A NATURAL AREAS INVENTORY OF THE LOWER PENINSULA OF VIRGINIA: CITY OF WILLIAMSBURG JAMES CITY COUNTY YORK COUNTY

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INTRODUCTION

In September 1988 the Virginia Department of Conservation and Historic Resources (now Conservation and Recreation), through its Natural Heritage Program, was contracted by the localities of James City County, the City of Williamsburg, and York County to conduct a natural areas inventory. The goal of this inventory was to systematically identify all of the localities' natural heritage areas: those sites supporting unique or exemplary natural communities, rare plants and rare animals, or other significant natural features.

While the contract covered only one year of work, it was understood by all parties that, contingent upon the availability of funds, a complete inventory would be conducted over a three-year period. In September 1989, funding for the second year of the inventory was approved by the localities. Thus, although this report is the final report for the contract, it is not the complete and thorough report that will be prepared at the completion of the inventory.

OVERVIEW OF THE STUDY AREA

Together, the localities of James City County, the City of Williamsburg, and York County cover the majority of a large peninsula bordered on the north by the York River, on the east by Chesapeake Bay, and on the south by the James River. This area is locally known as the Lower Peninsula, or, simply, the Peninsula.

Geology. The Peninsula lies entirely within Virginia's Coastal Plain physiographic province. Here, bedrock is buried by deep layers of unconsolidated materials that eroded from the mountainous western portions of the Commonwealth and were transported to the ocean by large rivers. Although now lying above sea level, these material were deposited on the sea floor and reworked as sea level moved alternately west and east. Evidence of prehistoric sea levels includes relatively long, steep slopes (scarps) that divide the Peninsula into terraces, lower on the east and higher on the west. Four scarps are currently recognized in the Peninsula. From east to west these are the Big Bethel, Suffolk, Kingsmill, and Surry (Johnson & Berquist, 1989).

The eastern tip of the Peninsula is covered with low-lying Pleistocene sands and gravels (Calver & Hobbs, 1963). This area now supports salt marshes, with maritime forests on the higher dune ridges.

Deposit of sands and gravels are exposed over much of the Peninsula. Although Calver & Hobbs (1963) included all of these

in the Yorktown formation, which they placed in the Miocene, more recent studies have divided these deposits into three Pliocene formations and five from the Pleistocene (Johnson & Berquist, 1989). These deposits are typically acidic, but where steep-walled ravines cut through fossiliferous beds, the conditions are circumneutral. They form the uplands of the Peninsula, and under pre-settlement conditions were undoubtedly forested.

The older Miocene deposits that make up the St. Mary's formation (the Eastover formation of Johnson & Berquist, 1989) are exposed in the lowlands along the James River and, to a lesser degree, York River (Calver & Hobbs, 1963). This formation includes beds of sands and clays, some of which contain fossils. Most outcrops of this formation support marshes and swamps.

Current Vegetation. The uplands of the Peninsula are largely forested. Most of the forests are composed of either hardwoods (primarily American Beech, Fagus grandifolia; Tulip Poplar Liriodendron tulipifera; and oaks Quercus spp.), or mixed pines (primarily Loblolly, Pinus taeda; Virginia, Pinus virginiana; and Shortleaf, Pinus echinata) and hardwoods. Although only a relatively small proportion of the Peninsula is currently in agriculture, most of the uplands were farmed in the past.

With steep slopes typical of the Peninsula, most stream channels are narrow, with little development of bottomland forests. Powhatan Swamp is the only extensive forested bottomland in the study area. This area supports a mixture of Bald Cypress (Taxodium distichum), Black Gum (Nyssa sylvatica), Red Maple (Acer rubrum), Sweetgum (Liquidambar styraciflua), and bottomland oaks.

Most of the wetlands in the Peninsula are marshes. Although tides are noticeable along the Chesapeake Bay's tributaries from the fall line, the York and James Rivers (and their tributaries) have sufficient flow that they remain fresh for a considerable distance downstream. As a result, the marshes on the northwest edge of the study area are bathed in freshwater while those at the southeast are inundated with salt water. As the salinity increases downstream, the diversity of plants and animals in the marshes decreases. Along the Chickahominy River, for example, are extensive marshes whose dominants change with the seasons. In the early summer low, plants such as Pickerel weed (Pontederia cordata) and Duck Potato (Peltandra virginiana) dominate. By late summer, however, Wild Rice (Zizania aquatica), Beggar Ticks (Bidens sp.), and Wild Senna (Cassia fasiculata var. macrosperma) dominate. Downstream, these and other freshwater species disappear and are replaced by species tolerant of increasing salinity. Big Cordgrass (Spartina cynosuroides) is the characteristic species of moderately salty stretches, while Black Needlerush (Juncus roemerianus) and

Saltmarsh Cordgrass (Spartina alterniflora) grow in extensive single-species patches along Chesapeake Bay.

THE VIRGINIA NATURAL HERITAGE PROGRAM

The Virginia Natural Heritage Program is the Commonwealth's principal manager of data on rare plants and animals, unique and exemplary natural communities, and other significant natural features such as caves, champion trees, and waterfalls.

Each of these significant natural features (species, community type, and category of geological feature) is an **element of natural diversity**, or simply an **element**. Each element is assigned a rank that indicates its relatively rarity on a five-point scale (1 = extremely rare; 5 = abundant; Table 1). These ranks are assigned both in terms of the element's rarity within Virginia (its State or S-rank) and the element's rarity over its entire range (its Global or G-rank). Taken together these two ranks give an instant picture of the real rarity of the element.

The spot on the landscape that supports a particular population of a specific species or a specific stand of a given community type is an **element occurrence**. The Natural Heritage Program currently has mapped over 3300 element occurrences on its complete set of USGS 7.5' topographic maps. Information on the location and quality of these element occurrences are also entered into the Program's computerized databases.

In addition to ranking each element in terms of rarity, the Virginia Natural Heritage Program ranks each element occurrence so that protection efforts can be aimed not only at the rarest elements, but at the best examples of each. In the case of species, an element occurrence is ranked in terms of the **quality** (size, vigor, etc.) of the population, the **condition** or naturalness of the habitat, the long-term **viability** of the population, and the **defensibility** of the occurrence. Given the intimate relationship between a natural community and its environment, communities are ranked in terms of their quality and their size. (Community grading criteria discussed in more detail in the Analysis section of this report.)

The Virginia Natural Heritage Program began conducting county natural areas inventory in order to gather information on the rare species and communities in a more thorough and systematic manner. Given that some regions of the Commonwealth face greater development pressures than others, the Natural Heritage Program is attempting to inventory the most highly threatened areas first.

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Table 1. Definition of Natural Heritage rarity ranks. These ranks should not be interpreted as legal designations.

The primary criterion for ranking species is the number of occurrences, i.e. the number of known distinct localities or populations. Also of great importance is the number of individuals at each locality or, if a highly mobile organism, the total number of individuals. Other considerations include the condition of the occurrences, the number of protected occurrences, and threats. However, the emphasis remains on the number of occurrences such that ranks are an index of known biological rarity.

S1 Extremely rare; usually 5 or fewer occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.

S2 Very rare; usually between 5 and 20 occurrences; or with many individuals in fewer occurrences; often susceptible to becoming endangered.

S3 Rare to uncommon; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.

S4 Common; usually >100 occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.

S5 Very common; demonstrably secure under present conditions.

SA Accidental in the state.

SH Historically known from the state, but not verified for an extended period, usually >15 years; this rank is used primarily when inventory has been attempted recently.

SN Regularly occurring migrants; transients; seasonal, non-breeding residents. Usually no specific site can be identified with its range in the state. (Note that congregation and staging areas are monitored separately).

SU Status uncertain, often because of low search effort or cryptic nature of the element.

SX Apparently extirpated from the state.

Global ranks are similar, but refer to a species' rarity throughout its range. Global ranks are denoted with a "G" followed by a character. Note that GA and GN are not used and GX means extinct.

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METHODS

The Natural Heritage Program conducts natural area inventories in five stages:

1) Review of aerial photographs. Aerial photographs of the entire survey area are reviewed in detail to identify Potential Natural Areas (PNAs) to be studied in the following stages. Where possible, both the oldest available photographs and the most recent ones are studied. Comparing these two sets of photographs with each other helps determine how long forests and other vegetation have been in their current condition. In addition, the photographs are compared with topographic, wetlands, and soils maps as aids to their interpretation.

2) Gathering existing information. Published and unpublished information on natural areas in the inventory area is collected and assimilated in conjunction with the review of aerial photographs. This includes gathering maps of public lands (federal, state and local) within the survey area, reviewing Natural Heritage data, consulting experts such as local naturalists, soil conservationists, foresters, and college faculty. During this stage, some PNAs are eliminated from further consideration while others are added.

3) Aerial reconnaissance. Selected PNAs are studied in more detail by flying over them in a small airplane. Typically, this is done in the spring when the ground is visible through the trees. This is especially useful where no recent photographs are available or there have been major changes in the landscape due to development, conversion of natural forests to managed plantations, etc. Flying allows the quick review of many tracts that would take days to visit by car and on foot. Making a videotape of the flight allows the flight to be replayed and reanalyzed. The goal of this stage is to eliminate from consideration the sites that are no longer in a natural state and to begin prioritizing the remaining PNAs for on-the-ground survey.

4) Initial ground survey. There are several purposes of this stage. One is to identify and contact the landowner. A second purpose is to screen the PNAs to eliminate those that show signs of substantial disturbance that are not visible in aerial photographs or from the air. A third is to plan for the main survey of PNAs that still show potential as natural areas. Among the decisions to be made are when the survey can best be conducted, which staff scientist(s) should be involved (i.e. what is the potential for rare plants, rare animals or exemplary communities), and how much time should be budgeted

for completing the survey. Where there is a need to verify the accuracy of the photo interpretation conducted during stage 1, these stages may overlap.

5) Thorough inventory of the PNA. At this time, detailed information is collected on the presence and status of rare species and unique or exemplary natural communities that are present, the extent of the feature(s) that make the PNA significant, and the area that needs to be protected to preserve those features. Threats and past or present disturbances are also noted. For sites found to be of statewide significance, these data are transcribed onto Natural Heritage Program maps and entered into the Natural Heritage databases.

RESULTS

The County Natural Heritage Inventory of Williamsburg City, York County and James City County is progressing on schedule. During the initial year of the contract, Virginia Natural Heritage Program staff scientists have at least begun all phases of the inventory. Ninety PNAs have been identified in the study area (Appendix A; Figure 1) and will be evaluated as the inventory progresses. With the close of the field season, Natural Heritage staff have more time to process data collected over the past several months. To date, the following work has been completed.

1) Review of aerial photographs. Black and white aerial photographs of the entire study area taken by the Virginia Department of Transportation in 1986 and 1987 were reviewed. During this review, 81 Potential Natural Areas (PNAs) were identified. These were compared with photographs taken in 1959 and 1960 by the US Agricultural Stabilization and Conservation Service (ASCS) to better determine the status of forests in selected PNAs. To learn more about wetlands on the PNAs, high altitude false color, infra-red photos from 1982 and 1983 were analyzed. This work resulted in the elimination of 4 PNAs from further consideration as significant communities, plus the acquisition of additional information on over half of the PNAs.

2) Interviews. Interviews were conducted with Tom Wieboldt (VPI), Bill Apperson and Gene Augsburger (Virginia Department of Forestry) and Drs. Gus Hall, Donna Ware, Gerry Johnson, and Stewart Ware (all on the faculty of the College of William and Mary). Individuals from the Virginia Institute of Marine Science have been interviewed as well. Based on these interviews, 7 new PNAs were identified and additional

information was gleaned on several PNAs that had been identified previously.

3) Collection of existing information. The major herbaria (Table 2) in Virginia have been searched for the locations of rare plants by Natural Heritage Program staff scientists. Records for the study area are being mapped and entered in the Natural Heritage databases. This work provided leads on several rare plant locations not previously entered in the Natural Heritage Program's databases. All major museum holdings for amphibians and reptiles have been canvassed and records entered into the databases. A search for all historical breeding bird records was conducted utilizing the Virginia Breeding Bird Atlas. With information remaining to be processed, the Natural Heritage Program currently has records of 4 vertebrates, 1 invertebrate, 35 plants, and 3 natural communities from the study area in its databases (Table 3).

4) Aerial reconnaissance. Three flights were made on two separate occasions by Natural Heritage Program staff. Additional information was provided by staff of The Nature Conservancy's national headquarters, who made a flight over the study area as part of their on-going efforts to develop and standardize County Natural Heritage inventory methods. As a result of these flights, two PNAs that had not been identified before were noted and several PNAs were eliminated from further consideration as unique or exemplary natural communities.

5) Preliminary ground evaluation. Eighteen of the PNAs were ground-truthed by Natural Heritage staff and others, including Jack White (National Coordinator of Site Surveys for The Nature Conservancy) and Dr. Donna Ware. This eliminated several PNAs and confirmed that three are significant, at least two of these (Grove Creek and Carter's Grove) are likely to be significant at a state-wide level. Preliminary fieldwork by Dr. Donna Ware has turned up several locations of rare plants that were not previously known to the Natural Heritage Program. One of these includes a new population of the Small Whorled Pogonia (Isotria medeoloides), which is listed as endangered under both US and Virginia endangered species laws.

6) Grading criteria. Draft criteria were developed for grading the natural communities known or expected to be present within the inventory area (Appendix B). Copies of these draft criteria have been sent to several people experienced in Natural Heritage Inventories and/or the study area for their comments. These comments will be used to expand or refine

Table 2. Major herbaria in Virginia that have been searched for specimens of rare plants.

Herbarium	Location	Number of Records in*	Percent of Species**
George Mason Univ.	Fairfax	0	50
Longwood College	Farmville	4	100
Old Dominion Univ.	Norfolk	1	20
Smithsonian	Washington, D.C.	12	30
UNC	Chapel Hill	5	50
Univ. of Richmond	Richmond	0	50
VCU	Richmond	0	50
VPI	Blacksburg	8	80
William & Mary	Williamsburg	29	80

* Number of records in the Natural Heritage database that are supported by specimens in the collection.

** Percent of the roughly 600 species monitored by the Natural Heritage Program that have been checked for records in James City Co., Williamsburg, or York Co.

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Table 3. Natural Heritage Resources documented from James City County, Williamsburg, and York County.

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	US STATUS	STATE STATUS
VERTEBRATES					
AMBYSTOMA MABEEI	MABEE'S SALAMANDER	G4	S2?		RSC
AMBYSTOMA TIGRINUM	TIGER SALAMANDER	G5	S1		LE
RANA VIRGATIPES	CARPENTER FROG	G5	S3		RSC
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	G3	S2S3	LE	LE
INVERTEBRATES					
ISCHNURA PROGNATHA	A DRAGONFLY	G4	S1		RSC
PLANTS					
AESCHYNOMENE VIRGINICA	SENSITIVE JOINT-VETCH	G2	S2	C2	C
ASCLEPIAS LANCEOLATA	FEW-FLOWERED MILKWEED	G5	S1		RSC
CAREX LACUSTRIS	LAKE-BANK SEDGE	G5	S1		RSC
CAREX LUPULIFORMIS	FALSE HOP SEDGE	G3G4Q	S1S2		RSC
CARYA AQUATICA	WATER HICKORY	G5	S1S2		
CUSCUTA INDECORA	PRETTY DODDER	G5	S1		
CYPERUS HASPAN	GALINGALE SEDGE	G5	S2		RSC
ELEOCHARIS VERRUCOSA	SLENDER SPIKERUSH	G3G5Q	SU		RSU
ERIOCAULON DECANGULARE	TEN-ANGLED PIPEWORT	G5	S1		RSC
EUPHORBIA AMMANNIOIDES	A SPURGE	G3G4	S1?		RSC
FIMBRISTYLIS PERPUSILLA	HARPER'S FIMBRISTYLIS	G2	S1	C1	LE
GLYCERIA GRANDIS	AMERICAN MANNAGRASS	G5	S1		RSC
HELENIUM BREVIFOLIUM	SHORTLEAF SNEEZEWEED	G4	S1		RSC
ISOTRIA MEDEOLOIDES	SMALL WHORLED POGONIA	G2	S1	LE	LE
JUNCUS CAESARIENSIS	NEW JERSEY RUSH	G2	S2	C2	RE
LIPARIS LOESELII	FEN ORCHID	G5	S2		RSC
LISTERA AUSTRALIS	SOUTHERN TWAYBLADE	G4	S2S3		RSC
LYTHRUM ALATUM	WINGED-LOOSESTRIFE	G5	S1		RSC
MALAXIS SPICATA	FLORIDA ADDER'S-MOUTH	G3G4	S2		RSC
NUPHAR SAGITTIFOLIUM	YELLOW COWLILY	G3Q	S2		RSC
PONTHIEVA RACEMOSA	SHADOW-WITCH	G4G5	S2		RSC
QUERCUS PRINOIDES	DWARF CHINQUAPIN OAK	G5	S2		RSC
QUERCUS SCHUMARDII	SCHUMARD OAK	G5	S2S3		RSC
SCIRPUS LINEATUS	DROOPING BULLRUSH	G4	S1		RSC
SCUTELLARIA INCANA	HOARY SKULLCAP	G5	S1		RSC
SOLIDAGO TORTIFOLIA	A GOLDENROD	G3G5	S1		RSC
SPIRANTHES ODORATA	SWEETSCENT LADIES'-TRESSES	G5	SU		RSC
STEWARTIA OVATA	MOUNTAIN CAMELLIA	G4	S2S3		RSC
TILLANDSIA USNEOIDES	SPANISH MOSS	G5	S2S3		RSC
TRIDENS STRICTUS	LONG-SPIKE FLUFF GRASS	G5	S1		RSC
TRIGLOCHIN STRIATUM	THREE-RIBBED ARROWGRASS	G5	S2		RSC
TRILLIUM PUSILLUM VAR VIRGINIANUM	VIRGINIA LEAST TRILLIUM	G3T2	S2	C2	RSC
UTRICULARIA FIBROSA	FIBROUS BLADDERWORT	G4G5	S1S2		RSC
XYRIS CAROLINIANA	CAROLINA YELLOW-EYED GRASS	G4G5	S1		RSC
WISTERIA FRUTESCENS	AMERICAN WISTERIA	G5	S1S2		RSC
NATURAL COMMUNITIES					
COASTAL PLAIN SINKHOLE POND			S1		
FRESHWATER INTERTIDAL MARSH			S3S4		
MARL RAVINE FOREST			S2S3		

the criteria, which will be utilized in the final report as the basis for recommending protection of "Peninsula Natural Areas".

7) Field survey. Based on the preceding work, PNAs were prioritized for detailed field survey. The boundaries of all PNAs and their priority ratings (high, medium, low) were provided to Dr. Donna Ware for evaluation. She has also been sent a copy of the draft community grading criteria for use in her field work.

ANALYSIS

THE STATE OF THE LANDSCAPE

The vegetation of the Peninsula has been greatly altered by man, especially during the past three and a half centuries. Successive waves of clearing for agriculture and then abandonment as the soil was depleted have replaced the primeval forest with a patchwork of urban areas, agricultural fields, pine plantations, and forests of varying successional ages. Flat upland areas have been particularly subject to human use, and mature "second-growth" forests are uncommon on the uplands. With few exceptions, patches of trees in excess of 100 years old are confined to ravines and other areas that have been too difficult to clear. Typically the largest trees in these areas are undesirable for logging: beech and poorly formed oaks and tulip poplars.

The topography of the study area has precluded the development of extensive swamp forests, Powhatan Swamp being the major example. As with the upland forests, the swamps that are present in the study area have been disturbed by man. Of particular use have been the large cypress trees along the freshwater rivers. While many of these were harvested for the rot-resistant wood, many others were left standing.

While extensive riparian forests are uncommon, there are small, isolated, seasonally-flooded upland areas that support wetland species. Of particular note are the Coastal Plain Sinkhole Ponds that form where deep-lying marl deposits dissolve, causing the surface of the land to subside, forming roughly circular depressions. The highest concentration of these ponds is in the Grafton area, north of Patrick Henry International Airport. Preliminary field studies by Natural Heritage Scientists have already revealed the presence of several rare plants and animals, with a high potential for more rare species to be found.

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Extensive marshes occur at each end of the Peninsula. On the eastern edge are large salt marshes. Although these marshes show little sign of causeways and ditches, the typical human disturbances of this community type, they were used as a target area by the Department of Defense and craters are evident in the aerial photographs. Most of these marshes are in Plum Tree national Wildlife Refuge, which is closed to human traffic, but provides habitat for waterfowl and other marsh species. Along the Chickahominy River on the western edge of the study area are extensive freshwater tidal marshes. As mentioned above, these are highly diverse communities. Wild Rice, one of the dominant species, is an extremely important food for migrating birds. These marshes appear to have received very little human disturbance and are likely to be of statewide significance. Along the York and James Rivers in the Peninsula's mid-section is a broad transitional band of brackish marshes. These marshes are rarely extensive, typically forming narrow bands along the tributary creeks. Most of these marshes have been greatly altered by the construction of mosquito ditches, but the upper reaches of Queen Creek apparently have not been ditched.

As a procedural matter, it was determined that aerial reconnaissance was not as productive as initially hoped because:

a) The photographic coverage of the Peninsula was recent and detailed.

b) There is a long history of disturbance on the Peninsula, with the same areas being disturbed repeatedly over time.

c) Large areas of the Lower Peninsula have been converted from hardwood forests to pine plantations. However, the majority of this land conversion took place in the late 1950s and early 1960s, and was readily identifiable on the aerial photographs.

d) Lands currently used for urban areas, pine plantations and agriculture are all readily detected in aerial photographs. Most of the remaining lands are in mature second growth, which makes detection of the relative degree of naturalness difficult.

The utility of further aerial reconnaissance will be evaluated this winter. If it is determined that particular areas can be profitably studied from the air, one or more additional flights will be conducted early next spring.

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LEVELS OF SIGNIFICANCE

The Natural Heritage Program recognizes two levels of significance in its assessments: **state-wide significance** and **regional significance.** Areas of statewide significance contain globally rare species, one of the best examples of a natural community, and/or high-quality occurrences of state-rare species. The Natural Heritage Program and The Nature Conservancy actively work to protect these areas using a variety of the available conservation tools (acquisition, easements, management agreements with public agencies, etc.).

Regionally significant sites are of lower significance because there are occurrences of higher quality elsewhere in the state. These sites may include disjunct populations (e.g. the best known population of a mountain plant in the coastal plain) or simply fine examples of a common community type (e.g. the best Mesic Ravine Forest in the county). While protection of these areas is desireable, it is frequently possible to protect them while maintaining other uses of the site. Low-development parks, watersheds for public water supplies, and greenbelts are examples of this. Regionally significant sites may also be protected through registry, a voluntary agreement between the landowner and a conservation group (e.g. The Nature Conservancy or the Native Plant Society). Another form of protection is zoning. Forestal zones, Chesapeake Bay Preservation Areas, and similar zones established by a locality can protect many regionally significant sites.

COMMUNITY GRADING CRITERIA

As noted above, the Natural Heritage Program ranks community types by their rarity and further ranks individual communities in terms of their quality and their size. In order to make the latter process more objective and understandable, the Natural Heritage program is developing community grading criteria.

The first step in this process was to develop generic criteria for judging quality and size (Tables 4, 5) that should be applicable to communities anywhere in the world. For convenience, the criteria recognize four letter grades (A, B, C, D). In the case of quality they are excellent, good, fair or poor; for size they are large, moderate, small and very small. Although community types differ greatly in their composition and structure, e.g. compare an oak-hickory forest with a salt marsh, excellent occurrences of either closely approximate the best naturally-occurring examples of the type, with all natural processes in operation, while poor occurrences have been heavily disturbed.

Table 4. Generic criteria for evaluating the quality of natural communities.

Excellent Occurrence. Protection of A-ranked occurrences is essential to conservation of the maximum diversity and viability of an element in the state. A-ranked communities are essentially undisturbed by humans, or have nearly recovered from early human disturbance. Species composition shows little departure from original structure and composition (except in seral or disturbance dependent communities).

Good Occurrence. Protection of these occurrences is important to the survival of an element in Michigan, especially if very few or no A-ranked occurrences exist, or in natural regions of the state where there are few or no A-ranked occurrences. A B-ranked community is still recovering from early disturbance or recent light disturbance but eventually will reach a B-rank. Presence of exotic species (if only localized and/or a minor component of the flora), recoverable departure from original structure and composition for the site (except in seral and disturbance dependent communities) result in a B-rank.

Fair Occurrence. Protection of these occurrences helps conserve the biotic diversity on a regional or local level and are important to state-wide conservation only if no higher-ranked occurrences exist. A C-ranked community is in an early stage of recovery from disturbance, or its structure and composition have been altered such that the original vegetation of the site will never rejuvenate, yet with management and time partial restoration of the community is possible.

Poor Occurrence. Protection of these occurrences is seldom worthwhile except for historical reasons or only if no better occurrences exist. D-ranked communities are severely disturbed, their structure and composition have been greatly altered, and recovery to original conditions, despite management and time, essentially will not take place.

Table 5. Generic criteria for evaluating the size of natural communities.

Large. A community element occurrence of this size class expected to maintain populations of plants, invertebrates, and small vertebrates over the long-term. Natural disturbance regimes are intact, generally pose no threat to the occurrence and, in fact, serve to maintain natural patch dynamics. Element occurrences in this size class are rare in fragmented landscapes.

Moderate. A community occurrence of this size class can sustain most of its natural species diversity in the long run with very few species extinctions. Fragmented element occurrences are sufficiently large to minimize edge effects. In landscapes fragmented by human settlement, some community occurrences are in this size class.

Small. A community element occurrence of this size class can sustain many of its component species in the long run, especially if there are nearby areas that can serve as sources for recolonization by populations eliminated by disturbances. In landscapes fragmented by human settlement, most community element occurrences are in this size class.

Very small. In fragmented landscapes, community occurrences of this size class are generally not recognized as element occurrences since they have minimal long-term viability due to edge effects, local species extinctions and susceptibility to catastrophic destruction. However, community occurrences completely buffered by natural quality land may be regionally significant, or even of state significance for extremely rare types. Recently fragmented occurrences falling in this size class may have temporary research value.

Similarly, large occurrences provide sufficient habitat with enough variation in that habitat to support the full complement of plant, invertebrate and small vertebrate species over the long-term while very small occurrences are unable to support many of the species that would naturally occur in the community.

Working from the generic criteria, the scientific staff of the Natural Heritage Program is developing criteria for each community type in the Commonwealth. As currently written, these specific criteria include the following components:

* **Benchmark Quality Standard:** What a community of this type would have looked like in pre-settlement times. Since in many cases no definitive pre-settlement information exists, this is an interpretation of the available data.

* **Grading Criteria:** The specific characteristics of a given community that should be evaluated in assigning a quality rank.

* **Element Occurrence Size-Classes:** As discussed above, a large occurrence can support the full species complement over the long term, while a small occurrence is inherently either depauperate or prone to loss of species over time.

* **Minimum Element Occurrence Specifications:** These combinations of quality and size, representing the Natural Heritage Program's synthesis of the available information, attempt to describe community occurrences that are of either statewide or regional significance. Note that all occurrences of the rarest community types are of statewide significance while only the best occurrences of common types are this significant. Site-specific factors (e.g. presence of rare species, juxtaposition of several community types, adjacent land uses) may raise or lower the significance of a particular community occurrence. In particular, an occurrence may be regionally significant only because it is disjunct from the typical range and hence is the best example in a locality.

* **Exemplary Occurrences:** The best known site(s) in Virginia. In many cases, insufficient survey has been done to identify exemplary occurrences.

RELATIONSHIP WITH THE CHESAPEAKE BAY PRESERVATION ACT

Regulations adopted by the Chesapeake Bay Local Assistance Department (CBLAD) on September 20, 1989 and effective October 1, 1989, require local governments to identify and protect Chesapeake Bay Preservation Areas in order "to protect and improve the water

quality of the Chesapeake Bay , its tributaries, and other state waters..." (VR-173-02-01, Chesapeake Bay Preservation Area Designation and Management Regulations). These regulations were promulgated after the Natural Heritage Program's inventory was well underway. Although the designation of Chesapeake Bay Preservation Areas was not a primary goal of this inventory, much of the work performed by the Natural Heritage Program will be of great utility to the localities as they begin the work mandated by CBLAD.

Under the CBLAD regulations, Chesapeake Bay Preservation Areas are divided into Resource Management Areas and Resource Protection Areas. Resource Protection Areas are defined as "sensitive lands at or near the shoreline that have an intrinsic water quality function...". Included in this category are tidal and non-tidal wetlands and tidal shores, plus a buffer area that extends at least 100' landward of these sensitive lands. Resource Management Areas include land types that need to be properly managed to prevent degradation of adjacent waters and reductions to the functional values of adjacent Resource Protection Areas. These areas include floodplains, non-tidal wetlands and highly erodible or permeable soils.

As part of its final report on the natural areas inventory, the Natural Heritage Program will identify areas of statewide and regional significance ("Peninsula Natural Areas"), with recommendations to the localities regarding their protection. For each of these significant areas, the Natural Heritage Program will provide boundaries of the element(s) of concern and the necessary buffer to ensure its (their) protection. Many of the PNAs identified to date lie in or along tidal wetlands and contiguous non-tidal wetlands and thus will be included in Resource Protection Areas and/or Resource Management Areas. For these Peninsula Natural Areas, the Natural Heritage program will delineate boundaries for the Resource protection Areas and recommend boundaries for Resource Management Areas, thus determining Chesapeake Bay Preservation Areas. This information should provide a template for the localities to use in establishing Chesapeake Bay Preservation Areas in wetlands contiguous to Peninsula Natural Areas. The Natural Heritage Program is willing to assist the localities in this endeavor.

RECOMMENDATIONS

1. **Continue the inventory.** The work done to date provides the basis for a comprehensive natural areas inventory. In the coming two years the Natural Heritage program will compile thorough information on the natural communities of the PNAs and focus on locating rare species within the study area.

2. **Utilize the PNAs in environmental review.** In the course of the inventory, many of the PNAs identified to date (especially the smaller ones) will prove to be not significant at either the state-wide or regional levels. However, the PNAs are the areas that hold the greatest likelihood of supporting unique or exemplary natural communities and rare species. As proposed developments come before the localities, they should be compared with the PNA map provided in this report (Figure 1). The Natural Heritage Program staff offers their information and expertise in reviewing project proposals, especially where the proposal includes a PNA.

3. **Begin preparing to incorporate PNAs in local zoning and planning.** The PNAs identified in the natural areas inventory thus far need to be considered as the localities prepare to meet the mandates of the Chesapeake Bay Preservation Act and other needs by revising comprehensive plans, zoning ordinances, subdivision ordinances, and erosion and sediment control ordinances. County and City planners and administrators should be aware of the areas the Natural Heritage Program is evaluating. As changes to the local comprehensive plans and zoning ordinances that may affect the PNAs are considered, the locality should contact the Natural Heritage Program for the most recent information.

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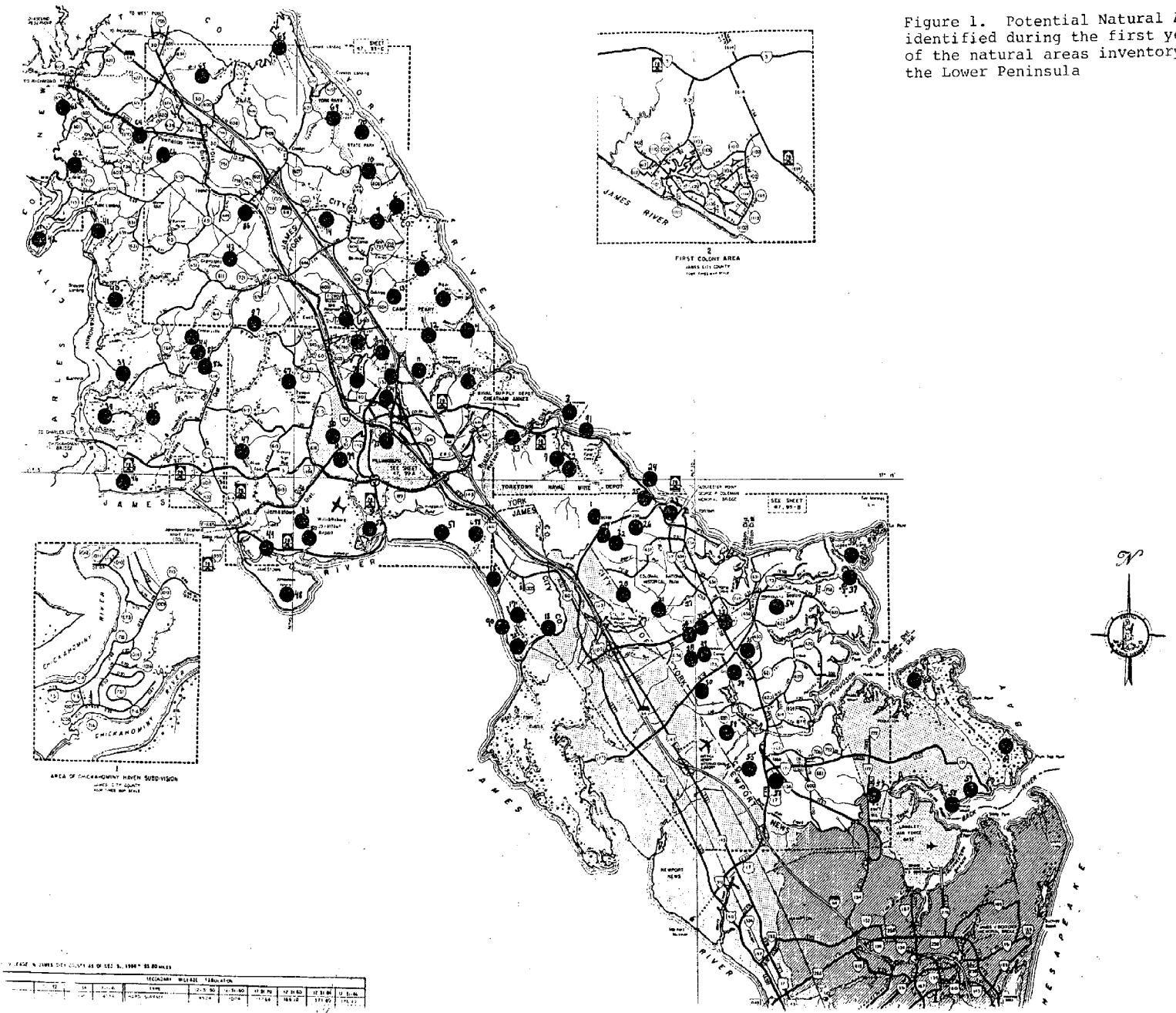

Figure 1. Potential Natural Areas identified during the first year of the natural areas inventory of the Lower Peninsula

Appendix A. Potential Natural Areas identified during 1989 by the Virginia Natural Heritage Program.

POTENTIAL NATURAL AREAS

PNA NO.	PNA Name	Owner*	Approx. Acres	Survey Feature**
1	Headquarters	F	160	Old-growth Forest
2	Felgates Creek & Black Swamp	F	290	Brackish Marsh
3	Penniman Spit		10	Brackish Marsh
4	Beaverdam Pond	F	130	Freshwater Tidal Marsh
5	Carter Creek	F	100	Brackish Marsh & Bottomland Hardwoods
6	Skimino Tributary	F	20	Brackish Marsh
7	Felgate Upland		260	Old-growth Forest
8	Bigler Mill Pond	F	70	Old-growth Forest
9	Skimino Creek		70	Brackish Marsh
10	Christensons Corner		80	Old-growth Forest
11	Interchange Tributary	F	50	Old-growth Forest
12	Haring Swamp	F	60	Old-growth Forest & Marsh
13	Oaktree	F	200	Old-growth Forest
14	Camp Skimino		60	Old-growth Forest
15	Carters Grove	P	410	Old-growth Forest
16	Queen Creek	P	420	Brackish Marsh & Old-growth Forest
17	Wood Creek		170	Marsh
18	Lower Skiffes Creek		180	Marsh & Old-growth Forest
19	Lackey		10	Coastal Plain Pond

POTENTIAL NATURAL AREAS

PNA NO.	PNA Name	Owner*	Approx. Acres	Survey Feature**
20	Washington Headquarters	L	40	Bottomland Hardwoods
21	Beaverdam Creek	F/L	180	Old-growth Forest & Marsh
22	Woodside Park (in Newport News - not included in project)	L/P	100	Coastal Plain Pond
23	Yorktown Creek	F	160	Brackish Marsh & Old-growth Forest
24	York River Cliffs	F	60	Bluff
25	Ballard Creek	F	60	Brackish Marsh
26	Great Run	F	90	Old-growth Forest
27	Grafton Ponds NW	L	310	Coastal Plain Pond
28	Grafton Ponds SW	L/P	370	Coastal Plain Pond
29	Grafton Ponds E	L	380	Coastal Plain Pond
30	Grafton Ponds SE	L	360	Coastal Plain Pond
31	Grafton Ponds NE	L	250	Coastal Plain Pond
32	Upper Baptist Run	L	60	Coastal Plain Pond
33	Harris Grove Ponds		110	Coastal Plain Pond
34	Poquoson River Mouth	L/P	440	Brackish Marsh, Coastal Plain Pond, & Bottomland Hardwoods
35	Acre Acres Pond		70	Coastal Plain Pond
36	Goodwin Islands	S	300	Maritime Forest & Salt Marsh
37	Claxton Creek		220	Salt Marsh
38	Gordons Island Marsh		1420	Freshwater Tidal Marsh

POTENTIAL NATURAL AREAS

PNA NO.	PNA Name	Owner*	Approx. Acres	Survey Feature**
39	Shields Point		330	Bottomland Hardwoods & Freshwater Tidal Marsh
40	Yarmouth Island	P	2160	Freshwater Tidal Marsh
41	Hog Neck - Uncles Neck		550	Freshwater Tidal Marsh
42	Big Marsh Point		230	Freshwater Tidal Marsh
43	Upper Yarmouth Creek	P	1170	Bottomland Hardwoods
44	Colby Swamp		380	Bottomland Hardwoods
45	Gordon Creek Uplands		440	Old-growth Forest
46	Governors Land	P	590	Freshwater Tidal Marsh
47	Powhatan Creek		500	Bottomland Hardwoods
48	Passmore Creek	F	430	Brackish Marsh
49	Back River Marshes	F	540	Marsh
50	College Woods	S	300	Old-growth Forest
51	Kings Mill Neck East		140	Old-growth Forest
52	College Creek	F/P	470	Brackish Marsh
53	King Creek	F	300	Brackish Marsh
54	Upper Crab Neck		620	Bottomland Hardwoods
55	Tabb West		340	Bottomland Hardwoods

POTENTIAL NATURAL AREAS

PNA NO.	PNA Name	Owner*	Approx. Acres	Survey Feature**
56	Tabb Lake		160	Bottomland Hardwoods
57	Brick Kiln Creek	F/P	600	Brackish Marsh
58	Back Landing		320	Maritime Forest & Salt Marsh
59	Long Creek		290	Salt Marsh
60	Black Walnut Ridge		1390	Maritime Forest & Salt Marsh
61	Plum Tree Island	F	1890	Maritime Forest & Salt Marsh
62	Mill Creek - Diascund Creek		310	Freshwater Tidal Marsh
63	Diascund Creek		230	Bottomland Hardwoods
64	Edwards Swamp		110	Marsh & Bottomland Hardwoods
65	Bird Swamp		1400	Bottomland Hardwoods
66	Upper Mill Creek		110	Marsh & Bottomland Hardwoods
67	Chisel Run	P	330	Old-growth Forest & Rare Plants
68	Ware Creek	P	1170	Marsh
69	Taskinas Creek	S/P	1350	Brackish Marsh & Old-growth Forest
70	York River State Park	S	990	Brackish Marsh & Old-growth Forest
71	Mulberry Island (in Newport News - not included in project)			
72	Gravel Pit Point		80	Old-growth Forest

POTENTIAL NATURAL AREAS

PNA NO.	PNA Name	Owner*	Approx. Acres	Survey Feature**
73	Tutters Neck Pond		140	Old-growth Forest
74	Forest Hill Park		50	Old-growth Forest
75	Interchange Ridge		40	Old-growth Forest
76	Waller Mill Park North	L	40	Old-growth Forest
77	Waller Mill Park South	L	190	Old-growth Forest
78	Plantation Heights		70	Old-growth Forest
79	Walmington Academy	P	70	Old-growth Forest
80	Mill Creek		180	Brackish Marsh
81	James River Church North		30	Old-growth Forest
82	James River Church South		40	Old-growth Forest
83	Powell Lake		100	Pond
84	Northeast Quarter Park	L?	380	Old-growth Forest?
85	Magruder School	P	130	Old-growth Forest
86	Norge		130	Old-growth Forest
87	War Hill		Indef.	Rare Plants
88	Grove Creek	P	540	Old-growth Forest
89	Kentucky Farms South		110	Coastal Plain Pond
90	Tiger Bluffs		10	Bluff
91	Colonial National Historical Park Bluffs	F	20	Bluff

POTENTIAL NATURAL AREAS

* Ownership Class: F = Federal Government
S = State Government
L = Local Government
P = Private
Blank = unknown, but most likely private

** A Survey Feature is a significant feature (rare species habitat, unique or exemplary natural community, natural feature, etc.) that is or may be present on the site as determined from interviews, Natural Heritage data, and the interpretation of maps and aerial photographs. Field investigations carried out at a later date will determine the significance of the site.

POTENTIAL NATURAL AREAS

Table A-1. Community types and Natural Features known or likely to occur in each survey feature identified during the initial stages of the natural areas inventory.

Survey Feature	Community
Bluff	Bluff*
Bottomland Hardwoods	N. Bottomland Hardwood Forest
	S. Bottomland Hardwood Forest
	S. Coastal Plain Swamp Forest
Brackish Marsh	Brackish Marsh
Coastal Plain Pond	Coastal Plain Sinkhole Pond
Freshwater Marsh	Freshwater Marsh
Freshwater Tidal Marsh	Freshwater Tidal Marsh
Maritime Forest	Maritime Forest
Old-growth Forest	Acidic Dry-Mesic Forest
	Acidic Ravine Forest
	Basic Ravine Forest
Salt Marsh	Salt Marsh
Semi-permanent Pond	Semi-permanent Pond

* A natural feature, not a community type.

APPENDIX B. Draft community grading criteria for natural communities of the Lower Peninsula of Virginia.

DRAFT COMMUNITY GRADING CRITERIA FOR THE LOWER PENINSULA

UPLAND COMMUNITIES

Acidic Dry-Mesic Forest (S5)

Description: Forest developed on acidic upland soils. Canopy species include Quercus alba, Q. rubra, Q. velutina, Carya spp., Fagus grandifolia, and Liriodendron tulipifera, with oaks dominating. Understory species include Ilex opaca, Cornus florida, and less commonly, Kalmia latifolia. The herbaceous layer is open and species-poor, with scattered patches of Polystichum acrosticoides, Podophyllum peltatum, and Lycopodium flabelliforme.
Benchmark Quality Standard: All-age stand with dominants 200+ yr old. Open shrub understory with good regeneration of canopy dominants. No sign of logging, grazing or other anthropogenic disturbance. No exotic species present.
Grading Criteria: Grade A occurrences are at or near benchmark standard. Grade B occurrences are recovering from past disturbance and although the trees are younger, most species are still present and the community will reach grade A condition with time. Grade C occurrences are heavily disturbed and light disturbance (e.g. selective logging) may be on-going Pines and early-successional species are present. The age structure may be substantially altered and many exotics are present. Recovery will require decades. Grade D occurrence are young or heavily disturbed stands. Pines are other early-successional species are abundant in the canopy.
Element Occurrence Size-Classes: <30 acres = Very Small; 30 - 89 acres Small; 90 - 299 acres = Moderate; 300+ acres = Large.
Minimum EO specifications: Statewide significance: Grade A and 90 acres or Grade B and 300 acres. Regional Significance: Grade B and 90 acres.
Exemplary Occurrences: Caledon

Acidic Ravine Forest (S4)

Description: Forest developed in a ravine that cuts through acidic deposits. Slopes are shaded and moist, but the soil is nutrient-poor. Fagus grandifolia is the dominant species. Other canopy species may include Quercus alba, Q. rubra, Q. velutina, Carya spp., and Liriodendron tulipifera. Understory species include Ilex opaca, Cornus florida, Kalmia latifolia. The herbaceous layer is open and species-poor, with scattered patches of Polystichum acrosticoides, Podophyllum peltatum, Lycopodium flabelliforme.
Benchmark Quality Standard: All-age stand with dominants 200+ yr old. Open shrub understory with good regeneration of canopy dominants. No sign of logging, grazing or other anthropogenic disturbance. No exotic species present.

Grading Criteria: Grade A occurrences are at or near benchmark standard. Grade B occurrences are recovering from past disturbance and although the trees are younger, most species are still present and the community will reach grade A condition with time. Grade C occurrences are heavily disturbed and the disturbance may still be on-going Pines may be present in the canopy. The age structure may be substantially altered, typically with only rare large trees, and many exotics are present. Recovery will require decades. Grade D occurrences are heavily and recently disturbed. Pines and other early successional species are abundant.
Element Occurrence Size-Classes: <10 acres = Very Small; 10 - 39 acres Small; 40 - 99 acres = Moderate; 100+ acres = Large.
Minimum EO specifications: Statewide significance: Grade A and 40 acres or Grade B and 100 acres. Regional Significance: Grade B and 40 acres.
Exemplary Occurrences: Caledon

Basic Ravine Forest (S2S3)

Description: Forest developed in a ravine that cuts through a substantial marl deposit. Slopes are shaded and moist with a rich soil. Dominant species include Acer barbatum, Tilia americana, Quercus muehlenbergii, and Ulmus americana. Understory species include Magnolia tripetala, Cornus florida, and Dirca palustris. The herbaceous layer is species-rich, with mesophytic dicots such as Aruncus dioica, Panax quinquefolius, Decumaria barbarea and Aralia racemosa.
Benchmark Quality Standard: All-age stand with dominants 200+ yr old. Rich shrub understory, including good regeneration of canopy dominants. Herbaceous layer with high diversity due to rich, moist soils. No sign of logging, grazing or other anthropogenic disturbance. No exotic species present.
Grading Criteria: Grade A occurrences are at or near benchmark standard. Grade B occurrences are recovering from past disturbance and although the trees are younger, most species are still present and the community will reach grade A condition with time. Grade C occurrences are heavily disturbed and the disturbance may still be on-going Pines may be present in the canopy. The age structure may be substantially altered, typically with only rare large trees, and many exotics are present. Recovery will require decades. Grade D occurrences are heavily and recently disturbed. Pines and other early successional species are abundant.
Element Occurrence Size-Classes: <10 acres = Very Small; 10 - 39 acres Small; 40 - 99 acres = Moderate; 100+ acres = Large.
Minimum EO specifications: Statewide significance: Grade A and 10 acres or Grade B and 40 acres. Regional Significance: Grade B and 10 acres.
Exemplary Occurrences: Grove Creek

DRAFT COMMUNITY GRADING CRITERIA FOR THE LOWER PENINSULA

Maritime Forest (S2S3)

Description: Semi-protected coastal stands of trees pruned by salt spray and often gnarled or deformed. There is a distinct canopy at least 5 m high, generally with an open understory more than head high. Dominant species include Pinus taeda and Quercus virginiana. Ilex opaca, Sassafras albidum and Diospyros virginiana appear in the understory.

Benchmark Quality Standard: All-age stand with dominants 100+ yr old. Rich shrub understory, including good regeneration of canopy dominants. Herbaceous layer may be low diversity due to shading by evergreen canopy species. No sign of logging, grazing or other anthropogenic disturbance. No exotic species present.

Grading Criteria: Grade A occurrences are at or near benchmark standard. Grade B occurrences are recovering from past disturbance and although the trees are younger, most species are still present and the community will reach grade A condition with time. Grade C occurrences are heavily disturbed and the disturbance may still be on-going The age structure may be substantially altered and many exotics are present. Recovery will require decades. Grade D occurrences are very heavily disturbed and support a low diversity of native species with an abundance of exotic. Note that a young stand may be due to recent additions to the barrier beach system and that species composition is more important in rating Maritime Forests than age.

Element Occurrence Size-Classes: <20 acres = Very Small; 20 - 59 acres Small; 60 - 149 acres = Moderate; 150+ acres = Large.

Minimum EO specifications: Statewide significance: Grade A and 20 acres or Grade B and 60 acres. Regional Significance: Grade B and 20 acres.

Exemplary Occurrences: False Cape State Park

DRAFT COMMUNITY GRADING CRITERIA FOR THE LOWER PENINSULA

WETLAND COMMUNITIES

Forested wetland communities

Northern Bottomland Hardwood Forest (S4)

Description: More or less permanently flooded swamps in tidal fresh waters. Dominants include Fraxinus pensylvanica, F. tomentosa, Nyssa sylvatica and Acer rubrum. The understory is moderately to very open and is composed of species such as Clethra alnifolia and ericads. Herbs are common and include many species from the adjacent marshes, e.g. Peltandra virginica, Leersia sp.
Benchmark Quality Standard: Many stand dominants 100+ yr old. Saplings of the dominant species are present. Shrub layer may be sparse, but the herbaceous layer is well vegetated. No sign of ditches, logging or other anthropogenic disturbance. No exotic species present.
Grading Criteria: Grade A occurrences are at or near benchmark standard. Grade B occurrences are recovering from past disturbance and although the trees are younger, most species are still present and the community will reach grade A condition with time. The hydrology has been altered minimally at most. Grade C occurrences are heavily disturbed and the disturbance may still be on-going The age structure may be substantially altered and many exotics are present. The stand shows clear evidence of logging and/or ditching. Recovery will require decades. Grade D occurrences are so heavily altered by logging, roads or ditching that recovery will be very slow at best.
Element Occurrence Size-Classes: <20 acres = Very Small; 20 - 49 acres Small; 50 - 99 acres = Moderate; 100+ acres = Large.
Minimum EO specifications: Statewide significance: Grade A and 50 acres or Grade B and 100 acres. Regional Significance: Grade B and 50 acres.
Exemplary Occurrences:

Southern Bottomland Hardwood Forest (S5)

Description: More or less permanently flooded swamps in tidal or non-tidal fresh waters. Saturated soils and seasonal flooding allow the dominant oaks to thrive while excluding other hardwoods and cypress. Dominants include Quercus bicolor, Q. lyrata, Q. michauxii, Q.nigra, and Q. phellos. The shrub layer may be open or patchy. Graminoids are abundant towards the upland margin, but elsewhere the herbaceous layer is sparse.
Benchmark Quality Standard: Many stand dominants 150+ yr old. Saplings of the dominant species are present. There is no evidence

of ditches, logging or other anthropogenic disturbance. No exotic species present.
Grading Criteria: Grade A occurrences are at or near benchmark standard. Grade B occurrences are recovering from past disturbance and although the trees are younger, most species are still present and the community will reach grade A condition with time. The hydrology has been altered minimally at most. Grade C occurrences are heavily disturbed and the disturbance may still be on-going The age structure may be substantially altered and many exotics are present. The stand shows clear evidence of logging and/or ditching. Recovery will require decades. Grade D occurrences are so heavily altered by logging, roads or ditching that recovery will be very slow at best.
Element Occurrence Size-Classes: <30 acres = Very Small; 30 - 59 acres Small; 60 - 199 acres = Moderate; 200+ acres = Large.
Minimum EO specifications: Statewide significance: Grade A and 60 acres or Grade B and 200 acres. Regional Significance: Grade B and 60 acres.
Exemplary Occurrences:

Southern Coastal Plain Swamp Forest (S4)

Description: More or less permanently flooded swamps in tidal or non-tidal, acidic waters. These hydrological conditions exclude most hardwoods, allowing Taxodium distichum, Nyssa sylvatica and/or N. aquatica to dominate. The understory varies from sparse to moderately dense and is composed of species such as Fraxinus spp., Clethra alnifolia, and ericads. Herbs are uncommon or absent due to prolonged flooding, and may occur only on cypress knees.
Benchmark Quality Standard: Stand dominants all 200+ yr old some canopy trees exceed 1 m dbh. Saplings of the dominant species are present. Shrub and herbaceous layers may be low in diversity due to shading. No sign of logging or other anthropogenic disturbance. No exotic species present.
Grading Criteria: Grade A occurrences are at or near benchmark standard. Grade B occurrences are recovering from past disturbance and although the trees are younger, most species are still present and the community will reach grade A condition with time. The hydrology has been altered minimally at most. Grade C occurrences are heavily disturbed and the disturbance may still be on-going The age structure may be substantially altered and many exotics are present. The stand shows clear evidence of logging and/or ditching. Recovery will require decades. Grade D occurrences are so heavily altered by logging, roads or ditching that recovery will be very slow at best.
Element Occurrence Size-Classes: <20 acres = Very Small; 20 - 49 acres Small; 50 - 149 acres = Moderate; 150+ acres = Large.
Minimum EO specifications: Statewide significance: Grade A and 50

acres or Grade B and 150 acres. Regional Significance: Grade B and 50 acres.
Exemplary Occurrences: Pompeii

Non-forested Wetland Communities

Brackish Marsh (S5)

Description: Emergent, graminoid-dominated marshes occurring in brackish waters along tidal rivers and Chesapeake Bay. The characteristic species are Spartina cynosuroides and Juncus roemerianus. Spartina patens, Distichlis spicata and other species may be locally abundant. A shrub zone frequently forms along the upland edge of these marshes. Dominants here are Iva frutescens and Baccharis halimifolia. Species diversity within small areas (< 1 acre) is naturally low, with dominants creating dense monocultures determined by minor topographic changes.
Benchmark Quality Standard: No alteration of hydrology. Patches of different species form a mosaic of relatively high diversity.
Grading Criteria: Grade A occurrences are at or near benchmark standard. Evidence of past ditching or filling can be located only by careful examination in the field. Grade B occurrences are recovering from past disturbance. Although causeways and ditches may be discernable on aerial photographs, they have deteriorated to the point where they no longer affect water flow. Grade C occurrences are heavily ditched, with the ditches still functional. Grade D occurrences are heavily degraded by roads, fill, and/or ditches. Phragmites communis or Typha angustifolia are major canopy dominants.
Element Occurrence Size-Classes: less than 50 acres = Very Small; 50 to 99 acres = Small; 100 to 199 acres = Moderate; 200+ acres = Large.
Minimum EO specifications: Statewide significance: Grade A and 200 acres. Regional Significance: Grade B and 100 acres.
Exemplary Occurrences:

Coastal Plain Sinkhole Pond (S2)

Description: More or less circular ponds formed by the subsidence of surface deposits resulting from solution of underlying marl deposits. Typically, ponds occur in clusters of a few to >50 within a region. Water levels fluctuate on a seasonal and annual basis and adjacent ponds may respond differently to precipitation. As a result, species composition varies in both time and space.
Benchmark Quality Standard: High density of ponds of various sizes (diameter and depth) within a preservable unit. Ponds have varying hydrological regimes and vegetation that provide refuge for many

species in both wet and dry years. Ponds have not been filled or used as slash piles, etc. from logging of adjacent uplands. No ditching or other alteration of the local hydrology (e.g. high density of shallow wells). Pond complex is not divided by roads or heavily disturbed powerlines (mowed powerline ROWs may provide refuge for open canopy species).
Grading Criteria: Grade A occurrences are at or near benchmark standard. Uplands have received minimal disturbance in past 50 years. Grade B occurrences are recovering from past disturbances such as logging, small ditches and off-road vehicles. Existing ditches have deteriorated to the point where they no longer affect water flow. Grade C occurrences are heavily ditched, logged or otherwise degraded, but would recover with reasonable management effort. Grade D occurrences are so heavily degraded that recovery is unlikely.
Element Occurrence Size-Classes: less than 15 acres = Very Small; 15 to 44 acres = Small; 45 to 100 acres = Moderate; 100+ acres = Large.
Minimum EO specifications: Statewide significance: Grade A and 15 acres or Grade B and 45 acres. Regional Significance: Any Grade A, or any Grade B, or Grade C and 15 acres.
Exemplary Occurrences: Grafton Ponds; Cat Ponds

Freshwater Marsh S3

Description: Occurring in fresh waters along non-tidal rivers in association with semi-permanent ponds. Dominants vary with nutrient level and water depth, but may include Typha latifolia, Peltandra cordata, Bidens spp. Eleocharis spp. or Polygonum spp. Patches of shrubs may be scattered in the marsh. This can be a very diverse wetland community.
Benchmark Quality Standard: Water levels fluctuate on a seasonal basis, exposing at least portions of the substrate in late summer. Species diversity is high.
Grading Criteria: Grade A occurrences are at or near benchmark standard. Grade B occurrences are recovering from past disturbance. Grade C occurrences are heavily ditched, with the ditches still functional. Exotic species may be present in moderate numbers. Grade D occurrences have been heavily ditched or filled. Exotics are dominate the community.
Element Occurrence Size-Classes: less than 5 acres = Very Small; 5 to 14 acres = Small; 15 to 39 acres = Moderate; 40+ acres = Large.
Minimum EO specifications: Statewide significance: Grade B and 15 acres. Regional Significance: Grade B and 5 acres.
Exemplary Occurrences:

DRAFT COMMUNITY GRADING CRITERIA FOR THE LOWER PENINSULA

Freshwater Tidal Marsh (S3)

Description: Emergent marshes occurring in fresh waters along tidal rivers. Dominants are replaced on a seasonal basis - Peltandra cordata in the spring, Amaranthus cannabinum and Zizania aquatica in mid-summer, and Bidens sp. and Polygonum spp. later in the year. Patches of shrubs or shrubby trees may be scattered in the marsh. This is a very diverse wetland community.
Benchmark Quality Standard: No alteration of hydrology. Species diversity is high (40 +), including some of the endemic taxa: Aeschyenomene virginica, Cassia fasiculata var. macrosperma, Bacopa spp., Nuphar sagitifolium.
Grading Criteria: Grade A occurrences are at or near benchmark standard. Evidence of past ditching or filling can be located only by careful examination in the field. Grade B occurrences are recovering from past disturbance. Although causeways and ditches may be discernable on aerial photographs, they have deteriorated to the point where they no longer affect water flow. Species diversity is high, but endemics may be absent. Grade C occurrences are heavily ditched, with the ditches still functional. Exotic species may be present. Grade D occurrences have been ditched, filled or otherwise substantially altered. Exotic species may be abundant.
Element Occurrence Size-Classes: less than 50 acres = Very Small; 50 to 99 acres = Small; 100 to 199 acres = Moderate; 200+ acres = Large.
Minimum EO specifications: Statewide significance: Grade A and 100 acres or Grade B and 200 acres. Regional Significance: Grade B and 50 acres.
Exemplary Occurrences: Lillypoint Marsh; Sweethall Marsh

Salt Marsh S5

Description: Emergent marshes of saline waters along the Atlantic coast of the Eastern Shore and the lowermost portions of Chesapeake Bay. The characteristic species is Spartina alterniflora. Juncus roemerianus, Spartina patens, Distichlis spicata and other species may be locally abundant, especially along the upland margin where there is freshwater influence. A shrub zone frequently forms along the inland edge of these marshes. Dominants here are Iva frutescens and Baccharis halimifolia.
Benchmark Quality Standard: No alteration of hydrology. Species diversity is naturally low, with dominants creating dense monocultures determined by minor topographic changes.
Grading Criteria: Grade A occurrences are at or near benchmark standard. Evidence of past ditching or filling can be located only by careful examination in the field. Grade B occurrences are recovering from past disturbance. Although causeways and ditches

may be discernable on aerial photographs, they have deteriorated to the point where they no longer affect water flow. Grade C occurrences are heavily ditched, with the ditches still functional. GRade D occurrences are heavily degraded by ditches, filling or oil and other pollutants.
Element Occurrence Size-Classes: less than 100 acres = Very Small; 100 to 299 acres = Small; 300 to 599 acres = Moderate; 600+ acres = Large.
Minimum EO specifications: Statewide significance: Grade A and 600 acres. Regional Significance: Grade B and 300 acres.
Exemplary Occurrences: Hog Island

Semi-permanent Pond (S5)

Description: Pond created when a stream is blocked by a beaver dam or small man-made dam (e.g. a millpond). May be a single pond or a series of small ponds with intervening Freshwater Marsh. At the pond center are floating or submerged plants. Emergent species may grow in bands along the shore, as may cypress and other bottomland or swamp species. Species composition varies greatly with nutrient levels; most rare species prefer acidic, nutrient-poor ponds.
Benchmark Quality Standard: Water levels may vary seasonally, but water has been impounded for at least 50 years, allowing vegetation to adjust to saturated soils. Rapid changes in water level (e.g. for flood control) do not occur. Aneilima keisak and other exotic species are absent.
Grading Criteria: Grade A occurrences are at or near benchmark standards. Trees killed at the time of impoundment are down and decaying or buried. Pond includes several distinct vegetational zones. Grade B occurrences have few or poorly-defined vegetation zones, there may be standing dead trees. Grade C occurrences are newer as shown by the abundance of standing dead trees. Vegetation zones are poorly defined and may include exotics. Grade D occurrences are very new. Few trees have fallen and vegetation zones are essentially lacking, a single species dominates large areas.
Element Occurrence Size-Classes: less than 10 acres = Very Small; 10 to 25 acres= Small; 25 to 50 acres = Moderate; 50+ acres= Large.
Minimum EO specifications: Statewide significance: Grade A and 50 acres. Regional Significance: Grade A and 25 acres or Grade B and 50 acres.
Exemplary Occurrences: Airfield Millpond

DRAFT COMMUNITY GRADING CRITERIA FOR THE LOWER PENINSULA

Table B - 1. Community types expected on the Lower Peninsula and the survey features that are likely to indicate them.

Community	Survey Feature
Upland Communities	
Acidic Dry-Mesic Forest	Old-growth Forest
Acidic Ravine Forest	Old-growth Forest
Basic Ravine Forest	Old-growth Forest
Maritime Forest	Maritime Forest
Wetland Communities	
Brackish Marsh	Brackish Marsh
Coastal Plain Sinkhole Pond	Coastal Plain Pond
Freshwater Marsh	Freshwater Marsh
Freshwater Tidal Marsh	Freshwater Tidal Marsh
N. Bottomland Hardwood Forest	Bottomland Hardwoods
Salt Marsh	Salt Marsh
Semi-permanent Pond	Semi-permanent Pond
S. Bottomland Hardwood Forest	Bottomland Hardwoods
S. Coastal Plain Swamp Forest	Bottomland Hardwoods
Natural Features	
Bluff	Bluff