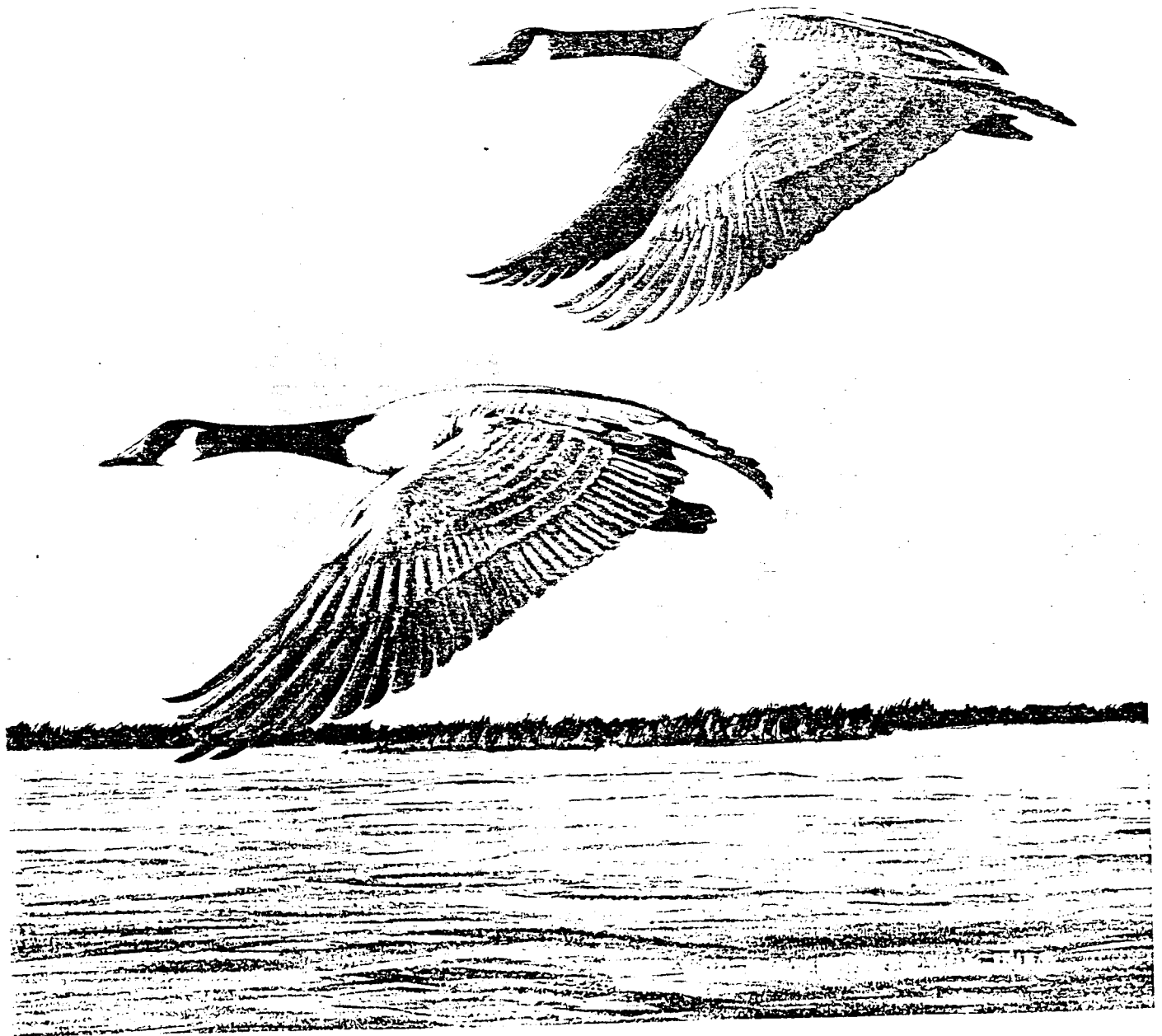


BACK BAY



PREFACE

The Back Bay National Wildlife Refuge, located in the city of Virginia Beach, Virginia, comprises 4,608 acres of barrier beach, fresh and brackish marsh, small woodland areas, and open water. An additional 4,600 acres of water in Back Bay complement the refuge by serving as a waterfowl sanctuary through a closure by Presidential Proclamation.

The refuge was established June 6, 1938, as a breeding ground and refuge for migratory birds and other wildlife. Back Bay is in the center of the historic wintering area for the once endangered greater snow geese. Here a variety of ducks and two races of Canada geese spend their winters as do several thousand whistling swans. Shore birds, gulls, terns, and various other marsh and water birds add to the refuge fauna.



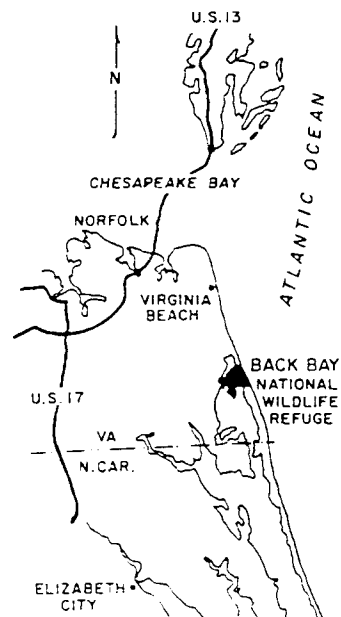
BACK BAY

NATIONAL WILDLIFE REFUGE

VIRGINIA BEACH, VIRGINIA

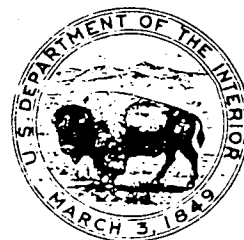
Master Plan

The National Wildlife Refuge System preserves and restores wildlife and wildlife habitat for the continued enjoyment and benefit of the American people. Each refuge plays a part in this nationwide conservation effort. This plan sets forth the purposes, management guidelines, and development proposals for the Back Bay National Wildlife Refuge.



VICINITY MAP

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

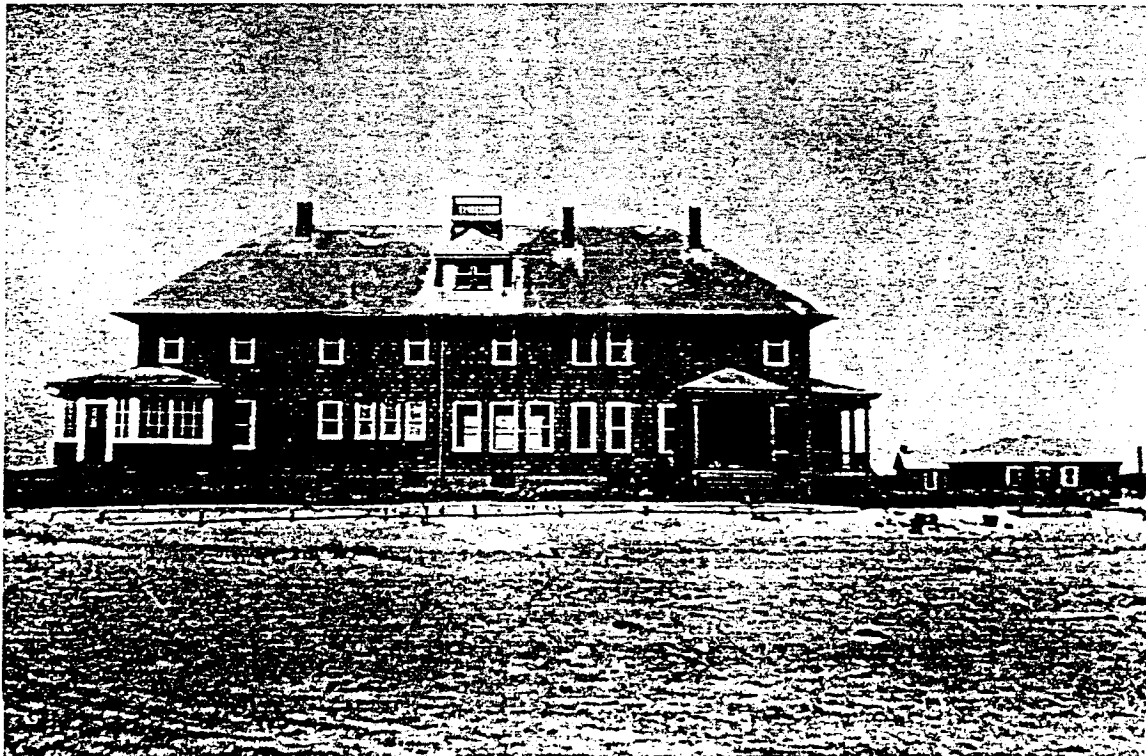


THE PAST

Before the Back Bay National Wildlife Refuge was acquired by the Federal government, the barrier beach was generally quite flat and sandy. The saline soils were unproductive. Periodically, northeast gales and hurricanes pushed large quantities of sea water across these flat beaches and into Back Bay. During the early 1930's the Civilian Conservation Corps built brush fences and planted cane and bulrush to catch the blowing sand, thus building and stabilizing sand dunes. Later on, sand fences of wood were built, and many of the dunes were planted to beachgrass. These dunes protected the bayside flats and allowed a marsh to be established.

Historically, the Back Bay area has been known for its concentrations of wintering waterfowl and shore birds, along with numerous furbearers, especially muskrats. Although cattle were grazed on the barren beaches and on the very narrow strip of marsh adjacent to the bay, hunting and fishing were the principal land uses prior to the establishment of the refuge. Hunting clubs were numerous, and the Ragged Island Club and the Princess Anne Club comprised the land that is now the refuge.

THE OLD PRINCESS ANNE HUNT CLUB LODGE. Salvage material from this building was used to construct the residences now on the refuge.





THE YEAR WAS 1915.



*THE DUCK NOW FALLS TO SWIFTER WEAPONS PERSUADED BY
MORE SOPHISTICATED DECOYS.*

THE PRESENT

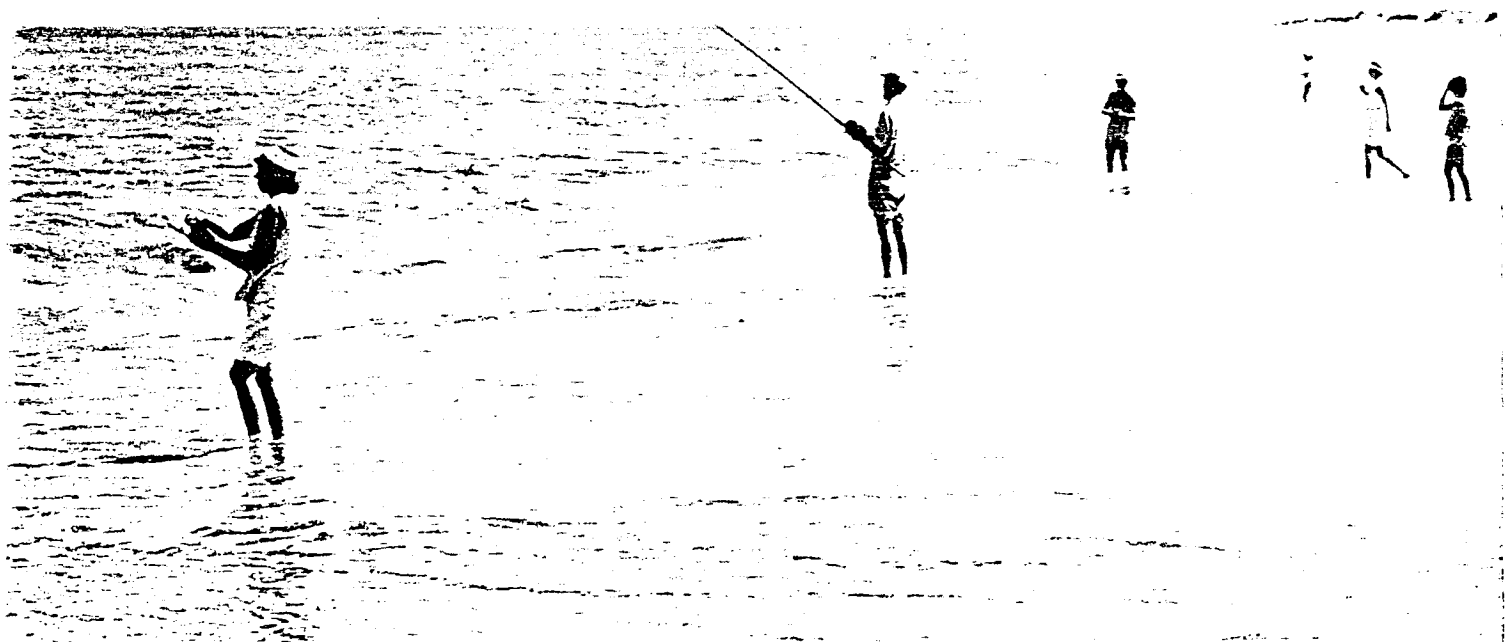
The Back Bay Refuge—a desolate piece of real estate only a few years ago—is now a part of Virginia Beach, a city of 166,000 people. All the pressures of a large and growing population are extending onto the refuge and mixing with the somewhat opposing efforts of protecting wildlife, its habitat, and the naturalness of the landscape.

This area where isolation once protected the wildlife now receives heavy use from people seeking pleasures not related to wildlife or the aesthetic values of a natural environment. Beach type recreation, such as swimming, sun bathing, and driving beach buggies, is particularly heavy. Potentially the refuge offers the public a place to observe and enjoy its vast wildlife resource. The beach is excellent for shelling, hiking, sightseeing, and surf fishing. The sand dunes, the scrubby oak and pine areas, and the marshes between the ocean and bay can provide a unique and interesting place for the public to enjoy wildlife.

The refuge includes 4½ miles of ocean beach and numerous islands in Back Bay. Sand dunes protect the bayside marshes and man-made water areas. Most of the islands are marsh that are flooded periodically by wind tides. The bay water is brackish. Its salinity varies between two and ten percent of sea strength.

The refuge provides wintering habitat for many waterfowl, including large numbers of diving ducks. More than 250 species of birds visit or live here year-round. A variety of shore and marsh birds are found on the ocean beach and marshes. Black ducks, mallards, great blue herons, osprey, least bitterns and three species of rails nest on the refuge.

Thousands of snow geese, Canada geese, mallards, green-winged teal, black ducks, and pintails feed and rest in the marshes and impoundments. American widgeon, scaup, canvasbacks, redheads, ruddy ducks, and coots often cover the bay. Whistling swans, immaculately white except for the jet black bills and the tinges of "cygnet gray," usually can be seen floating lazily in the coves from late fall to early spring.



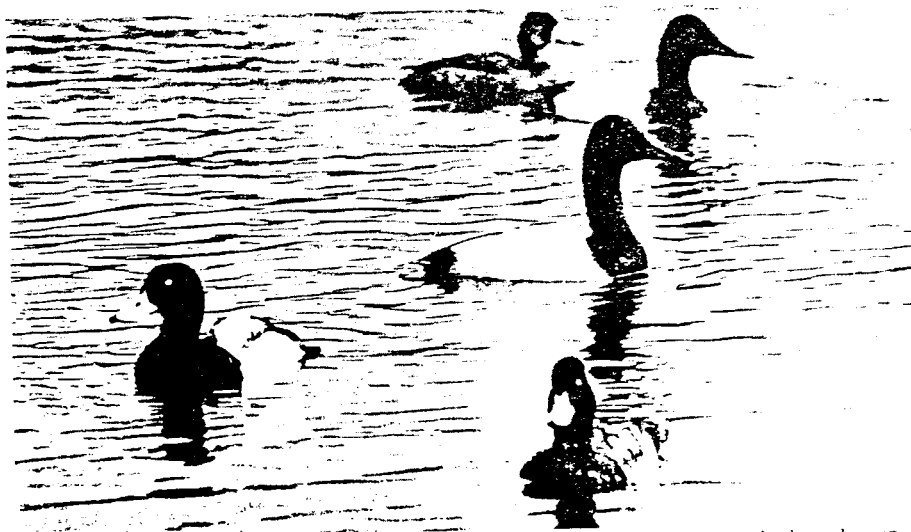


protective sand dunes

HABITAT. The refuge includes ocean beach and sand dunes, brackish- and fresh-water impoundments, natural and managed marshes, and a few small areas of timber.



greater snow geese



canvasbacks and scaup

The bird populations on the beach and ocean are like the environment—dynamic and everchanging. Gulls, loons, grebes, and gannets are abundant in winter. Terns and sandpipers along with gulls use the beach in summer.

Warblers, sparrows, wrens, snow buntings, bobwhites, and osprey can be seen frequently on the refuge. The rare Ipswich sparrow winters here, using the western slopes of the sand dunes. Muskrats, nutria, raccoon, opossums, foxes, and rabbits inhabit the marshes.

OBJECTIVES

Primarily the refuge is to provide habitat and protection for waterfowl, other migratory birds, and endangered species and to make these resources available to the American people for their enjoyment now and in the future. As an integral part of the National Wildlife Refuge System, the refuge strives to attain the following objectives.

- To develop and manage the refuge for a full spectrum of wildlife with special emphasis on waterfowl and shore birds and to cooperate with other agencies in improving and maintaining good waterfowl habitat in Back Bay.
- To help save all species of wildlife on the refuge whose survival is in jeopardy: mainly the Ipswich sparrow, the peregrine falcon, the bald eagle, and the osprey.
- To provide refuge visitors with opportunities for conservation education and wildlife-oriented recreation.
- To preserve the refuge beach for wildlife-oriented recreation and for the basic needs of nesting shore birds.
- To provide universities, colleges, and public schools with an outdoor classroom for environmental education with special emphasis on wildlife and habitat management.
- To preserve portions of the refuge in a natural state, including a stand of live oaks near the northern limits of the live oak range.



osprey

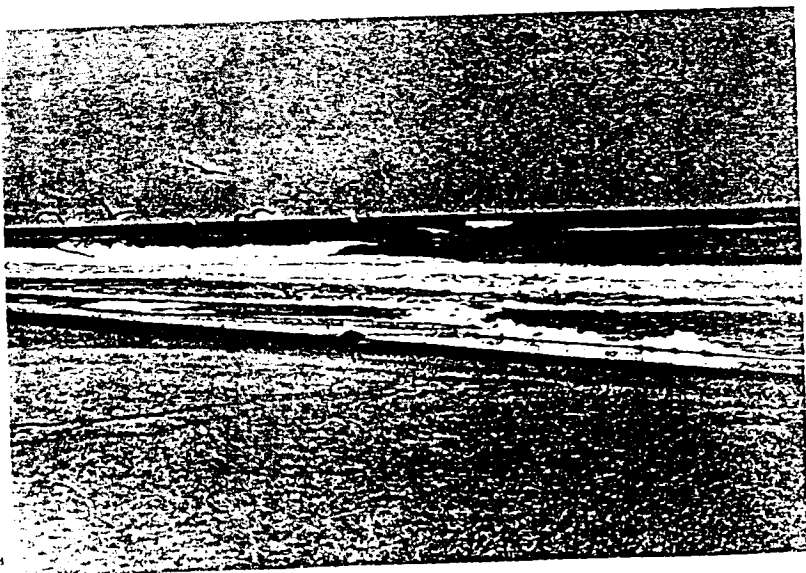


live oaks and scattered pine



whistling swans

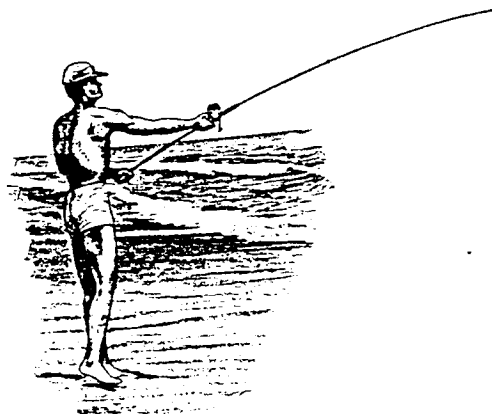
FUTURITY. Protection of endangered species, retention of certain areas — including a stretch of ocean beach — in their natural states, and provision for a full complement of wildlife are essential for proper public enjoyment of the refuge.



sea gulls

PLAN FOR THE FUTURE

BACK BAY NATIONAL WILDLIFE REFUGE



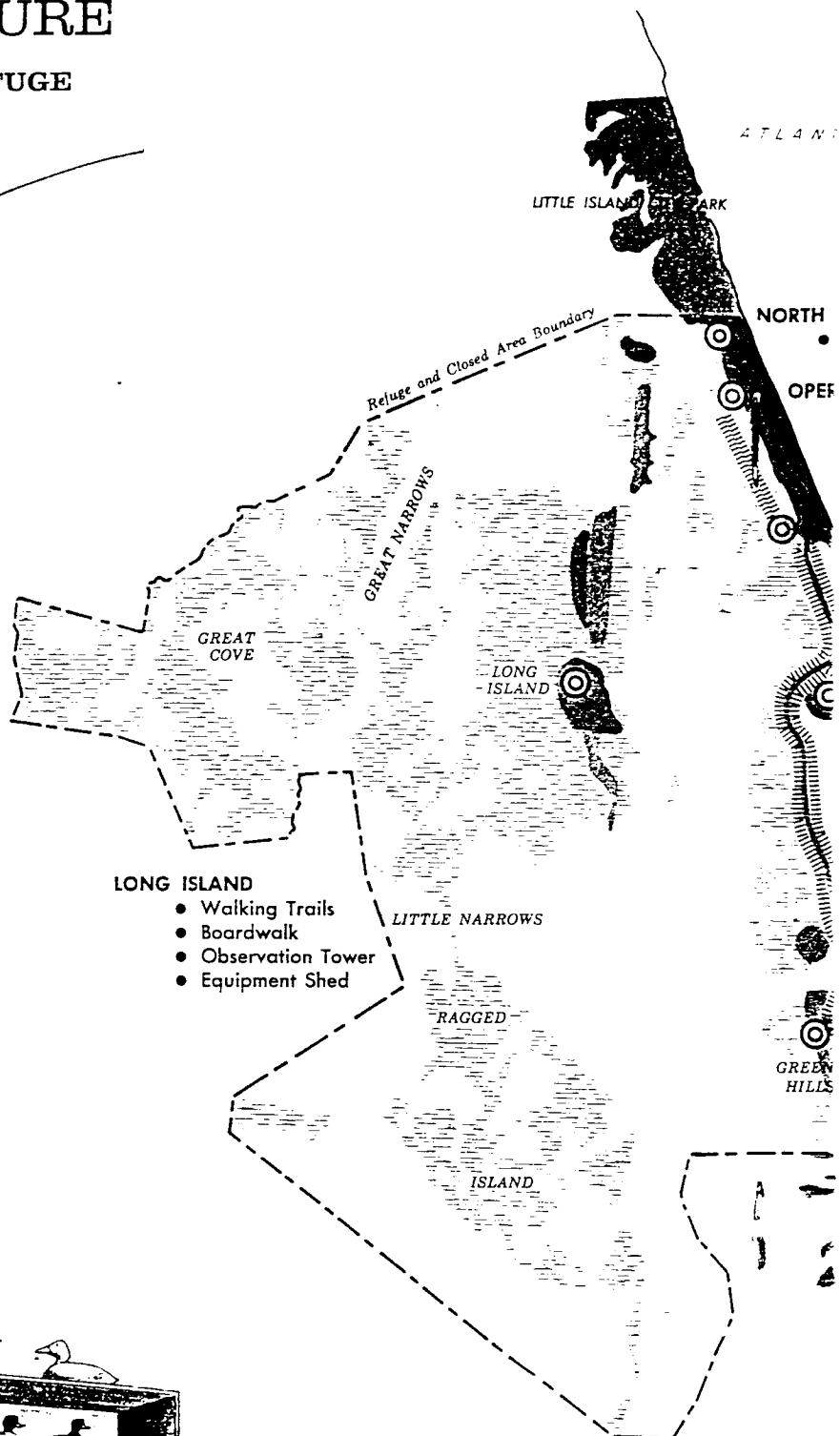
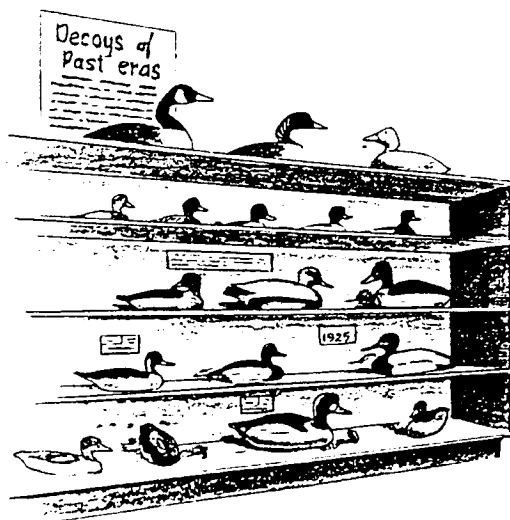
LEGEND

- BEACH AND SAND DUNES
- IMPOUNDMENTS
- BAY WATER
- MARSH
- CROPLAND
- WOODS
- STATE, CITY, OR PRIVATE LANDS
- ROADS
- WILDLIFE DRIVING TRAIL
- DIKES
- DEVELOPMENT SITES

MILES

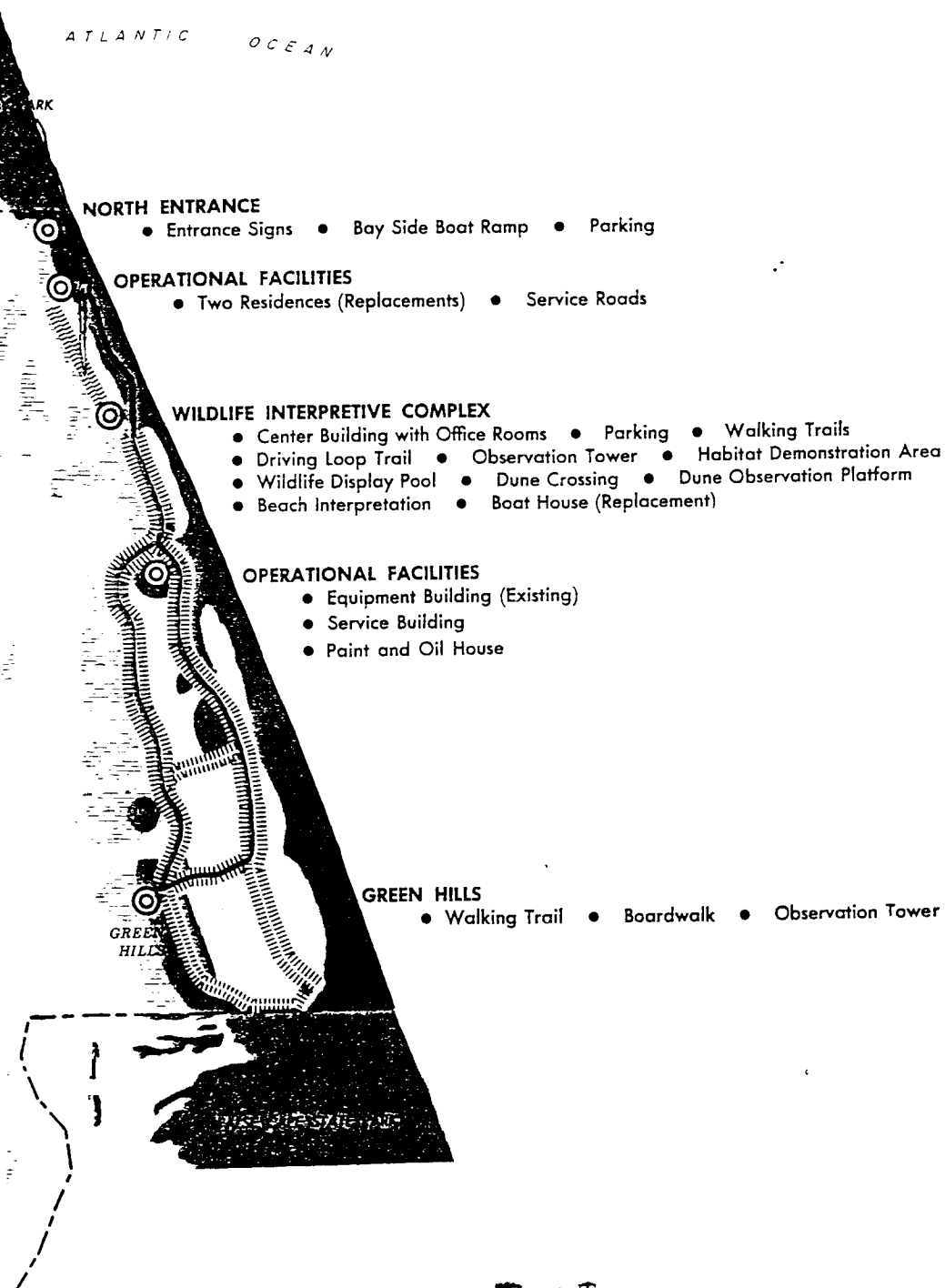


NORTH



HABITAT DEVELOPMENT

- Levee Repair of Existing
- Two Portable Pumps for
- Dike Construction for Pro
- Sand Dune Stabilization



BEACH USE

- Bird Watching
- Shelling
- Photography
- Hiking
- Surf Fishing
- Potential Shorebird Nesting
- Potential Loggerhead Turtle Nesting

ELOPMENT

- Repair of Existing Impoundments
- Portable Pumps for all Impoundments
- Construction for Proposed Impoundment
- Dune Stabilization



THE WILDLIFE INTERPRETIVE COMPLEX

This complex will center around the wildlife interpretive building that will be located about one mile south of the refuge's north boundary. From here visitors can enter the driving loop trail and enjoy the tower at Green Hills, various interpretive facilities, habitat demonstrations, and the best of the refuge's wildlife and habitat. Inside the building, stories of the refuge, its wildlife, its history, and its value will be told. Exhibits of local arts and crafts and examples of conservation of natural resources will be displayed. Facilities will be provided for conservation education and other public use programs. Visitors will be able to walk from the wildlife interpretive building to the sand dunes where stories of their formation and of the respective flora and fauna will be told. Here a crossing to the beach will be provided.

THE BEACH

The beach is a gift of nature and should remain in a wild and natural state. Here the shore birds can nest and people can comb the beaches, watch the many forms of wildlife, fish in the surf, or hike in the pleasant environment of the ocean breeze.

*THE REFUGE WELCOMES AND ENCOURAGES WILDLIFE-
AND NATURE-ORIENTED ACTIVITIES, ESPECIALLY THOSE
THAT PROMOTE LEARNING AND LEAD TO UNDERSTAND-
ING.*



LONG ISLAND

Facilities in this area will be designed primarily for organized field trips and for individuals desiring a more rugged experience than offered elsewhere on the refuge. Special emphasis will be placed on environmental education.

NORTH ENTRANCE

Here signs will tell the visitor that he is entering the refuge and direct him to the wildlife interpretive complex or to the planned ramp and parking facilities for those wishing to fish in Back Bay.

SOUTH ENTRANCE

When the public use facilities on the refuge are a reality and the False Cape State Park is completed, some type of an access route between these two areas may be desirable. Alternative means of access will be studied in light of conditions existing when the two areas are developed.



WHAT WILL BE DONE FOR WILDLIFE

The refuge as planned will contain 2,000 acres classified as barrier beach, 2,500 acres of natural marsh on the islands, and 100 acres of comparatively high land. The barrier beach includes approximately 800 acres of coastal beach and sand dunes, 800 acres of man-made impoundments, and 400 acres of marsh along the fringe of Back Bay. The 4,600 acres of marsh and water in Back Bay that are closed by Presidential Proclamation to hunting or molesting migratory birds are essential in the attainment of refuge objectives.

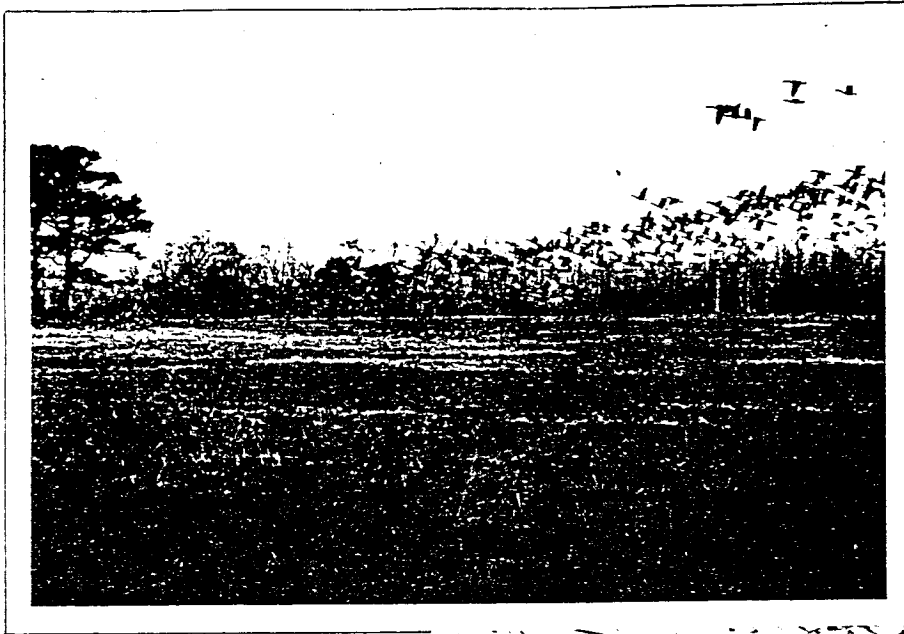
Habitat management practices include water manipulation and pest plant control in the man-made impoundments, control burning of the natural marshes, and a small amount of farming to produce green food for Canada geese. The prescribed burning program controls the dense emergent vegetation and provides better quality habitat for greater snow geese throughout the wintering season. Water management in the impoundments includes drawdown for wet-soil plants, fluctuating water levels for plants such as salt-marsh bulrush, and high pool levels when necessary to control pest plants and produce desirable aquatics. Wild celery, pond weeds, musk-grass, Eurasian milfoil, and widgeon grass produce most of the waterfowl food in Back Bay. This habitat is particularly valuable for diving ducks.

The refuge assures that nearly 10,000 acres of beach, marsh, and water will be retained in a near natural state and be managed for wildlife and public enjoyment. It will continue to help sustain the greater snow geese at a safe population level. It will provide habitat and protection for several endangered species and contribute significantly to the preservation of many species of migratory birds, especially waterfowl.

Objectives call for a full spectrum of wildlife and habitat capable of supporting 30,000 greater snow geese, 25,000 Canada geese, 10,000 whistling swans, and 70,000 ducks of the various species, along with improved nesting habitat for mallards, gadwalls, blacks, blue-winged teal, and wood ducks. Refuge management programs will favor those species of wildlife that contribute most to man's enjoyment. However, goals are to maintain all resident wildlife at optimum population levels in relation to the habitat and the public enjoyment offered by each species. At least forty different kinds of shore birds, gulls, and terns use the refuge. Loons, grebes, cormorants, herons, egrets and bitterns are important parts of the refuge's bird life. Efforts will be made to maintain sufficient numbers of these birds for frequent viewing by refuge visitors.

managed marsh has high carrying capacity for waterfowl as indicated here by the snow geese





agricultural crops attract Canada geese

sand dunes provide habitat
for Ipswich sparrows



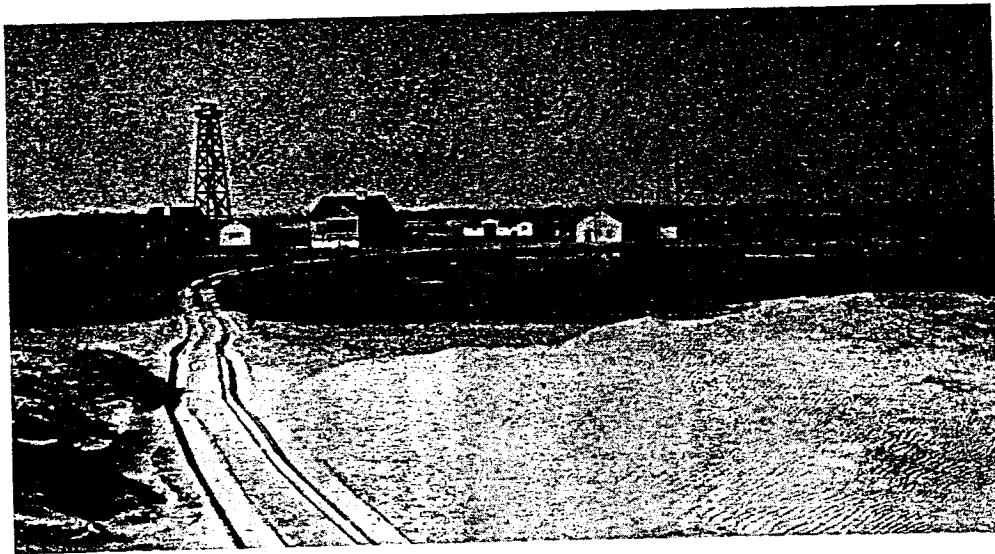
HABITAT VARIETY IS THE
SPICE OF WILDLIFE LIFE



bay aquatics are especially
valuable for diving ducks

WHAT WILL BE NEEDED FOR ADMINISTRATION

The two old residences located at the site of the proposed wildlife interpretive center will be replaced with new construction near the north entrance. The maintenance and storage area will be at the site of the existing equipment storage building just inside the driving loop trail. New construction will consist of a service building and paint and oil house. This work will be screened from the sight of visitors driving the trail.



EXISTING REFUGE HEADQUARTERS. This is the site for the proposed Wildlife Interpretive Center building.

WHAT WILL BE THE COST

Future development will cost an estimated \$1,500,000. This cost includes \$100,000 for detailed site planning and approximately \$1,000,000 for public use facilities. A detailed site plan must be prepared for each development site or complex before the start of construction. A high priority will be given to the development of public use facilities in the expenditure of funds allotted to the refuge.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources." The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

This administrative plan proposed and prepared by the Bureau of Sport Fisheries and Wildlife's Southeastern Region, Atlanta, Georgia, supports and furthers the high objectives of the Department of the Interior for the wise development, management, and use of the lands, waters, and other resources of the National Wildlife Refuge System.





black skimmers

BACK BAY NATIONAL WILDLIFE REFUGE

PRINCESS ANNE COUNTY, VIRGINIA

MASTER PLAN

BACKUP VOLUME

REVISIONS

DATE

DESCRIPTION

:

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PREFACE

This document contains the pertinent data from which the decisions and recommendations were made for presentation in the Back Bay Master Plan. The proposals are based on the best available data accumulated during the master planning process. Information contained herein consists of refuge objectives, management and development criteria, developments necessary to obtain objectives, and estimated costs. The more complex development proposals will require detailed site planning that will involve further study, field surveys, and design preparation. The plan indicates the general area and type and magnitude of needed developments and outlines the management to assure the Back Bay Refuge fulfills the requirements of a major sanctuary for wildlife and a place for public enjoyment of the fish and wildlife resource now and in the future.

CHAPTER 1

REFUGE OBJECTIVE STATEMENT

Back Bay National Wildlife Refuge was established by Executive Order No. 7907, June 9, 1938. A Presidential Proclamation of October 19, 1939, prohibits the hunting of migratory birds on an additional 4,600 acres of bay water adjacent to refuge lands. The refuge is classified as a migratory bird refuge and is administered under the authority of the Migratory Bird Conservation Act and of the Migratory Bird Hunting Stamp Act.

THE RESOURCE

The refuge includes 4-1/2 miles of coastal barrier beach and numerous islands in Back Bay. The entire refuge, consisting of 4,608 acres, lies within the city limits of Virginia Beach, Virginia, which includes all of Princess Anne County. This barrier beach with the man-made sand dunes protects an area of washed flats that were formed by past storms. Approximately 800 acres of these flats are diked for impoundment of bay and rain water. With the exception of about 80 acres of the highest land, of which 58 acres are in permanent goose pasture, the tidal marsh islands are subject to periodic flooding by wind tides of Back Bay. Back Bay waters are brackish, the salt content ranging between two percent and ten percent of sea strength.

Back Bay is the center of the historic wintering area for the once endangered greater snow geese which traditionally use the tidal marsh islands and beach flats in large concentrations. Two races of Canada geese and a fairly large number of whistling swans also winter on the refuge.

In the past bay waters have produced excellent stands of aquatic vegetation which provided winter food for waterfowl, including large populations of diving ducks. A large variety of shorebirds and marsh birds are found on the ocean beach and marshes. Black ducks, mallards, great blue herons, three species of rails, least bitterns, and ospreys nest here in limited numbers.

The refuge is strategically located in relation to centers of rapidly expanding human populations, other wildlife refuges, and waterfowl habitat where hunting pressure is heavy. Here the public has an opportunity to observe wildlife, especially waterfowl. The wild ocean beach is enjoyed by the general public, and the Back Bay waters are noted for their large mouth bass fishing.

REFUGE OBJECTIVES

To comply with overall objectives of the Bureau of Sport Fisheries and Wildlife and the Atlantic Flyway Management Plan, Back Bay Refuge must establish and pursue certain fundamental objectives of its own. Back Bay's primary function is to provide habitat and protection for waterfowl, other migratory birds, and endangered species and to manage these resources for enjoyment by the American people now and in the future. Refuge objectives in the order of their priority are as follows:

1. To provide habitat and protection to enhance the survival of the Ipswich sparrow, peregrine falcon, osprey, bald eagle, and possibly other species of wildlife where their survival is threatened. This objective rates first priority because:
 - a. These threatened species occur on the refuge in relatively small numbers that warrant special attention.
 - b. The refuge can do all that is practical for these birds without materially affecting its potential to fulfill other objectives, and should, therefore, give first consideration in planning future development and management to wildlife whose survival is in jeopardy.
 - c. Preservation of all threatened species constitutes a high Bureau objective and responsibility.
2. To provide adequate winter habitat for greater snow geese. This objective rates a high priority because:
 - a. The refuge was established to protect and provide wintering habitat for the then endangered greater snow geese.
 - b. Records show that in the past Back Bay Refuge has wintered large concentrations of greater snow geese.
 - c. The flyway population normally will not exceed 50,000 birds due to population constraints imposed by adverse weather conditions on the nesting grounds and other factors.
 - d. Sufficient habitat on the refuge will reduce depredation of agricultural crops on private land.
3. To cooperate with other agencies in improving and maintaining optimum waterfowl habitat in Back Bay. This objective rates a high priority because Back Bay is historically an important winter area for waterfowl, particularly for diving ducks and widgeons.

4. To develop and manage the refuge for a full range of wildlife and provide habitat capable of supporting the following populations:

| | <u>Peak Numbers</u> | <u>Use Days</u> |
|--------------------------------|--------------------------|-----------------|
| Canada geese | 25,000 | 1,350,000 |
| Snow geese | 30,000 | 2,000,000 |
| Ducks | 70,000 | 4,200,000 |
| Coots | 20,000 | 4,000,000 |
| Whistling swans | 10,000 | 650,000 |
| Shorebirds, gulls, terns, and) | | |
| marsh and water birds |) Sufficient numbers for | |
| Upland and big game |) frequent viewing by | |
| Furbearers |) refuge visitors | |

This objective rates a high priority because:

- a. Optimum populations of wildlife are essential to the attainment of all refuge objectives.
 - b. The improvement of habitat on the refuge will help compensate for losses and deterioration of feeding and nesting habitat within the flyway for waterfowl.
 - c. The population goals are in keeping with the National Wildlife Refuge System's responsibilities toward the protection and perpetuation of an adequate waterfowl breeding stock.
 - d. A full spectrum of wildlife in sufficient numbers for frequent viewing by refuge visitors is essential for the refuge's conservation education, wildlife-oriented recreation, and other public use programs.
5. To improve nesting and rearing conditions for gadwalls, mallards, blacks, and blue-winged teal, and to establish a wood duck nesting population on the refuge.
 6. To reserve a portion of the ocean beach as loafing habitat and nesting habitat for shore and sea birds that have historically used the eastern sea coast.
 7. To provide environmental education and wildlife-oriented recreational opportunities for an anticipated 225,000 refuge visitors annually. Although the refuge is an important attraction, a visit may include

only a trip through the refuge en route to and from False Cape State Park, a walk on the beach, a look and see trip on a wildlife interpretive trail, or a stop at the wildlife interpretive center. All of these activities may also be included in a single visit.

To achieve this objective the Public Use Program will include:

- a. Wildlife watching and photography
 - b. Opportunities for walking and driving through natural environments and managed habitat.
 - c. Other nature-oriented activities along with interpretation designed to broaden the visitor's understanding, appreciation, and enjoyment of the refuge resources.
 - d. Zoning the refuge portion of the ocean beach for nesting shorebirds and wildlife-oriented recreation, including surf fishing.
 - e. Wildlife Interpretive Center Complex designed to explain the wildlife resource and the Back Bay Refuge to relatively large numbers of people in a short period of time.
 - f. Opportunities for universities, colleges, and public schools to use the refuge as a place for environmental education and teaching, with special emphasis on wildlife and habitat management.
8. To preserve portions of the refuge in a near natural state, including stands of live oak. Back Bay is at the northern limits of the live oak range.

CHAPTER 2

MANAGEMENT AND DEVELOPMENT CRITERIA

The refuge objectives statement outlines the refuge goals for wildlife populations and public use activities. Back Bay, Mackay Island, and Fisherman's Island Refuges will continue under one administrative office. The main office will remain in ~~Princess Anne~~, Virginia. The following developments and improvements are planned to meet the objectives for the Back Bay Refuge.

BUILDINGS

Back Bay will maintain a field headquarters with adequate residences and equipment and storage buildings. Proposed construction consists of:

1. Two 3-bedroom residences with carport or garage space (replacements).
2. Service building with crews room, restroom, shower, automotive and equipment shop, and three automotive storage stalls.
3. Suboffice in the Wildlife Interpretive Center building.
4. Closed equipment storage building equipped with six stalls (existing).
5. Small equipment storage building on Long Island.
6. Storage building for paint, oil, and herbicides (20' x 30').
7. Boathouse (Replacement).

STRUCTURES AND UTILITIES

In addition to utilities associated with the required electrical power, telephone services, water supply and sewage disposal systems, and domestic fuel supplies, development should include:

1. Base radio tower
2. Gasoline and diesel storage tanks and pumps.

WATER SUPPLY

Rainfall and runoff from relatively small watersheds provide the sole source of fresh water for aquatic and marsh management in the impoundment areas. Back Bay with its erratic tides furnishes a supply of slightly brackish water.

With high tides and with low pool water levels, bay waters will flow by gravity into the impoundments. By pumping, the supply of brackish water is unlimited.

WATER FACILITIES

Existing levees with water control structures extend along the bay from the present headquarters area south to the refuge boundary. East-West cross-dikes extending to the edge of the sand dunes divide this area into three separate impoundments. Additional North-South cross-dikes form a division in each of these units. These marsh developments encompass an estimated 800 acres. Plans call for maintaining water levels ranging from a few inches on the higher elevations to approximately two feet on the lower marsh areas. Dikes and water control structures should be repaired to Bureau standards and pumps installed for flooding or dewatering each impoundment within a 7-day to 2-week period. One additional impoundment of approximately 50 acres is planned in the area north of existing headquarters.

In the past the Bureau has been concerned with the unfavorable water depths for growing aquatics and for waterfowl utilization in the various cove areas. Previous plans have called for watertight bulkheads to separate a number of cove areas from the bay waters. The Bureau has also been concerned with island erosion which resulted in the loss of considerable land acreage and caused increased water turbidity. Increased vegetation in the bay during the past few years has decreased both island erosion and water turbidity. Measures to control island erosion or diking of the cove areas are not considered feasible or desirable at this time.

BIOLOGICAL DEVELOPMENT

Biological improvements on Back Bay generally fall in management categories. However, sand dune stabilization warrants inclusion in master plan developments. Several rows of sand dunes exist along the Atlantic Ocean for the entire length of the refuge. Many of the dunes are of recent origin resulting from the erection of sand fences. Development will include sand fencing or other methods of repairing weak areas and stabilizing all dunes by planting American beach grass or other suitable plants.

ROADS

A public use road through the refuge is essential for the implementation of this plan. With such a road, the public will have access to the wildlife resources of the refuge, and vehicular traffic on the beach can be eliminated. In addition to this road, the road system will include an all-weather driving trail, service roads atop impoundment dikes, and spur roads to headquarters and the wildlife interpretive complex.

FENCING AND POSTING

The posting of islands and many miles of shore line on the bay side is a major task. Although the refuge is presently posted, additional signs and major repairs or replacements are included as development items.

RECREATION

Recreational planning provides that the refuge beach will be maintained for foot traffic only and in as near a wild or natural state as possible with the only access across the dunes near the wildlife interpretive center. The elimination of vehicular traffic on the beach necessitates an all-weather road through the refuge. Programs include facilities for public enjoyment of wildlife and wildlife habitat, educational environment, and other activities related to the fish and wildlife resource. The refuge will encourage birdwatching, sightseeing, shelling, hiking, photography, and sport fishing. Plans call for:

1. Refuge north entrance including appropriate signs, and bayside boat ramp, parking, and necessary dredging for boat entry into "navigable" water of the bay.
2. Wildlife interpretive complex including wildlife interpretive center building, parking, wildlife driving trail, observation tower, wildlife walking trails, wildlife display area, and demonstration unit to explain habitat and wildlife management. The Green Hills area is included as a part of this complex.
3. Long Island facilities, including a 3/4-mile wildlife walking trail, a 1/4-mile boardwalk, an observation platform or tower, and a small equipment storage building. The length of trail and boardwalk is approximate in order to provide a basis for cost estimates.
4. Refuge south entrance, including appropriate signs, parking, contact station, and interpretive facilities.

CHAPTER 3

DEVELOPMENT

Back Bay National Wildlife Refuge lies wholly within the city limits of Virginia Beach, Virginia. It is bound on the North by a city park, on the South by a State Park, on the West by Back Bay, and on the East by the Atlantic Ocean. Located as it is, in the heart of a high density summer vacation area, it contains 4 miles of relatively undisturbed ocean beach and more than 4,000 acres of beach and marsh land relatively undisturbed by the activity surrounding it. In the winter this is one of the most productive waterfowl wintering areas in the region with the bay, the marshes, and the marsh impoundments producing nearly all the food.

There are few choices available in any development situation. The sand ridge is narrow and partly used as a protective barrier dune. The part not occupied by the barrier dune varies in width from 100 to 1,000 feet and averages 400 feet. The marsh is wider and not much lower in elevation than the so-called sand ridge. It is feasible from an engineering standpoint to build land in the bay for roads, residences, and such, but any dredging or fill operation will damage not only that portion of the Bay being filled, but also large areas around it. In view of the Bureau's conservation position, we owe it to ourselves, the State of Virginia, and to our neighbors to save Back Bay relatively undisturbed.

Details of construction alternates available and reasons for making choices will be more fully explained for specific sites later in this chapter.

The theme of this plan is to improve existing pools to allow for greater manipulation of water levels and therefore better management, to remove vehicular traffic from the beach and permit foot traffic only, and to encourage people to visit the area to enjoy unique wildlife-oriented experiences in the center of the second largest population area on the eastern seaboard.

The development section furnishes the means for the refuge to reach the objectives listed in Chapter 1. In doing so, everything requested in Chapter 2, Functional Criteria, was furnished as requested with minor exceptions. Portable pumps will be cheaper and just as efficient as the requested permanently installed pumps. The Wildlife Interpretive Building was relocated; however, the Nature Drive loop continues to be a part of this interpretive Complex. For all practical purposes, it will fit in with the overall plan as well as the original location did.

Actual field surveys were run on all the existing and proposed pool areas, and on all the proposed building sites. The entrance road location was not surveyed.

MASTER PLAN SITE LAYOUT

Drawing Number 4R-VA-248-4 is the Base Map. It shows all proposed development and all existing development which will remain. Drawing Number 4R-VA-248-6 shows the proposed residence area and Drawing Number 4R-VA-248-5 shows the proposed work area. The Wildlife Interpretive Complex area, which is located at the site of the present subheadquarters is not shown. This was done purposely to permit the Planners to have full latitude to develop the Wildlife Interpretive Complex completely. This unit must be submitted later for approval.

EXISTING IMPROVEMENTS

Old Headquarters Area

All of the buildings in the old headquarters area except the boathouse will be removed when the Wildlife Interpretive Center is built. The boathouse is in good condition and will last for several more years. When and if it becomes necessary to replace it, consideration may be given to moving the boathouse.

New Work Area

This area is the one which was approved in 1964 as the New Headquarters Area. New conditions and new goals have, however, changed space requirements. As presently envisioned, only the existing equipment building and two other buildings will be required here. Drawing Number 4R-VA-248-5 shows the new layout for the headquarters work area.

Protective Sand Dune

The four miles of beach sand dune are manmade. Construction was first started on the dunes in the 1930's. Most of the original dune work was done by the CCC. Fortunately the dunes have suffered relatively little damage over the years. There, of course, has been some damage from time to time from storms. Maintenance is a problem of the first magnitude. It is noteworthy that although the barrier dunes on the refuge

were eroded by the March 7, 1962, storm the dunes were not breached on the refuge. Any plan for Back Bay must include annual maintenance funds for dune protection.

CONSTRUCTION FEATURES

All construction design must take into consideration certain peculiarities of the area in which construction is to be accomplished. The barrier reef between Back Bay and the Atlantic Ocean is naturally only about 2 to 3 feet above high tide normally. Much of the ridge could be inundated by high tides if it were not for the manmade dunes which run the full length of the ridge. Back Bay refuge has been very fortunate in that it has suffered very little damage from hurricanes over the years. Nevertheless, it is in the hurricane zone and would be especially vulnerable to a hard blow.

For the reasons mentioned above, all permanent buildings located on Back Bay must be of hurricane design. Each of the building sites must be a minimum of five feet above mean sea level. Six feet above mean sea level is preferred. All paved roads require special subgrade treatment. Minimum grade for paved roads should be 5.0 ft. m.s.l.

Buildings

All permanent buildings will be of hurricane design, masonry construction. Exterior materials may vary according to site. Ground elevations at all building sites should be 6.0 m.s.l. Floor elevation of all buildings except vehicle storage buildings should be a minimum of 9.0 m.s.l. Vehicle storage buildings should have a minimum floor elevation of 6.5. All buildings regardless of style and principal use must have pile foundations.

The minimum elevations above were selected after careful consideration of all facts. The three highest tides reported at Back Bay in the last 40 years are 8.0 m.s.l. in 1933, 8.5 m.s.l. in 1936, and 7.7 m.s.l. in 1962. These tide elevations would normally demand higher floor elevations and higher building site elevations, but in 1962 the high tide did not flood the refuge because of the protective sand dune even though the headquarters are nearly 4 ft. below the high tide elevation. Further, there are no areas on the entire refuge, except the manmade protective sand dunes, which are above 8.0 m.s.l. In view of the past experience with storms, it seems advisable to raise building floors above storm

tide level while raising the site elevations only a few feet. To raise each building site above high storm tide elevation would be more expensive, would offer little extra protection, and would not lessen the need for pile foundations under the buildings.

Table 1 is a list of Buildings proposed and existing for Back Bay Refuge along with other pertinent remarks.

TABLE 1
BUILDINGS

| <u>Building</u> | <u>Location</u> | <u>Material</u> | <u>Size</u> | <u>Remarks</u> |
|---------------------------|--------------------|-------------------------|-------------|----------------------------|
| 1. Equipment Storage | New work area | Brick Veneer | | Retain |
| 2. Service Bldg. | New work area | Brick Veneer | 30x37 | To match exist. |
| 3. Oil & Paint House | New work area | Brick Veneer | 20x30 | To match exist. |
| 4. Combination Bldg. | Wildlife Int. Area | Wood frame | -- | Condition Poor-- Remove |
| 5. Residence | Wildlife Int. Area | Wood frame | -- | Remove for WIC |
| 6. Residence | Wildlife Int. Area | Wood frame | -- | Remove for WIC |
| 7. Boathouse | Wildlife Int. Area | Wood frame | -- | Retain for time |
| 8. Boathouse | | Wood frame | 40x20 | Replace #7 |
| 9. Residence | New Residence Area | Brick Veneer | 28x67 | Replace #5 |
| 10. Residence | New Residence Area | Brick Veneer | 28x67 | Replace #6 |
| 11. Wildlife Center Bldg. | Wildlife Int. Area | To be selected | -- | Special design |
| 12. Pole Shed | Long Island | Creosote Timber - Metal | | |

New Residence Area

The new residence area will be located near the north boundary, close to school bus transportation and other conveniences. Landfill will be required to raise site elevations.

Residences. The residences will be similar to the standard design RL-84 in size. They will be somewhat different though in that the living room will be on the back to permit the picture window in the living room to frame a beautiful view of Sand Bay. Finish materials will be selected during design to harmonize with the site and with other refuge buildings.

Refuge work buildings. The refuge work buildings will match the existing brick veneer-concrete block building. The new service building will be like Drawing Number 4R-NC-160-7.0 and will include a shop, crew's room with toilet and shower, and 4 stalls for storage. The oil and paint house will be of standard design like RL-81. It will be wired for electricity with explosion proof switches and fixtures. Two pumps and tanks, one diesel and one gasoline, will be installed as part of the oil and paint house project. All of the above work buildings will be located in the new work area.

Two other work buildings are planned. The pole type equipment shed will be similar to RL-105. It will be located near the farm area on Long Island, and will be used to store the farm machinery used in that area. The final proposed work building, the boathouse, will not be built until deterioration of the present boathouse makes construction necessary. At that time a decision will be made according to need whether to move the boathouse nearer the work buildings or to replace it in its present spot. Both sites offer some merit, but since the boathouse is adequate for several years to come, no decision is necessary at this time.

Wildlife Interpretive Center. The building, the focal point of this area, will be specially designed to fit the theme of the area. Materials of construction will be selected to harmonize with the surroundings. Although the building will be constructed in the area now used as the headquarters-residence area, it will be necessary to raise the site grade above the minimum 6.0 m.s.l. specified earlier. The wildlife interpretive center building will include office space required for a subheadquarters. Expected visitor use for the entire refuge will be 300,000 visits per year. While not all visitors will avail themselves of the Wildlife Interpretive Center area, 55% or approximately 165,000 persons can be expected to visit the center annually.

Roads

The entrance road will be bituminous concrete paved with a 20-foot wide driving surface. It will have 3-foot wide shoulders for a total top width of 26 feet. The road will be built almost entirely on sand

fill removed from borrow ditches on each side of the road. A special soil-cement stabilization base course must be applied to the road in order to obtain a foundation capable of supporting the paved road surface. The entrance road will extend from the refuge North boundary to the beginning of the nature drive loop, and will pass both the residence area and the Wildlife Interpretive Center. The entrance road will be designed for a 35 mile per hour speed and be signed for a maximum of 25 mile per hour speed. The nature drive loop will be 24 feet wide shoulder to shoulder with 18-foot wide paved surface. It will be built entirely on top of pool dikes and like the entrance road, will need special base preparation. Entrances to the work area and the residence area will be paved. All public roads and public parking areas will be paved.

Water Impoundments

There are seven impoundments on Back Bay Refuge. These seven will remain but will be improved to permit more flexible management, while rebuilding the dikes to permit accommodation of the nature loop drive. At present the dike top elevations of the pools vary from 3.0 ft. to 5.5 ft. m.s.l. The 3.0 ft. elevation restricts the water surface elevation to 2.5 ft. m.s.l. with inadequate freeboard and inadequate water depth. Dike slopes have eroded to a slope of 1-1/2 to 1 and there is no berm between dike toe and borrow ditch. Dikes will be widened, slopes extended and berms formed. Upon completion, pool water surface elevation will be 3.5 or 4.0 ft. m.s.l. with a 2-ft. freeboard. Structures will be installed which will permit filling or draining by gravity when conditions permit. Two high capacity portable pumps will be used to fill or drain the pools at other times. Emergency spillways are not required since there is no watershed outside the pool dikes. One additional pool will be built near the north boundary. Table II gives pertinent information for all pools existing and proposed.

TABLE II
POOL DATA

| Pool Number | Full Pool Data | | | One Ft. Drawdown | | Two Ft. Drawdown | | Three Ft. Drawdown | | Size-Type* Structure |
|-----------------|------------------|-------|----------------------|------------------|----------------------|------------------|----------------------|--------------------|----------------------|-------------------------|
| | Surface Elev. | Acres | Capacity Acre-Ft. | Surface Acre | Capacity Acre-Ft. | Surface Acres | Capacity Acre-Ft. | Surface Acre | Capacity Acre-Ft. | |
| E (Proposed) | 3.5 | 64 | 102 | 35 | 32 | 13 | 6 | | | 1-18" A |
| C | 3.5 | 211 | 295 | 190 | 190 | 107 | 64 | 12 | 2 | 1-24" A |
| F | 4.0 | 43 | 43 | 28 | 17 | | | | | 1-18" B |
| B | 3.5 | 150 | 195 | 147 | 132 | 124 | 62 | | | 1-24" A |
| G | 4.0 | 54 | 54 | 28 | 17 | 20 | 4 | | | 1-18" B |
| A | 3.5 | 226 | 338 | 209 | 209 | 174 | 121 | 18 | 5 | 1-24" A |
| H | 4.0 | 66 | 66 | 59 | 35 | 32 | 6 | | | 1-18" B |
| D | 3.5 | 16 | 11 | | | | | | | 1-18" A |

* Type "A" Structure has Slide-Flap Gate both ends.

* Type "B" Structure has single slide gate on pool side.

Fencing, Posting and Signs

Fencing is not required at Back Bay. Boundary posting will be according to applicable Bureau regulations. An attractive entrance sign has recently been built at the North boundary of the refuge. This sign will be used until the entrance road and the North Entrance Recreation area are built, when a new sign may be built. Signs similar in style to the entrance signs will be erected at the Wildlife Interpretive Center, and the Nature Trail. The number, location, and design of interpretive signs will be decided upon when detailed planning is done.

Recreation

Situated as it is, inside the city limits of Virginia Beach, Virginia, a resort city which boasts of millions of visitors a year, and adjacent to a city park on the north and a State Park on the south, the problem at Back Bay will be to limit visitors to that number who can enjoy a quality wildlife experience without damage to the resource. From available statistical data one can expect 20,000 people annually on the walking trail, 120,000 annually on the beach and 40,000 annually at the fishing access. As many as 500,000 people annually may want to use the driving trail. These numbers might be accommodated if spread evenly throughout the year, but unfortunately the use pattern will be concentrated in a few weekend days in a few months.

In design of facilities, some control can be placed upon public use. The 40,000 annual fishing visitors can easily be accommodated with the one boat ramp and 60-car parking lot, without damage to the resources. The 20,000 expected visitors at the Green Hills Walking Trail could be handled easily if they would agree to spread themselves out evenly over the year. The more probable use pattern will be very light use at all times except spring and summer Sunday afternoons when extremely heavy use can be expected. To avoid the crowded conditions without seeming to, parking for only 10 cars will be provided. This will reduce peak walking trail loads to 40 visitors per mile, a slightly high figure but well below the 50 people per mile recommended in Comprehensive Plan for Wisconsin, Outdoor Recreation. This heavy use can be absorbed for short periods without undue damage.

The four miles of beach is projected as a wild or natural beach in the midst of 30 miles of highly developed and heavily used beach. In order to afford visitors the experience of walking on a relatively undisturbed beach, no more than 50 people per mile of beach can be accommodated. To limit beach use to that number without being obvious, parking for beach use will be limited to no more than 50 spaces total.

The driving trail loop will probably be the most popular facility offered since nearly every man, woman, and child will go driving for pleasure more than 10 times a year. Since there is no practical way to reduce traffic on the driving trail in design, it may become necessary to simply let autos enter as others leave on peak days. This can be handled by a gating arrangement at the beginning of the driving trail.

The Long Island developments will be relatively inaccessible to the general public. Only those groups with a particular interest in the program demonstrated there would be encouraged to use the Long Island development.

No use figures are offered for the Wildlife Interpretive Center area and Building. For cost estimating purposes, sizes as listed elsewhere were used; however, they are not intended as guidelines. The numbers expected to use the Wildlife Interpretive Area and the pattern of use can best be ascertained during the design planning stage.

While 700,000 people could be expected to want to avail themselves of some part of the recreational-educational facilities at Back Bay, by planning and management, this number will be held to 300,000 annually unless and until experience proves that this figure can be increased without damage to the resource that attracts the people. This number will probably be divided as follows: fishing 18%; nature trails including Long Island Environmental Education trail 11%; beachcombing 34%; nature drive 47%; Wildlife Interpretive building 55%. The total adds to more than 100% because many people will do more than one thing while at the refuge.

CONSTRUCTION SUPPORT ACTIONS

The new work area should be completed prior to construction of the Wildlife Interpretive area, since all buildings in the headquarters-residence area must be removed to accommodate that development. Employees can obtain housing off the refuge once the headquarters is connected by an all-weather road, but housing on the refuge will again be necessary once heavy public use starts; therefore, the new residence area should be built at about the same time the main visitor accommodations are built. Prior to construction of either the residence area or the Wildlife Interpretive Center, water and sanitary sewer should be completed to the construction sites.

Planning money should be programmed for the Wildlife Interpretive Center at least one year before construction begins.

Planning for the walking trails, the Nature drive, and the North Entrance should be done simultaneously. The pools must be rehabilitated at the time the nature drive is built because so much of both projects are interdependent. The Green Hills nature trail will not be used until after both the entrance road and the nature drive are built. The entrance road is required before any of the recreation work can be done, and it should be done prior to construction of any other project.

WATER

Back Bay Refuge is bounded on the east by the Atlantic Ocean and on the west by Back Bay. Back Bay is slightly brackish. Only the ocean is subject to uniformly semidiurnal tides. Back Bay is affected only by wind tides; winds from the south cause water levels to rise, and winds from the north cause them to fall.

Water Requirements

The principal source of water for Back Bay Refuge management purposes is Back Bay supplemented by rainfall. Due to the erratic nature of the wind tides, no dependence can be made upon gravity flow to fill and drain pools. Pumping will be required for both drainage and filling. Structures will be designed however to permit gravity drainage or fill whenever conditions will permit it. Table II gives pool capacity at various elevations.

Water Rights and State Laws

The State law in Virginia is based on riparian law. Under Virginia law, only that water which is above average flow is subject to appropriation by riparian land owners. The problem here is that average flow in Back Bay is a tenuous thing, poorly defined. The amount of water we take from Back Bay is not going to affect it much, and all water taken from Back Bay except that lost to evaporation and transpiration will be returned to it. Nevertheless, the State does require that the owner guarantee that stream flow below the pump or structure be no less than the average flow above the structure, or if the flow above the structure is below average, then the flow below must equal the flow above the structure. It would seem to this non-legal mind that in the instance of Back Bay this is an impossible

requirement if we are to obey the intent of the law as has been policy in the past.

Section 62-94.11 of the Code of Virginia in effect exempts the National government from this act, and this method can be resorted to if necessary, but as a matter of comity, every effort should first be made to build the pools and obtain water under State permit. The pertinent water laws are found in the Virginia Code, Section 62-94.1 through 62-94.12.

Ground Water

Potable water is available in small quantities from wells less than 40 feet deep. This water is extremely high in iron content. Deep wells are even less successful as far as potable water is concerned. Although good quality water is available from deep wells in Norfolk a few miles away, none is available in Princess Anne County. Wells at about 800 feet yield water containing 1200 parts per million in chloride. Large capacity wells are possible at this depth, but better water for management purposes is available cheaper from Back Bay; consequently, no deep wells are planned.

EXISTING EASEMENTS & RIGHTS-OF-WAY

An electric power line runs the full length of the refuge. Immediately south of the refuge a high density day-use park is planned. When this is completed, water will be required for the park and the most logical route will be through the refuge on the right-of-way already established for the power line.

UTILITIES

Telephone and electrical service are presently available at all construction sites. The city of Virginia Beach indicates that they can furnish water to all sites in the near future. The Bureau of Sport Fisheries and Wildlife may be required to help defray the cost of laying the main unless the park to the south of the refuge has the main extended before we tap in.

For estimating purposes in this plan, sewerage will be Bureau owned package treatment plants with necessary mains and laterals. The city of Virginia Beach may be able to furnish sewer lines before construction of Bureau facilities is started. In that event the Bureau should avail itself of the city's sewer service.

CHAPTER 4

COST ESTIMATES

The cost figures listed in the following pages are based on prices current at the time of this report. When these estimates were prepared in January 1970, the Engineering News Record Construction Cost Index was 1310, using the 1913 costs as base 100. In future years, the costs contained herein can be adjusted by changing individual costs proportionally to the change in the ENR Construction Cost Index.

The Engineering Cost Estimate is cross-referenced to the Development Schedule to aid supervisors in preparing annual budget submissions.

CHAPTER 5
ENGINEERING COST ESTIMATE

| <u>Work Area</u> | | <u>Cost</u> | <u>Program Item No.</u> |
|------------------------------|----------------------|--------------|-----------------------------|
| <u>Description</u> | | | |
| Clearing & Grubbing - Sparse | L.S. | \$ 500 | 16 |
| Grading Courtyard & Drive | 5,000 c.yds @ \$1.10 | 5,500 | 21 |
| Prepared Base Course | 2,500 s.yds @ \$1.45 | 3,600 | 21 |
| Asphaltic Concrete Surface | 2,500 s.yds @ \$4.10 | 10,500 | 21 |
| Oil & Paint House | 600 s.ft. | 12,500 | 11 |
| Service Building | 2,600 s.ft. | 62,000 | 12 |
| Diesel Fuel Tank & Pump | L.S. | 2,500 | 19 |
| Gasoline Tank & Pump | L.S. | <u>2,500</u> | 19 |
| | Total | \$99,600 | |

| <u>Residence Area</u> | | | |
|---|-----------------------|---------------|----|
| Clearing & Grubbing | 4.5 A @ \$300 | \$ 1,350 | 16 |
| Grading | 18,500 c.yd. @ \$1.10 | 20,300 | 16 |
| Prepared Road & Driveway Base | 1,250 s.yd. @ \$1.45 | 1,815 | 22 |
| Asphaltic Concrete Surface | 1,250 s.yd. @ \$4.10 | 5,140 | 22 |
| 2" Water Service | 400 l.f. @ \$3.00 | 1,200 | 17 |
| 1 1/4" Water Service | 550 l.f. @ \$2.05 | 1,130 | 17 |
| Sanitary Sewer Facilities | | 11,000 | 18 |
| Residences (Hurricane Construction) 2 ea. | | <u>65,000</u> | 13 |
| | Total | \$106,935 | |

Pools A & H *

| <u>Description</u> | | <u>Cost</u> | <u>Program Item No.</u> |
|--------------------|-----------------------|--------------|-----------------------------|
| Stripping | 23 A. @ \$300 | \$ 6,900 | 1 |
| Dike Fill | 32,100 c.yd. @ \$1.10 | 35,300 | 1 |
| Water Control Str. | 1 ea. Pool 6 to Bay | 19,100 | 4 |
| Water Control Str. | 1 ea. Pool 7 to 6 | <u>5,000</u> | 5 |
| | Total | \$66,300 | |

*Part of cost of Pool A listed in Nature Trail Costs

Pools C, F, B, G *

| | | | |
|-------------------------------|----------------------|---------------|---|
| Stripping | 6 A. @ \$165 | \$ 1,000 | 2 |
| Dike Fill between Pools 2 & 4 | 7,000 c.yd. @ \$1.10 | 7,700 | 2 |
| Structure Pools 3 to 2 | | 5,000 | 6 |
| Structure Pool 4 to Bay | | 19,100 | 9 |
| Structure Pool 5 to 4 | | 5,000 | 8 |
| Structure Pool 2 to Bay | | <u>19,100</u> | 7 |
| | Total | \$56,900 | |

*Part of cost of Diking these Pools listed in Nature Trail Costs

All Pools

| | | | |
|-----------------|---------------------------|-----------------|----|
| Pumps, portable | 6,000 gpm 2 ea. @ \$6,000 | <u>\$12,000</u> | 20 |
| | Total | \$12,000 | |

Pool E *

| | | | |
|-------------------------|-----------------------|---------------|----|
| Stripping | 9 A. @ \$165 | \$ 1,500 | 3 |
| Dike Fill | 16,500 c.yd. @ \$1.10 | 18,200 | 3 |
| Structure Pool 1 to Bay | | <u>19,100</u> | 10 |
| | Total | \$38,800 | |

*Part of Pool E costs are in North Entrance Rd. costs

Road North Property Line to Loop Trail

| <u>Description</u> | | <u>Cost</u> | <u>Program Item No.</u> |
|------------------------------------|-----------------------|---------------|-----------------------------|
| Clearing, grubbing & stripping | 13 A. | \$ 10,000 | 23 |
| Grading | 57,000 c.yd. | 62,800 | 23 |
| Borrow (extra cost) | 30,000 c.yd. @ 50¢ | 15,000 | 23 |
| Prepared Base Course | 21,100 s.yd @ \$1.45 | 30,700 | 23 |
| Asphaltic Concrete 2½" Total Thick | 21,100 s.yd. @ \$4.10 | <u>86,600</u> | 23 |
| Total | | \$205,100 | |

Nature Drive around Pools C & B

| | | | |
|-----------------------|-----------------------|----------------|----|
| Stripping | 100 A. @ \$165 | 16,500 | 26 |
| Grading for road dike | 140,000 c.yd. | 154,000 | 26 |
| Prepared Base Course | 49,800 s.yd. @ \$1.45 | 72,300 | 26 |
| Alphaltic Concrete | 49,800 s.yd. @ \$4.10 | <u>205,000</u> | 26 |
| Total | | \$447,800 | |

Wildlife Interpretive Center - Office

| <u>Description</u> | | <u>Cost</u> | <u>Program Item No.</u> |
|------------------------------------|-----------------------|---------------|-----------------------------|
| Landscaping & Site work | 6 A | 6,000 | 24 |
| Grading | 15,600 c.yd. @ \$1.10 | 17,200 | 24 |
| Borrow (extra cost) | 10,000 c.yd. @ 50¢ | 5,000 | 24 |
| Prepared Base Course | 7,200 s.yd. @ \$1.45 | 10,450 | 26 |
| Asphaltic Concrete Pavement | 7,200 s.yd. @ \$4.10 | 29,500 | 26 |
| 2" Water Line | 750 L.P. @ \$2.00 | 1,500 | 32 |
| Sanitary Sewer Facilities Complete | | 25,000 | 33 |
| Wildlife Interpretive Building | | 140,000 | 25 |
| Walking trail | 3,000 l.f. @ \$1.50 | 4,500 | 27 |
| Observation Platform - at Dunes | L.S. | 1,500 | 28 |
| Boat House (Replacement) | | <u>10,500</u> | 14 |
| | Total | \$251,150 | |

North Entrance Recreation Area

| <u>Description</u> | | <u>Cost</u> | <u>Program Item No.</u> |
|-------------------------------|-----------------------|--------------|-----------------------------|
| Clearing, Grubbing, Stripping | 3 A. | 1,800 | 24 |
| Fill Parking lot & Driveway | 11,500 c.yd. @ \$1.10 | 12,700 | 26 |
| Borrow (extra charge) | 8,000 c.yd. @ 50¢ | 4,000 | 26 |
| Prepared Base Course | 7,000 s.yd. @ \$1.45 | 10,200 | 26 |
| Asphaltic Concrete Pavement | 7,000 s.yd. @ \$4.10 | 28,700 | 26 |
| Landscaping | 2 A. | 2,000 | 24 |
| Entrance Sign & Misc. Signs | | 5,000 | 31 |
| Boat Ramp | L.S. | <u>1,000</u> | 34 |
| | Total | \$65,400 | |

Green Hills Walking Trail

| <u>Description</u> | | <u>Cost</u> | <u>Program Item No.</u> |
|---------------------------------|----------------------|--------------|-----------------------------|
| Clearing, Grubbing, Parking Lot | L.S. | 500 | 24 |
| Grading & Landscaping | L.S. | 1,500 | 24 |
| Prepared Base Course | 370 s.yd. @ \$1.45 | 535 | 26 |
| Asphaltic Concrete Pavement | 370 s.yd. @ \$4.10 | 1,520 | 26 |
| Walking Trail | 5,300 l.f. @ \$1.50 | 7,950 | 27 |
| Signs | | 3,000 | 31 |
| Tower | 1 ea. | 20,000 | 29 |
| Boardwalk | 3,500 s.ft. @ \$3.50 | 12,300 | 27 |
| Observation Platform | 400 s.ft. @ \$4.00 | <u>1,600</u> | 23 |
| | Total | \$48,905 | |

Long Island Development

| <u>Description</u> | | <u>Cost</u> | <u>Program Item No.</u> |
|---------------------------------|----------------------|--------------|-----------------------------|
| Boat Dock | L.S. | 7,000 | 30 |
| Marsh walking trail | 8,000 l.f. @ \$1.50 | 12,000 | 27 |
| Boardwalk | 3,000 s.ft. @ \$3.50 | 10,500 | 27 |
| Open equipment shed (farm area) | L.S. | <u>5,500</u> | 15 |
| | Total | \$35,000 | |

Planning

| <u>Description</u> | <u>Cost</u> | <u>Program Item No.</u> |
|--|---------------|-----------------------------|
| W.I.C. | \$75,000 | 35 |
| Green Hills Walking Trail, Nature Drive, North Entrance & Long Island | <u>25,000</u> | 35 |
| Total | \$100,000 | |
| Total | \$1,533,890 | |

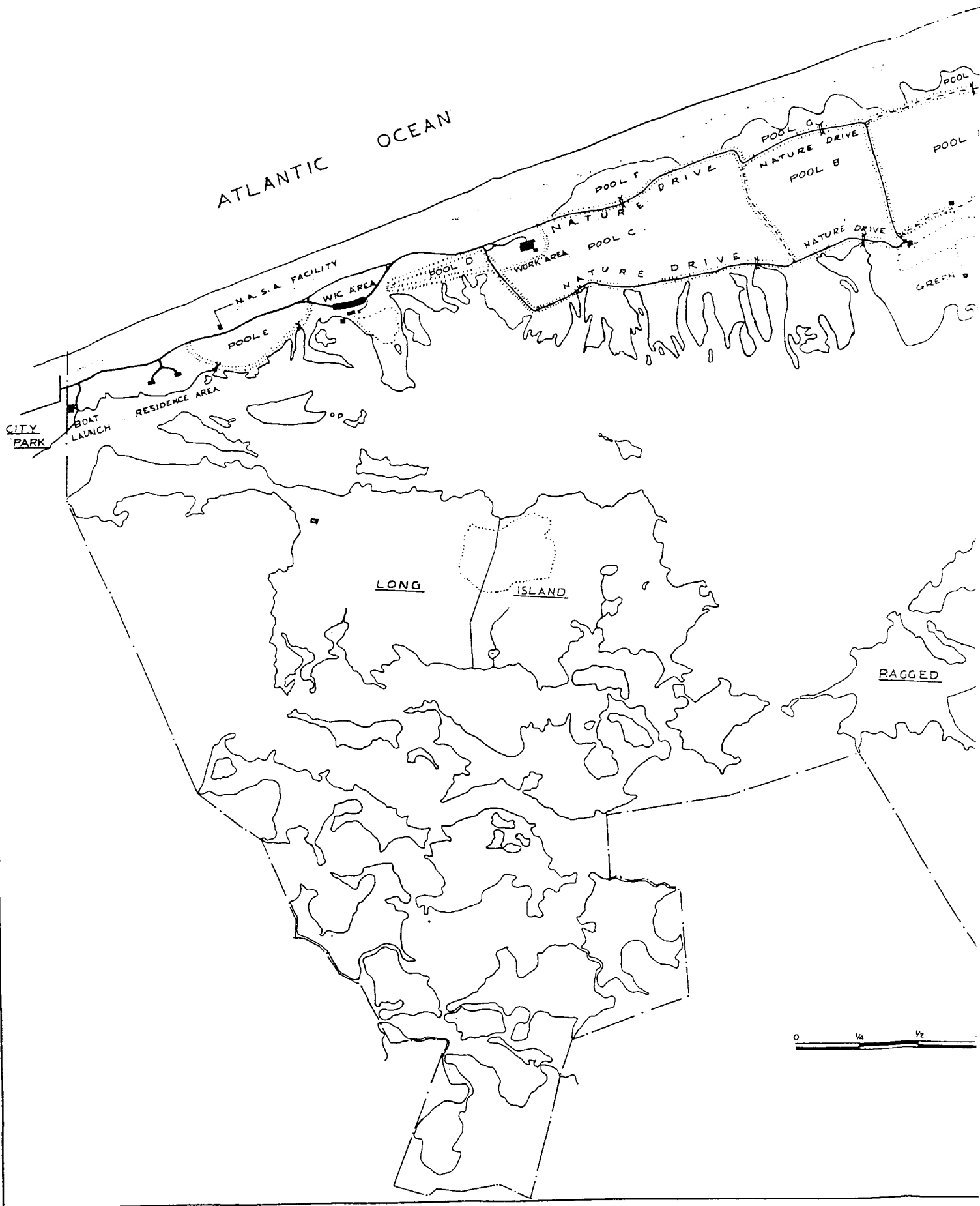
DEVELOPMENT SCHEDULE

| PROGRAM ITEM | | TOTAL DEVELOPMENT | | FIRST PHASE | | SECOND PHASE | | THIRD PHASE | |
|-----------------------------------|--------------------------|-------------------|----------------|-------------|----------------|--------------|------|-------------|---------------|
| NO. | DESCRIPTION | UNITS | COST | UNITS | COST | UNITS | COST | UNITS | COST |
| <u>WATER FACILITIES</u> | | Total | <u>162,000</u> | Total | <u>123,200</u> | Total | | Total | <u>38,800</u> |
| 1. | Dike, Pools A & H | 32,100 c.yd | 42,200 | 32,100 c.yd | 42,200 | | | | |
| 2. | Dike, Pools C & B | 7,000 c.yd | 8,700 | 7,000 c.yd | 8,700 | | | | |
| 3. | Dike, Pool 1 | 16,500 c.yd | 19,700 | | | | | 16,500 c.yd | 19,700 |
| 4. | Water Control Str A-Bay | 1 ea. | 19,100 | 1 ea. | 19,100 | | | | |
| 5. | Water Control Str A-H | 1 ea. | 5,000 | 1 ea. | 5,000 | | | | |
| 6. | Water Control Str F-C | 1 ea. | 5,000 | 1 ea. | 5,000 | | | | |
| 7. | Water Control Str C-Bay | 1 ea. | 19,100 | 1 ea. | 19,100 | | | | |
| 8. | Water Control Str G-B | 1 ea. | 5,000 | 1 ea. | 5,000 | | | | |
| 9. | Water Control Str B-Bay | 1 ea. | 19,100 | 1 ea. | 19,100 | | | | |
| 10. | Water Control Str E-Bay | 1 ea. | 19,100 | | | | | 1 ea. | 19,100 |
| <u>BUILDINGS</u> | | Total | <u>155,500</u> | Total | <u>80,000</u> | Total | | Total | <u>75,500</u> |
| 11. | Oil & Paint House | 600 s.ft | 12,500 | 600 s.ft | 12,500 | | | | |
| 12. | Service Building | 2,600 s.ft | 62,000 | 2,600 s.ft | 62,000 | | | | |
| 13. | Residences | 3,600 s.ft | 65,000 | | | | | 3,600 s.ft | 65,000 |
| 14. | Boathouse | 400 s.ft | 10,500 | | | | | 400 s.ft | 10,500 |
| 15. | Pole Equipt. Shed | 3,900 s.ft | 5,500 | 3,900 s.ft | 5,500 | | | | |
| <u>STRUCTURES & UTILITIES</u> | | Total | <u>52,480</u> | Total | <u>17,500</u> | | | Total | <u>34,980</u> |
| 16. | Landscaping & Sitework | 2 ea. | 22,150 | 1 ea. | 500 | | | 1 ea. | 21,650 |
| 17. | Water Service | 1 ea. | 2,330 | | | | | 1 ea. | 2,330 |
| 18. | Sanitary Sewer Serv. | 1 ea. | 11,000 | | | | | 1 ea. | 11,000 |
| 19. | Fuel Tanks | 2 ea. | 5,000 | 2 ea. | 5,000 | | | | |
| 20. | Portable Pumps (Equipt.) | 2 ea. | 12,000 | 2 ea. | 12,000 | | | | |

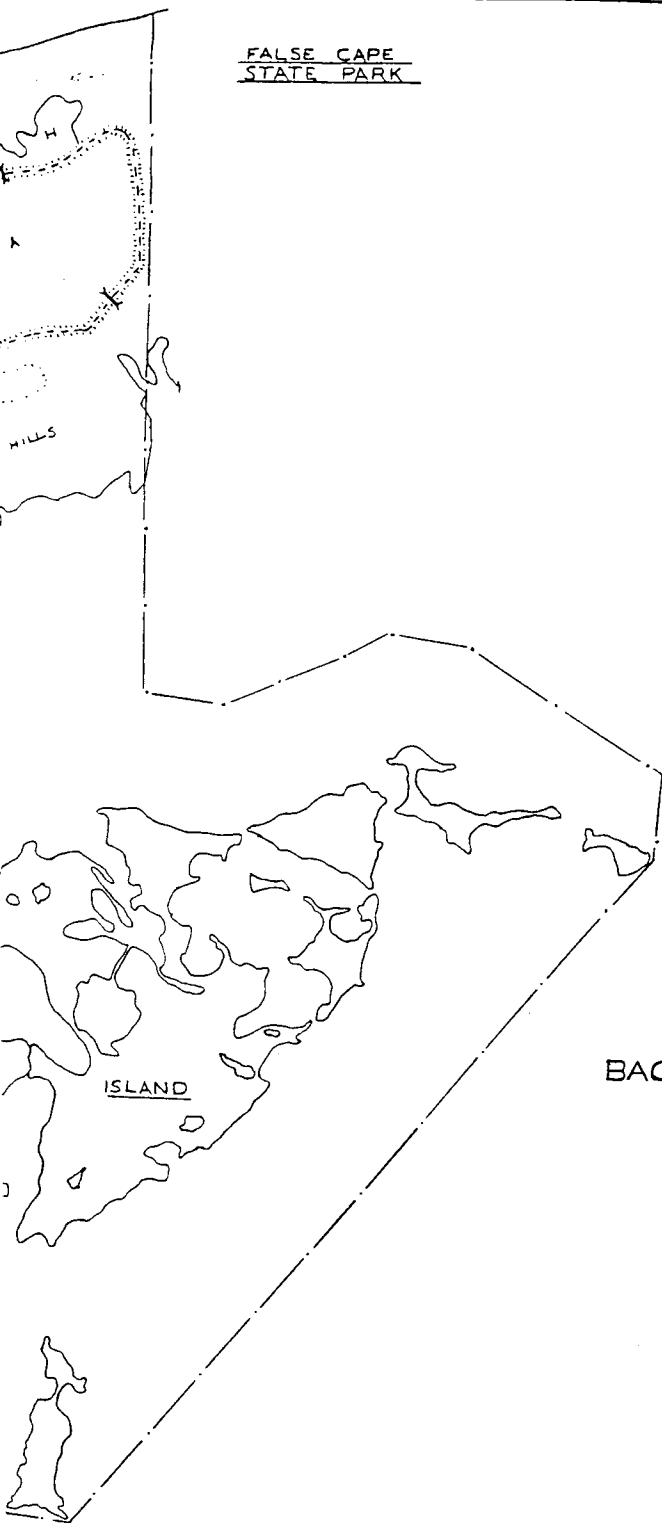
DEVELOPMENT SCHEDULE

| PROGRAM ITEM | | TOTAL DEVELOPMENT | | FIRST PHASE | | SECOND PHASE | | THIRD PHASE | |
|----------------|------------------------|-------------------|----------------|--------------|----------------|--------------|----------------|-------------|----------------|
| NO. | DESCRIPTION | UNITS | COST | UNITS | COST | UNITS | COST | UNITS | COST |
| ROADS & TRAILS | | Totals | <u>231,655</u> | | <u>224,700</u> | | | Total | <u>6,955</u> |
| 21. | Work Area Paving | 2,500 s.yd. | 19,600 | 2,500 s.yd. | 19,600 | | | | |
| 22. | Residential Driveways | 1,250 s.yd. | 6,955 | | | | | 1,250 s.yd. | 6,955 |
| 23. | Entrance Road | 21,100 s.yd. | 205,100 | 21,100 s.yd. | 205,100 | | | | |
| RECREATION | | Total | <u>932,255</u> | Total | <u>230,500</u> | Total | <u>550,950</u> | Total | <u>150,805</u> |
| 24. | Landscaping & Sitework | 3 projects | 34,000 | | | 1 project | 28,200 | 2 projects | 5,800 |
| 25. | Wildlife Int. Bldg. | 1 ea. | 140,000 | | | 1 ea. | 140,000 | | |
| 26. | Roads & Parking | 64,370 s.yd. | 545,405 | * | 170,500 | 57,000 s.yd. | 317,250 | 7,370 s.yd. | 57,655 |
| 27. | Walking Trails | 17,900 l.f. | 47,250 | | | 3,000 l.f. | 4,500 | 14,900 l.f. | 42,750 |
| 28. | Observation Platforms | 2 ea. | 3,100 | | | | 1,500 | | 1,600 |
| 29. | Observation Tower | 1 ea. | 20,000 | | | | | 1 ea. | 20,000 |
| 30. | Boat Dock | 1 ea. | 7,000 | | | | | | 7,000 |
| 31. | Signs | | 8,000 | | | | 3,000 | | 5,000 |
| 32. | Water Line | 1 ea. | 1,500 | | | 1 ea. | 1,500 | | |
| 33. | Sanitary Sewer System | 1 ea. | 25,000 | | | 1 ea. | 25,000 | | |
| 34. | Boat Ramp | 1 ea. | 1,000 | | | | | | 1,000 |
| 35. | Recreation Planning | | <u>100,000</u> | | <u>60,000</u> | | <u>30,000</u> | | <u>10,000</u> |
| Totals | | | \$1,533,890 | | \$675,900 | | \$550,950 | | \$307,040 |

* This cost is for roadway fill only, which must be built in conjunction with water facilities Items 1 & 2.



FALSE CAPE
STATE PARK



BACK BAY

LEGEND

| | |
|-------------------------|-------|
| PAVED ROAD | ————— |
| PAVED ROAD ON DIKE | ————— |
| UNPAVED ROAD ON DIKE | ————— |
| WALKING TRAIL | ————— |
| EXISTING BUILDING | ————— |
| PROPOSED BUILDING | ————— |
| WATER CONTROL STRUCTURE | ————— |
| MAN-MADE DUNES | ————— |

| | | |
|--|-----------|---|
| DATE | REVISIONS | BY |
| | | |
| | | |
| UNITED STATES DEPARTMENT OF THE INTERIOR FISH AND WILDLIFE SERVICE BUREAU OF SPORT FISHERIES AND WILDLIFE DIVISION OF ENGINEERING | | |
| SUBMITTED <i>[Signature]</i> REGIONAL DIRECTOR ATLANTA, GEORGIA | | BACK BAY NATIONAL WILDLIFE REFUGE PRINCESS ANN CO. VIRGINIA |
| DIVISION REVIEW <i>[Signature]</i> RECOMMENDED <i>[Signature]</i> REGIONAL ENGINEER | | BASE-MAP |
| W. O. APPROVAL | DATE | DESIGNED |
| | | |
| | | DRAWN BY |
| | | CHECKED |
| | | DATE MAR 70 |
| DRAWING NUMBER 4R-VA-248-4 | | SHEET OF |

1 MILE