	567.5	-2.55	3	38.3			95	08/12/93
BB-T1-Upland	Fraxinus pennsylvanica	617.5	-2.5	1		4			08/12/93
BB-T1-Upland	Fraxinus pennsylvanica	617.5	-2.5	1		3.25			08/12/93
BB-T1-Upland	Fraxinus pennsylvanica	617.5	-2.5	1		3.75			08/12/93
BB-T1-Upland	Ulmus rubra	617.5	-2.5	1		2.75			08/12/93
BB-T1-Upland	Fraxinus pennsylvanica	617.5	-2.5	1		4.5			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		4.5			08/12/93
BB-T1-Upland	Ulmus rubra	617.5	-2.5	1		2			08/12/93
BB-T1-Upland	Ulmus rubra	617.5	-2.5	1		8			08/12/93
BB-T1-Upland	Fraxinus pennsylvanica	617.5	-2.5	1		5.25			08/12/93
BB-T1-Upland	Fraxinus pennsylvanica	617.5	-2.5	1		6.25			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		9			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		4.25			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		7			08/12/93
BB-T1-Upland	Fraxinus pennsylvanica	617.5	-2.5	1		3.25			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		10			08/12/93
BB-T1-Upland	Ulmus rubra	617.5	-2.5	1		8			08/12/93
BB-T1-Upland	Viburnum prunifolium	617.5	-2.5	1		2			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		7			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		10.5			08/12/93
BB-T1-Upland	Ulmus rubra	617.5	-2.5	1		11.75			08/12/93
BB-T1-Upland	Cornus (florida)	617.5	-2.5	1		2			08/12/93
BB-T1-Upland	Quercus rubra	617.5	-2.5	1		24			08/12/93
BB-T1-Upland	Quercus rubra	617.5	-2.5	1		14			08/12/93
BB-T1-Upland	Cornus (florida)	617.5	-2.5	1		3.75			08/12/93
BB-T1-Upland	Cornus (florida)	617.5	-2.5	1		2			08/12/93
BB-T1-Upland	Cornus (florida)	617.5	-2.5	1		3			08/12/93

Table 6

Biomass Data for Transects on the Blackbird Creek and St. Jones River

Site Community Type #	Plant Species	Distance from Upland: (Feet)	Elevation (Feet)	# of Individuals	Dry Weight (g/m2)	DBH (Inches)	Height (Inches)	Total % Cover	Sample Date
BB-T1-Upland	Quercus rubra	617.5	-2.5	1		5.75			08/12/93
BB-T1-Upland	Cornus (florida)	617.5	-2.5	1		2.5			08/12/93
BB-T1-Upland	Quercus rubra	617.5	-2.5	1		14.5			08/12/93
BB-T1-Upland	Quercus rubra	617.5	-2.5	1		14.5			08/12/93
BB-T1-Upland	Liriodendron tulipifera	617.5	-2.5	1		12.5			08/12/93
BB-T1-Upland	Nyssa sylvatica	617.5	-2.5	1		5.5			08/12/93
BB-T1-Upland	Nyssa sylvatica	617.5	-2.5	1		3			08/12/93
BB-T1-Upland	Carya tomentosa	617.5	-2.5	1		10.5			08/12/93
BB-T1-Upland	Carya tomentosa	617.5	-2.5	1		5.5			08/12/93
BB-T1-Upland	Cornus (florida)	617.5	-2.5	1		2.25			08/12/93
BB-T1-Upland	Ulmus rubra	617.5	-2.5	1		8.5			08/12/93
BB-T1-Upland	Viburnum prunifolium	617.5	-2.5	1		2.25			08/12/93
BB-T1-Upland	Viburnum prunifolium	617.5	-2.5	1		6.25			08/12/93
BB-T1-Upland	Carya tomentosa	617.5	-2.5	1		6			08/12/93
BB-T1-Upland	Liquidambar styraciflua	617.5	-2.5	1		10			08/12/93
BB-T1-Upland	Ulmus rubra	617.5	-2.5	1		7.5			08/12/93
BB-T1-Upland	Ulmus rubra	617.5	-2.5	1		7			08/12/93
BB-T1-Upland	Viburnum prunifolium	617.5	-2.5	1		2			08/12/93
BB-T1-Upland	Carya tomentosa	617.5	-2.5	1		5.5			08/12/93
BB-T1-Upland	Liquidambar styraciflua	617.5	-2.5	1		19			08/12/93
BB-T1-Upland	Liquidambar styraciflua	617.5	-2.5	1		13			08/12/93
BB-T1-Upland	Juglans nigra	617.5	-2.5	1		11			08/12/93
BB-T1-Upland	Carya tomentosa	617.5	-2.5	1		7			08/12/93
BB-T1-Upland	Viburnum prunifolium	617.5	-2.5	1		2.25			08/12/93
BB-T1-Upland	Viburnum prunifolium	617.5	-2.5	1		2			08/12/93
BB-T1-Upland	Viburnum prunifolium	617.5	-2.5	1		2			08/12/93
BB-T1-Upland	Viburnum prunifolium	617.5	-2.5	1		2			08/12/93
BB-T1-Upland	Carya tomentosa	617.5	-2.5	1		8			08/12/93
BB-T1-Upland	Liriodendron tulipifera	617.5	-2.5	1		6.5			08/12/93
BB-T1-Upland	Carpinus caroliniana	617.5	-2.5	1		4			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		7			08/12/93
BB-T1-Upland	Quercus rubra	617.5	-2.5	1		21.25			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		10.75			08/12/93
BB-T1-Upland	Carya tomentosa	617.5	-2.5	1		2.75			08/12/93
BB-T1-Upland	Cornus (florida)	617.5	-2.5	1		2.75			08/12/93
BB-T1-Upland	Cornus (florida)	617.5	-2.5	1		2.5			08/12/93
BB-T1-Upland	Liriodendron tulipifera	617.5	-2.5	1		10.25			08/12/93
BB-T1-Upland	Liriodendron tulipifera	617.5	-2.5	1		8			08/12/93
BB-T1-Upland	Quercus rubra	617.5	-2.5	1		4.5			08/12/93
BB-T1-Upland	Carya tomentosa	617.5	-2.5	1		3.5			08/12/93
BB-T1-Upland	Liriodendron tulipifera	617.5	-2.5	1		5.5			08/12/93
BB-T1-Upland	Quercus rubra	617.5	-2.5	1		5			08/12/93
BB-T1-Upland	Cornus (florida)	617.5	-2.5	1		2.5			08/12/93
BB-T1-Upland	Quercus rubra	617.5	-2.5	1		3.5			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		3.5			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		6.25			08/12/93
BB-T1-Upland	Viburnum prunifolium	617.5	-2.5	1		2.5			08/12/93
BB-T1-Upland	Fraxinus pennsylvanica	617.5	-2.5	1		5			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		10.5			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		6.75			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		5			08/12/93
BB-T1-Upland	Carpinus caroliniana	617.5	-2.5	1		2			08/12/93
BB-T1-Upland	Carpinus caroliniana	617.5	-2.5	1		2			08/12/93
BB-T1-Upland	Carpinus caroliniana	617.5	-2.5	1		2.5			08/12/93
BB-T1-Upland	Carpinus caroliniana	617.5	-2.5	1		2			08/12/93
BB-T1-Upland	Acer rubrum	617.5	-2.5	1		11			08/12/93
BB-T1-Upland	Ulmus rubra	617.5	-2.5	1		4.5			08/12/93
BB-T1-Upland	Ulmus rubra	617.5	-2.5	1		6.25			08/12/93
BB-T1-Upland	Ulmus rubra	617.5	-2.5	1		2.5			08/12/93

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Biomass Data for Transects on the Blackbird Creek and St. Jones River

Site Community Type #	Plant Species	Distance from Upland: (Feet)	Elevation (Feet)	# of Individuals	Dry Weight (g/m2)	DBH (Inches)	Height (Inches)	Total % Cover	Sample Date
BB-T2-C1	Zizania aquatica	0.0	5.3	220	2.8		72	90	08/23/93
BB-T2-C1	Typha latifolia	0.0	5.3	43	93		73	90	08/23/93
BB-T2-C1	Scirpus robustus	0.0	5.3	78	212.7		58	90	08/23/93
BB-T2-C1	Leersia oryzoides	0.0	5.3	54	35.9			90	08/23/93
BB-T2-C1	Polygonum hydropiper	0.0	5.3	22	17.5			90	08/23/93
BB-T2-C1	Sagittaria latifolia	0.0	5.3	12				85	08/23/93
BB-T2-C1	Scirpus validus	0.0	5.3		20.6				08/23/93
BB-T2-C1	Peltandra virginica	0.0	5.3		0.8				08/23/93
BB-T2-C1	Acnida cannabina	0.0	5.3		17.9				08/23/93
BB-T2-C1	Cicuta maculata	0.0	5.3		6.5				08/23/93
BB-T2-C1	Eleocharis ambiens	0.0	5.3		1.5				08/23/93
BB-T2-C1	Bidens cernua	0.0	5.3		3				08/23/93
BB-T2-C1	Spartina alterniflora	0.0	5.3		622.1				08/23/93
BB-T2-C2	Zizania aquatica	552.0	7	104				90	08/23/93
BB-T2-C2	Peltandra virginica	552.0	7	135				90	08/23/93
BB-T2-C2	Spartina alterniflora	552.0	7	17	754.9		64	90	08/23/93
BB-T2-C2	Leersia oryzoides	552.0	7	53	103.3			90	08/23/93
BB-T2-C2	Pontederia cordata	552.0	7	7	16			90	08/23/93
BB-T2-C2	Polygonum hydropiper	552.0	7	59	18.8			90	08/23/93
BB-T2-C2	Scirpus robustus	688.0	8	46	16.1			80	08/23/93
BB-T2-C2	Typha latifolia	780.7	7	3				80	08/23/93
BB-T2-C2	Hibiscus palustris	780.7	7	3	65			80	08/23/93
BB-T2-C2	Sagittaria latifolia	780.7	7	1				80	08/23/93
BB-T2-C2	Acnida cannabina	780.7	7		47.8			80	08/23/93
BB-T2-C3	Phragmites australis	827.6	7	29	402.7		130		08/23/93
BB-T2-C3	Pontederia cordata	827.6	7	15	6.9				08/23/93
BB-T3-Upland	Quercus rubra	0.0	0	1		4.75			08/24/93
BB-T3-Upland	Nyssa sylvatica	0.0	0	1		7.5			08/24/93
BB-T3-Upland	Nyssa sylvatica	0.0	0	1		9			08/24/93
BB-T3-Upland	Quercus rubra	0.0	0	1		13			08/24/93
BB-T3-Upland	Quercus rubra	0.0	0	1		2			08/24/93
BB-T3-Upland	Quercus rubra	0.0	0	1		6			08/24/93
BB-T3-Upland	Carya tomentosa	0.0	0	1		10.5			08/24/93
BB-T3-Upland	Nyssa sylvatica	0.0	0	1		2			08/24/93
BB-T3-Upland	Quercus rubra	0.0	0	1		6			08/24/93
BB-T3-Upland	Nyssa sylvatica	0.0	0	1		5.5			08/24/93
BB-T3-Upland	Nyssa sylvatica	0.0	0	1		8.75			08/24/93
BB-T3-Upland	Nyssa sylvatica	0.0	0	1		10.5			08/24/93
BB-T3-Upland	Nyssa sylvatica	0.0	0	1		3			08/24/93
BB-T3-Upland	Nyssa sylvatica	0.0	0	1		6.5			08/24/93
BB-T3-Upland	Nyssa sylvatica	0.0	0	1		3			08/24/93
BB-T3-Upland	Liquidambar styraciflua	0.0	0	1		2			08/24/93
BB-T3-C1	Phragmites australis	38.0	-7	99	185.6		117	33	08/24/93
BB-T3-C2	Spartina alterniflora	161.0	-2.4	88	676.4		60	95	08/24/93
BB-T3-C2	Phragmites australis	161.0	-2.4	2				95	08/24/93
BB-T3-C2	Hibiscus palustris	161.0	-2.4	11				95	08/24/93
BB-T3-C2	Leersia oryzoides	161.0	-2.4	16	14.4			95	08/24/93
BB-T3-C2	Asclepias incarnata	161.0	-2.4	7				95	08/24/93
BB-T3-C2	Spartina patens	161.0	-2.4	30				95	08/24/93
BB-T3-C2	Polygonum hydropiper	161.0	-2.4	13	11.6			95	08/24/93
BB-T3-C2	Kosteletzkya virginica	161.0	-2.4		29.6			95	08/24/93
BB-T3-C2	Acnida cannabina	161.0	-2.4		32.6			95	08/24/93
BB-T3-C3	Phragmites australis	300.0	-2.2	135	512.2		100	90	08/24/93
BB-T3-C3	Polygonum hydropiper	300.0	-2.2	1				90	08/24/93
BB-T3-C3	Echinochloa walteri	300.0	-2.2		1.1			90	08/24/93
BB-T3-C3	Acnida cannabina	300.0	-2.2		4			90	08/24/93
BB-T3-C3	Bidens sp.	300.0	-2.2		2.2			90	08/24/93
BB-T3-C3	Leersia oryzoides	300.0	-2.2		7			90	08/24/93
BB-T3-C4	Spartina alterniflora	320.0	-2.2	1075	491.3		53	95	08/24/93

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Biomass Data for Transects on the Blackbird Creek and St. Jones River

Site Community Type #	Plant Species	Distance from Upland: (Feet)	Elevation (Feet)	# of Individuals	Dry Weight (g/m2)	DBH (Inches)	Height (Inches)	Total % Cover	Sample Date
BB-T3-C4	Polygonum hydropiper	320.0	-2.2	10	0.9			95	08/24/93
BB-T3-C4	Kosteletzkya virginica	320.0	-2.2	2				95	08/24/93
BB-T3-C4	unidentified herb	320.0	-2.2	2				95	08/24/93
BB-T3-C4	Scirpus robustus	320.0	-2.2	9				95	08/24/93
BB-T3-C5	Spartina cynosuroides	1058.0	-2.05	74	407.2		97	95	08/24/93
BB-T3-C5	Spartina alterniflora	1058.0	-2.05		37.1			95	08/24/93
BB-T3-C5	Pontederia cordata	1058.0	-2.05		1.7			95	08/24/93
BB-T3-C5	Peltandra virginica	1058.0	-2.05	12				95	08/24/93
BB-T3-C5	Scirpus robustus	1058.0	-2.05	4	2.3			95	08/24/93
BB-T3-C6	Spartina alterniflora	1332.0	-2.05	694	408		55	95	08/24/93
BB-T3-C6	Spartina cynosuroides	1332.0	-2.05	6				95	08/24/93
BB-T3-C6	Scirpus robustus	1332.0	-2.05	11				95	08/24/93
BB-T3-C6	Polygonum hydropiper	1432.0	-2.6	19				95	08/24/93
BB-T3-C6	Kosteletzkya virginica	1432.0	-2.6	3				95	08/24/93
BB-T3-C6	Acnida cannabina	1432.0	-2.6	1				95	08/24/93
BB-T3-C7	Spartina cynosuroides	1532.0	-2.45	69			95	85	08/24/93
BB-T3-C7	Scirpus robustus	1532.0	-2.45	2				85	08/24/93
BB-T3-C7	Spartina alterniflora	1532.0	-2.45	15				85	08/24/93
BB-T3-C7	Polygonum hydropiper	1532.0	-2.45	1				85	08/24/93
BB-T3-C7	Pontederia cordata	1532.0	-2.45	4				85	08/24/93
BB-T3-C7	Acnida cannabina	1532.0	-2.45	2				85	08/24/93
BB-T3-C8	Spartina alterniflora	1612.0	-2.5	439			50	53	08/24/93
BB-T3-C8	Pontederia cordata	1612.0	-2.5	45				53	08/24/93
BB-T3-C8	Scirpus robustus	1612.0	-2.5	15				53	08/24/93
BB-T3-C8	Spartina cynosuroides	1612.0	-2.5	10				53	08/24/93
BB-T3-C9	Spartina alterniflora	2174.0	-3.5	426			73	90	08/24/93
BB-T3-C9	Pontederia cordata	2174.0	-3.5	3				90	08/24/93
BB-T3-C10	Spartina alterniflora	2955.0	-2.6	217			73	50	08/24/93
BB-T3-C10	Phragmites australis	3049.5	-2.7	60			107	50	08/24/93
BB-T3-C10	Iris sp.	3049.5	-2.7	32				50	08/24/93
BB-T3-C10	Polygonum hydropiper	3049.5	-2.7	1				50	08/24/93
BB-T3-C10	Typha latifolia	3049.5	-2.7	1				50	08/24/93
BB-T3-C10	Hibiscus palustris	3049.5	-2.7		9			50	08/24/93
BB-T3-C10	Leersia oryzoides	3049.5	-2.7		16			50	08/24/93
BB-T3-C10	Peltandra virginica	3049.5	-2.7		0.7			50	08/24/93

Data were sporadically collected for tide heights and water salinities (Table 7) throughout the later part of the summer work effort. Graduated tide staff poles were attached to the Taylor's Landing bridge on the Blackbird and at the boardwalk boat area on the St. Jones. The Blackbird staff pole disappeared in a few days, while the St. Jones staff remained in place. Obtaining readings at meaningful tidal periods (dead high or dead low) proved difficult to do while conducting the year I primary tasks of vegetation mapping and collecting transect data. Detailed studies of each reserve's tidal hydrography, salinities, and other water quality parameters will be done during year III of the characterization work.

Table 7 Salinity Data

Date	Location	Time	Tide Stage	Salinity ‰
6-24-93	SJ - Mouth of River	13:15PM	HIGH	21
6-24-93	SJ - Mouth of Trunk Branch	13:54PM	HIGH	18
6-24-93	SJ - Mouth of Tributary Parallel to T-1	14:01PM	HIGH	19
6-24-93	SJ - Barkers Landing	14:07PM	HIGH	17
6-24-93	SJ - Mouth of Cypress Branch	14:20PM	HIGH	16
6-24-93	SJ - Lebanon Footbridge	14:37PM	HIGH	9
7-20-93	BB - T-1 Headwaters	12:10PM	HIGH	1
7-21-93	BB - T-2 Blackbird Landing	12:20PM	HIGH	5
7-21-93	BB - Beaverdam Branch Bridge	15:20PM	HIGH	5
7-21-93	BB - Taylors Bridge, East Bank	15:28PM	HIGH	10

Vegetation community profiles for the four completed transects are presented in Figures 7-10. The reserve portions of the Blackbird Creek marshes are characterized by forested tidal wetlands, scrub/forest, and scrub/marsh mixes, with a mixed emergent marsh most prevalent along creek and tributary open water. Transect BB-1 (Blackbird 1) does not represent creek bottom elevations but does extend across the creek from upland to upland. As the transects suggest, the mixed wooded and herbaceous wetlands of the upper Blackbird Creek grade into the *Spartina* emergent marshes when progressing seaward along Blackbird Creek. Large areas of exposed mud flats occur along the creek and Transect 3 ends in one of the large flats area. Transect SJ-1 on the St. Jones displays the central broad salt marsh area of the site. *Spartina alterniflora* communities dominates with wide interchannel areas of short form and tall form distributed along the channel banks. *Spartina cynosuroides* is also found in select areas along the channel banks. Patches of salt hay (*Distichlis spicata* and *Spartina patens*) occur throughout the area, particularly just below the upper marsh border.

Phragmites is distributed throughout the Blackbird Creek area, and transects were selected to cover both *Phragmites*-infested areas as well as uninfested areas. The current distribution of *Phragmites* clusters suggest their radiation from creek bank, upland boundary and occasional internal marsh locations. Later comparisons of this marsh community baseline data may display the characteristics of the species distribution within the reserve. *Phragmites* distribution is more restricted in the St. Jones site than the Blackbird site, probably due to higher salinity and is found only along the upland edge and major river banks.

Although the relative elevation data within each transect have not been referenced to a benchmark elevation or mean low water, we have made the assumption that the bank elevation is nearly three feet above mean low water. On this assumption,

Table 8 presents community elevation data for each transects. Since tidal ranges vary between the two estuary sites (Mean tidal range at the entrance is 2.9 feet for the Blackbird and 4.8 feet for the St. Jones.) and within each site, comparisons should not be made between transects until transect data are corrected to either State grid elevations or MLW.

Transect data presented in Tables 5 and 6 were reviewed for trends among community or species variations. Figures 11 through 23 present preliminary examples of trends in above ground biomass, stem density, per cent cover, height and DBH.

Table 8

Community - Elevation/Width

Transect	Community	Estimated Elevations Above MLW (Feet) Range	Average	Width
SJ-1	Iva frutescens	3.0	3.0	11.8
	Mixed Marsh	3.15	3.15	83.3
	Phragmites australis	3.0 - 4.0	3.5	24.0
	Spartina alterniflora	2.2 - 3.35	2.8	620.7
	Spartina cynosuroides	3.35	3.35	23.9
BB-1	Forested Upland	5.95	5.95	12.5
	Mixed Marsh	3.0 - 3.75	3.2	170.3
	Scrub Forest	3.45 - 4.4	3.9	165.5
	Scrub Marsh	3.25 - 3.4	3.3	150.0
BB-2	Mixed Marsh	2.0 - 3.10	2.7	201.2
	Phragmites australis	2.9 - 3.3	3.2	64.3
	Spartina alterniflora	3.0 - 4.10	3.5	228.7
BB-3	Phragmites australis	4.55 - 5.8	4.4	88.0
	Spartina alterniflora	3.0 - 4.75	4.1	430.0
	Spartina cynosuroides	3.75 - 4.05	3.1	59.7
	Mud Flat	2.7 - 4.1	2.8	588.7

Figures 11 through 28 display data by sampling station, which incorporates the gradients of elevation, tidal inundation, and salinity. Please refer to Figures 5 through 10 for the orientation of these transects. Blackbird transects begin in upland points, cross an emergent marsh, the main creek channel, an emergent marsh and end in an upland point. The St. Jones transect begins in an upland point and crosses an emergent marsh to end at the bank of the main river channel. Blackbird transects are identified as BB and St. Jones as SJ. T1, T2,... refer to different transects and labels, while C1, C2, ... refer to the different sample stations and associated plant communities. Biomass data were not collected for all sampling stations. Likewise, the collection of data for Diameter at Breast Height (DBH), stem height, and density depended on the plant community sampled.

On each figure Blackbird transects are shown on the left and St. Jones transect on the right. Within each Blackbird transect there is an elevation gradient from upland to tidal channel to upland. For the St. Jones transect the elevation gradient extends from the upland to the tidal river bank. We may generally assume that a gradient of tidal inundation is associated with elevation for each transect. Similarly, we may assume that there is a gradient of salinity from the lower (seaward) transects on the Blackbird to the upper (landward) transects. Salinity should also vary within each transect and is related to elevation, local tidal range, and the extent of tidal flushing.

Figure 11 presents the aboveground standing biomass for *Spartina alterniflora*. Among the stations sampled, *Spartina alterniflora* biomass values were comparable in range between the Blackbird and St. Jones study areas. Figure 12 also displays comparable ranges for density between the two areas and shows the greater occurrence on the St. Jones transect. In transects where *Spartina alterniflora* occurred, it was a dominant cover as shown in Figure 13. Stem height, Figure 14, generally reflects the

difference in salinity between the two study areas with taller plants in the lower salinity Blackbird marshes. When aboveground standing biomass is compared to elevation, Figure 15, there is no apparent trend along either Blackbird (3.0 to 11.1 foot elevation) or St. Jones (2.8 to 4.0 foot) transects.

A review of trends for *Phragmites australis* is shown in Figures 16 to 19. Within the stations sampled, biomass was greater at the St. Jones area than at the Blackbird area and density was comparable (Figures 16 and 17). This relation might change if lower portions of the Blackbird Creek estuary which are not within the study area, had been sampled. This lower portion is largely dominated by robust monotypic stands of *Phragmites australis*. Per cent cover, Figure 18 does reflect this greater occurrence on the most seaward of the three Blackbird transects. Figure 19 displays slightly higher stem lengths for the fresher Blackbird stations.

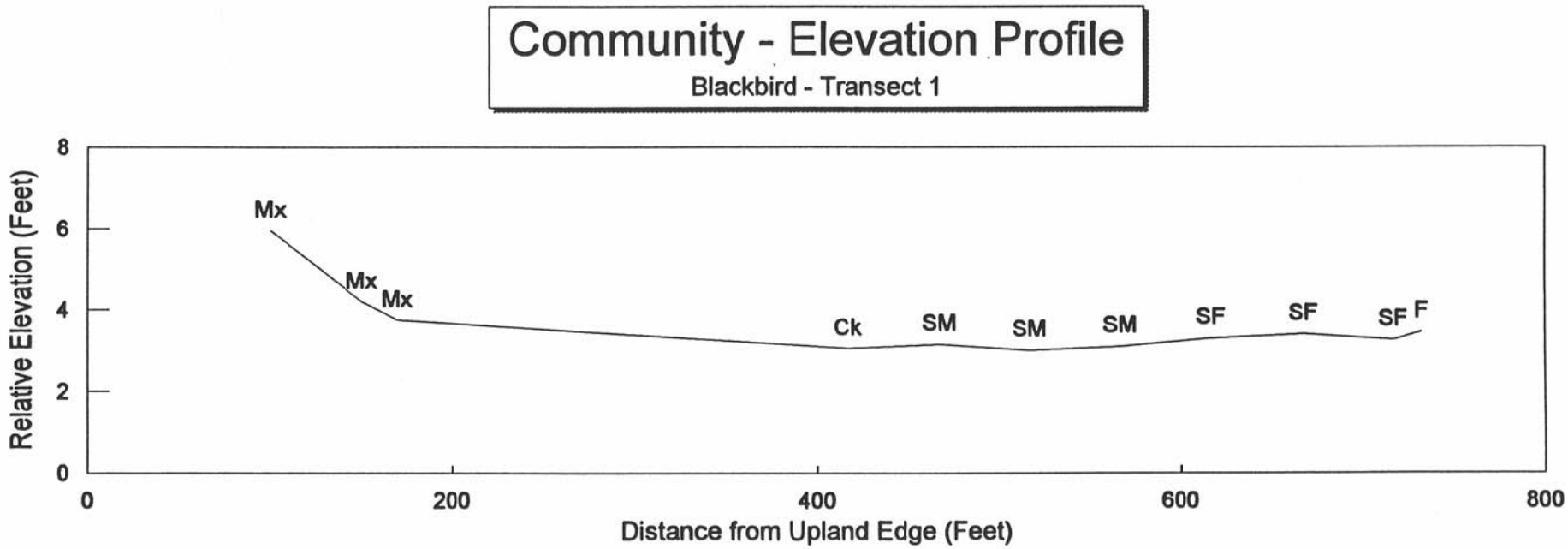
The data for other plant species common to both study areas were reviewed with regard to trends along and between transects. Most species had limited or spotty distribution. Data for the diameter at breast height are given for a few woody species for comparison in Figures 20 to 22. Sampling stations have been sorted by parameter value in these figures. Most values were collected along the marsh border and do not have associated site data on elevation or distance to the marsh edge.

The data sets for *Leersia oryxoides, Spartina patens* and *Polygonum hydropiper* had sufficient coverage to observe limited trends. *Leersia oryxoides* decreased in biomass (Figure 23) moving downstream on Blackbird Creek, but displayed no other trends. *Spartina patens*, Figures 24 to 26, was more prominent on the St. Jones at inland marsh stations, and showed a decrease in height moving toward the creek channel. *Polygonum hydropiper*, although distributed along all three Blackbird

transects, appeared to have greater biomass in the fresher water conditions of transect 1, but greater densities on the mid creek transect 2 (Figures 27 and 28).

The brief review of these 1993 data provide an initial overview of the vegetation data base. These data may be integrated with the GIS mapping data, and supplemented by focused efforts in following years of the Delaware National Estuarine Research Reserve monitoring project.

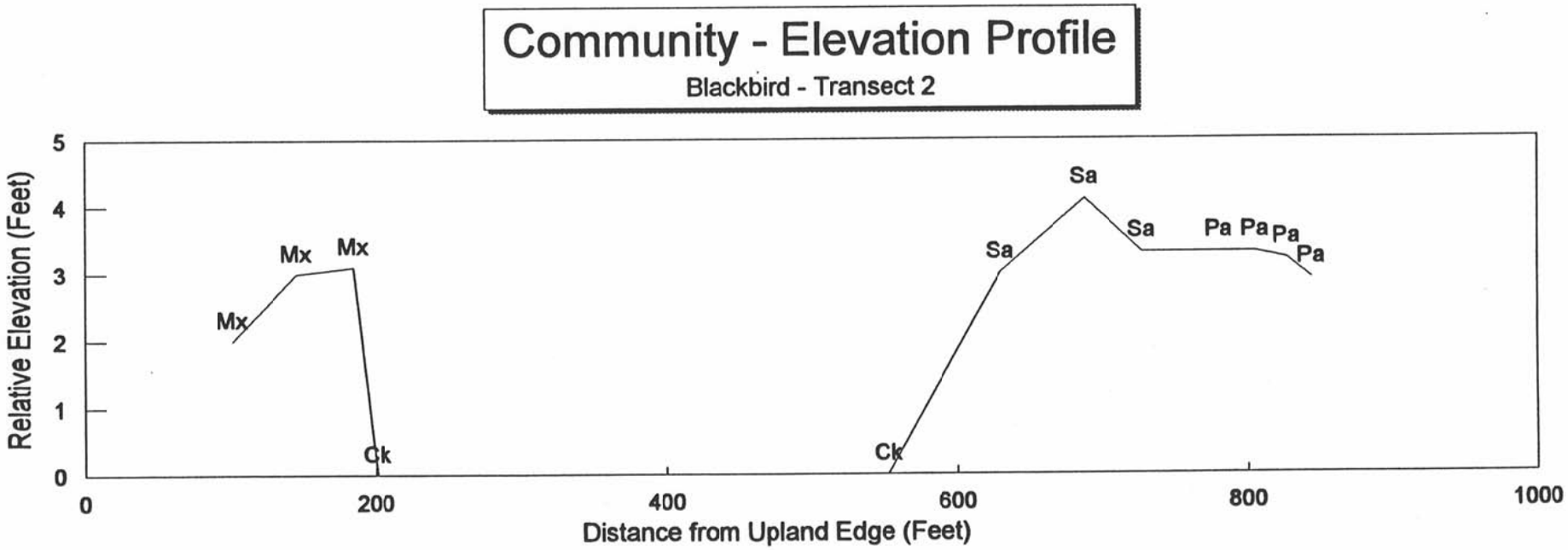
Figure 7



Legend

Sa	Spartina alterniflora	F	Forested Upland	Ck	(Creek)
Sc	Spartina cynosuroides	Mx	Mixed Marsh	MF	(Mud flat)
Ds	Distichlis spicata	SM	Scrub Marsh		
Pa	Phragmites australis	SF	Scrub Forest		
If	Iva frutescens				

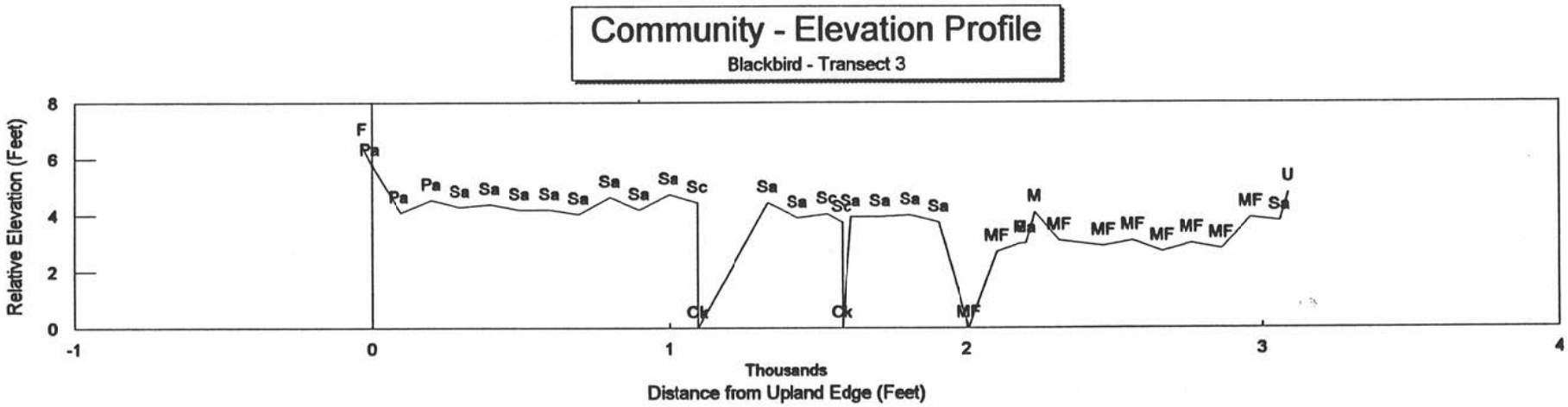
Figure 8



Legend

Sa	Spartina alterniflora	F	Forested Upland	Ck	(Creek)
Sc	Spartina cynosuroides	Mx	Mixed Marsh	MF	(Mud flat)
Ds	Distichlis spicata	SM	Scrub Marsh		
Pa	Phragmites australis	SF	Scrub Forest		
If	Iva frutescens				

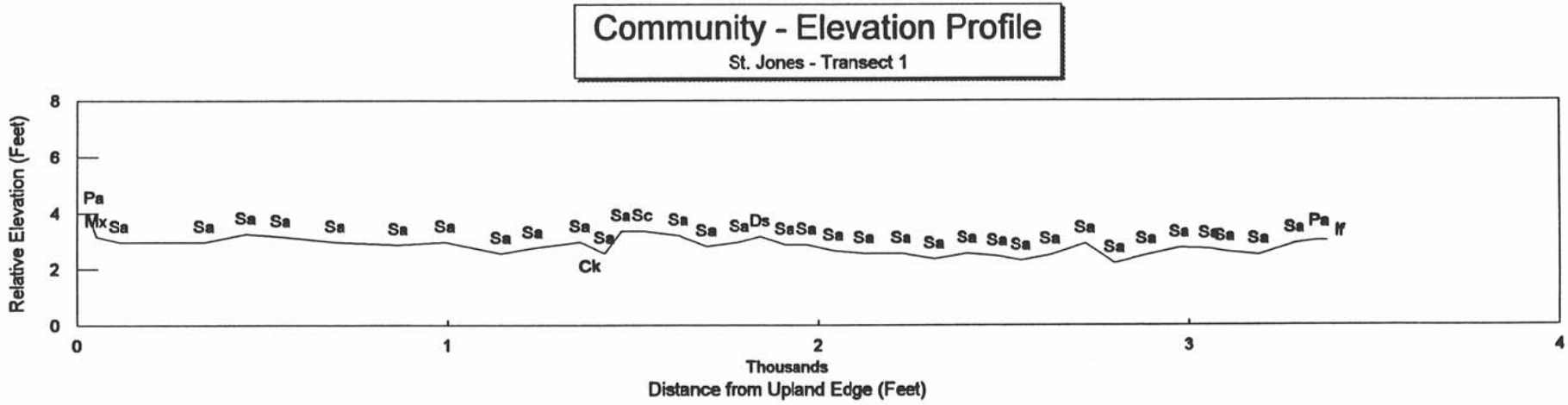
Figure 9



Legend

Sa	Spartina alterniflora	F	Forested Upland	Ck	(Creek)
Sc	Spartina cynosuroides	Mx	Mixed Marsh	MF	(Mud flat)
Ds	Distichlis spicata	SM	Scrub Marsh		
Pa	Phragmites australis	SF	Scrub Forest		
If	Iva frutescens				

Figure 10



Legend

Sa	Spartina alterniflora	F	Forested Upland	Ck	(Creek)
Sc	Spartina cynosuroides	Mx	Mixed Marsh	MF	(Mud flat)
Ds	Distichlis spicata	SM	Scrub Marsh		
Pa	Phragmites australis	SF	Scrub Forest		
If	Iva frutescens				

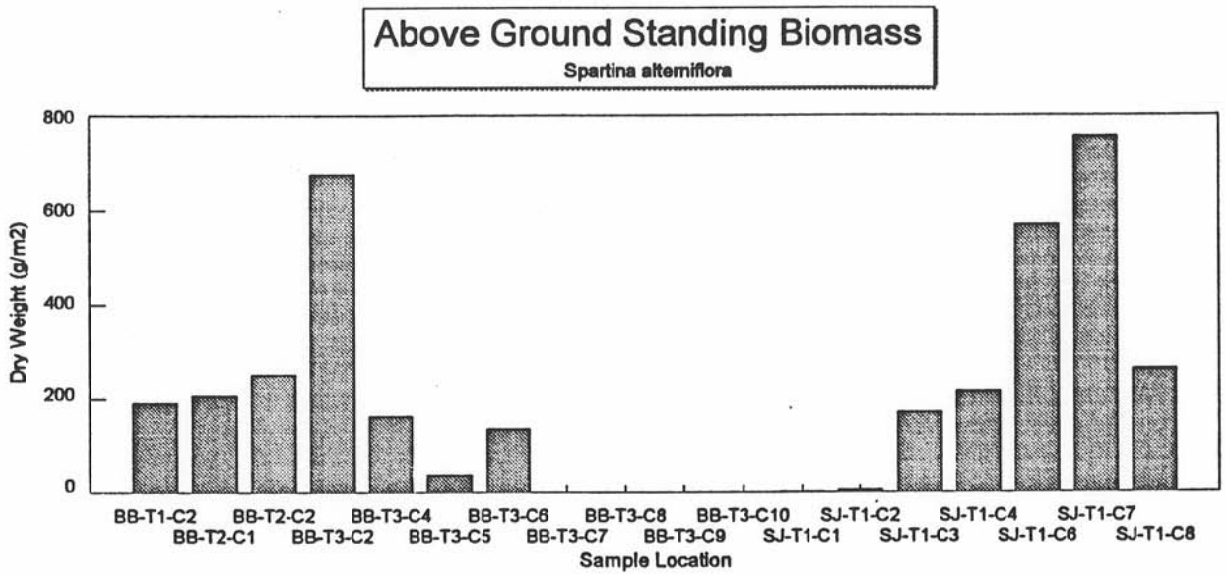


Figure 11

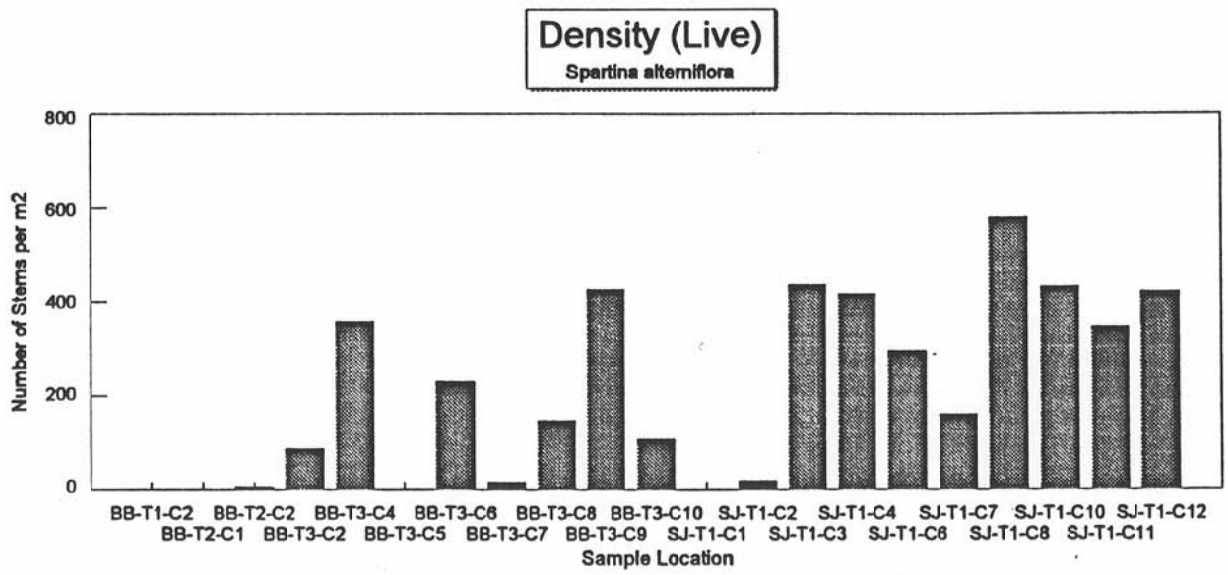


Figure 12

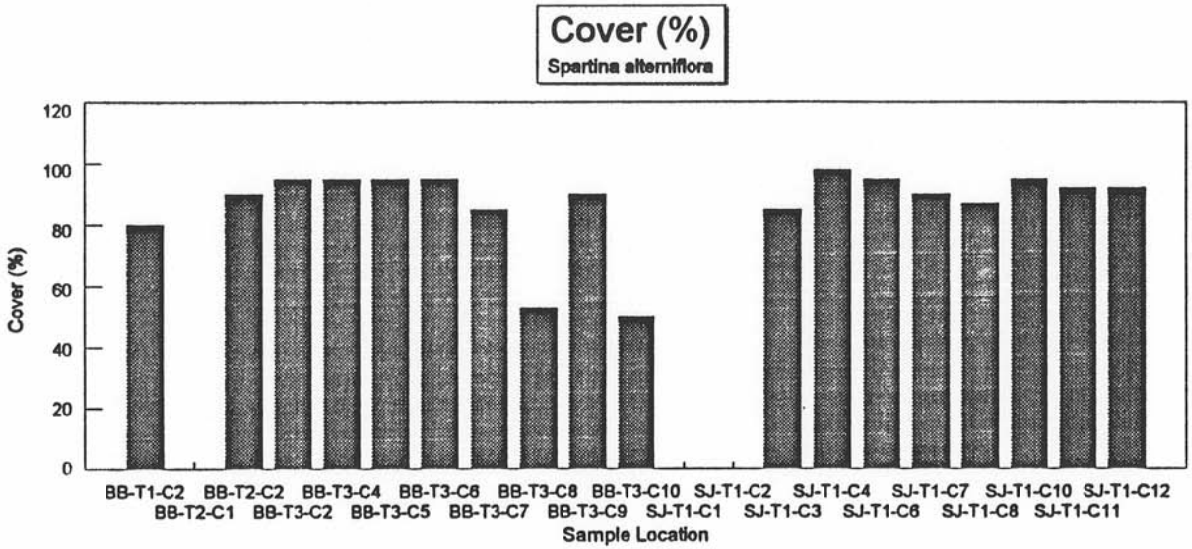


Figure 13

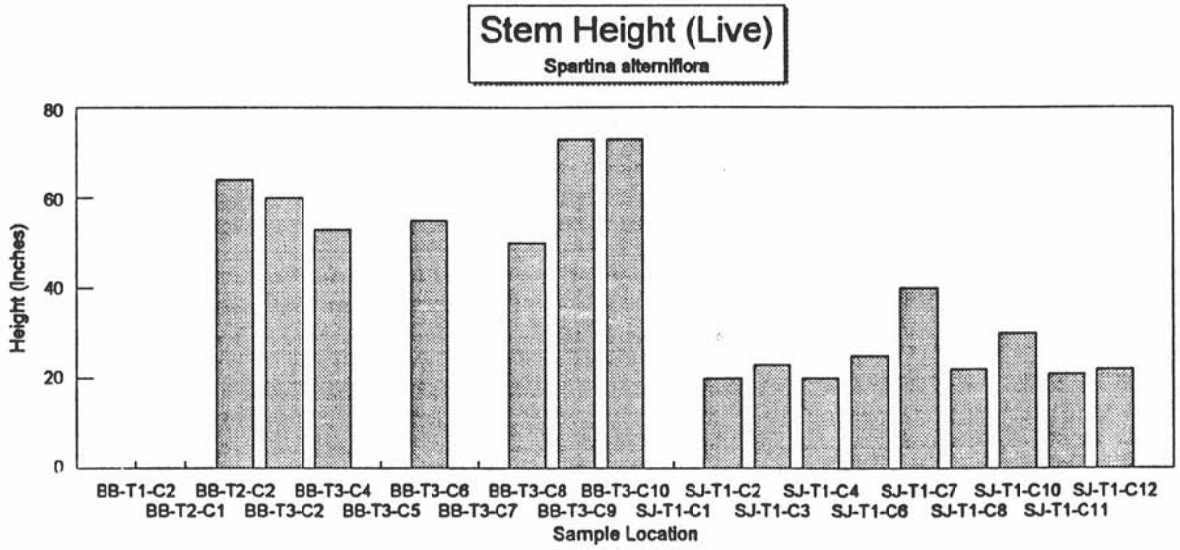


Figure 14

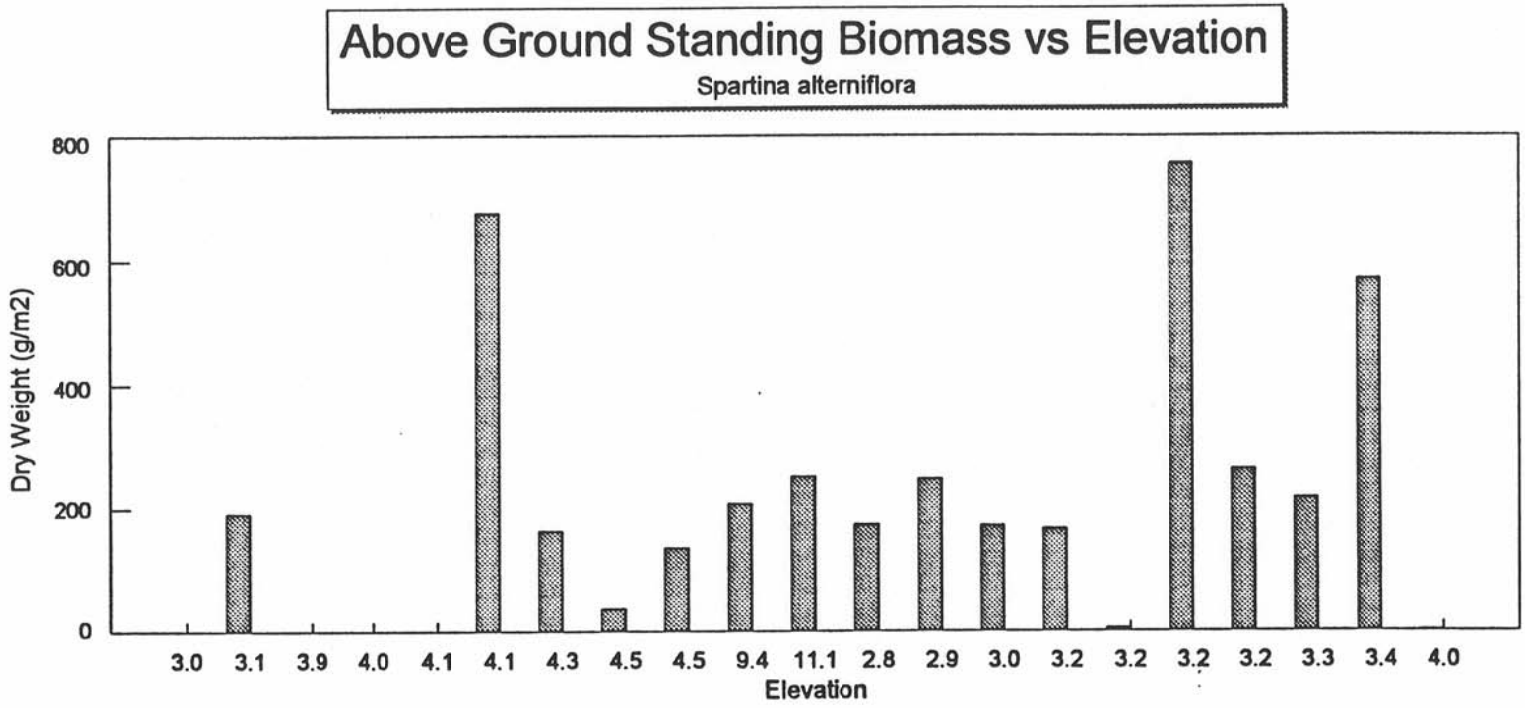

Above Ground Standing Biomass vs Elevation
Spartina alterniflora
Dry Weight (g/m2)
800
600
400
200
0
3.0
3.1
3.9
4.0
4.1
4.1
4.3
4.5
4.5
9.4
11.1
2.8
2.9
3.0
3.2
3.2
3.2
3.2
3.3
3.4
4.0
Elevation

Figure 15

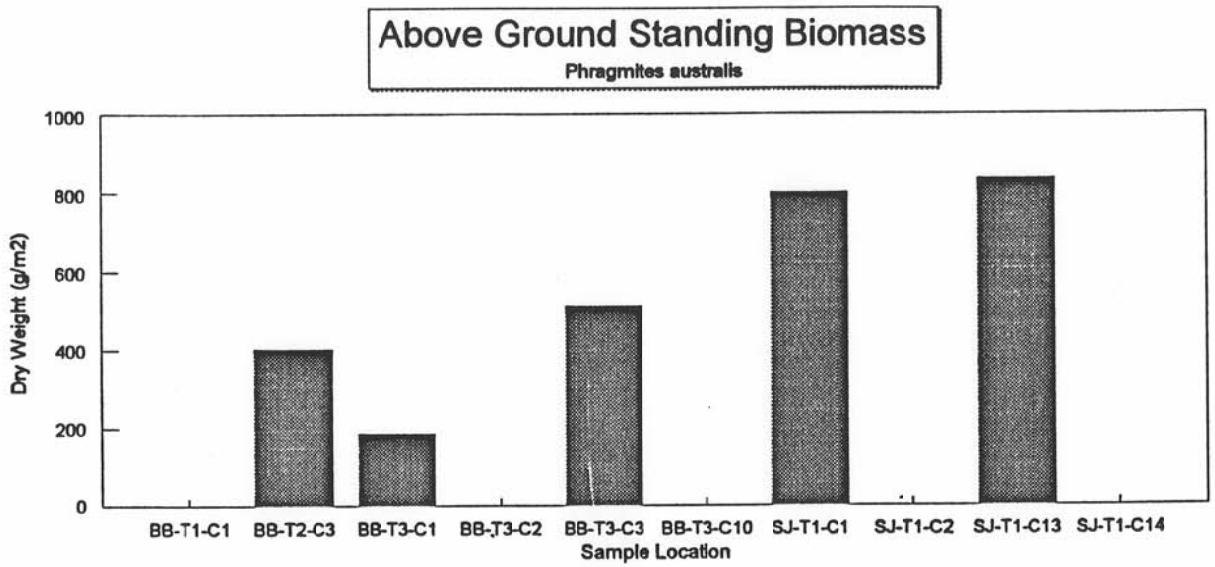


Figure 16

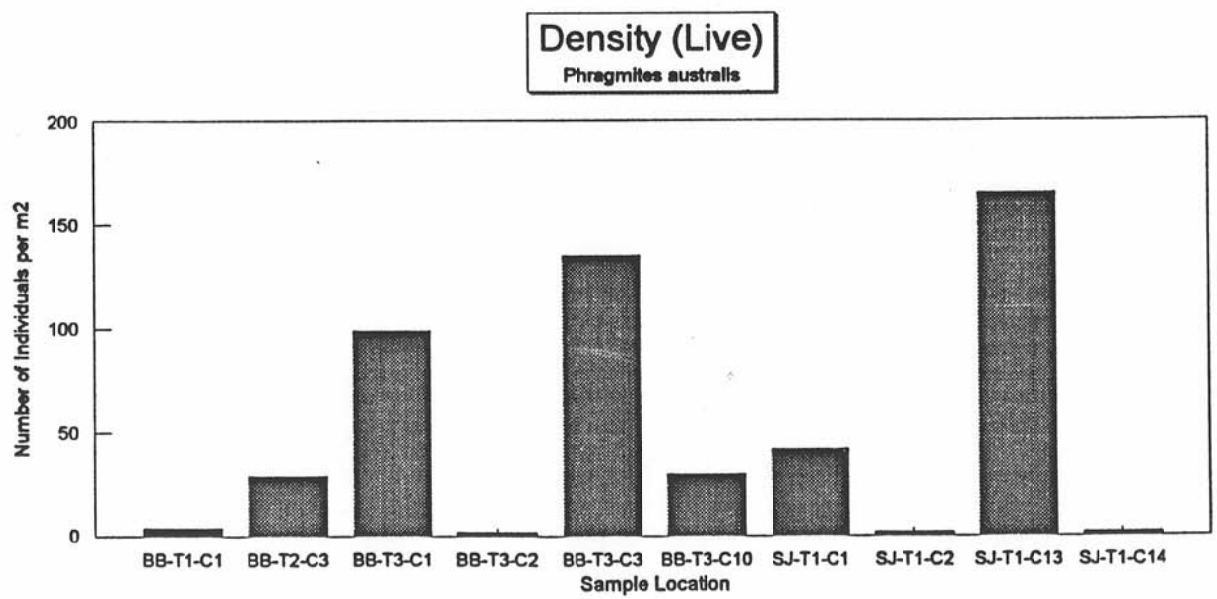


Figure 17

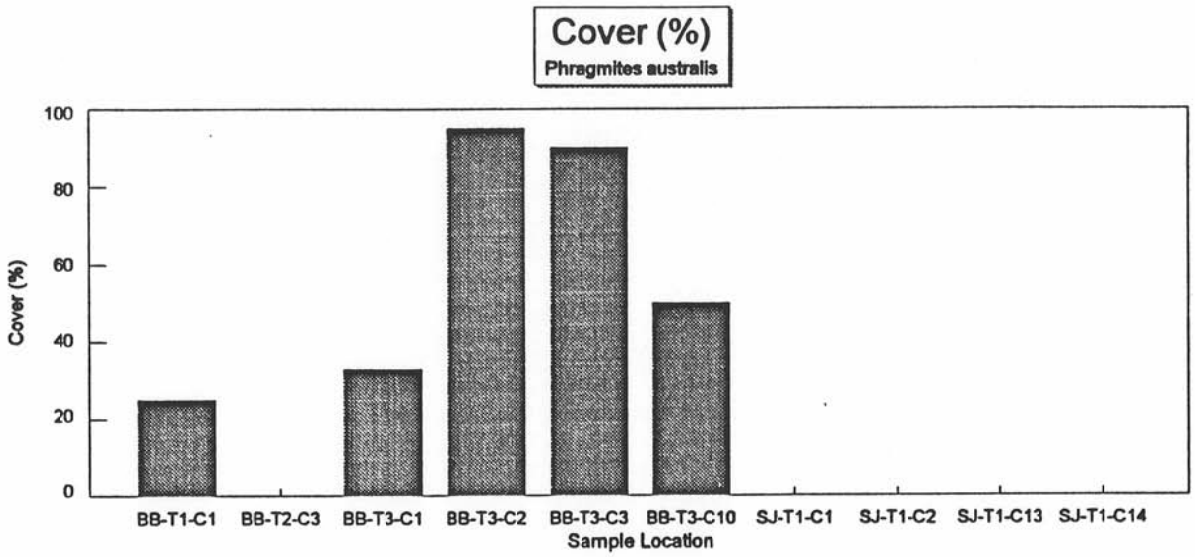


Figure 18

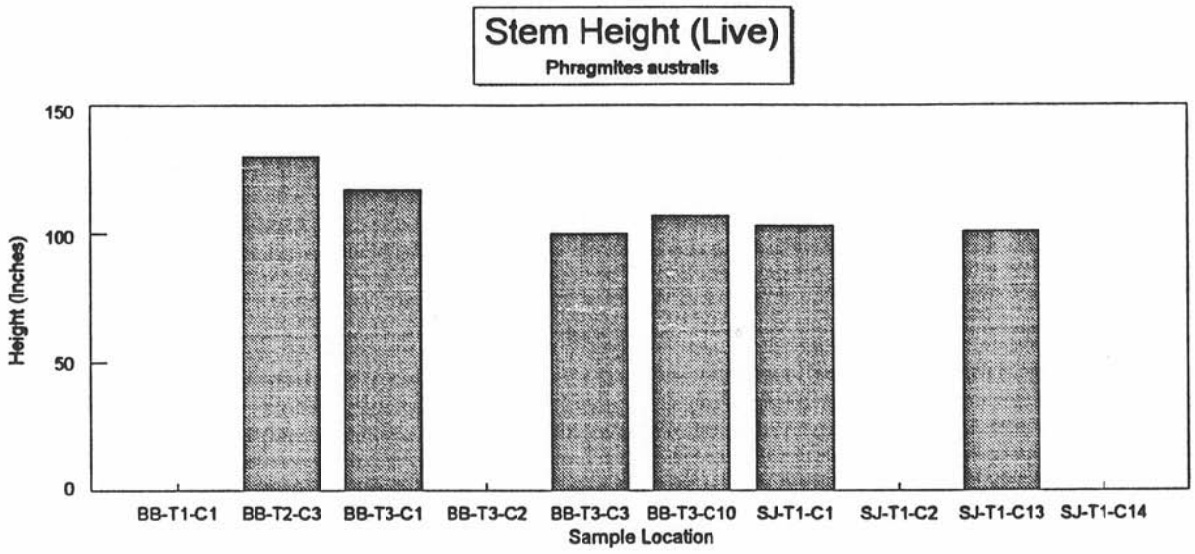


Figure 19

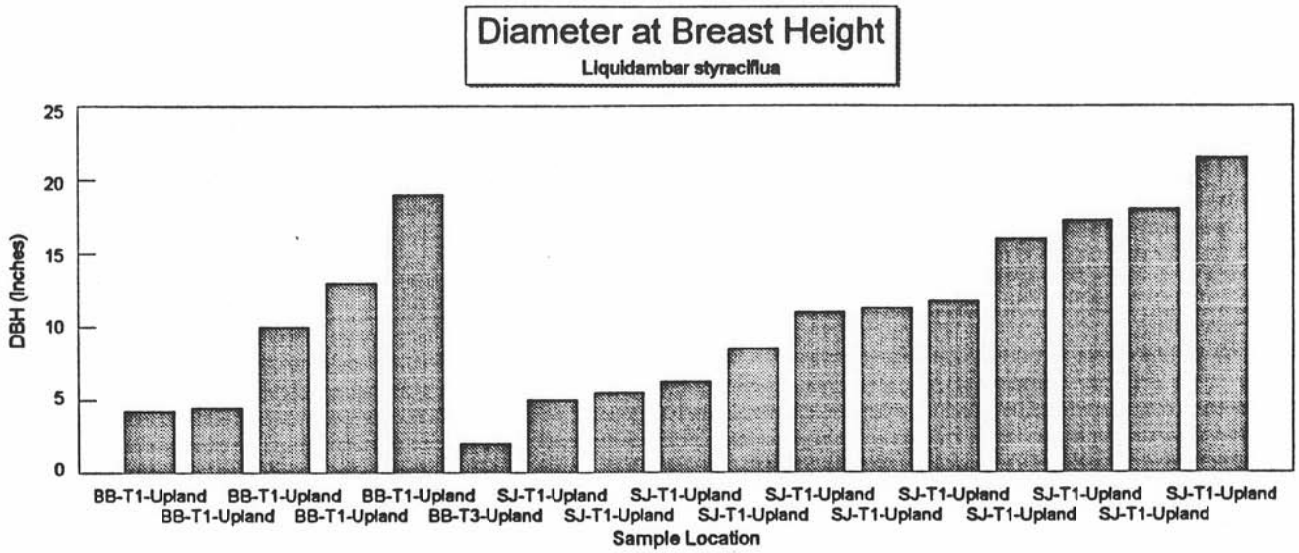


Figure 20

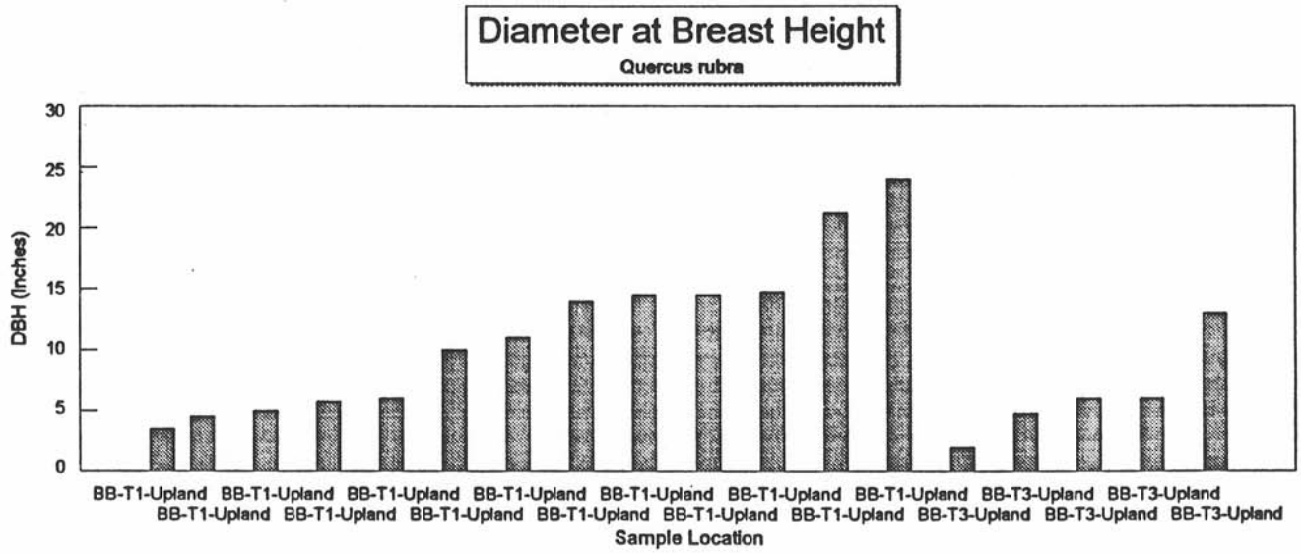


Figure 21

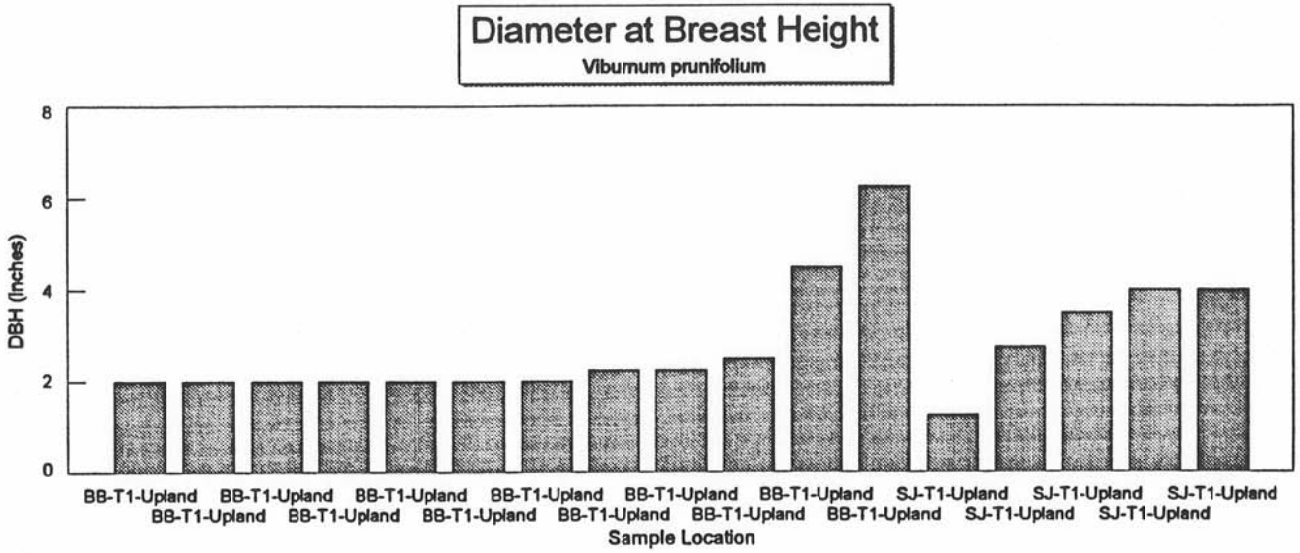


Figure 22

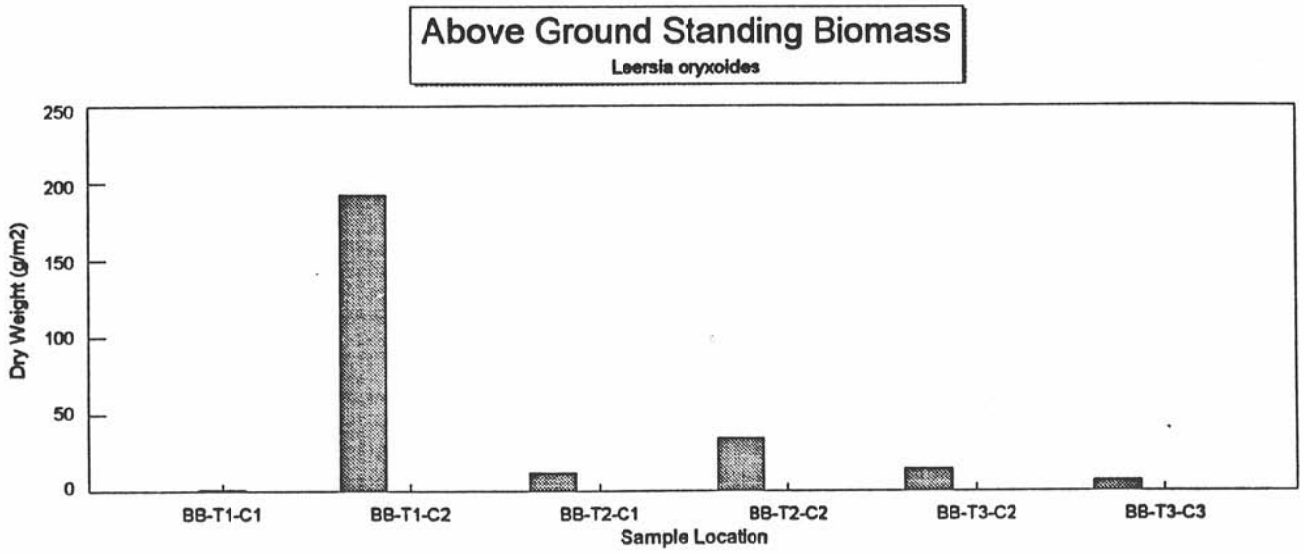
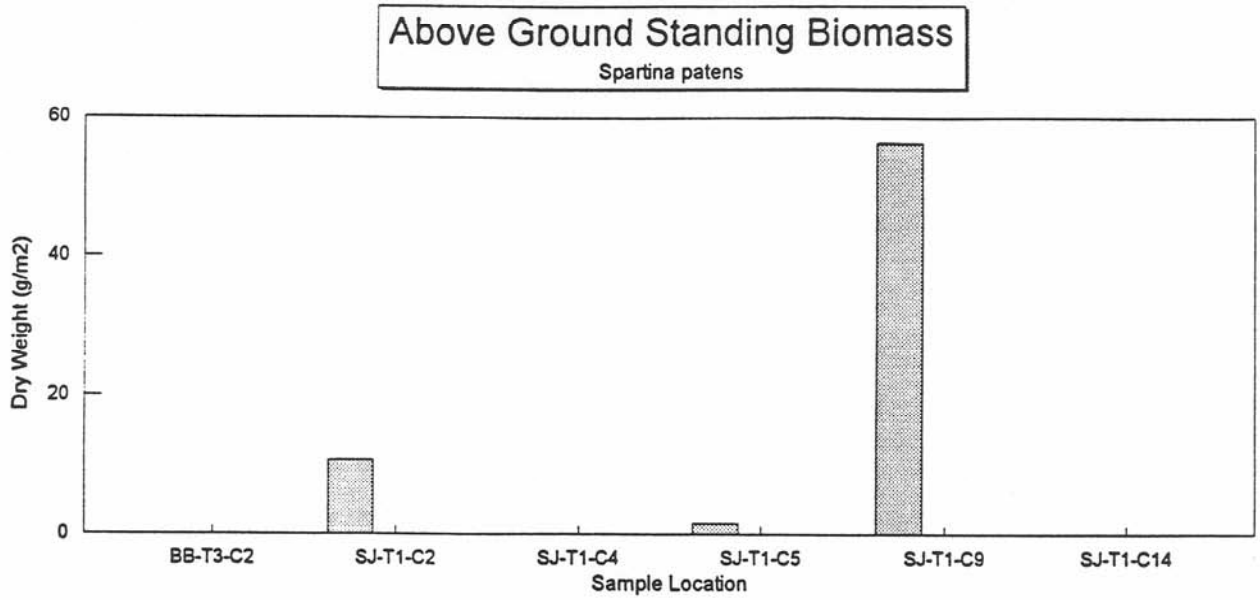


Figure 23



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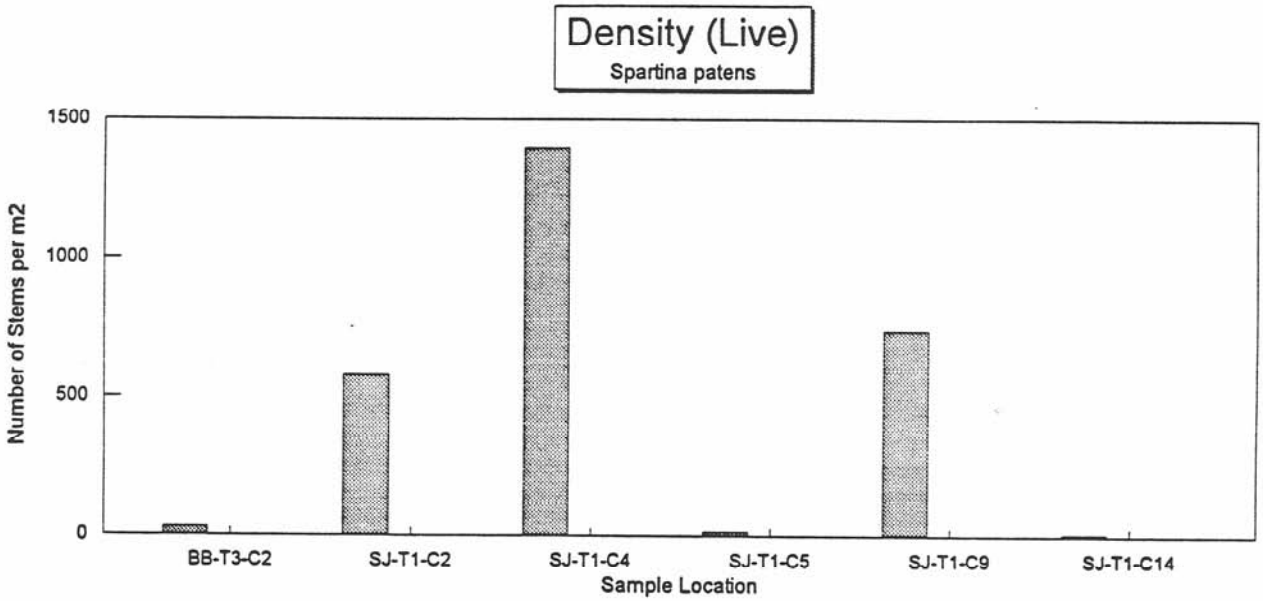

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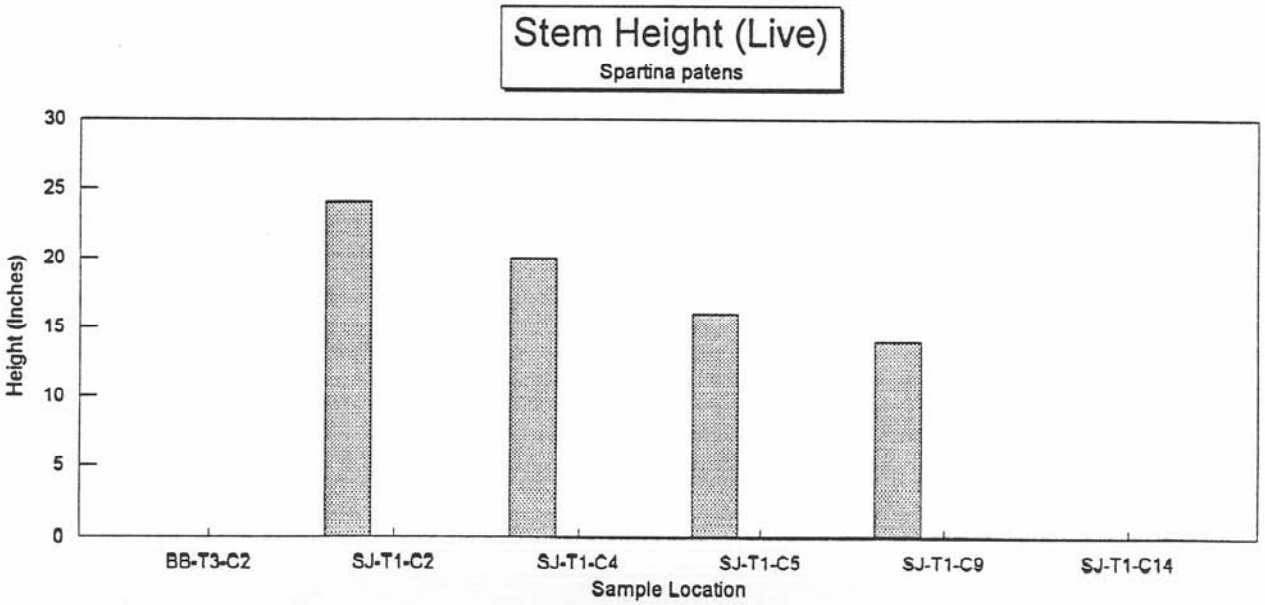


Figure 26

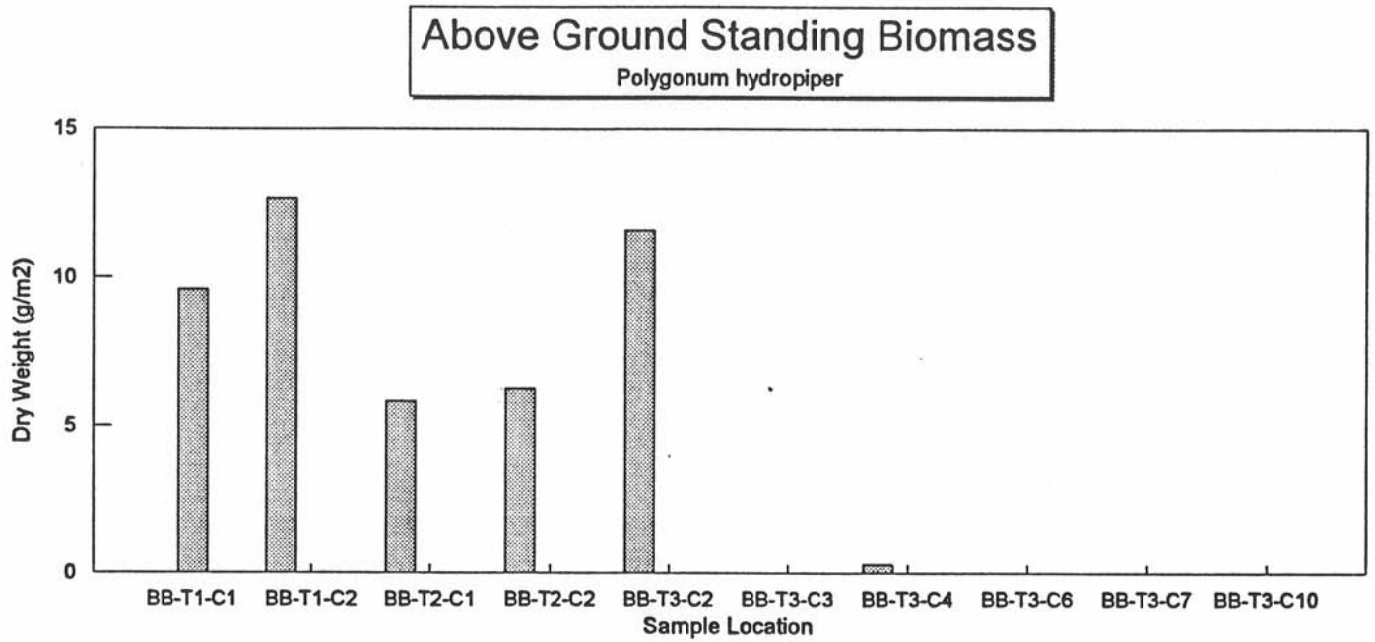


Figure 27

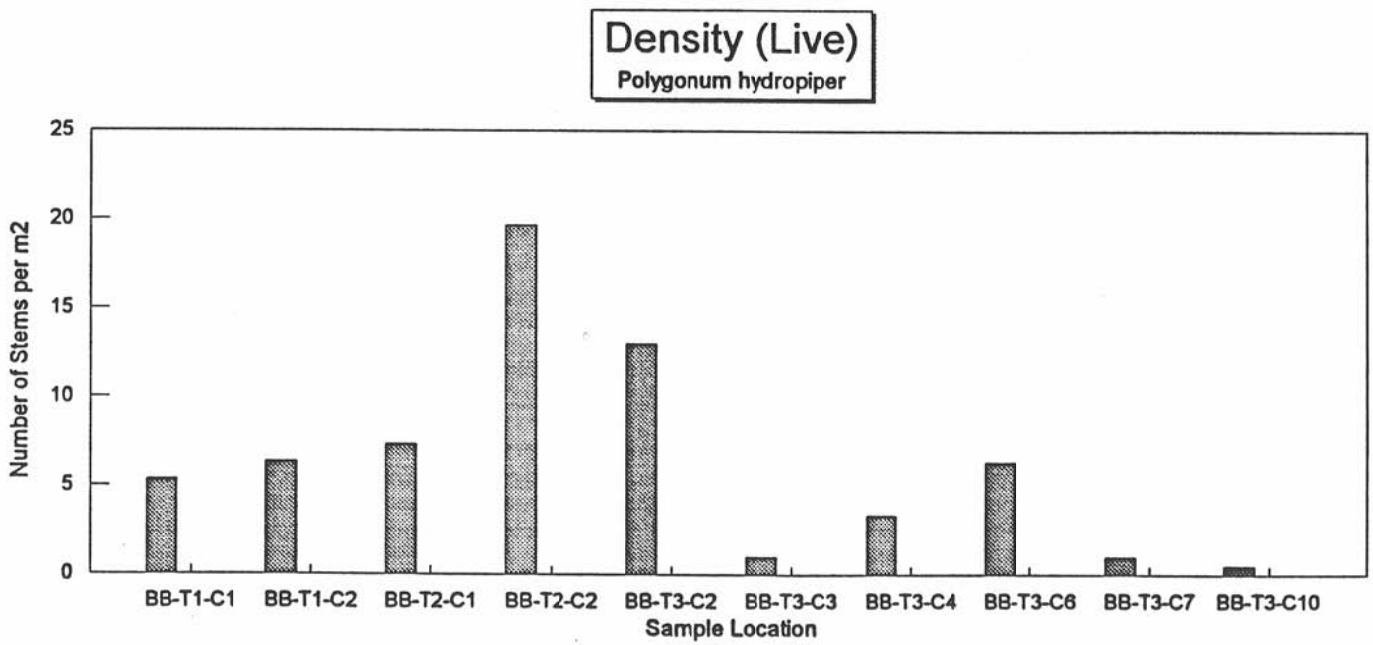


Figure 28

Appendix A - Index to Coastal Maps and Photos

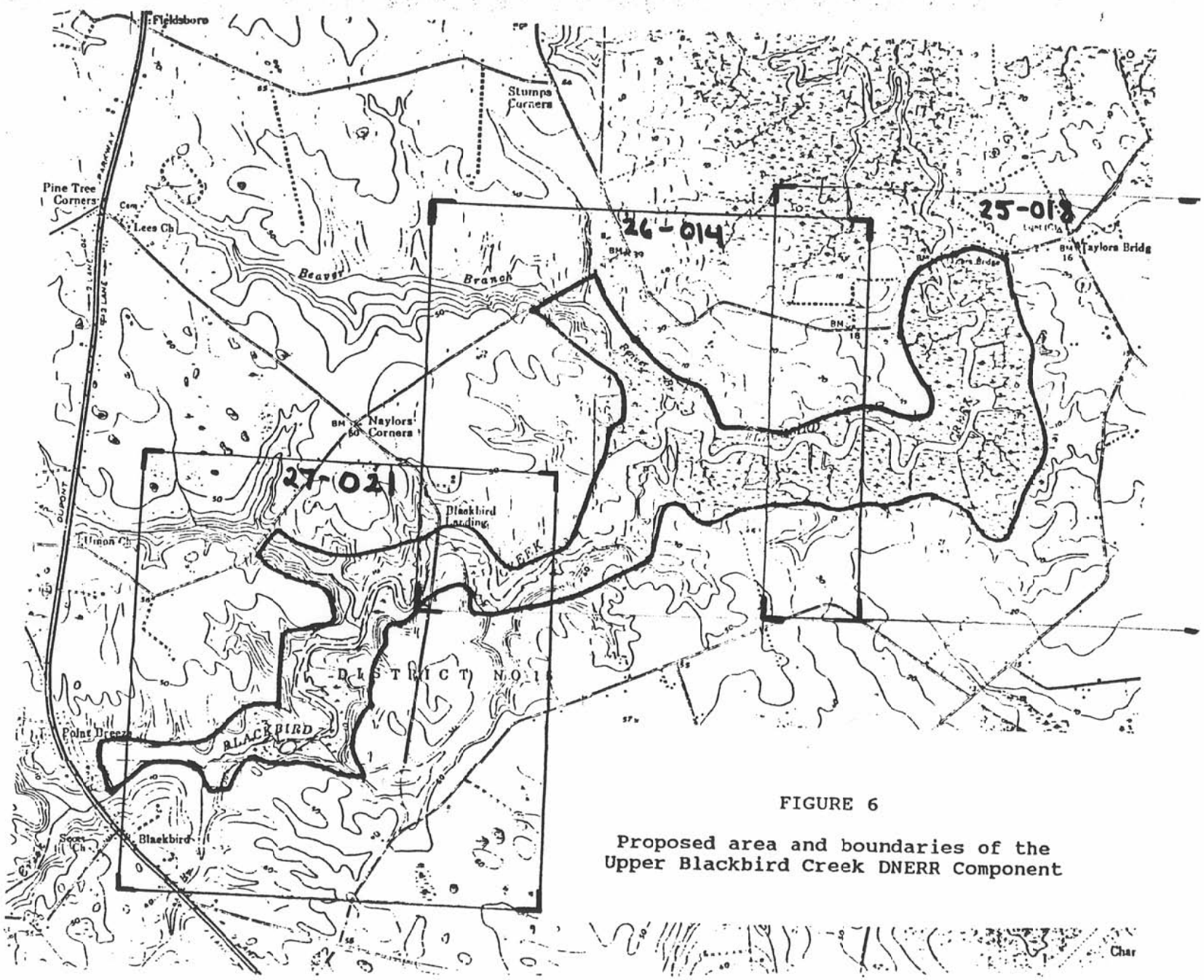


FIGURE 6

Proposed area and boundaries of the Upper Blackbird Creek DNERR Component

Blackbird
Aerial Photos(IR)

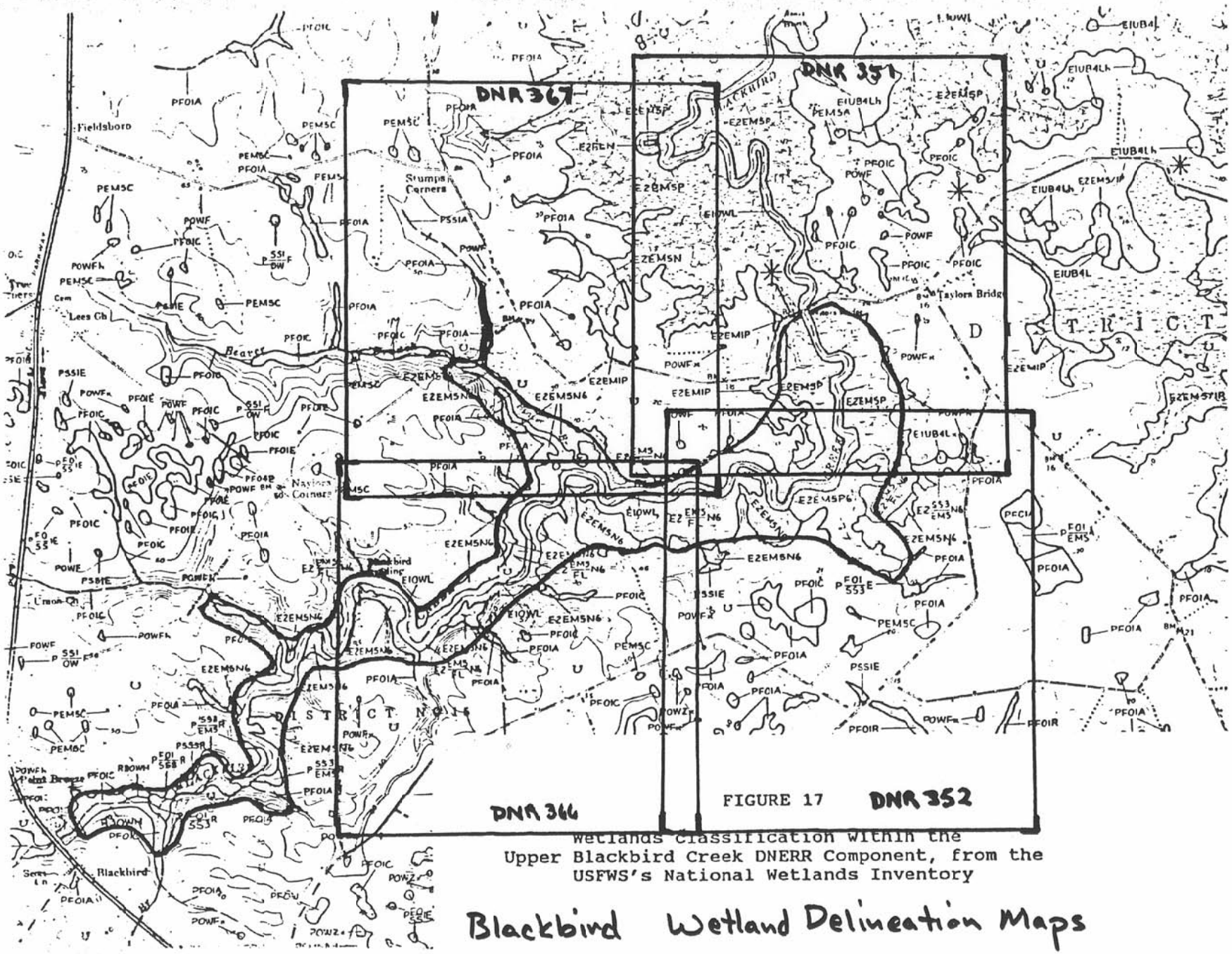


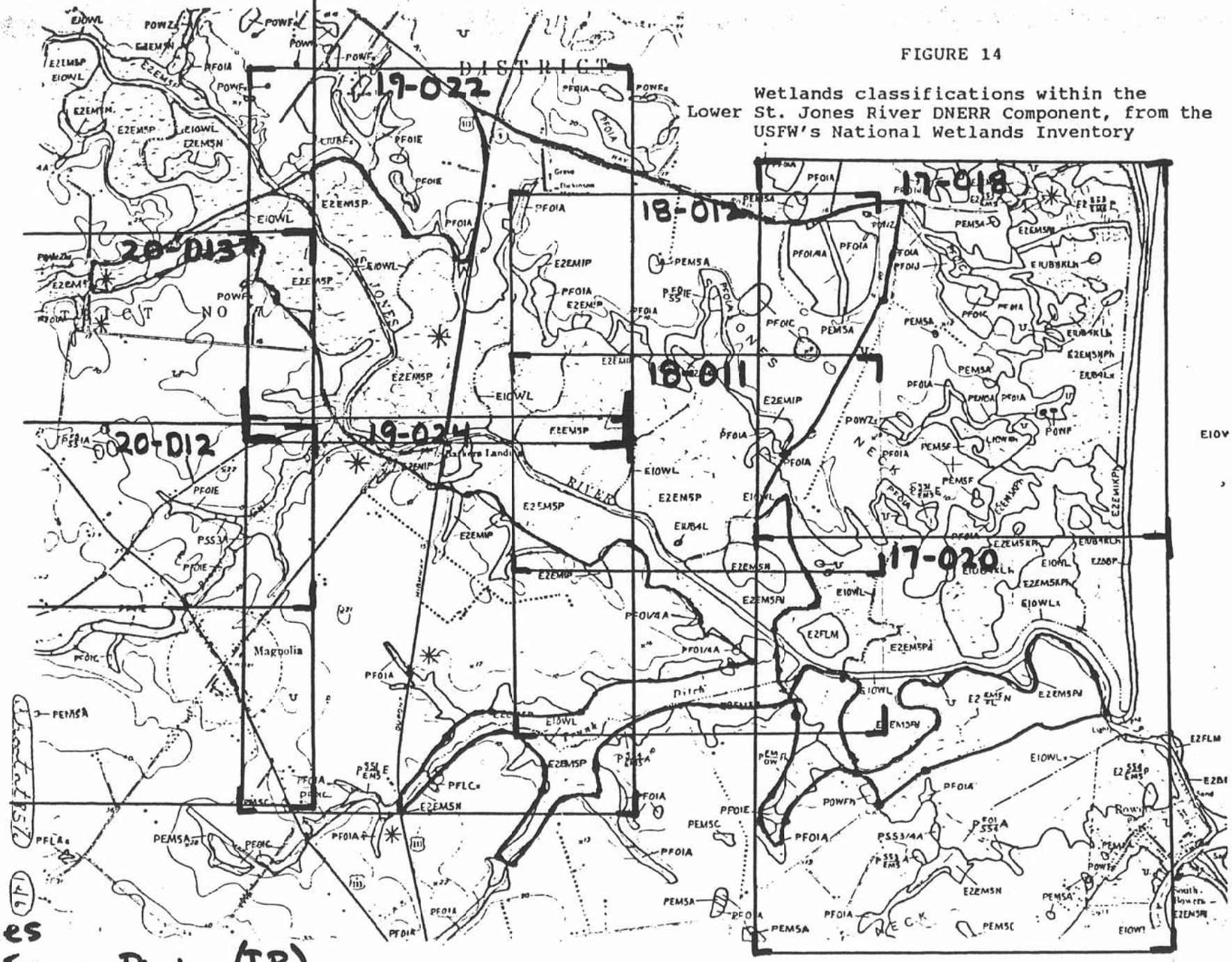
FIGURE 17

Wetlands Classification within the Upper Blackbird Creek DNERR Component, from the USFWS's National Wetlands Inventory

Blackbird Wetland Delineation Maps

FIGURE 14

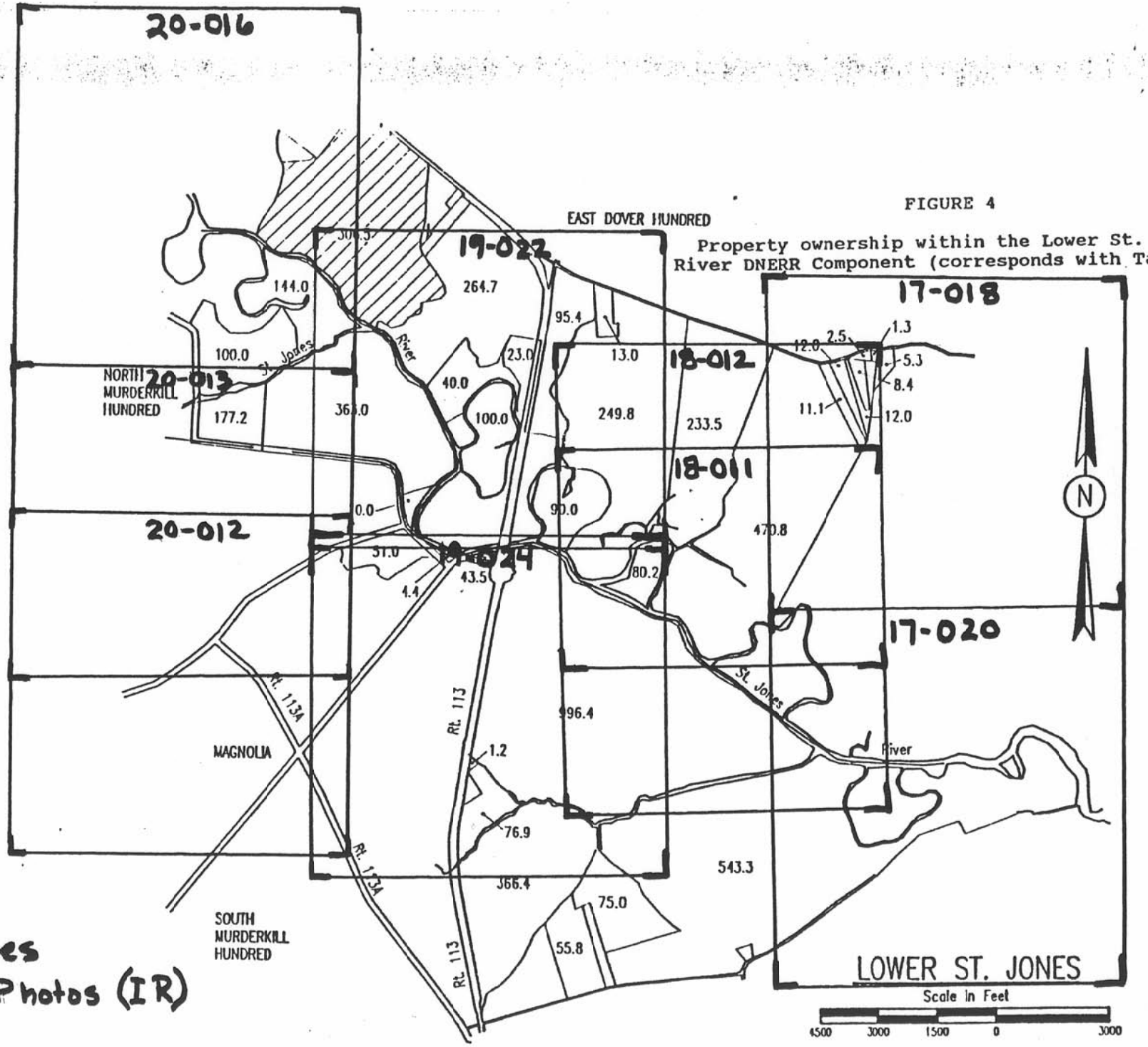
Wetlands classifications within the Lower St. Jones River DNERR Component, from the USFW's National Wetlands Inventory



St. Jones
Aerial Survey Photos (IR)

FIGURE 4

Property ownership within the Lower St. Jones River DNERR Component (corresponds with Table 1)



St Jones
Aerial Photos (IR)

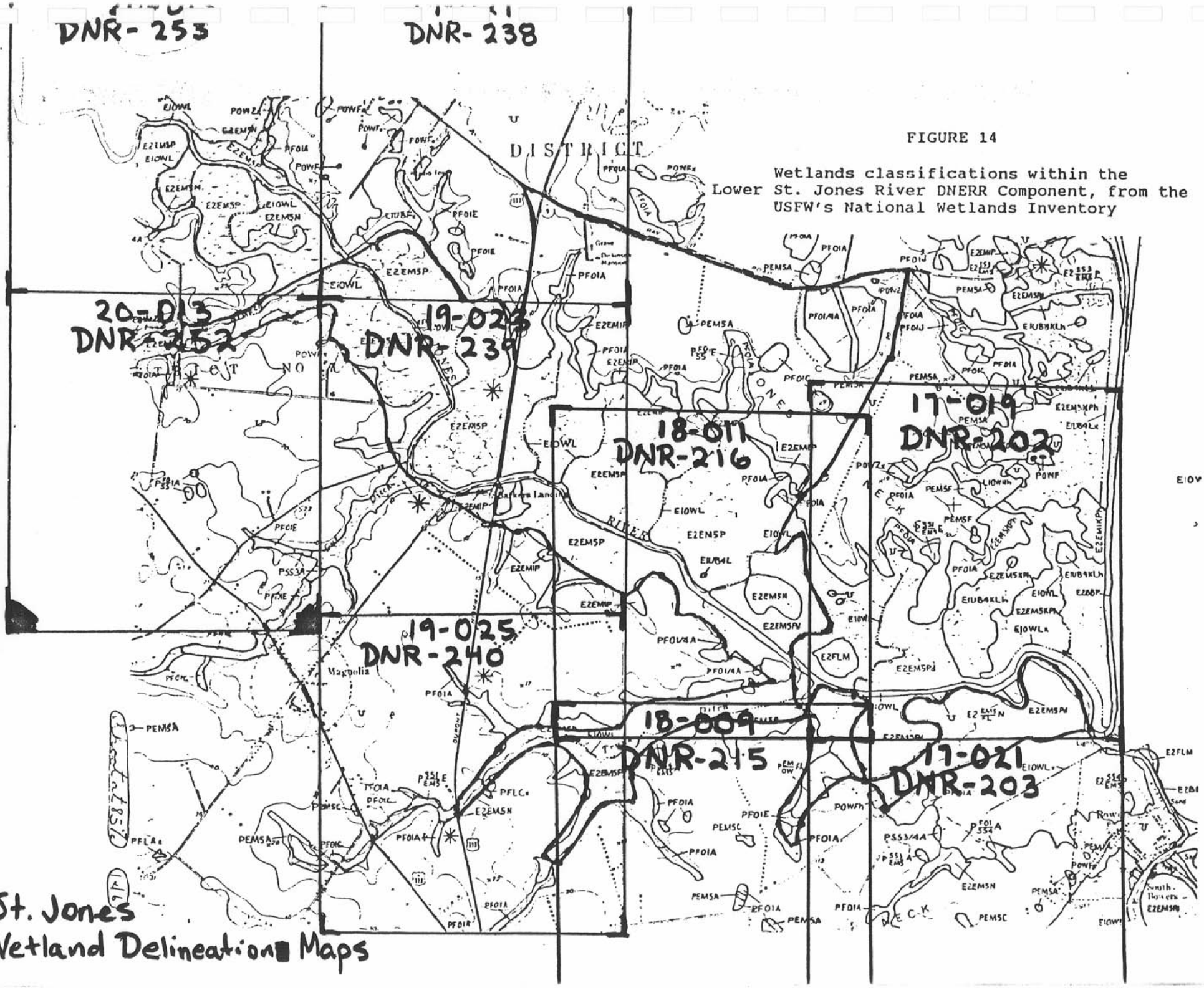


FIGURE 14

Wetlands classifications within the Lower St. Jones River DNERR Component, from the USFW's National Wetlands Inventory