PRELIMINARY - FOR DISCUSSION ONLY

PRELIMINARY ASSESSMENTS OF DRAINAGE IMPACTS IN THE EAST EVERGLADES AREA OF DADE COUNTY

October 1981

Ronald Mierau

E. C. Lane

Water Resource Division
Resource Planning Department

South Florida Water Management District

West Palm Beach, Florida

TABLE OF CONTENTS

	Page
SUMMARY	1
INTRODUCTION	2
A) Purpose	2
B) Background	2
C) Nondrainage Options	3-4
DRAINAGE DESIGN COMMON TO ALL ALTERNATIVES	5
A) Basic Considerations	5
B) Generalized Design	5-6
DRAINAGE SCENARIO 1	7
A) Description	7
B) Impact Assessment	7
1) Overdrainage and Water Supply	7
2) South Dade Conveyance System	7
3) Effects on Agriculture	7
4) Social Effects	9
5) Water Quality	9
6) Environmental Effects	9
C) Cost Analysis	10
1) First Cost	10
2) Operation and Maintenance	11
3) Total Cost	11
DRAINAGE SCENARIO 2	12
A) Description	12
B) Impact Assessment	12
1) Overdrainage and Water Supply	12
2) South Dade Conveyance System	12

TABLE OF CONTENTS
(Continued)

	Page
3) Effects on Agriculture	14
4) Social Effects	14
5) Water Quality	14
6) Environmental Effects	15
C) Cost Analysis	16
1) First Cost	16
2) Operation and Maintenance	17
3) Total Cost	17
DRAINAGE SCENARIO 3	18
A) Description	18
B) Impact Assessment	18
1) Overdrainage and Water Supply	18
2) South Dade Conveyance System	18
3) Effects on Agriculture	20
4) Social Effects	20
5) Water Quality	20
6) Environmental Effects	21
C) Cost Analysis	22
1) First Cost	22-23
2) Operation and Maintenance	23
3) Total Cost	23
APPENDIX	24
A) Pumping Energy Cost	25
B) Annual Pumping Volume	25-26
C) Work Request	27-47

SUMMARY

This Working Paper presents a description and evaluation of three alternative drainage scenarios for a portion of the East Everglades area. Each of the drainage scenarios is based upon a residential land use scenario developed by the staff of the Dade County Planning Department. The scenarios differ primarily in the size of the area which would be provided 1 in 10 year flood protection.

Both of the larger drainage options (Scenarios 2 and 3) would likely result in significant adverse impacts on water supply to Dade and Monroe Counties.

The particular drainage design considered in drainage Scenario 1 (5500 acres) appears acceptable in terms of impact on water supply and environmental concerns. While there does exist some potential for over-drainage with this option, this potential damage is not severe as long as the constraints on location, reservoirs, canal depth and location, and water levels which trigger pump operation are observed. This alternative, as well as the other two alternatives, are rather expensive ($160 per acre on a yearly basis) and may not be feasible from an economic point of view.

High project costs result primarily from high land costs and high interest rates. In addition, energy costs for the two larger drainage options are very high due to the large amount of seepage which must be pumped from the low lying area along the northwest boundary of the protected area.

The consideration of the various scenarios contained in this working paper <u>does not</u> imply that these scenarios are being advocated by the South Florida Water Management District. The District position regarding drainage and flood protection works in the subject area is clear - the District will not construct or contribute financially to such works. Moreover, this working paper does not constitute a regulatory review or position under Part IV, Chapter 373, F.S. Finally, it should be recognized that this is not a detailed engineering design study.

INTRODUCTION

A) Purpose

This analysis was initiated upon request dated August 5, 1981 from the Dade County Planning Department on behalf of the East Everglades Resource Planning Project. This study utilized three population and development scenarios provided by the Department to develop tentative drainage schemes for each and to evaluate the impacts of these specific drainage schemes. This analysis should provide sufficient detail to indicate whether it is worthwhile to allocate sufficient resources to complete a detailed study and to provide some indication of the direction detailed studies should take if they are authorized.

B) Background

Due to the unique geological characteristics south of Tamiami Canal and east of Everglades National Park, any type of drainage system that utilizes canals to provide positive drainage entails a substantial danger of inadvertent overdrainage of both the area for which flood protection was intended and the area surrounding it.

This problem can be visualized in a non-technical sense by imagining the underground rock as consisting of a "honeycomb of cavities" of varying sizes separated by walls of relatively impermeable rock. Strictly speaking, this picture of the underground rock is not exact, but is sufficient to illustrate the problem. In most cases the walls separating cavities provide sufficient structural strength to support large buildings and other engineered structures, so that the honeycomb nature is not readily apparent to the casual observer. It may, however, become significant to the underground flow of water when even small changes in the walls separating these "cavities" are made.

In the undisturbed condition this type of geology normally has high seepage rates, but the underground flow is kept under control by the walls separating the "cavities". When a canal or a deep ditch is dug through this type of rock, a strong possibility exists of breaking down the walls separating some of the larger cavities. The large cavities provide much less resistance to the flow of water than the smaller cavities, thus the underground flow of water may be speeded up considerably and the direction of flow altered as well.

Under more normal geologic conditions, control structures are placed in canals at appropriate intervals to maintain groundwater and canal water levels within desired ranges during times when full drainage capacity is not required. When this "honeycomb of cavities" exists, control structures may provide less control of water levels under non-flood conditions than is desired. This results from inadvertent connection of the larger cavities by the canal system which provides a strong possibility of greatly increased groundwater flow around the control structure by many and devious routes. Conventional geologic exploration techniques are not adequate to map the honeycomb structure in sufficient detail to eliminate this problem.

B) Background (continued)

To illustrate this problem, an example can be drawn from the network of canals operated by the South Florida Water Management District east of L-31N (the levee forming the eastern boundary of the East Everglades Area). It has not been possible to maintain water levels as high as desired upstream of the control structures during normal to dry hydrologic conditions. Since the East Everglades Area is an essential component of groundwater recharge to the coastal areas of south Dade County, any inadvertent lowering of groundwater levels in the East Everglades Area during normal to dry conditions could have extremely serious consequences to water supply and salinity intrusion in Dade County.

With this preface to the danger of overdrainage, it is with severe reservations as to the desirability of any type of additional channelization that the following drainage scenarios are offered for consideration along with the rationale for considering drainage improvements.

C) Non-Drainage Options

Given the projected population scenarios, the single alternative to drainage improvement is zoning restrictions and flood-proofing in the areas open for development. Flood-proofing must consist primarily of raising the elevation of roads, living areas, driveways, septic tank drainage areas, and work areas to a level commensurate with the level of damage, inconvenience, and health problems associated with extreme rainfall events. An analysis of the costs to the private and public sectors resulting from this type of alternative and an analysis of which roads and other public works would need to be upgraded are beyond the scope of this discussion.

The following disadvantages of flood-proofing are presented as adequate justification for considering drainage improvements:

1) The costs to the public sector such as upgrading roads and other utility improvements are substantial, particularly when applied to the type of residential areas normally associated with this zoning density.

2) Costs to the private sector for fill and landscaping are also substantial. This, in combination with lot sizes on the order of five acres, would probably restrict residential development to residences in the $100,000 and up range - resulting in further expectations for improvements from governmental agencies as mentioned in Item 1.

3) It is not practical to upgrade existing property development to more restrictive standards. Thus, as present property owners begin to experience weather conditions which are more normal than the last 10 years (which have been exceptionally dry) there will be increasing demands from the present owners of developed property for improved drainage. The situation may well be aggravated by any increase in development. Through a lack of understanding of the physical system or incomplete enforcement of criteria relating to interference with existing flow patterns, new development may increase water levels above that presently experienced under similar hydrologic events.

C) <u>Non-Drainage Options</u> (Continued)

Should pressure from the present holders of developed property (and/or new development for which exceptions have been granted) cause implementation of a drainage program after flood-proofing measures had already begun, the costs to both the public and private sector for flood-proofing within the area drained would have been wasted.

4) Enforcement of flood-proofing criteria must be strict and uniform for long periods of time in order for it to be effective (until the area is fully developed). This may be difficult to guarantee since the time span of development is often longer than the term of office of the administators having responsibility for enforcement. It is often hard to guarantee continuity of programs over this length of time.

DRAINAGE DESIGN COMMON TO ALL ALTERNATIVES

A) Basic Considerations

In order to minimize the adverse impacts of drainage of a part of the East Everglades Area on the south Dade area and the remainder of the East Everglades Area which is not provided drainage, the following basic considerations should be observed:

1) Keep the total drained area as small as possible.

2) Include, to the extent possible, all existing residential development.

3) Do not let drainage ditches cross land elevation contour lines.

4) Keep ditches as shallow as possible.

5) Store all water removed in a seepage reservoir at a land surface elevation not less than 6.5 ft. msl.

6) Maintain control elevations which trigger pump operation as close to land surface as possible.

7) Drain only the highest land elevations in the area.

8) Pay special attention to location relative to normal groundwater movement.

B) Generalized Design

1) Provide a pumped drainage of a primary ditch system with a levee on the outside of the protected area.

2) Provide a diked reservoir area above land surface to receive pumped discharge. Reservoir sized to prevent water depth exceeding 5 feet under normal conditions. Provide 5 feet of freeboard.

3) Provide a secondary drainage by ditches(6 feet deep, 5 feet bottom width) with 1:1 side slopes draining by gravity into a perimeter ditch system. Provide spacing at approximately 1 mile intervals so that swales providing access to individual sites need not be longer than 1/2 mile.

4) Provide individual site drainage by swale system connecting to secondary drains or primary ditch, as appropriate.

5) Provide a pump sized to remove 1-1/4 inch of free water per day. Pump to begin operation when water levels rise to elevation 6.0 ft. msl and pump down to elevation 5.5 ft. msl.

B) <u>Generalized Design</u> (Continued)

6) A private drainage district would be established by local interests in order to operate, maintain, and provide contract administration for the drainage works. This district would have the authority to collect an annual assessment on the basis of land area in order to finance construction and provide for operation and maintenance.

It would have the authority to issue property liens in case of non-payment. This district would also be responsible for obtaining the necessary rights of way for all reservoirs, project canals, and structures, as well as acquisition of rights of way and construction of swale drainage to provide each land parcel within the protected area access to the project facilities.

DRAINAGE SCENARIO 1

A) Description

Flood protection would be provided only on the area north of 168th Street and immediately west of L-31N. This area is delineated in Figure 1. Annual assessments to landowners are expected to be in the neighborhood of $160 per acre each year for 20 years.

Protection would be provided for a 10 year storm, with the pump set to go into operation when the stage in the canal rises to an elevation of 6.0 feet msl. The design is not adequate to handle extreme rainfall events such as occurred with tropical storm Dennis in 1981. The duration of flooding during this storm would, however, have been reduced to 10 days or less. It is not practical to provide full flood protection for this type of storm because of economic reasons. The annual assessment for protection from this type of storm would be well in excess of $1000 per acre each year for 20 years. Environmental and water supply damage due to overdrainage would also be severe.

B) Impact Assessment

1) Overdrainage and Water Supply

There is some potential for overdrainage with this option. The ditching system proposed might create the possibility of inadvertently interconnecting enough of the larger underground "honeycomb cavities" discussed earlier to greatly accelerate groundwater movement to the northeast. It is not possible to predict with any certainty the extent of the size, configuration, and the magnitude of the overdrainage problem. The relatively small size of the drained area and the establishment of a reservoir to receive the pumped discharge tend to reduce the possibility that overdrainage would occur. If the system acts as designed and the only effect on the hydrology of the protected area is the elimination of surface and groundwater stages higher than 6.0 feet msl, the impact on water supply to the Biscayne Aquifer would be very minor.

2) South Dade Conveyance System

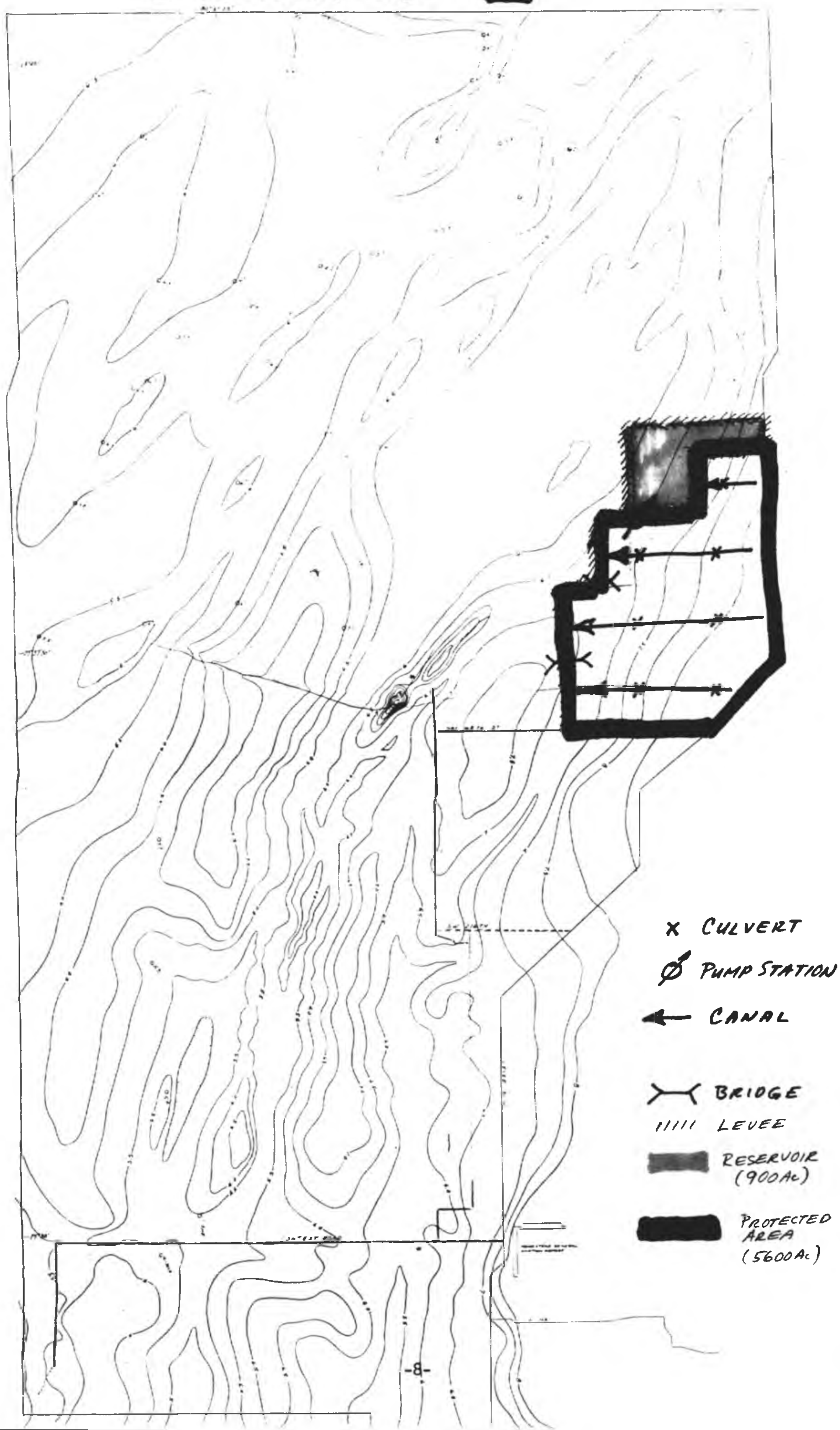
Similarly the effect of lowered water levels in this area is not expected to make a substantial difference in the design capability of the South Dade Conveyance System, because increased seepage losses are offset to a large extent by seepage gains from the reservoir which is adjacent to the L-31N borrow ditch.

3) Effects on Agriculture

The substantial assessments necessary to finance the drainage facilities and the increased pressures toward urbanization after flood protection is provided will largely preclude agricultural operations other than "backyard" farming and small, highly intensive operations.

This is another justification for keeping the area protected rather small and constraining it to the area where residential densities are presently highest.

SCENARIO 1



X CULVERT
PUMP STATION
CANAL
BRIDGE
///// LEVEE
RESERVOIR (900Ac)
PROTECTED AREA (5600Ac)

Drainage Scenario 1 (continued)

B) Impact Assessment

4) Social Effects

The relatively expensive drainage assessments in combination with minimum lot sizes of 5 acres will tend to cause a shift from agriculture, moderate income housing, and mobile homes to upper middle class ranchette type development due to the substantial investment in land associated costs. Concurrent with this shift in development patterns will probably be increased pressure for improved roads and other government services.

5) Water Quality

A small amount of surface water runoff presently reaches Everglades National Park (ENP) from the area to be protected under this scenario. This surface water would essentially be stopped but increased groundwater seepage out of the reservoir would probably make up the difference in quantity of water. While the net quantity of water reaching ENP from this area would probably remain about the same, the quality of the water may be slightly changed due to vegetative interactions in the reservoir and the natural filtering action of the soil media. Since the quantity of water involved is small, the impact is not expected to be large.

6) Environmental Effects

Vegetative changes are not expected outside of the protected area except in the reservoir area itself. A tendency toward a shift in vegetation to those associated with a longer hydroperiod may be expected in the reservoir, although the reservoir is expected to be dry for extended periods of time.

C) Cost Analysis - Scenario 1

1) First Cost

Land acquisition @ $1500/ac r/w; $2000/ac fee title	
Major canal r/w 150' wide x 6 miles = 108 ac	$ 162,000
Secondary canal r/w 30' wide x 7.8 miles = 28 ac	42,000
Swale r/w to indiv. plot 15' wide 32.7 ac/mile of secondary canal x 7.8 miles = 260 ac	- Gratis
Reservoir 900 ac	1,800,000
Sub-Total	2,004,000
Pumps 1 45,000 gpm pump station	170,000
Excavation	
Major canal 5.93 miles @ 73,392 cy/mile (375□ avg section) = 435,000 cy @ $2.20 cy	957,000
Secondary canal 7.82 miles @ 12,912 cy/mile (66□ avg section) = 101,000 cy @ $2.20 cy	222,200
Get-away channel in reservoir 1/2 mile @ 20,000 cy/mile = 10,000 cy @ $2.20 cy	22,000
Sub-Total	1,201,000
Emergency spilway in reservoir	30,000
Levee fill	
Perimeter levee TW 15', depth 4' (shape only) ss 1:3 (21,120 cy/mile) x 4 miles = 84480 cy @ $1.50	126,700
Reservoir levee TW 20', depth 10', ss 1:3 (98,000 cy/mile) x 6.0 miles = 588,000 cy @ $1.80	1,058,400
Sub-Total	1,185,100
Bridges 2 lane with shoulders 65' long 2 each @ 300,000	600,000
Culvert crossings 7 each @ 3400	24,000
Engineering supervision 5% of construction (3,210,300)	160,500
Contingencies 10% of $5,374,800	537,500
Legal start up	100,000
Total First Cost	$6,012,300

C) Cost Analysis - Scenario 1 (continued)

2) Operation and Maintenance

Pumping energy cost	
Avg 5,350 AF/yr with max demand 630 kw	
(300 cfs @ 10' head)	$ 38,500
Full time employee @ $20,000 maintenance, mowing, etc.	20,000
Equipment rental & repair	6,000
Aquatic weed control $230/ac on canal surface of 76 ac	17,500
Legal retainer & accounting	10,000
Misc 10% of $80,000	8,000
Total O&M	$ 100,000

Annual per acre assessment for O & M $17.86 per acre each year

Amortization of First Cost

Assume 20 yr life of facilities

$$PMT = PW \left(\frac{i}{1 - (i + 1)^{-n}}\right)$$

a) interest @ 7-3/4% - WRC official recommendation (constrained due to max rate of increase)

$$\$6,012,300 \times \left(\frac{.0738}{1 - (1.0738)^{-20}}\right) = 6,012,300 \times .097162$$

= $584,167/yr or $104.32/acre each yr

b) interest @ 10-1/4% - WRC preferred recommendation (if not constrained to max rate of increase)

$$6,012,300 \times \left(\frac{.1025}{1 - (1.1025)^{-20}}\right) = 6,012,300 \times 119470$$

= $718,289/yr or $128.27 per acre each yr

c) interest @ 15% - max to be considered

$$6,012,300 \times \left(\frac{.15}{1 - (1.15)^{-20}}\right) = \$6,012,300 \times .159761$$

= $960,531/yr of $171.52/ac each yr

2) Total Cost

Total assessment is equal to the annual O & M + Amortization of First Cost in lieu of a good estimate of current bond rates for new drainage districts a 10-1/4% interest rate is assumed making an estimate of the annual per acre assessment of $128.27 + 17.86 = $146.13 per acre or $730.65 per year for a typical 5 acre lot.

DRAINAGE SCENARIO 2

A) Description

Flood protection under this drainage scenario would be provided for the area delineated in Figure 2. This layout is not entirely satisfactory because there is not a suitable site (outside of the protected area) for a reservoir to receive the water from the south end. In addition, providing drainage in the low lying areas of the northwest corner of the protected area is an inefficient and possibly dangerous situation (in the sense of potential for overdrainage of the area). A more acceptable drainage design could be achieved if the northwest portion were deleted from the area of protection and a provision for dividing the reservoir area between the present location and an additional site adjacent to L-31N between 168th and 216th Streets.

Protection would be provided for a 10 year storm with pump A set to go into operation at a stage of 6.0 feet msl, pump B at 4.75 feet msl, and pump C at 4.75 feet msl. This design is not adequate to handle extreme rainfall events such as occurred with tropical storm Dennis in 1981. The duration of flooding during this storm would, however, have been reduced to 10 days or less.

Annual assessments to landowners is expected to be in the neighborhood of $160 per acre each year for 20 years.

B) Impact Assessment

1) Overdrainage and Water Supply

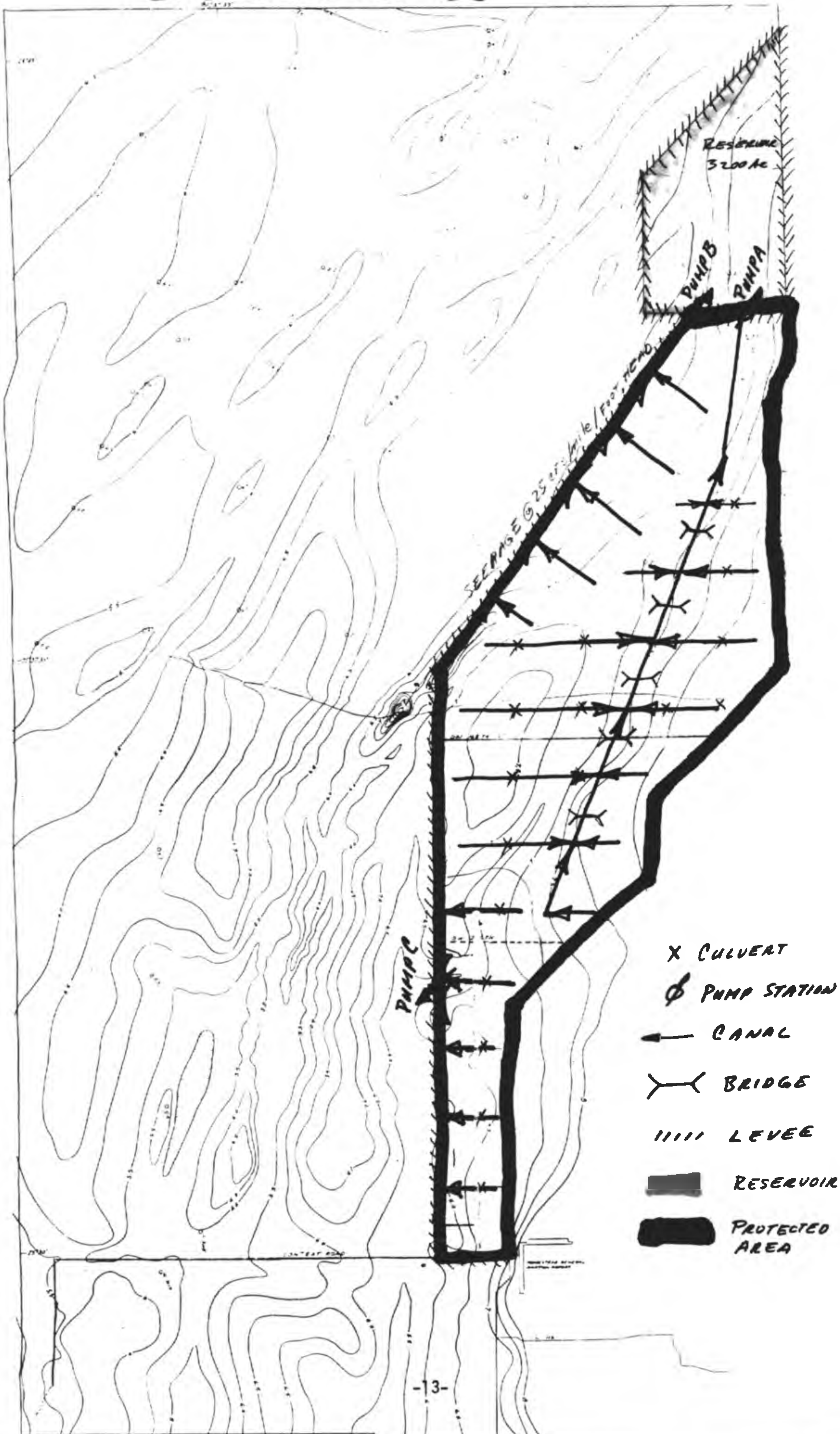
There is the potential for very severe impacts on water supply for the south Dade area under this scenario. Any inadvertant lowering of dry season water levels in the area south of 168th Street is unacceptable. This area is a major source of recharge for the wellfields west of Homestead which supply the Homestead area and the Florida Keys. These wellfields are stressed during drought periods under present demands and any reduction in recharge will probably require curtailing withdrawals for extended periods or risking severe and permanent salinity intrusion.

The drainage canals on the western boundary (those associated with pumps A and C), in conjunction with the low water levels which must be held in these canals, add substantially to the danger of overdrainage of the protected areas.

2) South Dade Conveyance System

Some impacts on the operation of the South Dade Conveyance System are possible under this drainage scenario, particularly if overdrainage should occur. Lower water levels in the portion of the protected area south of S-331 will increase seepage out of the L-31N downstream of S-331. While this is partially compensated by increased seepage out of the reservoir area, this increased seepage enters upstream of S-331, thus decreasing the effective pump capacity of S-331 in a manner similar to increased seepage through the structure.

SCENARIO 2



Reservoir 3200 Ac
PUMP B
PUMP A
SEEPAGE @ 25 cfs/mile/FOOT HEAD
PUMP C
X CULVERT
PUMP STATION
CANAL
BRIDGE
LEVEE
RESERVOIR
PROTECTED AREA

B) Impact Assessment

3) Effects on Agriculture

The substantial assessments necessary to finance the drainage facilities and the increased pressures toward urbanization after flood protection is provided will largely preclude agricultural operations other than "backyard" farming and small, highly intensive operations. Since the protected area encompasses nearly all of the land suitable (or marginally suitable) for agriculture, truck farming and most fruit growing operations would be effectively eliminated or prevented from developing in the East Everglades Area (the only exception being the area adjacent to L-31W south of the drained area.

4) Social Effect

The relatively expensive drainage assessments in combination with minimum lot sizes of 5 acres will tend to cause a shift from agriculture, moderate income housing, and mobile homes to upper middle class ranchette type development due to substantial investment in land costs. Concurrent with this shift in development patterns will be increased pressure for improved roads and other governmental services in widely separated, highly localized areas.

It seems extremely unlikely that the population will increase from the current 450 to the projected 12,700 necessary to fully utilize the protection provided within a short time after project construction. This will make collection of annual assessments by the drainage district extremely difficult and foreclosures will probably be common.

5) Water Quality

Approximately one-half of the surface water presently developed in the protected area currently drains into North East Shark River Slough. From there the portion which is not involved in the evapotranspiration process enters Everglades National Park near the southern end of L-67 extension. The remainder flows to Taylor Slough eventually entering the Park near the east entrance.

The quality of the water entering North East Shark River Slough is expected to change somewhat due to a shift from surface water flow to groundwater flow and possible nutrient removal by vegetation in the reservoir. Quantity will probably increase due to a shift in drainage divides and interception of groundwater which would normally move eastward.

The opposite is true for the portion of surface water that currently flows to Taylor Slough. Increased surface water runoff associated with improved drainage will be largely offset by a shift in drainage divides which diverts a larger portion to the north. Water quality is expected to be degraded somewhat due to increased development and a larger component from surface water than was the case historically.

Drainage Scenario 2 (continued)

B) Impact Assessment

6) Environmental Effects

No substantial changes in vegetation or hydroperiod is expected outside of the protected area with the exception of the reservoir and in Taylor Slough near pump station C.

A tendency toward a shift in vegetation to those species associated with a longer hydroperiod may be expected in the reservoir. Pumping of seepage from pump B is expected to keep the reservoir area wet.

Major changes in the annual hydroperiod of Taylor Slough are not expected. The character of the flow near pump station C is expected to change somewhat. There will be a tendency toward much higher peak stages of shorter duration which will dampen out to more normal hydrographs further downstream from the pump. It is not clear whether this change in surface water flow characteristics and water quality will change vegetation characteristics. The potential for ecologically significant shifts exists.

C) <u>Cost Analysis</u> - <u>Scenario 2</u>

1) <u>First Cost</u>

Land acquisition @ $1500/ac r/w, $2000/ac fee	
Canal A r/w 3 miles x 170' &	
primary 4 miles x 160' + 2 miles x 90' = 161/ac =	$ 242,000
secondary 30' x 26 miles = 94/ac =	142,000
Canal B r/w	
Primary 5 miles @ 80' = 50/ac	73,000
secondary 4-1/2 miles @ 30' = 16/ac	24,000
Canal C r/w	
Primary 5 miles @ 80' = 50/ac	73,000
secondary 5-1/2 miles @ 30' = 20/ac	30,000
swale r/w 15' wide 32/7 ac/mile of	
secondary = 32.7 x 40 1300/ac	Gratis
perimeter levee r/w 120' x 16 miles = 233/ac	350,000
Reservoir 3200/ac @ $2000	6,400,000
Sub-Total	7,334,000
Emergency Spillway in Reservoir	
Pump Sta. A 900 cfs, Sta. B 200 cfs, Sta. C 200 cfs	738,000
Excavation	
Canal A	
Major 3 miles @ 244,000 cy/miles + 4 miles @ 195,000	
+ 2 miles @ 56,320 = 1,624,640 @ $2.20	3,574,000
secondary 26 miles @ 12,912 cy/mile = 355,710 cy @ $2.20	738,500
Canal B	
Major 5 miles @ 33,000 cy/mile = 165,000 cy @ $2.20	363,000
secondary 4-1/2 miles @ 12,910 cy/mile 58,000 cy @ $2.20	128,000
Canal C	
Major 5 miles @ 33,000 cy/mile = 165,000 cy @ $2.20	363,000
secondary 5-1/2 miles @ 12,910 cy/mile = 71,000 cy @ $2.20	156,000
Get away channels in reservoirs 3/4 mile	
@ 2000 cy/mile = 15000 cy @ $2.20	33,000
Sub-Total	5,355,000
Levee Fill	
Perimeter Levee	
16 miles @ 21120 cy/mile = 338,000 cy @ $1.80 (haul & ship)	608,000
Reservoir levee 11 miles @ 98,000 cy/mile =	
1,078,000 cy x $1.80	1,940,000
Sub-Total	2,548,000
Bridge 2 line with shoulders	
4-120' long $800,000	
1-60' long $300,000	3,500,000
Culvert crossings	
16 each @ 3,400	55,000
Engineering & supervision 5% of construction ($12,296,000)	615,000
Contingencies 10% of $19,630,000	1,963,000
Legal Start Up	200,000
TOTAL FIRST COST	$22,408,000

C) Cost Analysis - Scenario 2 (continued)

2) Operation & Maintenance

Pumping Energy Cost		
Avg 19,100 AF/yr with max demand 2,730 kw (1300 cfs @ 10' head)		$ 122,000
See page from Area B		131,300
Salaries		90,000
Equipment		20,000
Aquatic weed control $230/ac on 231/ac canal surface		53,000
Legal retainer and accounting		10,000
Contingencies 10% of $416,000		42,000
	Total O & M	468,300

Annual per acre O & M = $23.42

Amortization of First Cost

Assume 20 yr life and interest rate of 10.25%

Annual payment = 22,408,000 $\left(\frac{.1025}{1 - (1.1025)^{-20}}\right)$ = 2,677,000

or $133.85 per acre

3) Total Cost

Total assessment is equal to annual O & M + amortization of first cost. In lieu of a good estimate of current bond rates a 10-1/4% interest rate is assumed. The estimate of annual assessment is then $157.27 per acre or $786.33 per year for a typical 5 acre lot.

DRAINAGE SCENARIO 3

A) <u>Description</u>

Flood protection under this drainage scenario would be provided for the area delineated in Figure 3. This layout is not entirely satisfactory because there is not a suitable site (outside of the protected area) for a reservoir to receive the water from the south end. In addition, providing drainage in the low lying areas of the northwest corner of the protected area is an inefficient and possibly dangerous situation (in the sense of potential for overdrainage of the area). A more acceptable drainage design could be achieved if the northwest portion were deleted from the area of protection and a provision for dividing the reservoir area between the present location and an additional site adjacent to L-31N between 168th and 216th Street.

Protection would be provided for a 10 year storm with pump A set to go into operation at a stage of 6.0 feet msl, pump B at 4.75 feet msl, and pump C at 4.75 feet msl. This design is not adequate to handle extreme rainfall events such as occurred with tropical storm David in 1981. The duration of flooding during this storm would, however, have been reduced to 10 days or less.

Annual assessments to landowners is expected to be in the neighborhood of $160 per acre each year for 20 years.

B) <u>Impact Assessment</u>

1) <u>Overdrainage and Water Supply</u>

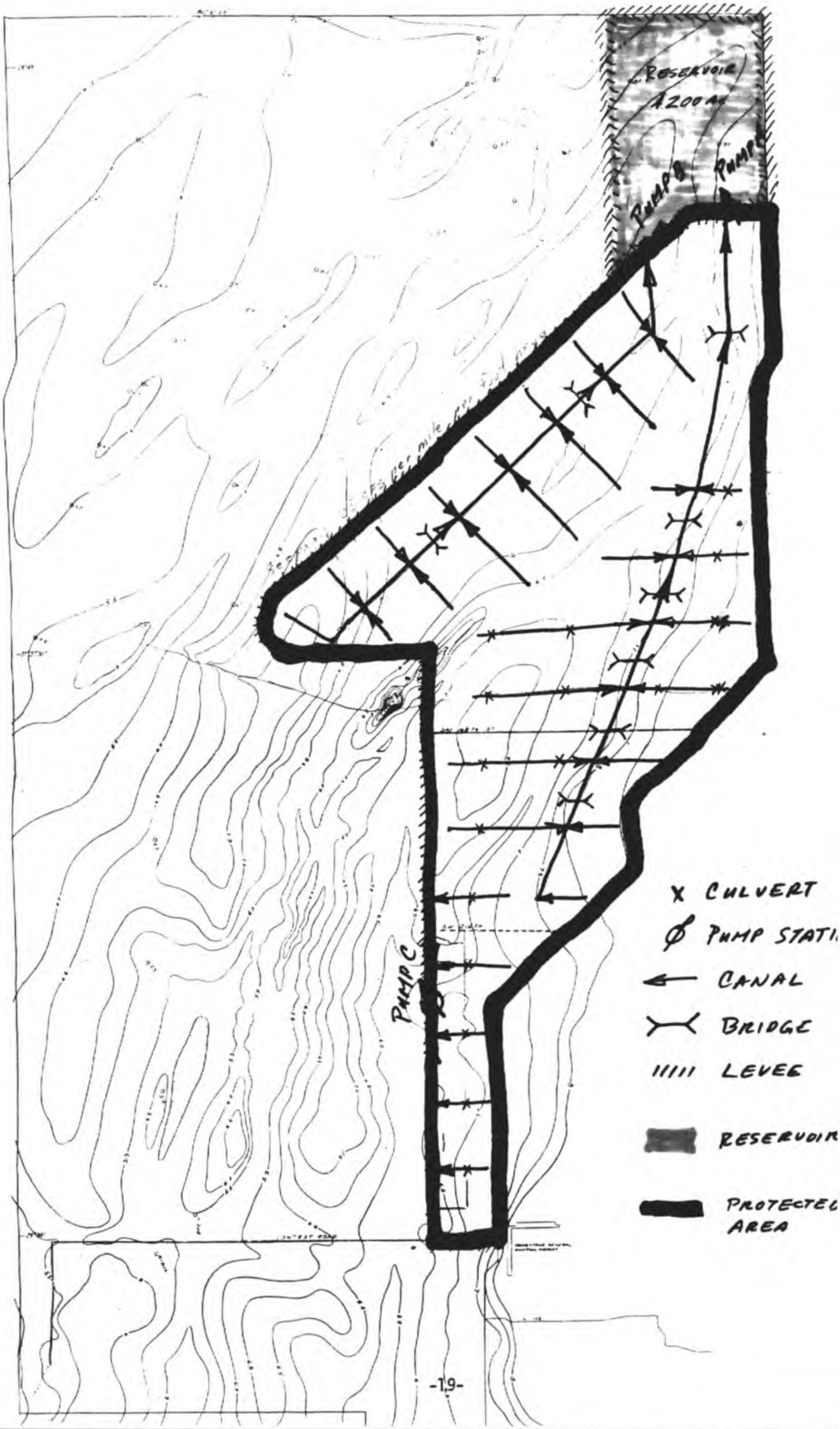
There is a potential for very severe impacts on water supply for the south Dade area under this scenario. Any inadvertent lowering of dry season water levels in the area south of 168th Street is unacceptable. This area is a major source of recharge for the wellfields west of Homestead which supply the Homestead area and the Florida Keys. These wellfields are stressed during drought periods under present demands and any reduction in recharge will probably require curtailing withdrawals for extended periods or risking severe and permanent salinity intrusion.

The drainage canals on the western boundary (those associated with pumps A and C), in conjunction with low water levels which must be held in these canals, add substantially to the danger of overdrainage of the protected area.

2) <u>South Dade Conveyance System</u>

Some impacts on the operation of the South Dade Conveyance System are possible under this drainage scenario, particularly if overdrainage should occur. Lower water levels in the portion of the protected area south of S-331 will increase seepage out of the L-31N downstream of S-331. While this is partially compensated by increased seepage out of the reservoir area, this increased seepage enters upstream of S-331 thus decreasing the effective pump capacity of S-331 in a manner similar to increased seepage through the structure.

SCENARIO 3



RESERVOIR
1200 AF
PUMP B
PUMP A
PUMP C
x CULVERT
Ø PUMP STATI
← CANAL
BRIDGE
///// LEVEE
RESERVOIR
PROTECTED AREA

Drainage Scenario 3 (continued)

B) Impact Assessment

3) Effects on Agriculture

The substantial assessments necessary to finance the drainage facilities and the increased pressures toward urbanization after flood protection is provided will largely preclude agricultural operations other than "backyard" farming and small, highly intensive operations. Since the protected area encompasses nearly all of the land suitable (or marginally suitable) for agriculture, truck farming and most fruit growing operations would be effectively eliminated or prevented from developing East Everglades Area (the only exception being the area adjacent to L-31W).

4) Social Effect

The relatively expensive drainage assessments in combination with minimum lot sizes of 5 acres will tend to cause a shift from agriculture, moderate income housing, and mobile homes to upper middle class ranchette type development due to substantial investment in land costs. Concurrent with this shift in development patterns will be increased pressure for improved roads and other governmental services in widely separated, highly localized areas.

It seems extremely unlikely that the population will increase from the current 450 to the projected 18,000 necessary to fully utilize the protection provided within a short time after project construction. This will make collection of annual assessments by the drainage district extremely difficult and foreclosures will probably be common.

5) Water Quality

Approximately one-half of the surface water presently developed in the protected area currently drains into North East Shark River Slough. From there the portion which is not involved in the evapotranspiration process enters Everglades National Park near the southern end of L-67 extension. The remainder flows to Taylor Slough eventually entering the Park near the east entrance.

The quality of the water entering North East Shark River Slough is expected to change somewhat due to a shift from surface water flow to groundwater flow and possible nutrient removal by vegetation in the reservoir. Quantity will probably increase due to a shift in drainage divides and interception of groundwater which would normally move eastward.

The opposite is true for the portion of surface water that currently flows to Taylor Slough. Increased surface water runoff associated with improved drainage will be largely offset by a sift in drainage divides which diverts a larger portion to the north. Water quality is expected to be degraded somewhat due to increased development and a larger component from surface water than was the case historically.

Drainage Scenario 3 (continued)

B) Impact Assessment

6) Environmental Effects

No substantial changes in vegetation or hydroperiod is expected outside of the protected area, with the exception of the reservoir and in Taylor Slough near pump station C.

A tendency toward a shift in vegetation to those species associated with a longer hydroperiod may be expected in the reservoir. Pumping of seepage from pump B is expected to keep the reservoir area wet.

Major changes in the annual hydroperiod of Taylor Slough are not expected. The character of the flow near pump station C is expected to change somewhat. There will be a tendency toward much higher peak stages of shorter duration which will dampen out to more normal hydrographs further downstream from the pump. It is not clear whether this change in surface water flow characteristics and water quality will change vegetation characteristics to any large degree. The potential for ecologically significant shifts exists.

C) Cost Analysis - Scenario 3

1) First Cost

Land Acquisition		
Canal A R/W		
Primary 4 miles x 170' + 4 miles @ 160' + 2 miles @ 90' = 182/ac		273,000
secondary 30' x 26 miles = 94/ac		142,000
Canal B R/W		
Primary 6 miles @ 150' + 3 miles @ 110' = 149/ac		223,500
secondary 17-1/2 miles @ 30' = 63/ac		94,500
Canal C R/W		
Primary 5 miles @ 80' = 50/ac		73,000
secondary 5-1/2 miles @ 30' = 20/ac		30,000
Swale NW 32.7 + 53 miles = 1733/ac		Gratis
Reservoir 4200/ac @ $2000		8,400,000
Levee R/W 20 miles @ 120' - 29/ac		436,000
	Sub-Total	9,672,000
Emergency spillway in reservoir		130,000
Pumps Station A 9-45,000 gpm units = 900 cfs		510,000
Station B 6-45,000 gpm units = 600 cfs		340,000
Station C 2-45,000 gpm units = 200 cfs		114,000
	Sub-Total	964,000
Excavation		
Canal A		
Primary 4 miles @ 244,000 + 4 miles @ 195,000 + 2 miles @ 56,320= 1,868,640 cy @ $2.20		4,111,000
Secondary 26 miles @ 12,912 = 335,710 cy @ $2.20		738,000
Canal B		
Primary 6 miles @ 150,000 + 3 miles @ 88,000 = 1,164,000 cy @ $2.20		2,561,000
Secondary 17-1/2 miles @ 12,912 = 225,960 cy @ $2.20		497,000
Canal C		
Major 5 miles @ 33,000 = 165,000 cy @ $2.20		363,000
Secondary 5-1/2 miles @ 12,910 = 71,000 cy @ $2.20		156,000
Get away channel in reservoir 3/8 mile @ 20,000 = 15,000 cy @ $2.20		33,000
	Sub-Total	8,459,000
Levee Fill		
Perimeter levee 20 miles @ 21,120 = 422,400 cy @ $1.80		760,000
Reservoir levee 12 miles @ 98,000 = 1,176,000 cy @ $1.80		2,117,000
	Sub-Total	2,877,000

C) Cost Analysis - Scenario 3 (continued)

1) First Cost

Bridges 2 lane with shoulders 3 - 130' long @ 900,000 4 - 120' long @ 800,000 1 - 60' long @ 300,000	$6,200,000
Culvert Crossings 17 @ $3,400	58,000
Engineering & supervision 5% of construction ($18,688,000)	934,000
Contingencies 10% of $28,360,000	2,836,000
Legal start up	250,000
Total First Cost	32,380,000

2) Operation and Maintenance

Pumping Energy Cost Average volume pumped 29,180AF/YR with max. power demand of 3600 kw (1700cfs @ 10' head	165,000
seepage from Area B	319,000
Salaries	110,000
Equipment	25,000
Aquatic weed control $230/ac on 356 acres of canal surface Canal A 185ac, Canal B 139ac, Canal C 32ac	82,000
Legal retainer & accounting	10,000
Contingencies 10% of $701,000	70,000
Total O&M	781,000

Annual per acre cost $26.03

Amortization of First Cost

Assume 20 yr life and interest @ 10.25%

Annual payment = $32,380,000 \left(\frac{.1025}{1 - (1.1025)^{-20}}\right) =$ 3,868,000

or $129.00/acre

3) Total Cost

The total assessment is equal to annual O&M plus amortization of first cost. In lieu of a good estimate of current bond rates a 10-1/4% interest rate is assumed. The estimate of annual assessment is then $155.03 per acre or $775.17 per year for a typical 5 acre lot.

A) Pumping Energy Cost

FP&L rate structure as per 9-28-81

1) Monthly charge \$25
2) Consumption charge
   1st 20 kwh @ 3.4634¢/kw.hr
   over 20kwh @ 2.823¢/kw.hr
3) Demand charge
   1st 20 kw free
   over 20 kw \$2.56/kw
4) Add 9.06%
5) Fuel adjustment 2.745¢/kw.hr

Scenario 1

Installed capacity 300 cfs (600af/day) @ 10' head
avg yearly volume pumped = 5350 af/yr
avg hours pumped per month @ capacity = $\frac{5350 \times 24\text{hr}}{600 \times 12 \text{ month}} = 17.83$ hrs

whp = $\frac{300\text{cfs} \times 62.4 \times 10'}{550} = 340$ hp @ 40% efficiency

$\frac{340 \text{ hp}}{.4} = 851\text{hp} \times .746 \frac{\text{kw}}{\text{m}} = 630$ kw demand

avg monthly consumption = 630 x 17.83 = 11,230 kwh/month

monthly bill = [\$25 + 11,230 (\$.03463) + (630 - 20) \$2.56] 1.09

+ 11,230 x \$.02745 = \$2461.65/month

avg yearly bill \$29,500

Scenario 2

Installed capacity 1300cfs (2600af/day) @ 10' head
Avg yearly volume pumped $\left(\frac{20,000}{5,500}\right) 5350 = 19,454$ af/yr
avg hrs pumped per month @ capacity = $\frac{19,454 \times 24}{26,000 \times 12} = 14.96$ hr

whp = $\frac{1300 \text{ cfs} \times 62.4 \times 10'}{550} = 1475$ hp @ 40% efficiency

capacity demand = $\frac{1475 \text{ hp}}{.4} \times .746$ kwh/hp = 2750 kw

avg month consumption = 2750 x 14.96 = 41,140 kwh/month

monthly bill = [\$25 + \$.03463 (20,000) + \$.02823 (41,140 - 20,000)

+ (2750 - 20) \$2.56] 1.09 + \$.-2745 x 41,140 = \$10,180

avg yearly bill = \$122,000

Appendix (continued)

A) Pumping Energy Cost - Scenario 3

installed capacity 1700 cfs (3400 af/day) @ 10' head

avg yearly volume pumped = $\left(\frac{30,000}{5,500}\right)$ 5350 = 29,182 af/yr

avg hrs pumped per month @ capacity = $\frac{29,182 \times 24}{3400 \times 12}$ = 17.17 hrs/month

whp = $\frac{1700 \text{ cfs} \times 62.4 \times 10'}{550}$ = 1930 hp @ 40% efficiency

capacity demand = $\frac{1930}{.4}$ hp x .746 kwh/hp = 3600 kw

avg month consumption = 36kw x 17.17 hr = 61,812 kwh/month

monthly bill = [$25 + $.03463 (20,000) + $.02823 (61,812 - 20,000)

+ (3600 - 20) $2.56] 1.09 + $.02745 x 61,812 = $13,755

avg yearly bill $165,000

Seepage from Area B - Alternative 3

Seepage @ 500 af/day = 182,500 af/yr

additional pumping cost Area B for seepage @ 600 cfs = 360 hrs/month

B 600 cfs = 457,040 kwh/month

add to monthly bill for pumping seepage from Area B

$26,610 = $319,320/yr

Seepage from Area B - Alternative 2

Seepage @ 275 af/day = 100,375 af/yr

@ 300 cfs = 335 hrs/month = 187490 kwh/month

add to monthly bill for seepage pumping $10,942 = $131,300/yr

Appendix (continued)

Cavaets:

The consideration of the various scenarios contained in this working paper does not imply that these scenarios are being advocated by the South Florida Water Management District. The District position regarding drainage and flood protection works in the subject area is clear - the District will not construct or contribute financially to such works. Moreover this working paper does not constitute a regulatory review or position under Part IV, Chapter 373, F.S. Finally, it should be recognized that this is not a detailed engineering design study.

WORK REQUEST

METROPOLITAN **DADE** COUNTY, FLORIDA

PLANNING DEPARTMENT
SUITE 900, BRICKELL PLAZA
909 S.E. 1ST AVENUE
MIAMI, FLORIDA 33131
(305) 579-2800

noted: PR 8/11/81
1. Marban
See me.

August 5, 1981

Mr. Pete Rhoads, Director
Resource Planning
South Florida Water Management District
Box V
West Palm Beach, Fl. 33402

Dear Pete:

Enclosed is a staff working paper outlining three scenarios for the future zoning in the East Everglades. As I mentioned in our conversation on Monday, Scenario A is included in the most recent draft zoning ordinance as the County staff recommendations for the development of the East Everglades. As such, it should be regarded as a "best case" future for the area, with Scenario B a very real prospect. Scenario C is an approximation of the land use recommendations suggested by the attorney for the Rural Southwest Dade Property Owners Association and could be characterized as a worst case event.

There exist within the property owners a very strong opinion that much of the East Everglades does not need flood protection, and that those areas in need can be protected without impacting water supplies. Of greater concern is the seemingly low level of interest within Dade County that indicates either (1) a lack of understanding of the magnitude of the problem, or (2) a belief that the residential buildout can occur without drainage or (3) that if drainage is needed, engineers can solve any water supply problems that might arise. It is clear that if these perceptions prevail at the public hearing on the zoning overlay ordinance, the County and the Water Management District will be facing some difficult times in the future.

Accordingly, I have prepared a list of questions for each scenario that I think must be answered concisely and in layman's terms in the context of the public hearing in October. There are certainly other equally important issues that will occur to you and you should feel free to address them.

1. Is it realistic to expect that a buildout to the proposed density can occur without flood protection?

2. What flood protection options are available for the scenario? Is it possible to provide flood protection without drainage?

3. What will be the water supply impacts of the flood protection required for the scenario?

4. Would the SFWMD issue a surface water management permit for the needed drainage?

5. How much would the necessary flood protection system cost to build and maintain and where would the funding come from?

I am aware of the heavy workload that the District has for August and September and apologize for the timing of these questions. However, the difference between the Steering Committee's recommendation and the present "best case" scenario in the draft ordinance should give you an idea of the direction that Dade County is moving in. Having worked with you over the last five years towards a proper solution to the resource management problem, I am convinced that you also will want the Board of County Commissioners to be fully aware of the consequences of their actions on land use regulations in the East Everglades.

Sincerely,

Sam

Sam Poole, Director
East Everglades Resources
Planning Project

SP:ss

(scenarios revised in accordance
with 8-17-81 working paper.)

Summary of Zoning Scenarios

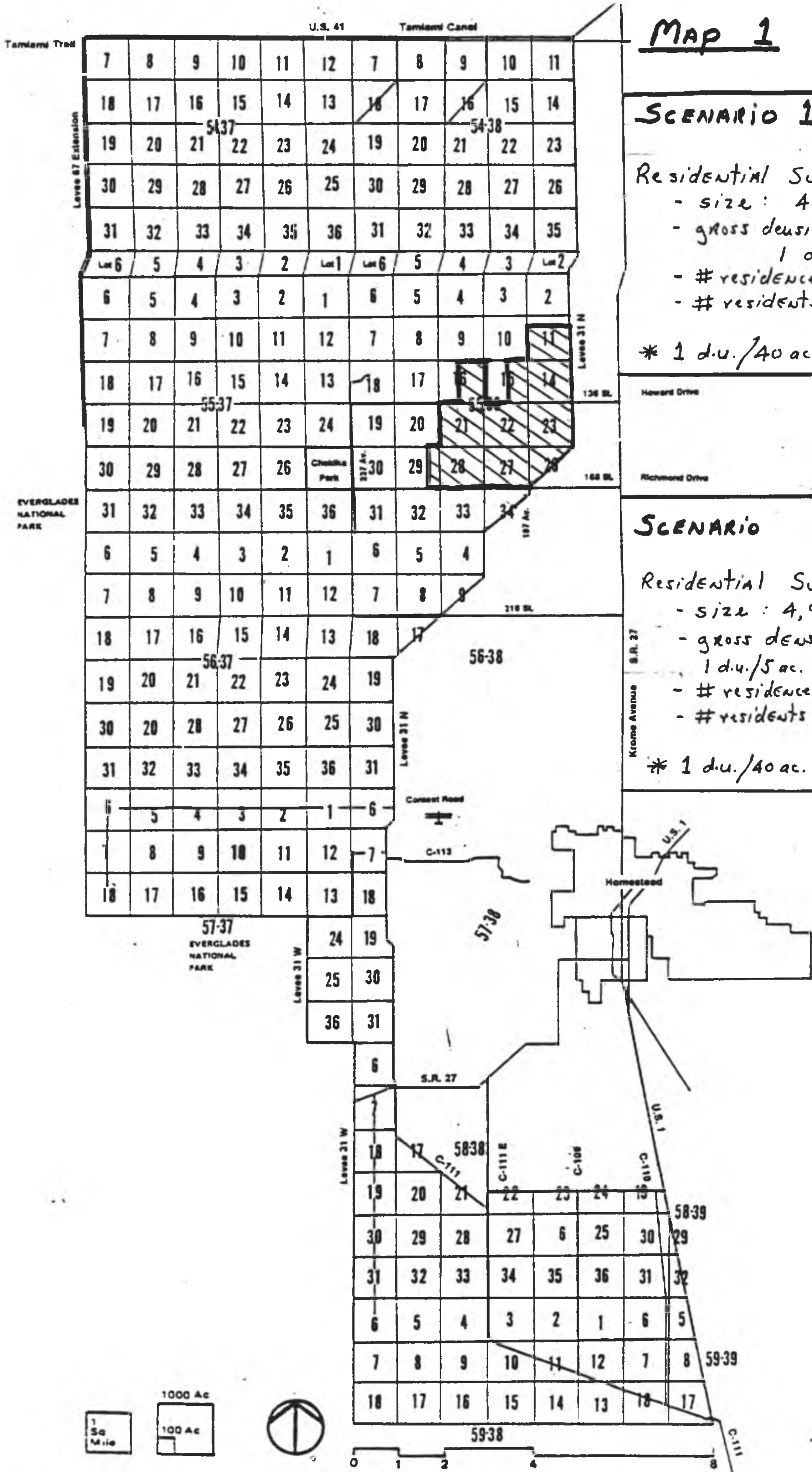
Scenario A

This zoning scenario presumes a gross density of 1 d.u. per 5 acres in the residential portion of Management Area 1 (all of Management Area 1 north of S.W. 168 St. less the north 1/4 of Section 11 and the west 1/2 of Section 15 in Township 55E, Range 38S) and a density of 1 d.u. per 40 acres in the agricultural portion of Management Area 1 as well as Management Areas 2A, 2B, 3A, 3B, and 3C. There are now about 280 residences (houses or mobile homes) in the East Everglades and 95% of them are located in the residential portion of Management Area 1. A buildout of 900 dwelling units in the residential subzone would be a substantial increase in the number of residences in this subarea. Assuming 2.6 persons per d.u., approximately 2,160 people would live in the residential subzone of Area 1.

The primary conditional uses would be for properties which have 200 feet of frontage along Tamiami Trail or U.S. 1 and a minimum lot size of 5 acres. 133 parcels along Tamiami Trail meet this criteria.

This scenario also assumes that a sufficient number (to service the proposed density) of minimum standard roads (i.e. filled, paved, and culverted) would be provided in Management Areas 1, 3B, and 3C. Access to property in Management Areas 2A, 2B, and 3A would be by airboat or ORV.

Map 1



East Everglades Resources Planning Project

Scenario 1:

Residential Subarea
- size: 4,900 acres
- gross density: 1 du./5 ac.
- # residences - 980
- # residents - 2940

* 1 d.u./40 ac. elsewhere

Scenario 1A:

Residential Subarea
- size: 4,900 acres
- gross density: 1 d.u./5 ac. w/grandfath[er]
- # residences - 1455
- # residents - 4365

* 1 d.u./40 ac. elsewhere

TABLE 1

Scenario 1

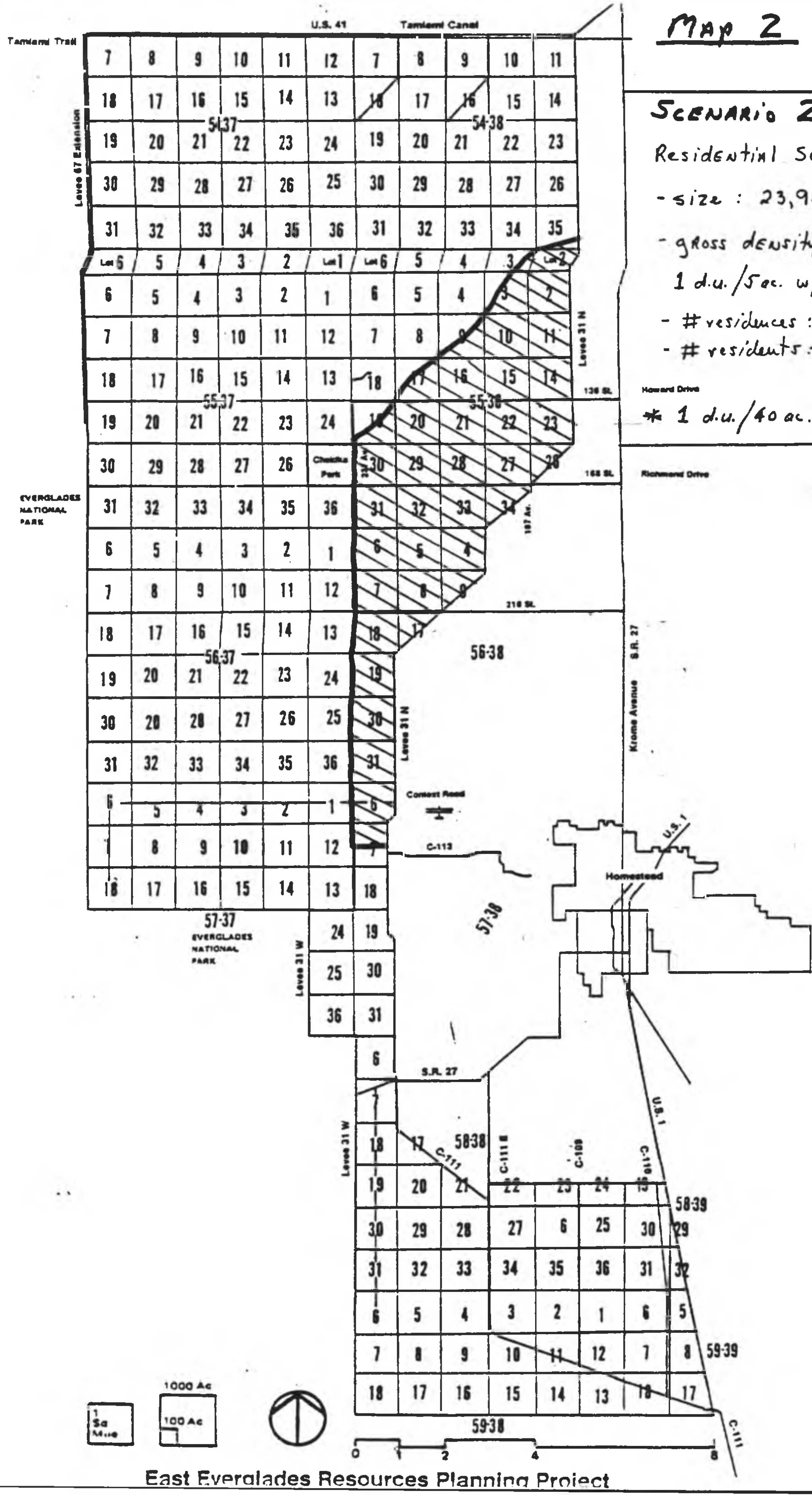
Management Area	Total Acreage	Gross Density	# Residences @ Buildout	Population @ Buildout
1- Residential	4,900	1:5	980	2,940
1- Agricultural	9,600	1:40	240	720
2A	46,400	1:40	1,160	3,480
2B	25,600	1:40	640	1,920
3A	23,700	1:40	592	1,776
3B	12,000	1:40	300	900
3C	31,600	1:40	790	2,370
Total	153,800	___	4,702	14,106

TABLE 2

Scenario 1A

Management Area	Total Acreage	Gross Density	# Residences @ Buildout	Population @ Buildout
1- Residential	4,900	Grandfathered at 1:5	1,455	4,365
1- Agricultural	9,600	1:40	240	720
2A	46,400	1:40	1,160	3,480
2B	25,600	1:40	640	1,920
3A	23,700	1:40	592	1,776
3B	12,000	1:40	300	900
3C	31,600	1:40	790	2,379
Total	153,800	___	5,177	15,531

Map 2



East Everglades Resources Planning Project

Scenario 2:

Residential Subarea

- size : 23,940 acres
- gross density:
  1 d.u./5 ac. w/grandfather
- # residences : 6013
- # residents : 18,039

* 1 d.u./40 ac. elsewhere

residential subarea delineated in the previous scenarios and to Management Area 3B north of SW 168th St. (Richmond Drive). This expanded residential subarea totals 10,340 acres. Zoning of one dwelling unit on five acre lots (no grandfathering) is applied to the agricultural area in Managment Area 1 and to 3C south of SW 152nd Street. Table 3 presents the assumptions and buildout figures for each management area. This scenario will yield 9,260 residences throughout the entire study area with a total population of 27,780.

<u>Scenario 3</u>

This scenario extends five acre minimum building densities to over 30,000 acres. Map 3 delineates the residential area for Scenario 3. The highest density residential area, which allows 1.25 to 5 acre lots, remains the same as in Scenario 2. However, the next higher density category (five acre lots) is expanded to include Management Area 3C north of SW 152nd Street containing 9,920 acres. Table 4 presents the assumptions and buildout figures by management area for this scenario. Residences in the East Everglades under Scenario 3 will total 10,996, yielding a total population of 32,989.

TABLE 3

Scenario 2

Management Area	Total Acreage	Gross Density	# Residences @ Buildout	Population @ Buildout
1- Residential	4,900	Grandfathered at 1.5	1.455	4,365
1- Agricultural	9,600	1:5	1,920	5,760
2A	46,400	1:40	1,160	3,480
2B	25,600	1:40	640	1,920
3A	23,700	1:40	593	1,779
3B- N. of 168 St.	5,440	Grandfathered at 1.5	1,838	5,514
3B- S. of 168 St.	6,560	1:40	164	492
3C- S. of 152	4,000	1:5	800	2,400
3C- Remainder	27,600	1:40	690	2,070
Total	153,800	—	9,260	27,780

TABLE 4

Scenario 3

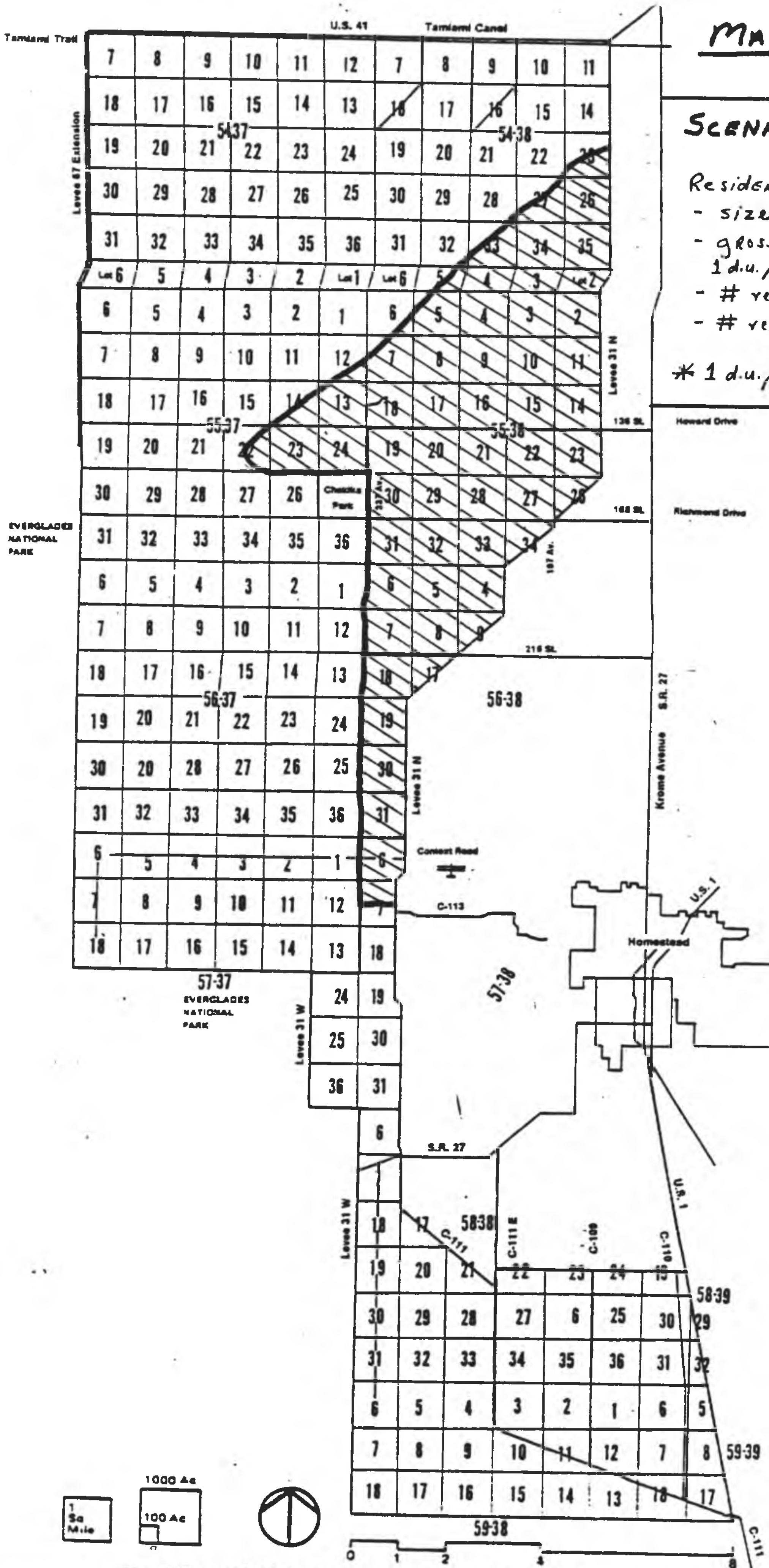
Management Area	Total Acreage	Gross Density	# Residences @ Buildout	Population @ Buildout
1- Residential	4,900	Grandfathered @ 1.5	1,455	4,365
1- Agricultural	9,600	1:5	1,920	5,760
2A	46,400	1:40	1,160	3,480
2B	25,600	1:40	640	1,920
3A	23,700	1:40	593	1,779
3B- N. of 168 St.	5,440	Grandfathered @ 1:5	1,838	5,514
3B- S. of 168 St.	6,560	1:40	164	492
3C- N. of 152 St.	9,920	1:5	1,984	5,952
3C- S. of 152 St. and E. of 237 Ave.	4,000	1:5	800	2,400
3C-S. of 152 St. and W. of 152 St.	17,680	1:40	442	1,326
Total	153,800	—	10,996	32,988

Map 3

Scenario 3:

Residential Subarea
- size : 33,860 acres
- gross density : 1 d.u./5 ac. w/ grandfathe
- # residences : 7,997
- # residents : 23,991

* 1 d.u./40 ac. elsewhere



East Everglades Resources Planning Project

Dade County Planning Department
August 17, 1981

Residential Land Use Scenarios for the East Everglades Area

Introduction

This working paper presents four scenarios of future development in the East Everglades area of Dade County. They are proposed in order to enable the assessment of significant impacts resulting from each projection. The scenarios assume total residential buildout at a stated zoning density.

Residence and Population Projections

The development of residence and population estimates for each scenario involved the following steps. First, the total acreage was determined for each building density category, either one unit per five acres or 40 acres. Then the acreage figures were divided by the appropriate minimum lot size (5 or 40) giving the total residences per zoning category.

This methodology was supplemented in Scenarios 1A, 2, and 3 to allow for (grandfathered) substandard lots in the highest density residential subarea. To estimate grandfathered parcels the parcelization characteristics of each section of land were examined and estimates of future trends were made. Additional residences due to grandfathering were added to the base projection for each land section.

The scenarios assume an average household size of 3.0 persons. This is a projection based on a residential survey of single family homes in the East Everglades area in 1978 which should show an average household size of 4.0 persons and the Florida census average of 2.55. Total estimated residences multiplied by average household size gives estimated populations in each scenario.

Scenario 1

As currently drafted, the proposed Zoning Overlay Ordinance for the East Everglades study area contains a residential subarea, 4900 acres in size, where the current zoning density of one dwelling unit per 5 acre parcel would apply. However, "grandfathering" of substandard parcels (less than 5 acres) would not be permitted. These assumptions are the basis for Scenario 1. Map 1 shows the location of the residential subarea. The remaining 150,000 acres of the study area are assumed to buildout at one unit per 40 acres. Table 1 presents total acreage, gross density, residences, and population by management area for this scenario. The residential subarea would have 980 units generally on five acre tracts, while the entire East Everglades would have 4702 units.

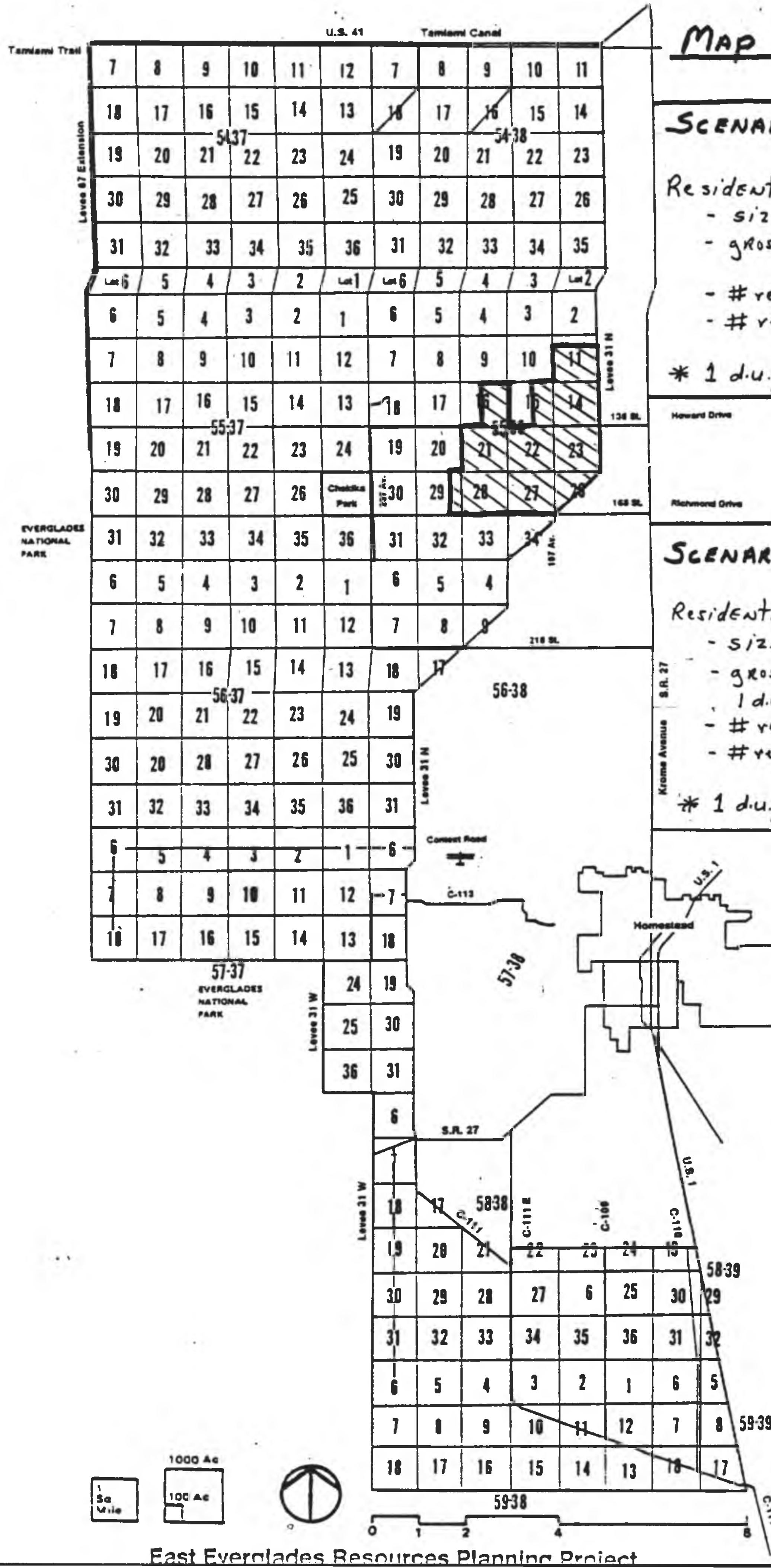
Scenario 1A

This scenario takes the assumptions from Scenario 1 and adds the grandfathering clause in the higher density residential subarea. This clause permits substandard parcels with a building right under current zoning regulations to retain that status. Thus the residential subarea remains 4900 acres in size (Map 1), but building lots will vary from 1.25 acres to five acres in size. Table 2 indicates the density assumptions, acreages, and buildout totals for each management area. Total units in the residential subarea are estimated at 1455 units, while the entire area would contain 5,177 units at buildout.

Scenario 2

This scenario assumes substantial residential density increases in most of Management Area 1 and parts of 3B and 3C. Map 2 shows the expanded residential area which totals approximately 24,000 acres. The highest density zoning of five acre lots with grandfathering is applied to the

Map 1



Scenario 1:

Residential SubareaE
- size: 4,900 acr
- gross density:
1 du./5ac.
- # residences - 980
- # residents - 2940

* 1 d.u./40 ac. elsewher

Scenario 1A:

Residential SubareaE
- size: 4,900 acre
- gross density:
1 d.u./5 ac. w/grandfa
- # residences - 1455
- # residents - 4365

* 1 d.u./40 ac. elsewher

East Everglades Resources Planning Project

TABLE 1

Scenario 1

Management Area	Total Acreage	Gross Density	# Residences @ Buildout	Population @ Buildout
1- Residential	4,900	1:5	980	2,940
1- Agricultural	9,600	1:40	240	720
2A	46,400	1:40	1,160	3,480
2B	25,600	1:40	640	1,920
3A	23,700	1:40	592	1,776
3B	12,000	1:40	300	900
3C	31,600	1:40	790	2,370
Total	153,800	—	4,702	14,106

TABLE 2

Scenario 1A

Management Area	Total Acreage	Gross Density	# Residences @ Buildout	Population @ Buildout
1- Residential	4,900	Grandfathered at 1:5	1,455	4,365
1- Agricultural	9,600	1:40	240	720
2A	46,400	1:40	1,160	3,480
2B	25,600	1:40	640	1,920
3A	23,700	1:40	592	1,776
3B	12,000	1:40	300	900
3C	31,600	1:40	790	2,379
Total	153,800	—	5,177	15,531

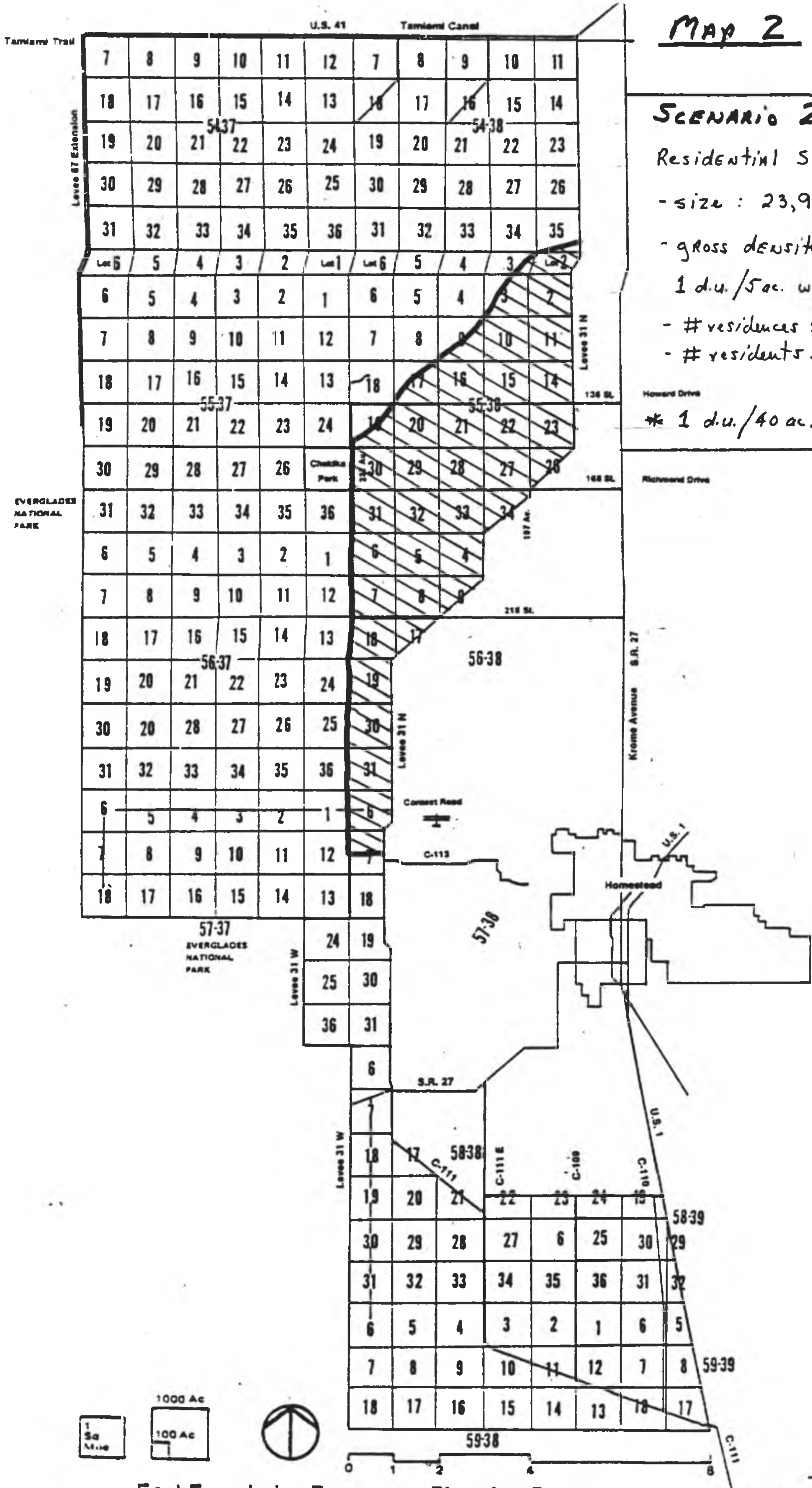
Map 2

Scenario 2:

Residential Subarea

- size : 23,940 acres
- gross density : 1 d.u./5 ac. w/ grandfathe
- # residences : 6013
- # residents : 18,039

* 1 d.u./40 ac. elsewhere



East Everglades Resources Planning Project

residential subarea delineated in the previous scenarios and to Management Area 3B north of SW 168th St. (Richmond Drive). This expanded residential subarea totals 10,340 acres. Zoning of one dwelling unit on five acre lots (no grandfathering) is applied to the agricultural area in Managment Area 1 and to 3C south of SW 152nd Street. Table 3 presents the assumptions and buildout figures for each management area. This scenario will yield 9,260 residences throughout the entire study area with a total population of 27,780.

Scenario 3

This scenario extends five acre minimum building densities to over 30,000 acres. Map 3 delineates the residential area for Scenario 3. The highest density residential area, which allows 1.25 to 5 acre lots, remains the same as in Scenario 2. However, the next higher density category (five acre lots) is expanded to include Management Area 3C north of SW 152nd Street containing 9,920 acres. Table 4 presents the assumptions and buildout figures by management area for this scenario. Residences in the East Everglades under Scenario 3 will total 10,996, yielding a total population of 32,989.

TABLE 3

Scenario 2

Management Area	Total Acreage	Gross Density	# Residences @ Buildout	Population @ Buildout
1- Residential	4,900	Grandfathered at 1.5	1.455	4,365
1- Agricultural	9,600	1:5	1,920	5,760
2A	46,400	1:40	1,160	3,480
2B	25,600	1:40	640	1,920
3A	23,700	1:40	593	1,779
3B- N. of 168 St.	5,440	Grandfathered at 1.5	1,838	5,514
3B- S. of 168 St.	6,560	1:40	164	492
3C- S. of 152	4,000	1:5	800	2,400
3C- Remainder	27,600	1:40	690	2,070
Total	153,800	—	9,260	27,780

TABLE 4

Scenario 3

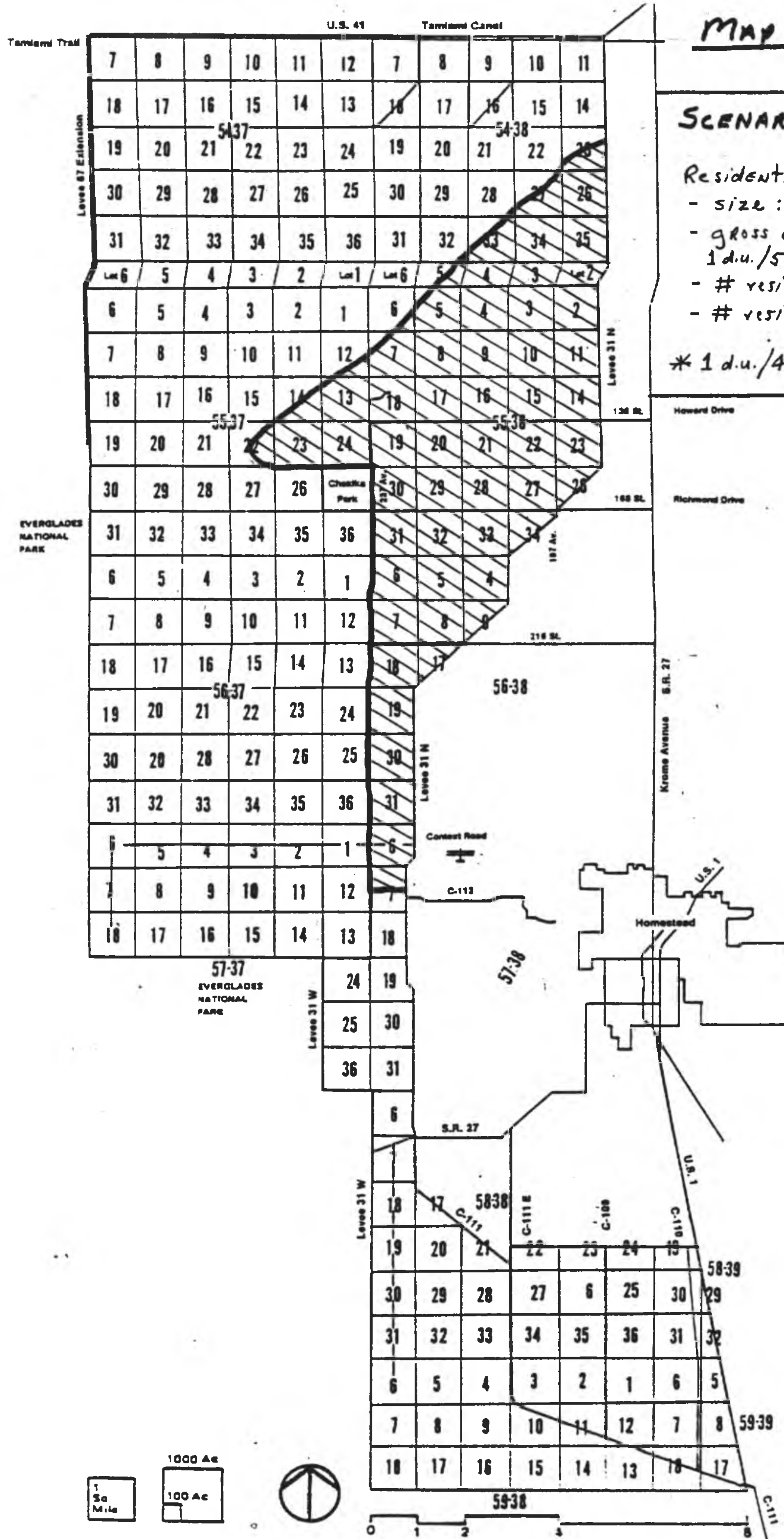
Management Area	Total Acreage	Gross Density	# Residences @ Buildout	Population @ Buildout
1- Residential	4,900	Grandfathered @ 1.5	1,455	4,365
1- Agricultural	9,600	1:5	1,920	5,760
2A	46,400	1:40	1,160	3,480
2B	25,600	1:40	640	1,920
3A	23,700	1:40	593	1,779
3B- N. of 168 St.	5,440	Grandfathered @ 1:5	1,838	5,514
3B- S. of 168 St.	6,560	1:40	164	492
3C- N. of 152 St.	9,920	1:5	1,984	5,952
3C- S. of 152 St. and E. of 237 Ave.	4,000	1:5	800	2,400
3C-S. of 152 St. and W. of 152 St.	17,680	1:40	442	1,326
Total	153,800	—	10,996	32,988

Map 3

Scenario 3:

Residential Subarea
- size : 33,860 acres
- gross density : 1 d.u./5 ac. w/ grandfather
- # residences : 7,997
- # residents : 23,991

* 1 d.u./40 ac. elsewhere



East Everglades Resources Planning Project

Scenario 1

Management Area	Total Acreage	Gross Density	# Residences @ Buildout	Population @ Buildout
1- Residential	4,900	1:5	980	2,352
1- Agricultural	9,600	1:40	240	576
2A	46,400	1:40	1,160	2,784
2B	25,600	1:40	640	1,536
3A	23,700	1:40	592	1,422
3B	12,000	1:40	300	720
3C	31,600	1:40	790	1,896
Total	153,800	—	4,702	11,286

Scenario 1A

Management Area	Total Acreage	Gross Density	# Residences @ Buildout	Population @ Buildout
1- Residential	4,900	Grandfathered at 1:5	1,455	3,492
1- Agricultural	9,600	1:40	240	576
2A	46,400	1:40	1,160	2,784
2B	25,600	1:40	640	1,536
3A	23,700	1:40	592	1,422
3B	12,000	1:40	300	720
3C	31,600	1:40	790	1,896
Total	153,800	—	5,177	12,426

Scenario 2

Management Area	Total Acreage	Gross Density	# Residences @ Buildout	Population @ Buildout
1- Residential	4,500	Grandfathered at 1:5	1,360	3,264
1- Agricultural	10,000	1:5	2,000	4,800
2A	46,400	1:40	1,160	2,784
2B	25,600	1:40	640	1,536
3A	23,700	1:40	593	1,423
3B- N. of 168 St.	5,440	Grandfathered @ 1.5	1,838	4,411
3B- N. of 168 St.	6,560	1:40	164	394
3C- S. of 152	4,000	1:5	800	1,920
3C- Remainder	27,600	1:40	690	1,656
Total	153,800	—	9,245	22,188

Scenario 3

Management Area	Total Acreage	Gross Density	# Residences @ Buildout	Population @ Buildout
1- Residential	4,500	Grandfathered @ 1.5	1,360	3,264
1- Agricultural	10,000	1:5	2,000	4,800
2A	46,400	1:40	1,160	2,784
2B	25,600	1:40	640	1,536
3A	23,700	1:40	593	1,423
3B- N. of 168 St.	5,440	Grandfathered @ 1:5	1,838	4,411
3B- S. of 168 St.	6,560	1:40	164	394
3C- N. of 152 St.	9,920	1:5	1,984	4,761
3C- S. of 152 St. and E. of 237 Ave.	4,000	1:5	800	1,920
3C-S. of 152 St. and W. of 152 St.	17,680	1:40	442	1,061
Total	153,800	—	10,981	26,354