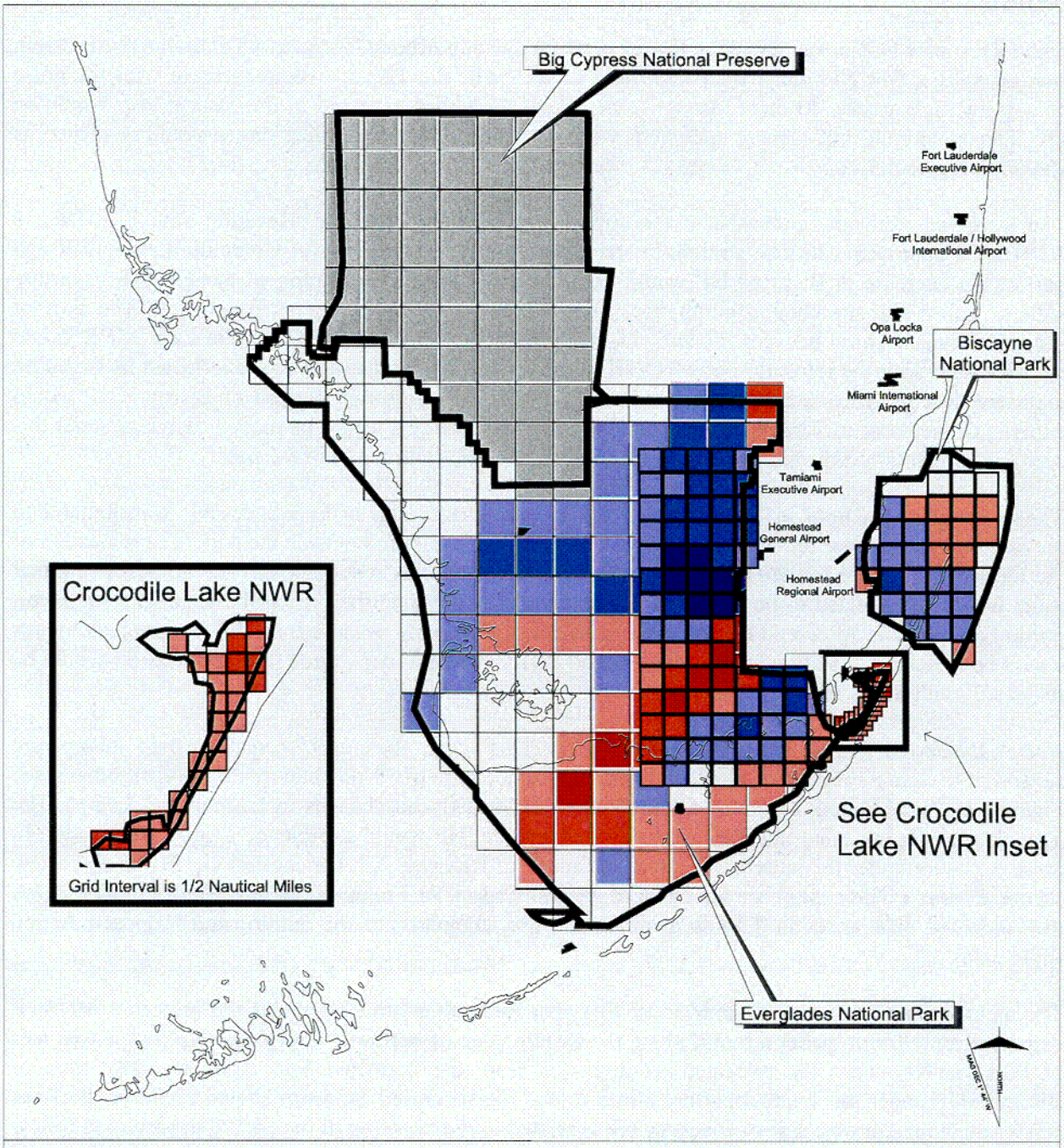


862501826

LEGEND

- Crocodile Lake NWR Grid Interval 0.5 Nautical Miles
- Eastern Everglades and Biscayne National Park Grid Interval 2.5 Nautical Miles
- Everglades National Park Grid Interval 4.0 Nautical Miles

Change in TAamb Level*

- > 30 minute decrease
- 10 - 29.9 minute decrease
- 0.1 - 9.9 minute decrease
- No Change
- 0.1 - 9.9 minute increase
- 10 - 29.9 minute increase
- > 30 minute increase
- No Data

0 10 20
Scale in Miles

Source:
Landrum & Brown 1999b

Figure 4.5-18
Proposed Action vs. Flight Track Alternative 1
Maximum Use One-Runway Differences in TAamb

C-1

***Traditional Ambient (excluding aircraft noise) is used to define ambient levels.**

approach course to Runway 23, along the far eastern edge of northeast Everglades NP, in the northeastern portion of Biscayne NP, and within Crocodile Lake NWR, the TAamb would increase with the noise abatement flight tracks. At most locations, the degree of change expected in the earliest year would be less than one minute, but as more operations were introduced to the area, the changes would be higher, as shown in Figure 4.5-18.

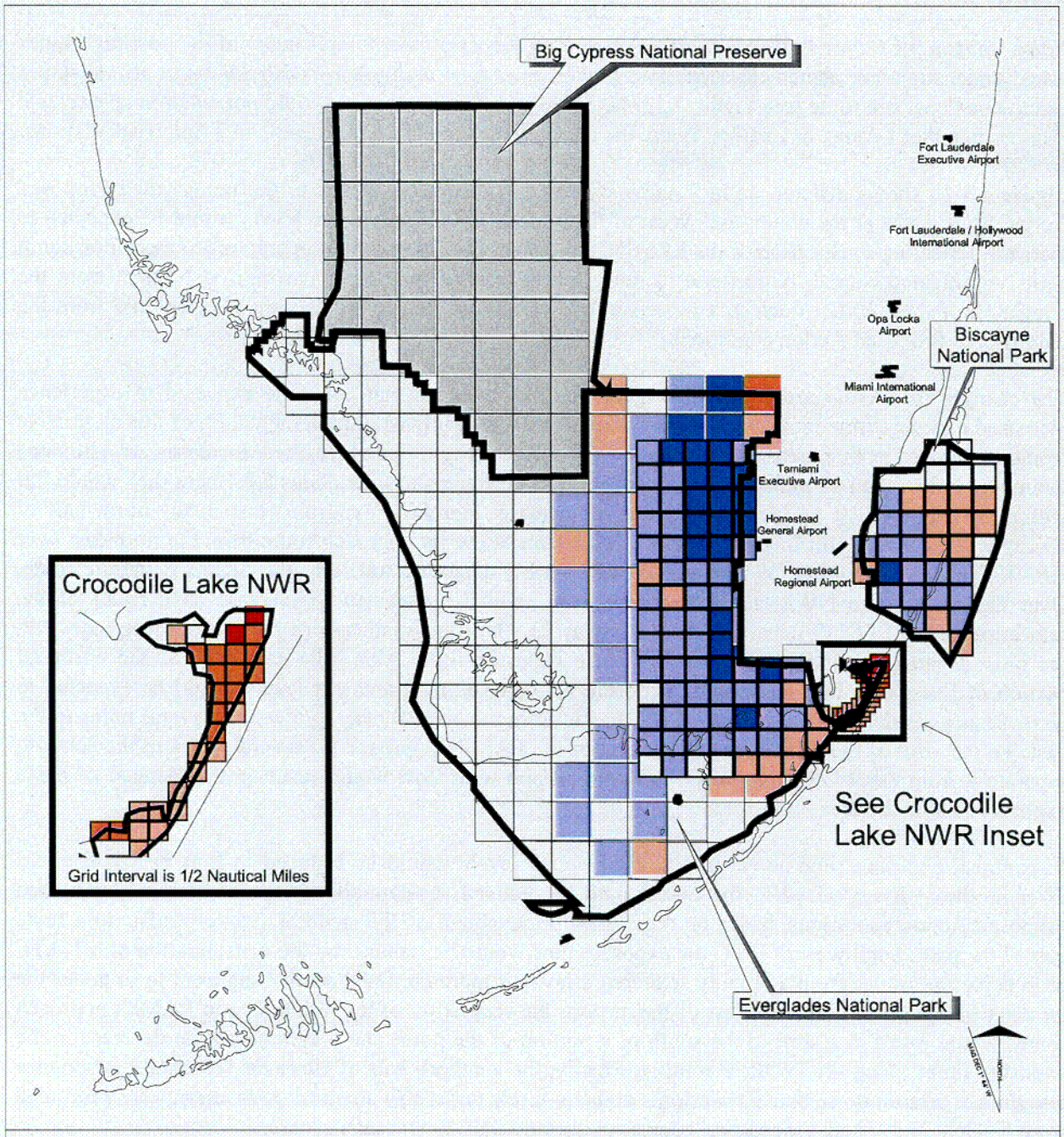
The increased exposure southwest of the airport would be the result of relocating both FAMIN and JUNUR jet approaches to long straight-in arrival courses. The increase over Crocodile Lake NWR and part of the decrease in Biscayne NP would be associated with the relocation of the EEONS departure path to follow the southbound climb track from its current location across Elliot Key. The area of reduced exposure times between the straight-in approach to Runway 5 and Crocodile Lake NWR would be associated with the relocation of MNATE departures to the southeast, a move reflected in increased exposure over the Keys south of Crocodile Lake NWR. The northeast portion of Biscayne NP would experience increases in TAamb because the approach route for jets would be moved eastward under this scenario, which in turn would result in lower TAamb over the central part of the park.

The substantial reductions in TAamb shown along the northeast edge of Everglades NP is attributable to moving the IFR corridor for small aircraft several miles to the east and outside the park. The relocation of the jet departure route to the HEDLY fix also plays a role in this reduction, but the aircraft using that route would be expected to be above 18,000 feet MSL by the time they reach the area. The southwest portion of Biscayne NP would be exposed to less noise principally because the JUNUR approach by jets would be relocated to a straight-in alignment and SKIPS/VALLY departures from Runway 23 would be relocated south of the park.

Noise Abatement Flight Path Alternative No. 2. This noise abatement scenario would incorporate several of the same routes as evaluated under abatement alternative No. 1 and modify several others (see Figure 2.11-2). Modeling of this scenario resulted in virtually no changes in LAmax and Leq(h). The TAamb analysis indicated that the east half of Everglades NP would experience a general reduction in noise exposure under this alternative, as would much of Biscayne NP. Crocodile Lake NWR and a few scattered areas would experience increases of generally less than 3 minutes per day. **Figure 4.5-19** shows the computed differences in TAamb at maximum use, compared to the unmitigated Proposed Action flight paths.

The areas exposed to more TAamb under this abatement alternative lie under the relocated MNATE departure route for propeller aircraft, along the eastern edge of northeast Everglades NP, in the east half of Biscayne NP under the relocated jet approach from the northeast, and along the west side of Biscayne NP under the south departure climb route. The increased exposure shown in Crocodile Lake NWR and along the west side of Biscayne NP is related to the rerouting of the SKIPS departure to follow the VALLY route over the top of HST prior to turning on course, as well as the southward rerouting of the EEONS departures in east and west flow and the SKIPS and VALLY departures in west flow.

Decreases in TAamb shown in Figure 4.5-19 in northeast Everglades NP are attributable to the relocation of IFR general aviation traffic in the north-south flight corridor to a route east of the park. Reductions over southern and southeastern Everglades NP are related to the relocation of the MNATE departure courses from widely scattered tracks across Florida Bay to more definitive courses to the east. In Biscayne NP, the reduction of TAamb in the north half of the park is associated with rerouting the SKIPS departure from Runway 5, while the reduction in the south half of the park is related to relocation of the EEONS departure from a route across Elliot Key to a southerly course.



-621007218

LEGEND

- Crocodile Lake NWR Grid Interval 0.5 Nautical Mile
- Eastern Everglades and Biscayne National Park Grid Interval 2.5 Nautical Miles
- Everglades National Park Grid Interval 4.0 Nautical Miles

Change in TAamb Level*

- > 30 minute decrease
- 10 - 29.9 minute decrease
- 0.1 - 9.9 minute decrease
- No Change
- 0.1 - 9.9 minute increase
- 10 - 29.9 minute increase
- > 30 minute increase
- No Data

0 10 20
Scale in Miles

Source:
Landrum & Brown 1999b

Figure 4.5-19
Proposed Action vs. Flight Track Alternative 2
Maximum Use One-Runway Differences in TAamb

*** Traditional Ambient (excluding aircraft noise) is used to define ambient levels.**

L-2

Noise Abatement Flight Path Alternative No. 3. This scenario incorporates many of the potential routes tested under the other abatement scenarios, as well as several additional modifications to arrival routes and to one departure route (see Figure 2.11-3). This abatement alternative would not result in appreciable changes in either LAmax or Leq(h). Again, the changes are principally noticeable in TAamb calculations.

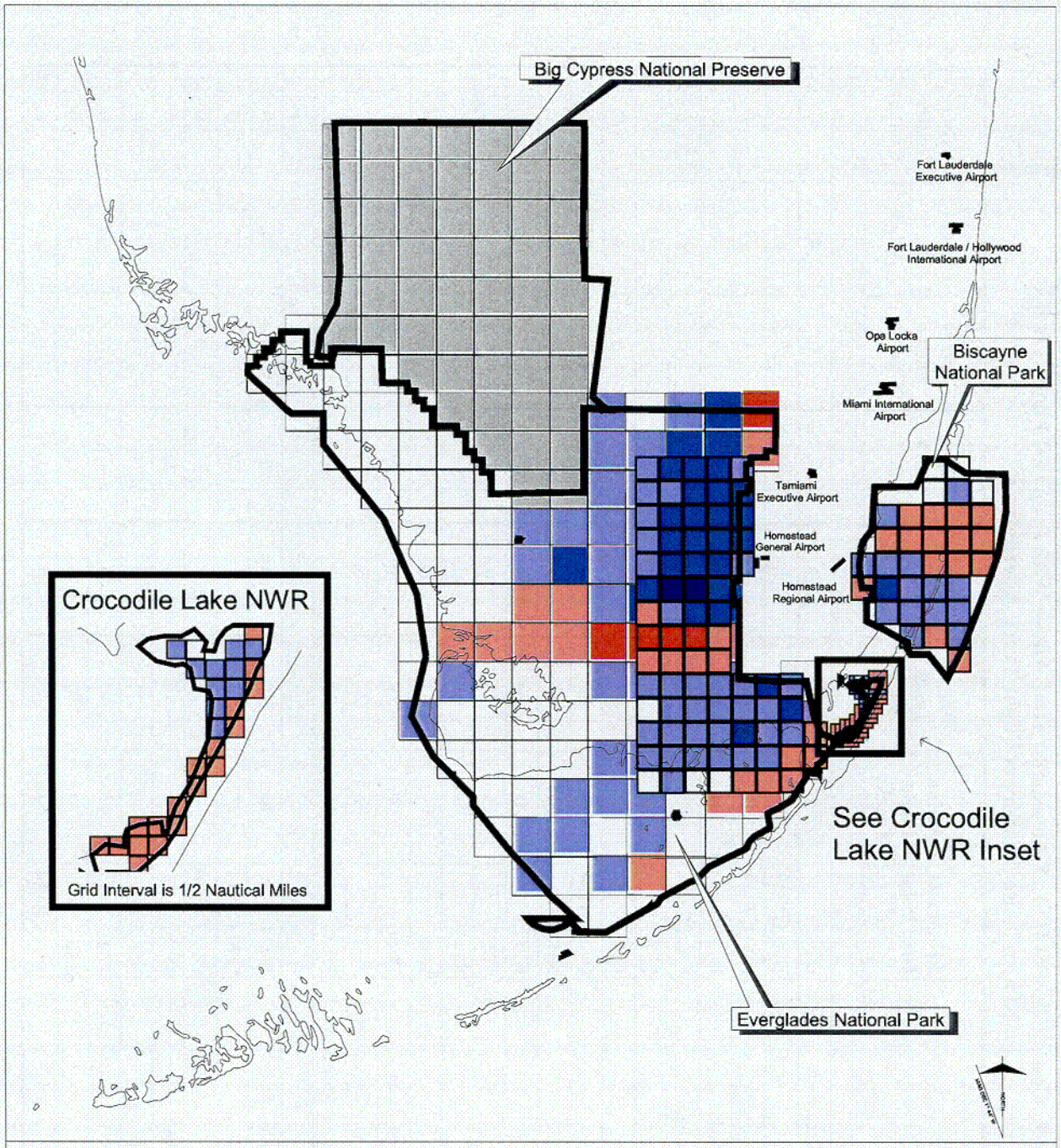
Figure 4.5-20 shows differences in TAamb with this scenario, compared to the unmitigated Proposed Action flight paths at maximum use. West of the airport, the LAmax noise levels would be expected to increase, reflecting a relocation of the FAMIN approach route for east flow operations to a position south of its unmitigated course. A decrease in noise levels west of this location would also result from the relocation of the FAMIN track to a more southerly position. Leq(h) levels would differ little from the unmitigated Proposed Action conditions.

The changes in TAamb are shown in Figure 4.5-20. The areas that could be expected to experience increased exposure time to noise above traditional ambient levels with implementation of this alternative would be located in five areas and related to five different flight track measures. Increases are estimated to amount to less than 10 minutes per day except for a few areas in Everglades NP where they would fall within the range of 10 to 30 daily minutes of increase. Increased exposure time in the north half of Biscayne NP would result initially from the relocation of the jet approach route from the northeast over HEATT and, in later years, by the addition of VALLY departure traffic to the SKIPS departure route. Over Crocodile Lake NWR, noise exposure time could be expected to increase as a result of the relocation of the EEONS departure from Runway 23. Over the southeastern portion of Everglades NP, the prop departures to MNATE would increase exposure time. Along the east edge of the northeast portion of Everglades NP, the time of exposure above traditional ambient levels would be expected to increase as a result of the relocation of IFR traffic from the VFR flyway to a course several miles to the east. To the west of the airport, the movement of the FAMIN approach by several miles to the south to separate it from the WORPP approach in both east and west flow would result in the increase of noise exposure time in the area.

In contrast, exposure time above traditional ambient levels would be reduced in four principal areas. Over northeast Everglades NP, the time would be reduced substantially compared to the unmitigated Proposed Action conditions, based on the eastward movement of IFR general aviation traffic to a route east of the park. Southwest of HST, the exposure time would be reduced by the consolidation of MNATE prop departure routes from a broadly scattered array to a more confined routing adjacent to or under the jet departure route to that fix. West of the airport, the separation of the WORPP and FAMIN approach routes would result in a shift to the south of a portion of the noise and a commensurate decrease in the exposure times along the WORPP routing. Finally, the southern half of Biscayne NP would experience less time of aircraft noise above traditional ambient levels under this alternative, as aircraft were rerouted from EEONS and VALLY departure courses and from JUNUR approach courses.

Table 4.5-9 shows the noise effects of the three noise abatement flight track alternatives on community and other park locations.

Other potential mitigation measures are discussed above in the Mitigation Measures section of Section 4.5.2.1.



711405420

LEGEND

- Crocodile Lake NWR Grid Interval 0.5 Nautical Miles
- Eastern Everglades and Biscayne National Park Grid Interval 2.5 Nautical Miles
- Everglades National Park Grid Interval 4.0 Nautical Miles

Change in TAamb Level*

- > 30 minute decrease
- 10 - 29.9 minute decrease
- 0.1 - 9.9 minute decrease
- No Change
- 0.1 - 9.9 minute increase
- 10 - 29.9 minute increase
- > 30 minute increase
- No Data

0 10 20
Scale in Miles

Source:
Landrum & Brown 1999b

Figure 4.5-20
Proposed Action vs. Flight Track Alternative 3
Maximum Use One-Runway Difference in TAamb

* Traditional Ambient (excluding aircraft noise) is used to define ambient levels.

Table 4.5-9. Comparison of DNL, LAmax, and Time Above With Proposed Flight Tracks and Three Noise Abatement Flight Track Alternatives

Site Designa-tion	Site Name	Proximate Grid Point	Proposed Action Flight Tracks	Flight Track Alt. 1	Alter-native Change	Flight Track Alt. 2	Alter-native Change	Flight Track Alt. 3	Alter-native Change
DNL (dB)									
BBP	Bill Baggs Cape Florida State Park	D131	42	42	0	42	0	42	0
ORX	Ocean Reef	D90,C1213	39	40	1	40	1	40	1
ACX	Angler's Club	D90,C1214	40	41	1	41	1	41	1
RFP	Redland Fruit and Spice Park	B125	40	40	0	40	0	40	0
HCC	Homestead Community College	F58,F75	42	42	0	42	0	42	0
KGX	Keys Gate	F71	51	51	0	51	0	51	0
FCH	Florida City City Hall	F38	43	43	0	43	0	43	0
CKL	Key Largo	B115,B134	31	32	1	32	1	32	1
NHA	Nursing Home	NHA	44	44	0	44	0	44	0
MH1	South Dade Center	F177,F178	70	70	0	70	0	70	0
NJA	Naranja Housing Area	F217	45	45	0	45	0	45	0
HTA	Homeless Trust Housing	F215	54	54	0	54	0	54	0
HSH	Homestead High School	F90	43	43	0	43	0	43	0
JPP	John Pennekamp Coral Reef State Park	D100	38	39	1	39	1	39	1
FK1	Florida Keys National Marine Sanctuary 1	A233	17	22	5	23	6	22	5
FK2	Florida Keys National Marine Sanctuary 2	D135	34	32	–2	32	–2	32	–2
LAmax (dB)									
BBP	Bill Baggs Cape Florida State Park	D131	70	70	0	70	0	70	0
ORX	Ocean Reef	D90,C1213	77	77	0	77	0	77	0
ACX	Angler's Club	D90,C1214	77	77	0	77	0	77	0
RFP	Redland Fruit and Spice Park	B125	74	74	0	74	0	74	0
HCC	Homestead Community College	F58,F75	71	71	0	71	0	71	0
KGX	Keys Gate	F71	97	97	0	97	0	97	0
FCH	Florida City City Hall	F38	72	72	0	72	0	72	0
CKL	Key Largo	B115,B134	69	69	0	69	0	69	0

Site Designa-tion	Site Name	Proximate Grid Point	Proposed Action Flight Tracks	Flight Track Alt. 1	Alter-native Change	Flight Track Alt. 2	Alter-native Change	Flight Track Alt. 3	Alter-native Change
NHA	Nursing Home	NHA	83	83	0	83	0	83	0
MH1	South Dade Center	F177,F178	107	107	0	107	0	107	0
NJA	Naranja Housing Area	F217	81	81	0	81	0	81	0
HTA	Homeless Trust Housing	F215	83	83	0	83	0	83	0
HSH	Homestead High School	F90	80	80	0	80	0	80	0
JPP	John Pennekamp Coral Reef State Park	D100	79	79	0	79	0	79	0
FK1	Florida Keys National Marine Sanctuary 1	A233	52	52	0	52	0	52	0
FK2	Florida Keys National Marine Sanctuary 2	D135	72	72	0	72	0	72	0
TA (minutes)[1,2]									
BBP (55)	Bill Baggs Cape Florida State Park	D131	7	7	0	7	0	7	0
ORX (65)	Ocean Reef	D90,C1213	<1	<1	0	<1	0	<1	0
ACX (65)	Angler's Club	D90,C1214	<1	<1	0	<1	0	<1	0
RFP (65)	Redland Fruit and Spice Park	B125	<1	<1	0	<1	0	<1	0
HCC (65)	Homestead Community College	F58,F75	1	1	0	1	0	1	0
KGX (65)	Keys Gate	F71	5	5	0	5	0	5	0
FCH (65)	Florida City City Hall	F38	1	1	0	1	0	1	0
CKL (65)	Key Largo	B115,B134	0	0	0	0	0	0	0
NHA (65)	Nursing Home	F107	2	2	0	2	0	2	0
MH1 (65)	South Dade Center	F177,F178	217	217	0	217	0	217	0
NJA (65)	Naranja Housing Area	F217	6	6	0	6	0	6	0
HTA (65)	Homeless Trust Housing	F215	19	19	0	19	0	19	0
HSH (65)	Homestead High School	F90	2	2	0	2	0	2	0

Notes: [1] Time Above is indicated in minutes above levels shown in parentheses next to site designation.
[2] Time Above not calculated for John Pennekamp State Park or FKNMS.

Possible Future Expansion

As difficult as it is to predict aircraft noise characteristics and airport operations far into the future, it is even more difficult to predict future air traffic control parameters that would enable reasonable assumptions to be made about the location of aircraft along flight paths in far future years. Technology is advancing at a truly rapid pace in this arena. The primary navigation system coming on line in the 21st century will be a Global Navigation Satellite System to replace the current ground-based navigation system. It will provide a quality of aircraft positioning information never before available and will permit greater precision in directing aircraft operations. A concept called "free flight" has been established as the key direction for evolution of the National Airspace System. Free flight is designed ultimately to permit aircraft to fly the most direct routes between takeoff and landing instead of having to fly routes structured around ground-based navigation systems. The uncertainties inherent in new technologies make quantitative predictions far into the future unreliable. They would be obsolete by the time the future years are approached.

Beyond the immediate airport environs, few changes would be anticipated in the early years of a second runway. Since the runways would be parallel and only 3,500 feet apart, the direction and general location of aircraft departures and arrivals would be the same as with one runway. Aircraft arrival noise would shift slightly to the southeast near the airport upon final approach. The grid point analysis performed for the maximum one-runway condition is also the best available prediction of noise effects over the national parks and refuges for the early years of a second runway. The total numbers of aircraft operations on flight tracks and types of aircraft would be expected to be approximately the same.

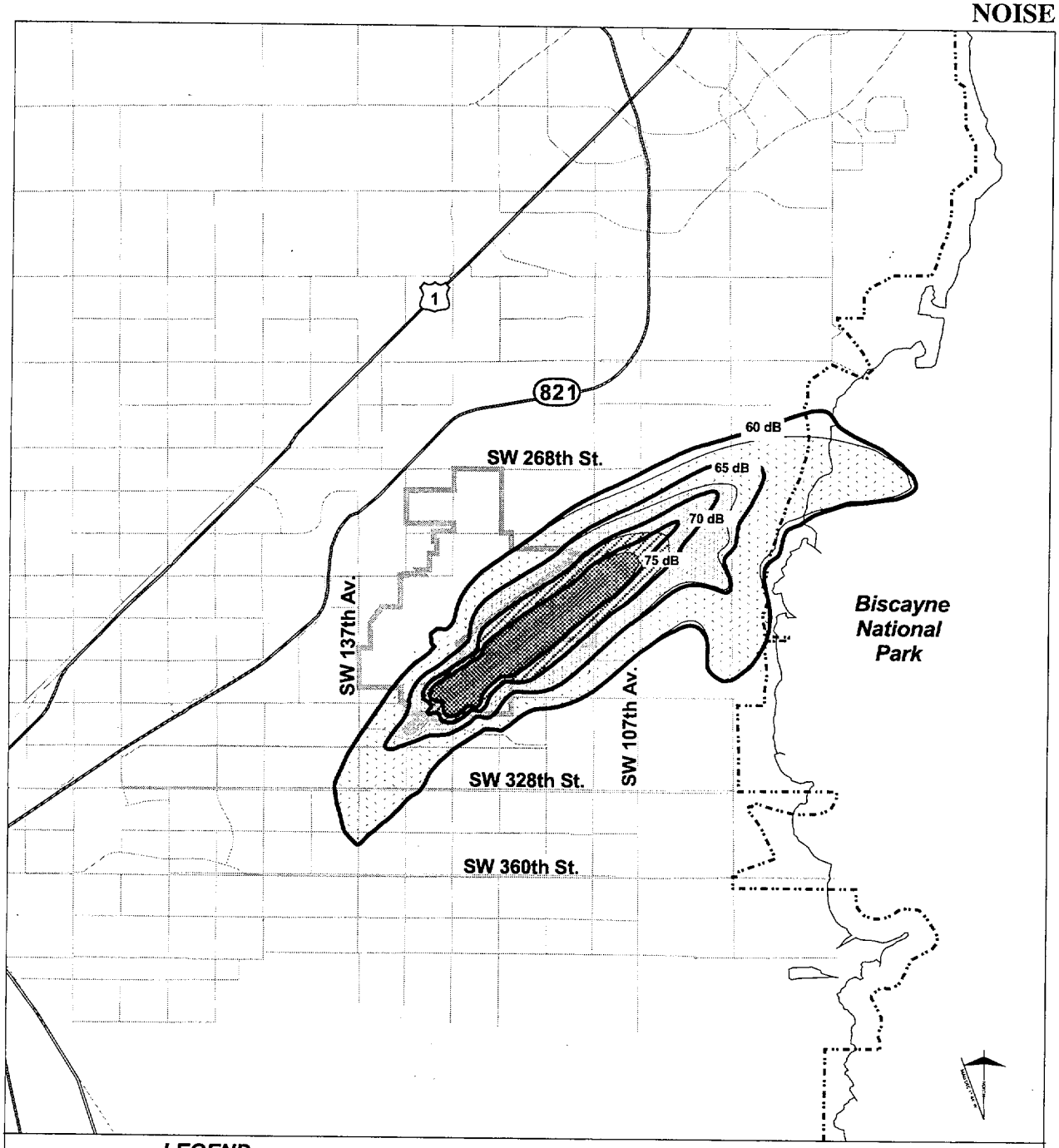
As aircraft activity grew on a two-runway system at HST, the assumption is that there would be increased numbers of aircraft flights over the national parks and refuges. Modifications to airspace in the area would be anticipated to handle additional traffic (not only for HST, but also for MIA and other airports), as well as to incorporate technological advances. Aircraft departure noise could assume a somewhat different pattern over Biscayne NP, with departures more balanced on two runways and a divergent departure from the southerly runway at times of simultaneous departures. Increases in numbers of aircraft arrivals can be assumed for the eastern portion of Everglades NP that would lie directly southwest of the centerlines of the runways. Any noise increases, either in TAamb or Leq(h), would be assumed to be related to increased numbers of aircraft operations and/or modifications to flight tracks, rather than to louder aircraft.

4.5.3 Commercial Spaceport Alternative

The Commercial Spaceport alternative would differ from the Proposed Action both in the character of the aircraft (launch vehicle) operating from Homestead, and in the number and frequency of operations. As a result, the effects on the surrounding communities and on the national parks and refuges would be different.

4.5.3.1 Community Noise

DNL Contours. **Figure 4.5-21** displays the modeled DNL contours at 60 dB and above for this alternative in 2005, compared to the projected baseline for the same year. As can be seen, the contours are computed to be virtually identical southwest of the northeast end of the runway. To the northeast of the airport, the Commercial Spaceport contours are larger, exhibiting increases of several decibels in some locations. The computed 75 dB contour of the Commercial Spaceport alternative extends beyond



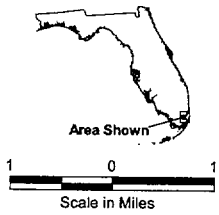
LEGEND

60 dB Proposed Action DNL Contour

Projected Baseline DNL

- 60 - 65 db
- 65 -70 db
- 70 - 75 db
- > 75 db
- Former Homestead AFB
- National Park Boundary
- Street
- U.S. Highway
- State Highway

897676273



Derived from:
Landrum & Brown 1999b

Figure 4.5-21
Comparison of Commercial Spaceport Alternative and Projected Baseline DNL Contours (2005)

the 70 dB baseline contour, and the 70 dB contour for the Commercial Spaceport alternative extends nearly to the 65 dB baseline contour. The 65 dB contour is shown to be larger than the baseline, but remains west of Biscayne NP.

By 2015, the Spaceport is projected to reach its full forecast activity level. **Figure 4.5-22** presents the DNL contours for 2015 (which is the same as full buildout). Land areas within the 60–65, 65–70, 70–75, and above 75 dB contours are estimated to be 4,103, 1,600, 812, and 890 acres, respectively. No schools would be located within the DNL 60 dB contour.

The increase in DNL levels under the Commercial Spaceport alternative would exceed that of the Proposed Action to the northeast of the airport. **Figure 4.5-23** indicates the areas that are projected to experience increases in DNL of 1.5 dB or more inside the 65 dB contour by 2005. A small area within the 60–65 dB contour is projected to experience increases of 3.0 dB or more. In both cases, the areas affected would be west of the Biscayne NP shoreline on lands that are currently largely undeveloped.

Figure 4.5-24 shows areas projected to be exposed to DNL increases of 1.5 and 3.0 dB by 2015. The area projected to experience an increase of 1.5 dB within the 65 dB contour is larger than in 2005. To the northeast of the airport, two areas within the 60–65 dB contour are projected to experience increases of 3 dB or more. One area is shown to reach into the northwest portion of Biscayne NP near Black Point.

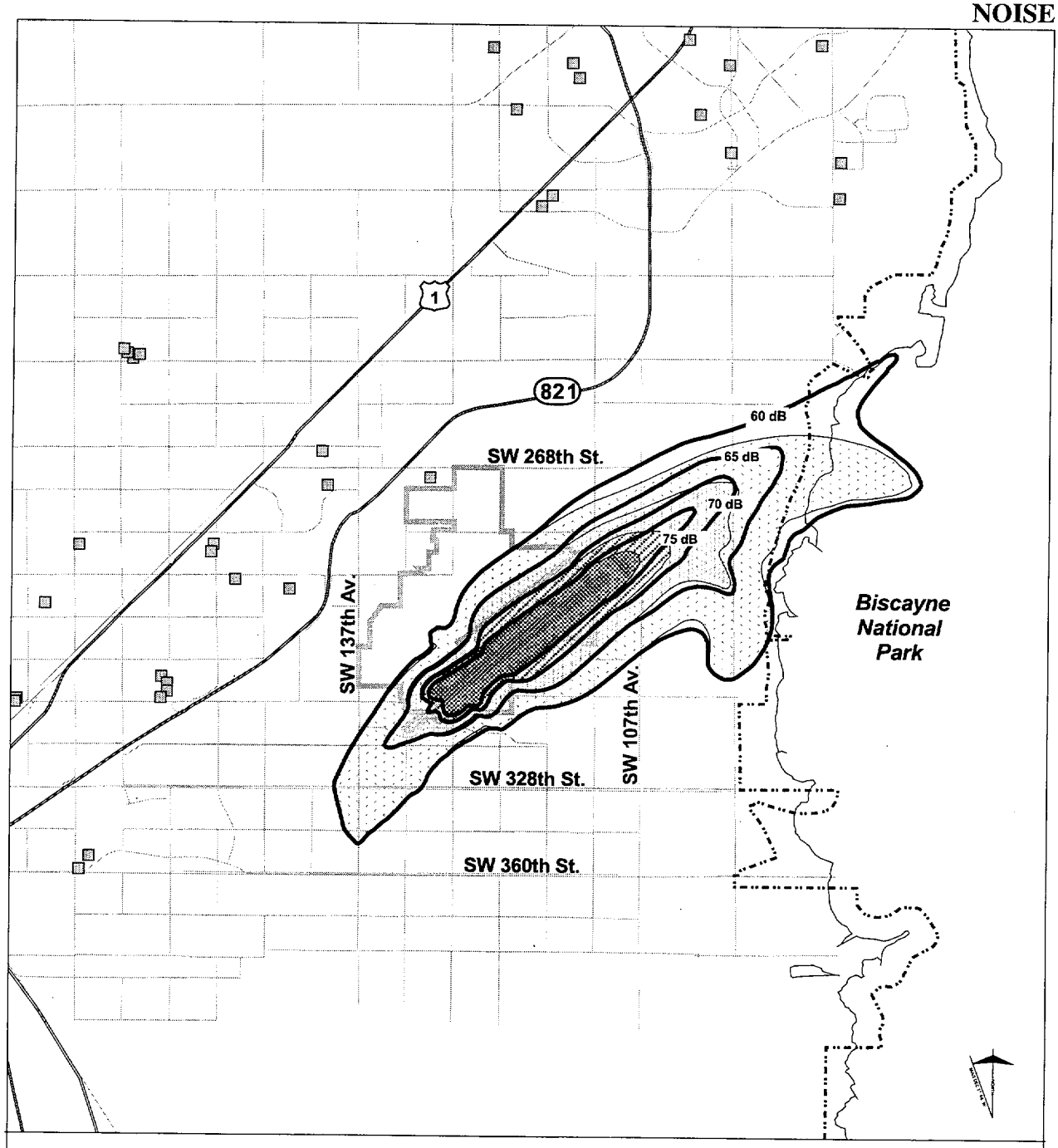
Table 4.5-10 indicates the land area, number of dwelling units, and population that would be exposed to DNL 60 dB and higher under the Commercial Spaceport alternative as modeled for this analysis.

SEL Contours. SEL contours were modeled for two potential space vehicle configurations, the Astroliner towed by a Boeing 747 as proposed by Kelly Space and Technology, Inc., and the Aerospacecraft (ASC) proposed by Space Access LLC.

For this analysis, the Kelly Space and Technology system was represented by two Boeing 747 aircraft taking off simultaneously (or as if one Boeing 747 had eight engines), with two separate landings. **Figure 4.5-25** provides the SEL footprint for a dual takeoff and single landing of the Astroliner system. The departure pattern is long and narrow, reflecting a straight-out course, climbing very slowly. The 85 dB contour extends across Biscayne NP to Key Biscayne, where the aircraft are estimated to be at an altitude of about 7,000 feet. The 90 dB contour reaches about 45,000 feet into Biscayne NP, with the 95 and 100 dB contours extending just beyond the shoreline at Black Point. To the southwest, the 85 dB contour extends about 45,000 feet from the landing threshold, ending several miles east of Everglades NP.

For the Space Access system, the Concorde aircraft was used for the noise analysis. It is the only readily available supersonic aircraft in the INM of comparable design to the ASC. Given the heavy weight anticipated for the ASC, the heaviest Concorde available in the INM was used for the noise computations. The ASC was assumed to depart under full power and return to the airport unpowered. For noise modeling purposes, this effectively equates to a takeoff without a landing. **Figure 4.5-26** displays the SEL footprint that would be expected for one departure operation of the ASC.

The SEL footprint is located almost entirely northeast of the airport. The 100 dB contour extends completely across the north half of Biscayne NP, reflecting the vehicle's slow ascent. It appears to start climbing more rapidly about 28 miles into flight, as indicated by the close spacing of the 85, 90, and 95 dB contours. The pattern is several miles wide along most of its length, reflecting the loudness of the aircraft.



873865095

LEGEND

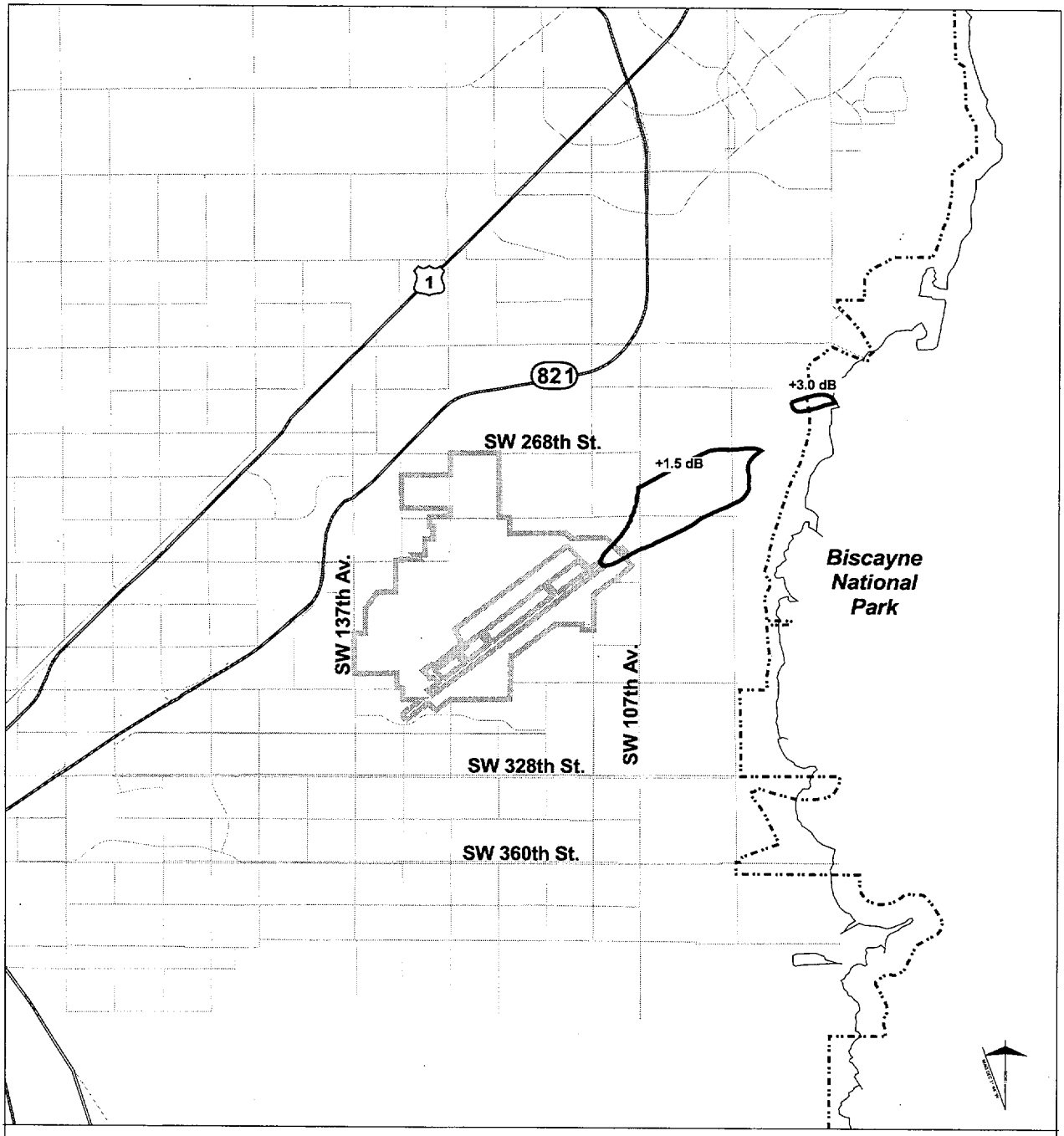
60 dB Proposed Action DNL Contour
Projected Baseline DNL
- 60 - 65 db
- 65 -70 db
- 70 - 75 db
- > 75 db
- School

- Former Homestead AFB
- National Park Boundary
- Street
- U.S. Highway
- State Highway

1 0 1
Scale in Miles

Derived from:
Landrum & Brown 1999b,
Metro-Dade County 1998f

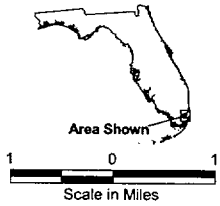
Figure 4.5-22
Comparison of Commercial Spaceport Alternative and Projected Baseline DNL Contours (2015/ Full Buildout)



-2030644036

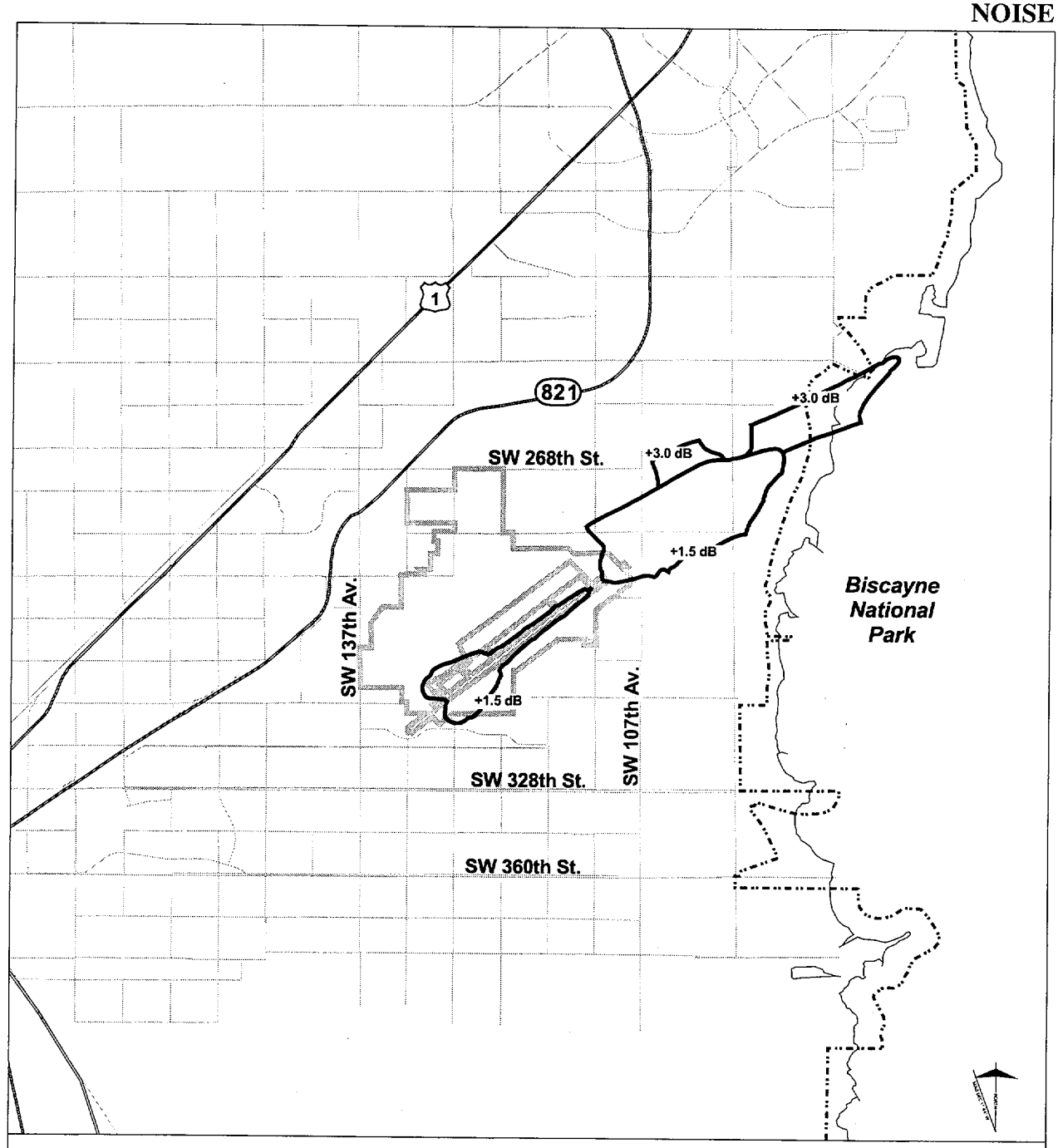
LEGEND

- DNL Contour Increase
- Former Homestead AFB
- National Park Boundary
- Street
- U.S. Highway
- State Highway



Derived from:
Landrum & Brown 1999b

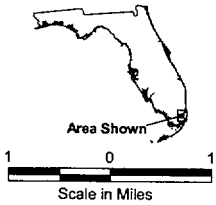
Figure 4.5-23
1.5 dB and 3.0 dB Difference Contours,
Commercial Spaceport Alternative (2005)



-8106739

LEGEND

- DNL Contour Increase
- Former Homestead AFB
- National Park Boundary
- Street
- U.S. Highway
- State Highway



Derived from:
Landrum & Brown 1999b

Figure 4.5-24
1.5 dB and 3.0 dB Difference Contours,
Commercial Spaceport Alternative (2015)

Table 4.5-10. Dwelling Units and Population Within DNL Contours—Commercial Spaceport Alternative

DNL Contour	Current Operations		Commercial Spaceport Alternative					
			2000		2005		2015/Full Buildout	
	Units	Pop	Units	Pop	Units	Pop	Units	Pop
Existing Residents								
60–65 dB	202	1,148	212	1,188	205	1,172	212	1,201
65–70 dB	95	656	95	656	99	663	100	664
70–75 dB	0	0	0	0	4	9	2	16
Above 75 dB	0	0	0	0	0	0	1	2
Total Above 60 dB	297	1,804	307	1,844	308	1,844	315	1,883
Projected Growth[1]								
60–65 dB	NA	NA	234	1,243	254	1,291	312	1,463
65–70 dB	NA	NA	98	666	111	696	133	760
70–75 dB	NA	NA	0	0	7	16	19	51
Above 75 dB	NA	NA	0	0	0	0	3	7
Total Above 60 dB	NA	NA	332	1,909	372	2,003	467	2,281

Source: **Landrum & Brown 1999b**.
Note: [1] Assumes growth in vicinity of HST is not controlled.
NA Not applicable

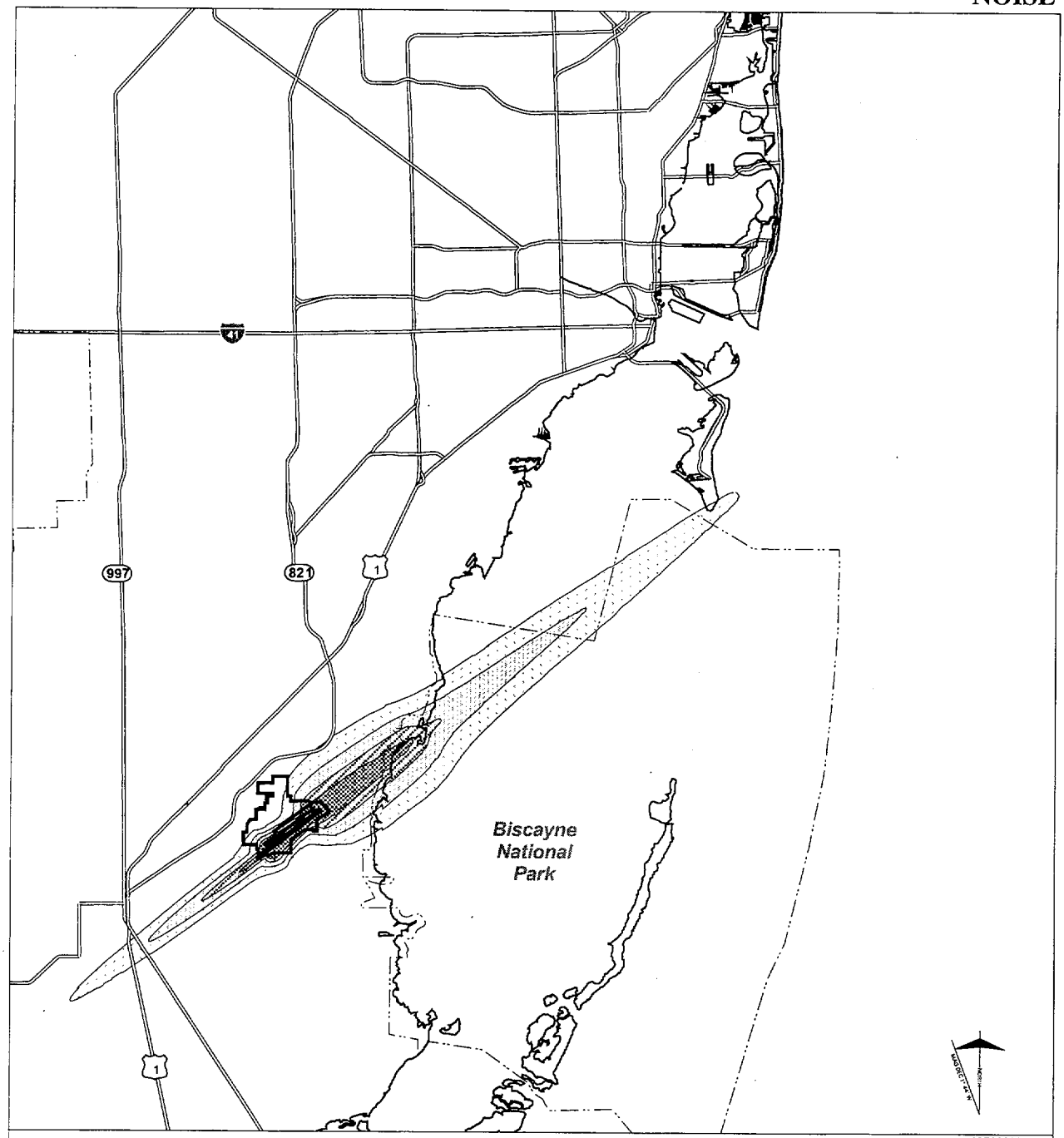
Community Grid Point Analysis. **Table 4.5-11** presents modeled DNL, LAmax, and TAamb levels for the 12 sample community grid points at full buildout of the Commercial Spaceport alternative, compared to current conditions.

Combined Commercial Spaceport/Airport

INM computer modeling was not performed separately for a combined Commercial Spaceport/Airport. This is because, as described in Section 2.3, the number of conventional civil aircraft operations that could be accommodated in this option is assumed to be limited. Little or no change in DNL would be expected due to the dominance of the military aircraft and space launch vehicles in the noise environment.

Cumulative Impacts

Cumulative impacts involve the assessment of the effects of regional air traffic from other airports combined with HST air traffic. Within the DNL 60 dB contour for the Commercial Spaceport alternative in 2015, all DNL levels attributable to other airports in the region would be below DNL 50 dB. Cumulative effects would therefore be less than 1 dB.



1970322303

LEGEND

SEL

- **100 db**
- **95 db**
- **90 db**
- **85 db**

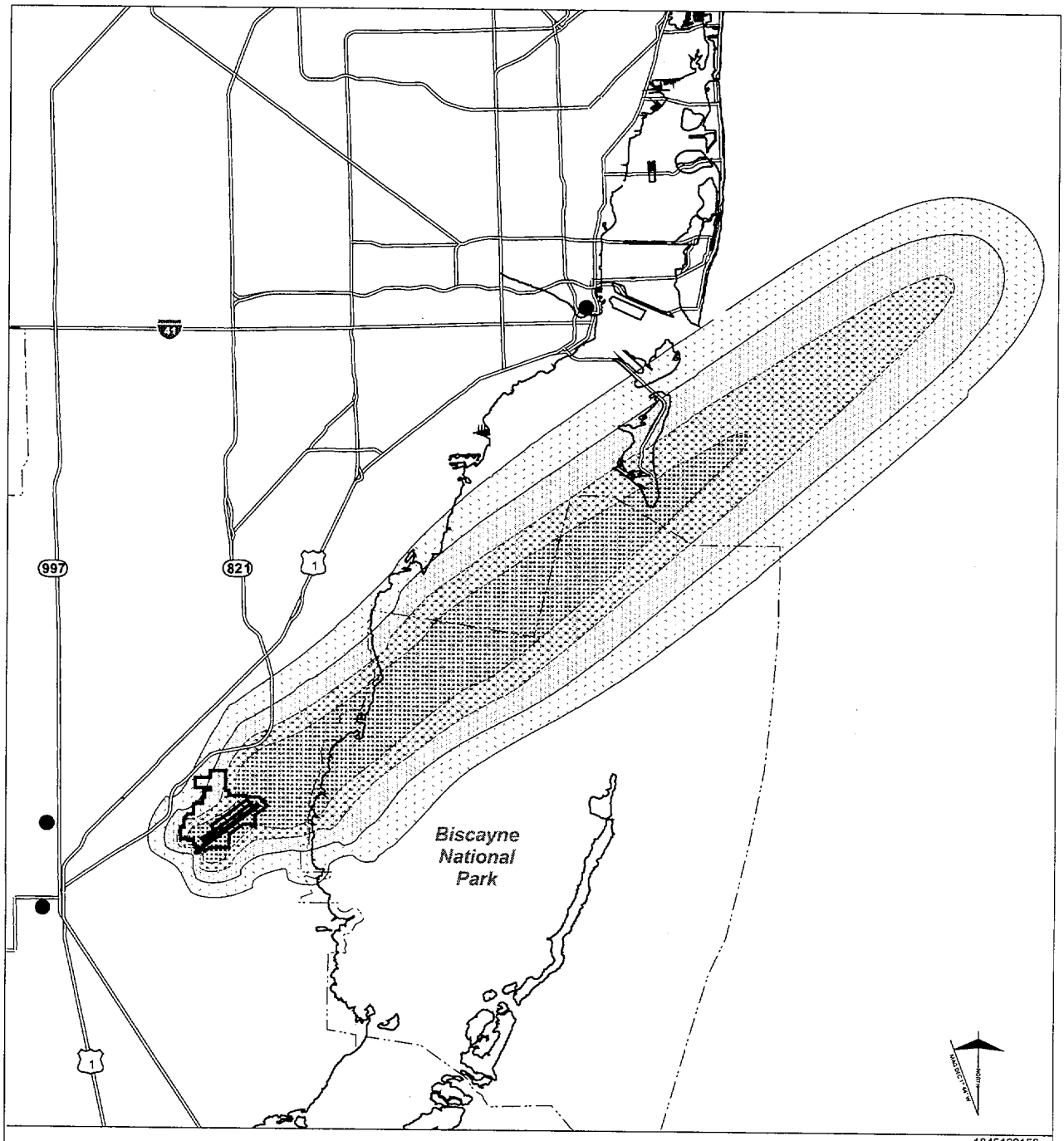
- **Former Homestead AFB**
- **National Park Boundary**
- **Major Road**
- **U.S. Highway**
- **State Highway**
- **Interstate Highway**

3 0 3 6

Scale in Miles

Derived from:
Landrum & Brown 1999b

Figure 4.5-25
SEL Contours, 747-Based Space Launch, Two Departures and One Arrival



-1845162156

LEGEND

SEL
- 100 db
- 95 db
- 90 db
- 85 db

- Former Homestead AFB
- National Park Boundary
- Major Road
- U.S. Highway
- State Highway
- Interstate Highway

3 0 3 6
Scale in Miles

Derived from:
Landrum & Brown 1999b

Figure 4.5-26
SEL Contours,
One Concorde Departure

Table 4.5-11. Sample Community Noise Levels—Commercial Spaceport Alternative at Full Buildout

Location	Map Designation[1]	DNL (dB)		LAmax (dB)		Time Above[2] (minutes)	
		Commercial Spaceport Alternative	Projected Baseline/ No Action	Commercial Spaceport Alternative	Projected Baseline/ No Action	Commercial Spaceport Alternative	Projected Baseline/ No Action
Miami-Dade County Community College–Homestead Campus	HCC	40	39	71	71	1	1
Keys Gate Community	KGX	43	43	97	97	2	2
South Dade Center	MH1	71	70	107	107	90	86
Naranja	NJA	47	45	82	78	6	5
Homeless Trust Center	HTA	56	54	89	83	17	16
Homestead High School	HSH	43	43	80	80	2	2
Nursing Home	NHA	44	44	83	90	2	2
Florida City City Hall	FCH	39	39	72	72	1	1
Redland	RFP	37	37	74	74	<1	<1
Ocean Reef Community	ORX	35	35	77	77	<1	<1
Angler's Club	ACX	35	35	77	77	<1	<1
Key Largo	CKL	23	23	69	69	0	0

Source: Landrum & Brown.
Notes: [1] See Figure 3.5-8.
[2] Time above DNL 65 dB.
<1 Less than 1

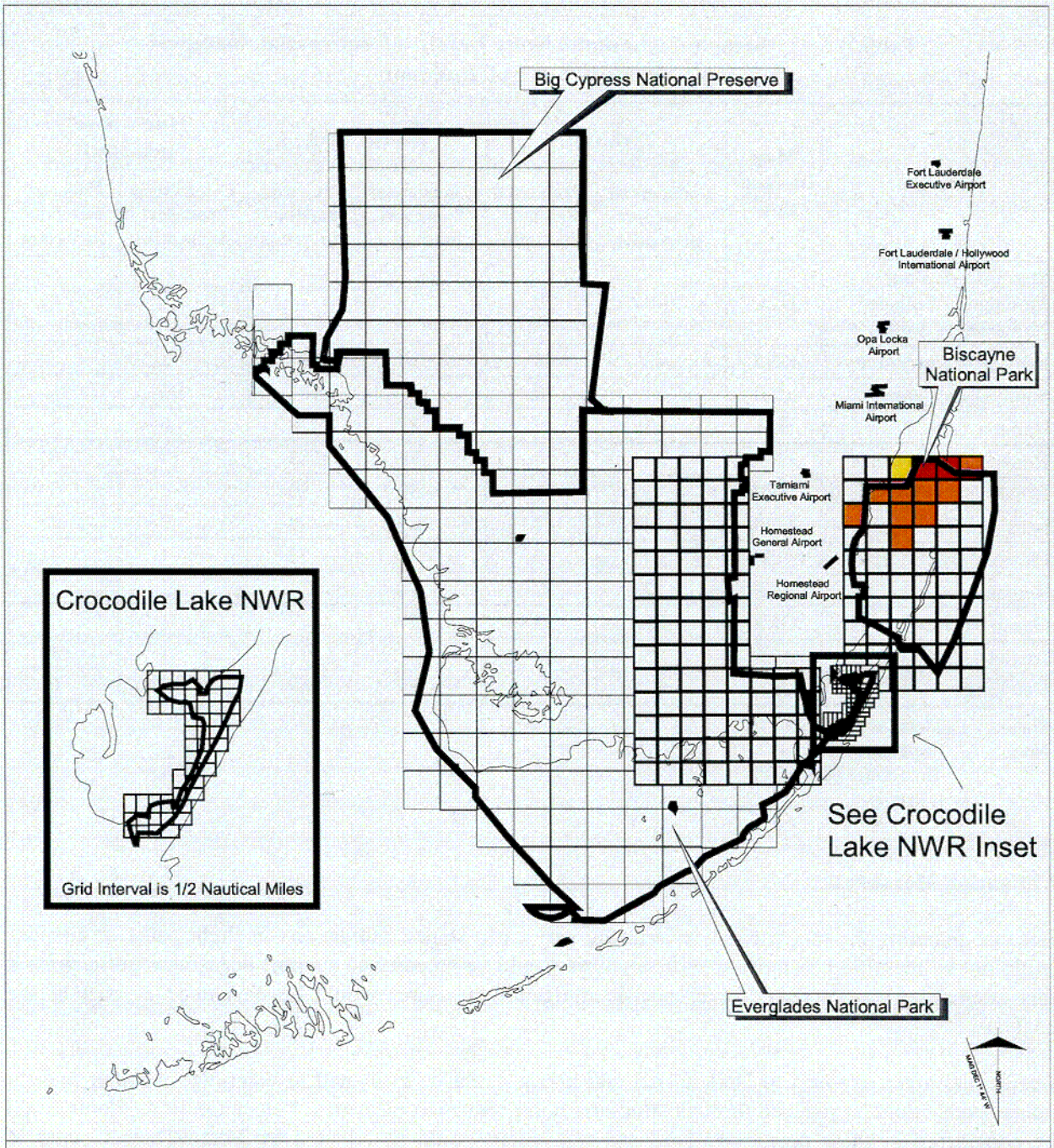
Mitigation Measures

Because planning for this alternative is in the very early stages, mitigations in flight paths or airspace could not be identified. A more specific analysis would be prepared to support licensing requirements if this alternative were selected, and specific mitigation measures would be developed as part of the analysis.

Residential areas exposed to DNL 65 dB and above could be evaluated to determine whether interior noise levels could be reduced through structural noise reduction measures. Relocation of residents could be considered in these areas, and land use restrictions could be adopted by Miami-Dade County to prohibit future residential development in high noise areas.

4.5.3.2 National Parks and Refuges

A full grid point assessment was conducted to ascertain the broad area effects of the Commercial Spaceport alternative. Detailed mapping and discussion are provided in the Technical Memorandum (**Landrum & Brown 1999b**). This section presents a summary of the findings based on the results computed for LAmax, Leq(h), and TAamb. For each metric, the same years are used as were reported for the Proposed Action to facilitate comparison. Changes in noise levels compared to the projected baseline are graphically depicted in **Figures 4.5-27, 4.5-28, and 4.5-29** for the LAmax, Leq(h), and TAamb metrics at full buildout (reached by 2015), respectively.



321377146

LEGEND

- Crocodile Lake NWR Grid Interval 0.5 Nautical Miles
- Eastern Everglades and Biscayne National Park Grid Interval 2.5 Nautical Miles
- Everglades National Park Grid Interval 4.0 Nautical Miles

Change in LAmax

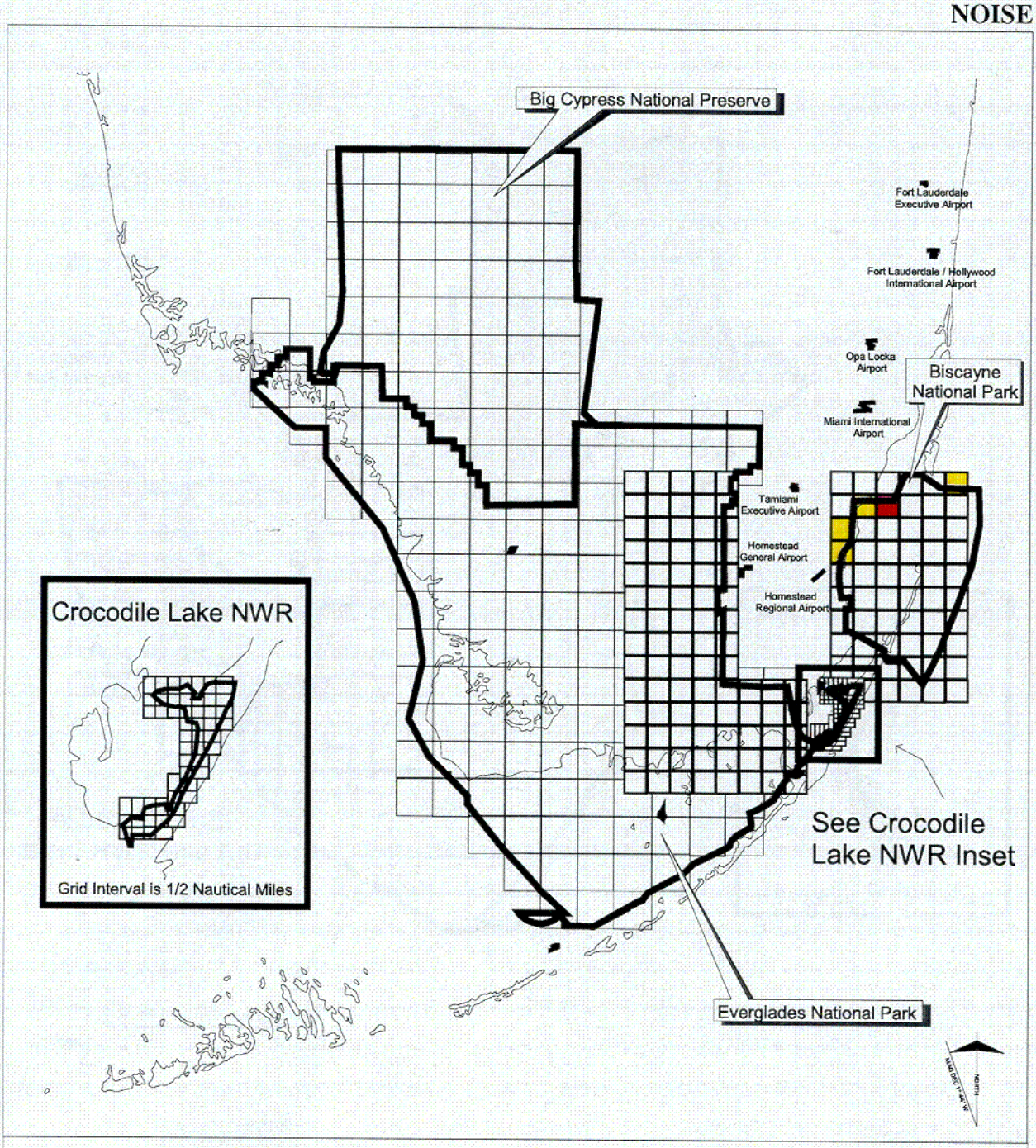
- >10 dB decrease
- 5 - 9.9 dB decrease
- 3 - 4.9 dB decrease
- No readily perceptible change
- 3 - 4.9 dB increase
- 5 - 9.9 dB increase
- >10 dB increase

0 10 20
Scale in Miles

Source:
Landrum & Brown 1999b

Figure 4.5-27
Differences in LAmax—Commercial Spaceport Alternative at Full Buildout

C-4



LEGEND

578799731

- Crocodile Lake NWR Grid Interval 0.5 Nautical Miles
- Eastern Everglades and Biscayne National Park Grid Interval 2.5 Nautical Miles
- Everglades National Park Grid Interval 4.0 Nautical Miles

Change in Peak Leq (h)

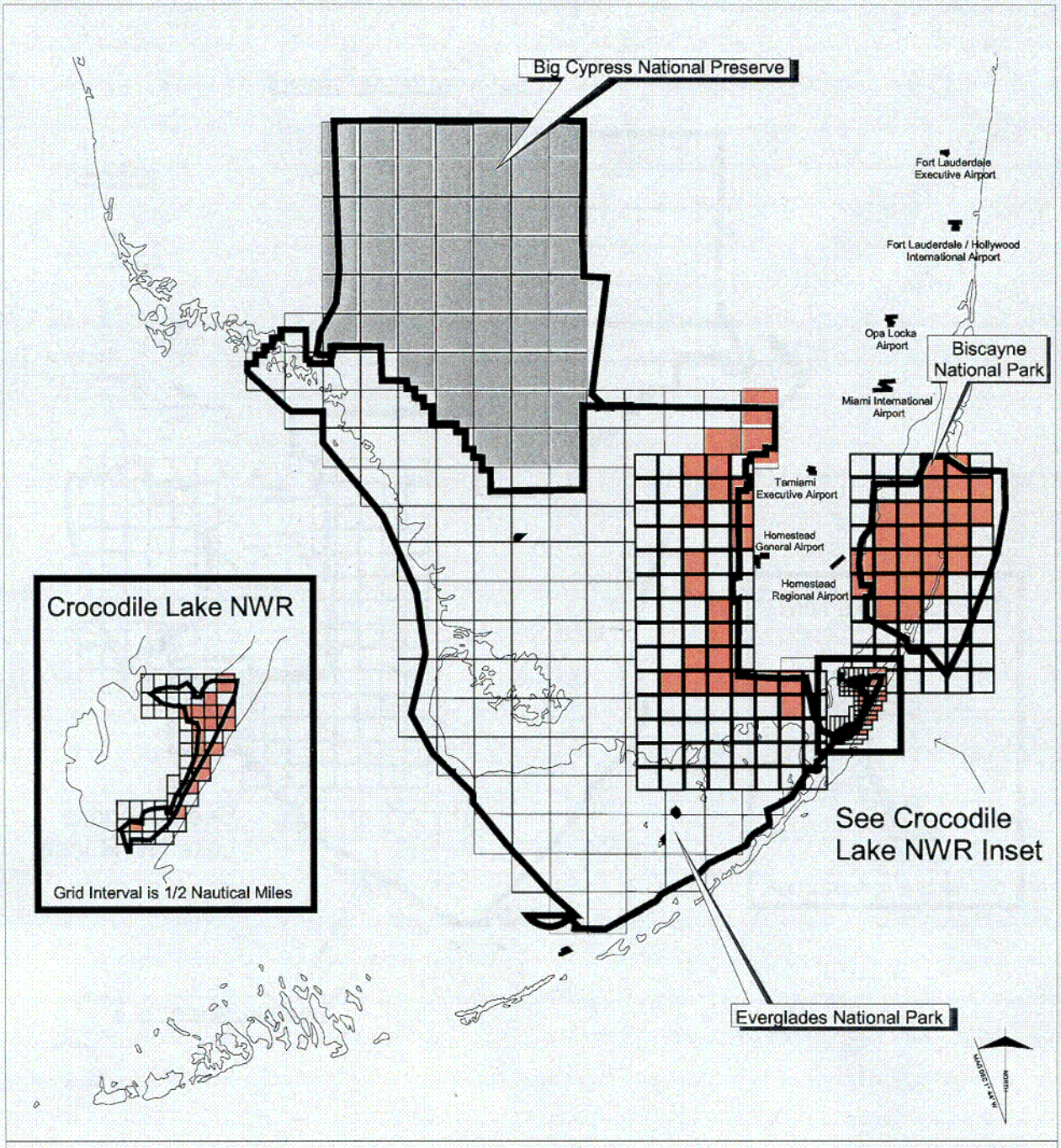
- 15 dB or greater decrease
- 10 - 14.9 dB decrease
- 5 - 9.9 dB decrease
- No change
- 5 - 9.9 dB increase
- 10 - 14.9 dB increase
- 15 dB or greater increase

0 10 20
Scale in Miles

Source:
Landrum & Brown 1999b

Figure 4.5-28
Differences in Peak Leq(h)—Commercial Spaceport Alternative at Full Buildout

C-5



-62026184

LEGEND

- Crocodile Lake NWR Grid Interval 0.5 Nautical Miles
- Eastern Everglades and Biscayne National Park Grid Interval 2.5 Nautical Miles
- Everglades National Park Grid Interval 4.0 Nautical Miles

Change in TAamb Level*

- > 10 minutes less
- 3.0 - 9.9 minutes less
- 0.1 - 2.9 minutes less
- No Change
- 0.1 - 2.9 minutes more
- 3.0 - 9.9 minutes more
- > 10 minutes more
- No Data

0 10 20
Scale in Miles

Source:
Landrum & Brown 1999b

Figure 4.5-29
Differences in TAamb—Commercial Spaceport Alternative at Full Buildout

L-6

*** Traditional Ambient (excluding aircraft noise) is used to define ambient levels.**

The only area computed to experience an increase in LAmax of more than 5 dB by 2005 is the northwest side of Biscayne NP, where the space vehicle departures are projected. This would further intensify by 2015 and full buildout. Similarly, changes to the Leq(h) levels attributable to the implementation of the Commercial Spaceport alternative indicate an intensification of the peak hour noise level northeast of the airport. The Leq(h) is expected to increase by 5 dB or more at five points in 2015/full buildout (Figure 4.5-28). Because Leq(h) is a function of the average daily traffic level, the data may overpredict the peak hour noise level for this alternative, particularly if other operations have to be discontinued during departure and arrival periods. These data, then, are considered to be a worst-case estimate of the effect on Leq(h) of the Commercial Spaceport alternative. As shown in Figure 4.5-29, increases in the TAamb over the projected baseline would be expected to be concentrated in the immediate vicinity of the airfield and under the departure path. In all cases, the estimated increase in TAamb averages less than 3 minutes per day, accounting for the low number of forecast Spaceport operations.

Florida Keys National Marine Sanctuary

At the northern sample point examined in FKNMS, DNL in 2015 (same as full buildout) was modeled at 25 dB, which represents no change from the projected baseline. LAmax would also remain the same as the projected baseline of 72 dB. At the southern sample point, DNL would remain the same as the projected baseline of 8 dB, and LAmax would also remain the same at 30 dB. See Appendix E for more discussion of noise at these locations.

State Parks

DNL at John Pennekamp State Park for the Commercial Spaceport alternative in 2015/full buildout was modeled at 37 dB, which would represent no change from the projected baseline. LAmax would also remain the same as the projected baseline at 79 dB. Bill Baggs Cape Florida State Park would experience an increase in DNL and LAmax. DNL in 2015/full buildout was modeled at 48 dB, compared to a projected baseline of 42 dB. LAmax would increase to 86 dB from a projected baseline of 70 dB. See Appendix E for more discussion of noise at these locations.

Combined Commercial Spaceport/Airport

Adding limited conventional civil aviation to spaceport operations at Homestead could result in noise exposures from conventional civil aircraft operations similar to those reported for the Proposed Action in 2005 (see Section 4.5.2.2), because the maximum number of conventional operations would likely be limited by Spaceport operations at locations overflown by both Spaceport and conventional operations, LAmax could be expected to be dominated by launch vehicles, and TAamb would likely be higher than for the Spaceport without conventional civil operations.

Cumulative Impacts

Cumulative impacts involve the assessment of the effects of regional air traffic from other airports combined with HST air traffic. The cumulative impacts of the Commercial Spaceport alternative would be smaller than for the Proposed Action, because the influence of space launch vehicles is assumed to be concentrated over a much smaller area aligned with Runway 5 departures. Along this flight path, the first 3 miles would be dominated by military aircraft operations, while at greater distances, they would become increasingly dominated by MIA traffic. In the extended over-water areas under the space launch vehicle flight path, the launch vehicles are estimated to be more than 10 dB above the noise levels associated with MIA traffic for the LAmax and Leq(h) metrics, and cumulative effects would be less than 1 dB.

The Commercial Spaceport alternative is estimated to contribute a maximum of 4.8 minutes over an average day to TAamb at point F-177 in 2015. Point F-177 is at the approach end of Runway 5 and would be influenced by launch vehicle run-ups and acceleration after brake release on takeoff. All other increases are estimated to be less than 3.5 minutes.

Mitigation Measures

Because planning for this alternative is in the very early stages, no mitigation measures were identified. This would be performed as part of more detailed analyses for licensing.

4.5.4 Mixed Use Alternative

The Mixed Use alternative would not involve any additional civil aviation activity at former Homestead AFB. Noise effects from continued military and government operations would be the same as projected baseline conditions and same as the No Action alternative.

Although this reuse alternative would not include increased aircraft noise, the reuse developer or Miami-Dade County could voluntarily relocate the residents currently exposed to aircraft noise levels of DNL 65 dB and higher from military and government operations. The county could impose land use controls to prevent future development of residential and other incompatible land uses in areas that would continue to be exposed to these elevated noise levels.

4.5.5 No Action Alternative

Aviation noise levels under the No Action alternative would remain the same as projected for the baseline conditions.

4.5.6 Independent Land Use Concepts

None of the independent land use concepts would affect aviation noise levels.

4.6 LAND USE AND AESTHETICS

4.6.1 Introduction

This section describes the potential impacts of the Proposed Action and alternatives on land use and visual resources. Topics considered in this section include community land use, special use areas, agriculture, and aesthetics. The impact analysis focuses on:

- Compatibility of reuse construction and operations with existing land uses and visual resources.
- Consistency of land use development with the objectives of applicable land use plans, policies, and controls, including plans and policies for national parks, refuges, and preserves; state lands and parks; and local jurisdictions.
- Effects of secondary development on surrounding land uses.
- Effects of reuse-related activities on recreation, particularly on use and enjoyment of national and state parks in the ROI.
- Effects of reuse alternatives on conversion of agricultural lands to development.
- Impacts on sensitive visual resources in the ROI.

Miami-Dade County lies within the Florida Coastal Management Program. This program consists of 23 Florida Statutes administered by eleven state agencies and four water management districts. Each agency is required to ensure that federal activities comply with the specific statutes and authorities within its jurisdiction. The Florida Department of Community Affairs reviewed the Draft SEIS and notified the Air Force that, at this stage, the proposed transfer of former Homestead AFB is consistent with the enforceable policies included in the Florida Coastal Management Program (**Department of Community Affairs 2000**).

4.6.2 Community Land Use

This section discusses the impact of the Proposed Action and alternatives on existing land use, land ownership, and general plans and zoning, including southern Miami-Dade County, former Homestead AFB, and portions of Monroe County. This section also discusses a smaller, more focused area defined by the Transportation Analysis Districts (numbers 84, 85, 86, 87, and 88) adjacent to and including the former base (see Figure 3.5-1). Chapter 163 of the Florida Statute requires consistency between local plans, applicable regional plans, the State Comprehensive Plan, and all development regulations and orders.

4.6.2.1 Proposed Action

Miami-Dade County. Under the Proposed Action, land use on the disposal property is expected to change from largely vacant land to primarily industrial and industrial-type (aviation support) uses, with some commercial uses. Miami-Dade County has prepared a master plan for HST, adopted an amendment to the CDMP, and developed an Airport Layout Plan for the aviation portion of the site. Should the Proposed Action be implemented, it is likely a specific plan and additional plan amendments would be developed by the county, and the existing plan would be superseded. Subsequent to transfer, the areas would be rezoned by Miami-Dade County prior to development.

On-site land uses would be mixed under the Proposed Action, as industrial and commercial development increased on the disposal property in areas adjacent to the previously conveyed property. Most land uses

would be generally compatible, but the residential uses associated with the Homeless Trust Center could be exposed to noise and traffic from nearby industrial activities.

The dominant land use adjacent to the disposal property is agriculture. Most existing development occurs west and north of former Homestead AFB and along U.S. Highway 1 and includes residential, commercial, and industrial land uses. Development of the disposal property is not expected to affect agricultural lands, but secondary development related to the Proposed Action, including additional airport-related facilities and adjunct commercial and industrial businesses, could extend beyond the airport property. Secondary development could occur on both agricultural and unprotected vacant lands (as defined in the county Traffic Analysis Zones) in the surrounding area.

Commercial and industrial development would be expected to continue to expand initially in areas already designated for those uses. The CDMP anticipates that projected development can be accommodated within the UDB through 2005. The CDMP provides for the 2015 Urban Expansion Area for growth outside the UDB. Urban infrastructure and services could be planned for eventual extension into the UEA between 2005 and 2015. Any development outside the UEA must be consistent with the CDMP and applicable implementing ordinances. The growth forecasts accounted for in the CDMP would be adequate to accommodate the estimated off-site development projected as part of the Proposed Action, assuming a moderate level of baseline growth.

Residential development is located north and west of the former base and within the cities of Homestead and Florida City. New residential development attributable to increased employment associated with the Proposed Action is not anticipated to exceed the forecasts of the existing regional plans. Section 4.1.4.1 discusses estimated housing impacts of the Proposed Action. Residential uses in TADs adjacent to HST may experience more urbanization and mixed land uses as a result of off-site commercial development associated with the airport. There could also be a potential for incompatible land use adjacencies if industrial development expanded near residential areas.

In addition to potential impacts on land use patterns and plans, areas in the immediate vicinity of HST could be affected by a number of changes associated with development and operations of the former base property. During construction, properties adjacent to the construction areas would be temporarily exposed to increased noise and fugitive dust from construction traffic and activities. After construction is complete, increased industrial and commercial activity could be expected to generate additional traffic on local roads and increased noise associated with truck traffic and other heavy equipment in aviation support and industrial areas. As described in Section 4.2, vehicle traffic along certain roadways is projected to increase and could affect levels of service.

Noise from aircraft operations would also increase. Under the Proposed Action, the overall land area in the airport vicinity within the Day-Night Average Sound Level contours indicating significant noise exposure (DNL 65 dB and above) and moderate noise exposure (DNL 60–65 dB) would be expected to change very little from existing conditions. Currently, an estimated 6,458 acres is located within the DNL 60 dB contour. The total land area within the DNL 60 dB contour is calculated to increase by 262 acres by 2005, another 1,069 acres by 2015, and an additional 237 acres at maximum use of one runway. By maximum use, the total area exposed to DNL 60 dB and above is estimated to be 1,568 acres (24 percent) more than the projected baseline conditions (**Landrum & Brown 1999b**).

At most areas newly exposed to DNL 65 dB or higher, the increase would be less than 1.5 dB. An area within the 65 dB contour directly southwest of the runway, and out about a mile, could experience increases exceeding 1.5 dB (in DNL) by 2015 under the approach path to the runway (see Figure 4.5-6). Southwest of that is an area that extends for about another mile that would be exposed to DNL between 60 and 65 dB, and where the increase in noise level would be more than 3 dB (in DNL). These areas are

zoned as agricultural, recreational, commercial, and vacant unprotected lands. The land is currently mostly vacant, although the South Dade Center housing area is adjacent to the southwest boundary of the former base with an estimated 311 dwelling units. A portion of this housing area would be within the modeled DNL 65 dB contour and could be exposed to increases in DNLs of more than 1.5 dB.

Monroe County. The Proposed Action is not anticipated to have land use impacts on Monroe County. Flights would increase by an estimated 16 percent over portions of Monroe County. The increase in average noise levels is not expected to produce overall increases in community sensitivity to noise because of the altitude of the overflights and the low DNL exposure levels compared to existing conditions and normal community ambient noise levels. The Ocean Reef Communities and Angler's Club area could be exposed to relatively low DNLs from aircraft overflights of about 39–40 dB (compared to 35 dB currently), and the City of Key Largo could be exposed to DNL of 31 dB (compared to 22 dB currently) at maximum use of a single runway.

Cumulative Impacts

The South Florida Ecosystem Restoration Project and the Central and Southern Florida Project Comprehensive Review Study could affect the way land is used and management plans are prepared. For example, as a result of the Florida Keys Carrying Capacity Study, adoption of new comprehensive plan goals and objectives may be necessary to protect the natural ecology of the south Florida and Florida Bay. In order to implement these objectives, zoning and land use regulations may change, thereby affecting growth and development.

The widening of U.S. Highway 1 would improve the level of service along that route. This improvement could provide more opportunities for commercial development along the highway corridor. The high level of population growth forecast by Miami-Dade County, if it occurred, would also increase the pressure for development. The combination of these pressures could promote a change from a primarily rural landscape to a more urbanized environment. Because so much of south Florida is protected from development, the increased development is likely to be concentrated in higher densities in unprotected areas, even more so if ecosystem restoration and Restudy initiatives are implemented and remove more land from development. The result could ultimately be a land use pattern characterized by highly urbanized areas and protected natural areas, with a loss of lower-density rural agricultural areas. The development of a commercial airport at former Homestead AFB could contribute to increased urbanization in the immediate vicinity of the airport, but if high-growth population forecasts are realized, the increased urbanization would occur with or without the Proposed Action.

Mitigation Measures

There is a potential for noise from industrial development and vehicle traffic associated with the Proposed Action to affect the Homeless Trust Center. The airport developer could mitigate these effects by constructing landscape barriers to reduce noise and visual intrusions and by constructing major truck routes to avoid this area.

The concept of a land buffer between HST and Biscayne NP has been put forth by several entities. The effects of such a buffer on land use plans and policies would depend on how the buffer was implemented. Currently, the land within the area analyzed as a buffer by NPS is identified in the CDMP as agriculture and open land, and the establishment of a buffer would not be expected to change those land uses (potential effects on agriculture are discussed in more detail in Section 4.6.4). In fact, a buffer could assist in preserving these areas and protecting them from urban encroachment. As analyzed by NPS, however, the buffer would prohibit development in a portion of the UEA northeast of the base. That would

eliminate some of the area currently identified for development and could increase development pressures and densities in areas within the current UDB.

Depending on the implementation details, the buffer could potentially interfere with some aspects of the proposed development of HST and its possible expansion in the future. Specifically, the extension of the Turnpike interchange at 112th Avenue would be in the UEA, and the area tentatively identified for a second runway is also within the buffer analyzed by NPS. More generally, the buffer could inhibit any expansion of the airport or associated secondary development to the south and east. Consequently, development would be concentrated north and west of the airport, in areas currently dominated by residential uses. Those areas could become more exposed to land use conflicts and potential incompatible adjacencies.

These potential incompatibilities could be mitigated in Miami-Dade County's planning process and land use controls. To avoid the potentially deleterious effects of uncontrolled secondary development in the vicinity of the airport, areas for this development could be specifically identified in the CDMP. Transportation routes to commercial and industrial areas could be planned and designed to minimize traffic through residential areas, and noise attenuation measures such as greenbelt buffers and, if necessary, noise barriers along major roadways could be implemented. Currently, the CDMP addresses development of HST primarily within the airport boundaries. To reduce potential adverse effects from secondary development, future CDMP amendments could take a broader, more comprehensive approach to the area surrounding the airport to better control and channel associated off-site development.

The noise abatement flight paths evaluated (see Figures 2.11-1 through 2.11-3) would not noticeably affect the areas around HST exposed to DNL 60 dB and above. DNL is not expected to change noticeably at Ocean Reef or the Angler's Club with any of the three noise abatement flight path alternatives. More discussion of these flight paths is contained in Section 4.5. Other potential mitigations to reduce aircraft noise are also described in Section 4.5.

Possible Future Expansion

Future expansion of the airport to include a second runway would require acquisition of an estimated 1,060 acres of additional property to the south and east of the existing runway, outside the UDB. The expansion would require further amendments to the CDMP. In addition to the airport expansion itself, a larger airport with more service would likely stimulate further secondary development off site and increase traffic in the area. These activities could affect existing land uses near the airport.

4.6.2.2 Commercial Spaceport Alternative

Miami-Dade County. The existing CDMP does not include a plan for developing former Homestead AFB as a Commercial Spaceport. If this alternative were implemented, such a plan would need to be prepared and used to support amendments to the CDMP and applicable implementing ordinances (e.g., zoning). On-site development under this alternative would be similar to the Proposed Action but less intensive. In particular, there is assumed to be less commercial development and associated traffic. The potential for land use conflicts between industrial and residential areas could be similar to the Proposed Action.

Under this alternative, the overall land area affected by high average noise levels is forecast to change little from the baseline. Some areas could be exposed to slightly higher DNLs than under the Proposed Action. The increase in total land area within the DNL 60 dB contour is calculated to increase by 435 acres (about 22 percent) by 2005 and then by another 512 acres by 2015/full buildout.

The land areas most affected by noise would be northeast of the base in currently agricultural, vacant, recreation, and national park lands. Areas where noise levels have been identified to increase 3 dB within the 60 dB contour and 1.5 dB over the 65 dB contour are currently either vacant or in agricultural use and are outside the UDB. A few isolated residents could experience changes in DNL exceeding 3 dB.

The TADs surrounding the former base could be expected to experience secondary development associated with the spaceport. The level of development is anticipated to be less than under the Proposed Action and would likely include more office and industrial type development and less retail commercial development. Vehicle traffic would be expected to be less without the passenger traffic associated with a commercial airport.

Monroe County. The Commercial Spaceport alternative would not be expected to affect land use in Monroe County. Spaceport operations are assumed to be oriented primarily to the northeast, not toward Monroe County. DNL at Ocean Reef and the Angler's Club, as well as at Key Largo, would remain essentially the same as current conditions.

Combined Commercial Spaceport/Airport

A combined Commercial Spaceport/Airport would result in industrial and commercial development similar to but less intense than the Proposed Action. The CDMP would have to be amended to accommodate this development. Noise contours would not be appreciably different from those calculated for the spaceport without a civil airport component. Secondary development and vehicle traffic in the TADs adjacent to the spaceport/airport would likely be higher than projected for the spaceport alone, but unlikely to reach levels projected for the Proposed Action.

Cumulative Impacts

The cumulative impacts under this alternative would be essentially the same as described for the Proposed Action.

Mitigation Measures

Potential mitigation measures and their effects would be as described for the Proposed Action. The noise abatement flight paths would only be applicable to a combined Commercial Spaceport/Airport.

4.6.2.3 Mixed Use Alternative

Miami-Dade County. The effects of this alternative on land use depend on how the alternative would be implemented and would differ among the Market-Driven development, the Collier-Hoover proposal, and the original Collier and Hoover plans. Any of these options would require amendments to the CDMP with associated amendments to the applicable implementing ordinances.

All four approaches to this alternative are assumed to include some type of residential use on former base property. The residential emphasis would be generally compatible with some of the activities on the previously conveyed property, including the Job Corps and Homeless Trust Centers. The potential for incompatible land use adjacencies would still exist with commercial and industrial development and existing military uses.

The Collier-Hoover proposal would include three primary activity areas. At the northwestern end of the disposal property would be a luxury RV park interspersed with a golf course. These residential and recreational uses would be adjacent to existing residential areas and would be generally compatible with

those land uses. If the RV park generated high levels of traffic and noise, it could adversely affect adjacent housing areas.

The second main area would be the commercial hub in the center of the site. This area would include the aquarium and other principal visitor attractions. It would be adjacent to the Homeless Trust Center and the Job Corps Training Center. As a major visitor attraction, the commercial hub would have the potential to generate large amounts of traffic and associated noise that could affect adjacent land uses. The Collier-Hoover proposal includes plans to limit personal vehicle traffic to peripheral parking lots and use electric vehicles to move visitors within the site. This combined with landscaping would reduce the potential for noise and traffic impacts and increase the safety of residents at the Homeless Trust Center.

The third main activity area of the Collier-Hoover proposal is a commercial/industrial area interspersed with golf courses and waterways and landscaping. This area is envisioned as an office-industrial park type setting. The adjacent land uses would include the airfield, Homestead ARS, and other previously conveyed industrial and institutional properties. The land uses proposed in the Collier-Hoover plan would be compatible with those activities.

The Collier-Hoover proposal currently includes plans to develop a golf course on a portion of the property previously conveyed to Miami-Dade County for a regional park. The plan includes offsetting adjacent acreage that the proponent proposes to exchange for that property. If the exchange is accomplished, the regional park should be able to be developed for public use as planned.

The original Collier proposal would provide for lower planned density, involve fewer daily vehicular trips, and place an overall emphasis on recreational and commercial land uses. It is expected to include some office and industrial development and an RV park, but no permanent residential development. If the RV park generated high levels of traffic and noise, it could affect adjacent housing areas. CDMP amendments would be required for this proposal and may include provisions to reduce potential adverse effects on adjacent land uses.

The original Hoover plan includes research and education facilities, which would be generally compatible with the projected residential land uses in the northern portion of the disposal property and previously conveyed areas like the Homeless Trust Center. High visitor use assumed in connection with this scenario could be expected to increase vehicle traffic through areas adjacent to the site, and could adversely affect adjacent residential areas.

Under this alternative, the aircraft-related noise levels and the land areas affected would not change from the baseline conditions.

Monroe County. The Mixed Use Alternative would not be expected to affect land use in Monroe County.

Cumulative Impacts

The cumulative impacts of the Mixed Use alternative in combination with other projects and developments in the ROI would be similar to those described for the Proposed Action. The contribution of reuse of the disposal property to cumulative growth and development would be less than with the Proposed Action.

Mitigation Measures

Potential mitigation measures and their effects would be as described for the Proposed Action. In particular, the developers of the Collier-Hoover plan could include measures in their final design to

reduce potential noise and safety impacts from high visitor traffic on the Homeless Trust Center through traffic separation and landscaping. The noise abatement flight paths would not apply to this alternative.

4.6.2.4 No Action Alternative

The No Action alternative assumes that the Air Force would retain ownership of all of the disposal property (1,632 acres). The airfield, 915 acres, would continue to be used for military and other government aircraft operations. The remaining 717 acres of disposal property would be maintained in caretaker status. The land use on this property would remain primarily vacant open lands. No impacts on the surrounding land uses are anticipated. Aircraft-related noise levels would remain the same as the baseline conditions.

4.6.2.5 Independent Land Use Concepts

The independent land use concepts are similar to land uses associated with the Proposed Action and other reuse alternatives. Implementation of one or more of the independent land use concepts would not be expected to impact existing land uses.

4.6.3 Special Use Areas

Southern Florida attracts visitors drawn to its unique natural resources. Biscayne NP, Everglades NP, Big Cypress National Preserve, and Florida Keys National Marine Sanctuary are located within a few hours' drive of one another. These areas provide a variety of recreation experiences (hiking, nature-watching, boating, snorkeling, scuba diving, fishing, etc.) in a unique natural setting. The Proposed Action and alternatives may affect these areas and their visitors through population growth and aircraft overflights.

The potential for reuse of former Homestead AFB to affect the natural resources of these areas, which lie at the heart of their preservation values and attraction to visitors, is discussed in Sections 4.8 (Air Quality), 4.10 (Water Resources), and 4.11 (Biological Resources). The discussion in this Land Use section focuses on the relationship of the Proposed Action and alternatives to the plans and policies established for these areas, and on potential impacts on park visitor experiences.

4.6.3.1 Proposed Action

Construction associated with the Proposed Action is not expected to directly affect Biscayne NP, Everglades NP, Big Cypress National Preserve, Florida Keys National Marine Sanctuary, Crocodile Lake National Wildlife Refuge, John Pennekamp State Park, or Bill Baggs Cape Florida State Park. Encroachment on those areas is discouraged in the Miami-Dade County CDMP, which provides for future growth within the UDB and UEA. The Save Our Rivers program and the county's EEL program, which focus on preserving environmentally sensitive areas, also contribute to the protection of sensitive resources areas.

While there may be some increased pressures on recreational resources in the ROI from population in-migration stimulated by the Proposed Action, particularly locally popular areas such as John Pennekamp State Park, Section 4.1 indicates that population increases attributable to the Proposed Action are not expected to be a substantial contributor to regional population growth. The aspects of the Proposed Action with the most potential for affecting special use areas in the ROI are related to aircraft operations.

Limited research exists that specifically addresses impacts of aircraft overflights on visitors to national parks and recreation areas. In 1987, Public Law 100-91 directed NPS and the U.S. Forest Service to conduct studies of aircraft overflights that might be affecting visitors of national parks and National

Forest System wilderness areas, and to report the results to Congress. The *Report on Effects of Aircraft Overflights on the National Park System* (**NPS 1995**) and the *Potential Impacts of Aircraft Overflights of National Forest System Wildernesses* (**USFS 1992**) are among the only large-scale studies in which a concerted effort has been made to apply quantitative methods to the problems of measuring outdoor recreationists' reactions to aircraft noise exposure in wilderness-type environments, including national parks.

The NPS report identified problems associated with aircraft overflights over particular parks and distinguished between impacts caused by sightseeing aircraft, military aircraft, commercial aviation, general aviation, and other forms of aviation that affect those parks. Reactions varied widely among individuals, depending upon their expectations and the context in which the event occurred. The study found that aircraft overflights produce impacts on national park resources and visitors. These impacts are not uniform throughout the national park system and depend on the air traffic a specific park is exposed to and on the local park management objectives.

NPS-sponsored studies supporting the report to Congress suggested that visitors to national parks have different expectations and tolerances for intrusions during their visits than they would in other areas, including the places they live. Respondents to NPS visitor surveys ranked enjoyment of natural quiet and viewing natural scenery as equally important reasons for visiting some national parks. NPS has also expressed the belief that adverse reactions to noise intrusions occur at lower sound levels in park settings than in residential or recreation areas around airports (**Fidell 1997**).

Information contained in the NPS study (**NPS 1995**) indicated that the vast majority of park visitors enjoyed and were satisfied with their outdoor recreational experiences. About a fifth of all park visitors recalled hearing airplane noise (including visitors to parks with frequent low-altitude commercial air tour flights). Two to 3 percent of visitors thought aircraft noise had an impact on them, and less than 2 percent of visitors believed that aircraft noise interfered with enjoyment of their visits or was annoying. Among park visitors who expressed annoyance of any degree, most reported they were slightly or moderately annoyed. The study also found that duration of aircraft overflights can affect a visitor's experience in a natural area. The longer the visibility or sound of the aircraft, the greater the potential for the visitor to be annoyed.

NPS surmised that negative reactions to aircraft noise would be stronger among people who spend more time in isolated areas, such as wilderness areas, and may have different expectations about solitude. When questioned by mail after their park visits, about a third of wilderness permit holders recalled some annoyance or intrusion from aircraft noise during their outdoor recreation experiences.

The major emphasis of the USFS study (**USFS 1992**) was to determine the effects of aircraft overflights on visitor enjoyment in remote wilderness areas. Wilderness visitors were interviewed during and shortly after their wilderness visits to assess the impact from exposure to aircraft overflights while using wilderness areas. This approach was used instead of conducting a more general poll of public opinion about a hypothetical question of whether aircraft overflights are compatible with the wilderness experience. Some key findings of the study included the following:

- Aircraft noise intrusions did not appreciably impair the surveyed wilderness users' overall enjoyment of their visits to wilderness areas or reduce their reported likelihood of repeat visits.
- The majority of the users interviewed were not annoyed by overflights. The visitors, in general, did not notice aircraft even when they were present. This was especially true for high-altitude aircraft. Low-altitude, high-speed aircraft were reported as the most annoying type of aircraft heard or seen. This was attributed to the "startle effect" that occurs when a very loud noise (e.g., low-altitude jet

aircraft) is experienced in a setting where it is not expected (e.g., a wilderness area) and when there is no visual or audible warning of the noise source.[1]

- Annoyance associated with aircraft overflights was more strongly related to noise exposure than to the visibility of the aircraft or the condensation trail. Aircraft were rarely noticed unless accompanied by noise.

Different settings were used for the study to account for the many different landscapes comprising wilderness areas. Respondents were also exposed to a number of different types of aircraft. For example, those interviewed in the Golden Trout Wilderness were susceptible to overflights by military aircraft flying during the day and at night at very low altitudes producing sound exposure levels above 100 dB.

More respondents reported that they did not notice any aircraft at all during their wilderness visits than reported noticing any particular type of aircraft. The aircraft noticed most often were high-altitude jet aircraft. About 10 to 13 percent of the respondents reported noticing both helicopters and low flying jets during their wilderness visits.

USFS believes that aircraft noise is becoming more intrusive and distracting from the recreation visit. Reports to National Forest System field units from visitors indicated an increase in incidents of intrusion from tourism flights on the solitude and quality of visits to wilderness and other scenic and recreation areas (**USFS 1992**).

The most recent research on noise effects on parks visitors has been conducted by FAA and NPS at Bryce Canyon National Park. In *Development of Noise Dose/Response Relationships for the National Parks Overflight Rule: Bryce Canyon National Park Study* (July 1998), it was found that a correlation existed between aircraft noise levels and the percentage of park visitors that were annoyed (**Fleming et al. 1998**).

In that study, the primary subject was aircraft operated for sightseeing and tours, as opposed to commercial airport traffic. The sites examined were considered to be "front country" trails, meaning that they were used by relatively high volumes of visitors for short hikes of one hour or less.

The FAA and NPS are in the process of conducting joint research to establish noise standards for assessing aircraft noise over national parks to support Public Law 100-91. FAA's *National Park Overflights Rule Noise Research Plan* of February 1998 (**FAA 1998b**) provides a description of the proposed research elements and how they will lead to noise standards and assessment criteria. The research plan calls for additional research regarding dose-response relationships at "backcountry" sites, but it has not yet been completed.

All of the studies described above involved specific geographic areas and conditions. Conditions and expectations could be expected to differ in Biscayne and Everglades NPs. No systematic visitor surveys dealing with noise have been conducted at either park. The following paragraphs provide some general observations that could apply to visitors in these types of areas.

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[1] The startle effect often occurs in canyon regions or thickly forested areas where a low-flying jet may not be heard until it suddenly appears directly overhead. In primitive wilderness areas, where visitors experience quiet periods, the startle effect can decrease the wilderness experience by disturbing the tranquility and solitude of the outdoor setting. On open plateaus, where vegetation is low and visibility is uninterrupted, the visual effects of low-flying aircraft may also impair the sense of solitude and naturalness for individuals seeking a primitive recreation experience. However, the intrusions from any single overflight are transitory and would not necessarily impair the overall opportunity for a visitor to find solitude.

When aircraft fly over outdoor recreational areas within large parcels of airspace, the experience of aircraft noise during a typical visit can take the following form:

- For any given visit to an area where noise from other recreation visitors, cars, wildlife, etc., is common, visitors would be less likely to notice aircraft noise, particularly if it is far enough away as to be only slightly audible, even in areas with low natural noise levels. Within the national park areas, this would be expected to include high-use areas and visitor centers.
- For a visit to more remote areas with high visitor use, noise from distant aircraft operations may be noticeable to outdoor recreationists when they are not hiking, talking, or making any other noises themselves. Factors that could be expected to affect visitor annoyance in these areas would be aircraft altitude, distance, noise level, and frequency of overflight.
- For visitors in outstanding natural areas and primitive areas, noise from aircraft operating within a few miles, although not particularly loud, may intrude to some degree on enjoyment of solitude and natural quiet.
- For visitors in outstanding natural areas and primitive areas, aircraft flying directly overhead at low altitudes could be considered invasive. On such occasions, a visitor would hear a very loud noise for a short period of time. This noise would probably be annoying and may be startling as well.

Perceptions and reactions can vary greatly from individual to individual, depending upon expectations and the context in which the event occurs.

Independent of visitor expectations and reactions, the natural soundscape of a national park is a resource that NPS is mandated to preserve. Any increase in noise is considered by NPS as incompatible with goals to preserve and enhance the natural soundscape. Increased aircraft noise generated by the Proposed Action could be expected to have a diminishing effect on the natural soundscape. It would complicate NPS initiatives to manage the natural soundscape and could either frustrate some goals or require greater reductions in other noise sources to achieve those goals.

The highest noise effects would be expected in areas closest to approach and departure tracks to and from HST, especially where aircraft would be at lower altitudes. This might occur in certain areas of Biscayne NP and the eastern edge of Everglades NP. Areas underlying airspace where aircraft would not regularly concentrate would probably experience fewer effects. Such conditions would be expected in areas of Everglades NP farthest from HST and in Big Cypress National Preserve where flight activity would be at higher altitudes.

The FAA's approach to impact analyses involving noise focuses on the effects of aircraft noise on people (i.e., visitors) and wildlife. In the absence of identifiable adverse impacts on these receptors, FAA does not identify and cannot quantify an impairment of park resources. FAA's view is that noise does not produce an effect apart from human and animal hearing and reactions, and that it does not linger in the environment as a permanent impact or impairment.

The following sections discuss anticipated noise levels from aircraft overflights for the Proposed Action at a few key locations within the special use areas in the ROI. More detailed information on noise levels throughout these areas is provided in Section 4.5. Section 4.11 specifically discusses noise effects on wildlife within these areas.

To provide a sense of the effect of individual operations, seven locations were selected to provide more detailed descriptive information on aircraft overflights and noise levels: five in Biscayne NP, one in Everglades NP, and one in Crocodile Lake NWR. **Table 4.6-1** provides information on average daily operations (in 2015), estimated altitude, slant distance, and SEL for the five largest user groups of flight tracks from HST passing over the points examined: the F-16 military fighter, MD-80 narrow-body passenger jet, turboprop passenger aircraft (e.g., Dash-8, ATR-42), BEC-58 multi-engine general aviation aircraft, and single-engine general aviation aircraft. No other aircraft is projected to have an average of more than 12 operations per day in the vicinity of any location, and most others would have less than three average daily operations. The points are shown by their letter designators on Figure 3.5-4. The year 2015 was selected because it is within a foreseeable time frame with a reasonable probability of occurring. Maximum use has considerable uncertainty, especially with respect to timing.

Biscayne National Park. Table 2.2-6 shows forecast average daily numbers of jet and propeller aircraft operations by flight track for each year analyzed. By 2015, approximately half of all operations would be expected to fly over some portion of Biscayne NP. Most operations would be in east flow, with an estimated 137 departures per day over Biscayne NP in 2015. The proposed east flow departure tracks include routes directly east, southeast, and northeast over Biscayne NP, Crocodile Lake NWR, and a portion of Florida Keys National Marine Sanctuary. In addition, aircraft headed northwest and southwest would loop to the south around the western shoreline of Biscayne NP.

The five noise point locations examined in Biscayne NP cover the expanse of the park from east to west and north to south. They include the Visitor Center at Convoy Point, Mangrove Key in the southwest portion of the park, Elliot Key on the eastern shore of Biscayne Bay, Soldier Key at the northern end of the park, and Pacific Reef at the eastern edge of the park.

An average of approximately 105 operations per day are estimated to use flight tracks that would pass in the vicinity of the Biscayne NP Visitor Center in 2015. The most operations are projected to be flown by general aviation aircraft. The most common large commercial jet is expected to be the MD-80, with an estimated 19 average daily operations. As Table 4.6-1 shows, the altitudes of these aircraft in this area would likely range from about 900 to over 6,000 feet. Estimated slant distances would range from 1,300 feet to more than 18,000 feet away (slant distance is the straight-line distance between the aircraft and the ground, considering both altitude and side distance). The loudest aircraft would continue to be the F-16. The MD-80 would be the loudest commercial aircraft. It would be at similar distances from the Visitor Center as the F-16. It is also projected to have the highest number of operations. General aviation aircraft could represent about a third of total operations in this area. They generate lower individual noise levels than larger commercial aircraft, but because they tend to fly at lower altitudes, the resulting SELs on the ground can be similar.

SEL levels calculated at Mangrove Key are slightly lower overall than at the Visitor Center, reflecting increasing altitudes at the greater distances. At an average of 65 per day, the number of operations is also projected to be less. A larger percentage of aircraft forecast to fly over this area are general aviation aircraft.

Elliot Key is forecast to experience the highest number of aircraft events of the seven locations analyzed, with an estimated total daily average of 232 in 2015. The wide range of slant distances shown in Table 4.6-1 indicates that aircraft on a number of flight tracks at various distances from the point would be heard at Elliot Key. Turboprop aircraft are shown to be the dominant aircraft type, followed by single-engine general aviation aircraft. The F-16 is still projected to be the loudest aircraft heard in this location, with lower SELs for civil aircraft reflecting their generally higher altitudes.

Table 4.6-1. Select Aircraft Overflight Data for Sample Points (2015)

Location[1]	Aircraft				
	F-16	MD-80	Turboprop	BEC-58	GA
Biscayne NP Visitor Center (Point MG)					
Average Daily Operations	15	19	13	13	20
Altitude (feet)	1,500–6,400	1,700–5,000	3,700–5,000	900–3,800	900–3,700
Slant Distance (feet)	3100–18,400	3,400–18,300	4,100–8,900	1,300–10,500	1,300–4,400
SEL (dB)	75.0–103.6	68.8–86.7	64.3–71.3	65.7–79.5	68.0–75.3
Mangrove Key (Point MH)					
Average Daily Operations	11	13	5	10	18
Altitude (feet)	2,000–5,200	5,000–5,700	5,000–5,400	900–5,000	900
Slant Distance (feet)	3,500–10,800	5,200–7,100	5,300–6,300	4,200–5,300	4,200
SEL (dB)	70.3–103.1	72.2–81.0	68.1–73.0	70.0–72.1	65.8
Elliot Key (Point MI)					
Average Daily Operations	16	32	64	26	46
Altitude (feet)	2,000–6,600	3,900–7,100	3,000–7,000	900–11,300	900–5,000
Slant Distance (feet)	3,200–52,000	7,000–48,000	7,000–48,000	7,900–37,400	7,900–55,800
SEL (dB)	49.6–76.5	43.6–65.2	41.3–67.8	43.9–66.8	45.6–58.8
Soldier Key (Point ML)					
Average Daily Operations	15	26	43	21	30
Altitude (feet)	1,200–15,000	3,000–26,400	3,000–9,000	900–7,000	900–5,700
Slant Distance (feet)	4,200–82,400	7,500–69,700	7,000–74,300	4,900–79,800	4,700–72,600
SEL (dB)	43.9–72.4	44.6–67.1	38.9–68.4	38.7–72.0	35.3–65.5
Pacific Reef (Point ME)					
Average Daily Operations	13	23	45	16	28
Altitude (feet)	4,000–6,800	6,000–14,800	3,000–10,900	900–7,000	900–5,000
Slant Distance (feet)	5,000–60,700	6,000–70,500	6,000–65,200	4,000–70,500	4,000–49,400
SEL (dB)	52.0–71.8	44.8–69.7	45.0–68.4	45.3–70.1	40.3–62.4
Hidden Lake, Everglades NP (Point MR)					
Average Daily Operations	6	18	25	17	17
Altitude (feet)	1,500–9,000	3,900–20,300	2,600–4,500	3000	3000
Slant Distance (feet)	14,000–54,900	4,300–65,000	4,300–34,000	3,000–14,800	3,000–12,500
SEL (dB)	47.3–57.5	49.4–65.8	47.7–71.0	56.5–74.1	53.5–67.1
Hardwood Hammock (Point MW)					
Average Daily Operations	13	16	28	14	27
Altitude (feet)	4,000–8,000	8,100–11,700	4,000–11,800	4,000–7,400	4,000–10,800
Slant Distance (feet)	5,600–40,600	11,800–48,100	10,000–45,300	9,600–31,700	7,900–26,200
SEL (dB)	43.1–83.9	52.7–75.0	46.5–65.6	48.5–66.2	44.5–68.2

Source: SAIC, Landrum & Brown.
Note: [1] See Figure 3.5-4.
dB decibel
GA General Aviation (single-engine)
SEL Sound Exposure Level

The range of slant distances and SELs for Soldier Key is even larger than shown for Elliot Key, again indicating that aircraft on various flight tracks and at various distances would be heard at this location. Total average daily operations are estimated to be somewhat less (165). The distribution of operations by aircraft type is similar to Elliot Key, as is the range of SEL levels.

The total number of average daily operations (153) and range of altitudes, distances, and SELs forecast for Pacific Reef are similar to those for Soldier Key.

Other noise metrics for these locations, including Maximum Sound Level, Peak Hour Equivalent Sound Level, and Time Above traditional ambient levels are provided in Section 4.5 (see Tables 4.5-5, 4.5-6, and 4.5-7).

Visitors at Biscayne NP would be exposed to more aircraft events under the Proposed Action. It is surmised that visitors in power boats would be less likely to notice aircraft noise over their own motors. In the northern area of the park where bone fishing is popular, as well as in the southern, more remote areas, the overflights might be considered intrusive by visitors. In these areas, the natural ambient sounds made by wildlife and lapping waves would be more prevalent.

Biscayne NP is preparing a Soundscape Preservation and Noise Management Plan. Increased noise from aircraft associated with the Proposed Action could make it more difficult for the park to accomplish the goals it sets forth in the plan, especially efforts to reduce noise intrusions and return to a more natural sound environment.

Everglades National Park. As shown in Table 4.6-1, overflight and SEL data were calculated for five aircraft types that are forecast to represent the main users of flight tracks overflying Everglades NP. These data are provided for point MR, located at Hidden Lake on the eastern boundary of the park. Aircraft that may be heard from this location could be traveling on a number of flight tracks at various distances from the point. As Table 4.6-1 shows, at this location, the loudest events are not expected to be associated with military aircraft. That is because the flight tracks used by military aircraft do not pass near this point. The flight tracks forecast to be used by the commercial passenger aircraft would be closer, as reflected in the higher SELs shown for the MD-80 and turboprops. A forecasted 100 average daily operation may be heard from this location.

At Everglades NP, the wilderness, primitive, and outstanding natural areas would also see an increase in aircraft overflights under the Proposed Action. Visitors to these areas could experience a decrease in solitude, thereby affecting that aspect of their recreation experience. For those visitors seeking a wilderness experience, the overflights may or may not be perceived as annoying and incompatible with the surrounding area. One view of a wilderness experience is that any reminder of civilization or society, however slight or brief, can completely nullify the experience for an entire wilderness visit. In this absolute sense, reminders of civilization that eliminate the experience of solitude could include encountering other visitors at trailheads, hearing sounds or seeing tracks generated by other outdoor recreationists within the wilderness, finding fire rings or other signs of prior campsite use, seeing signs of trail maintenance or constructed stream crossings, as well as hearing an overflying aircraft or even seeing a high-altitude aircraft condensation trail. In this case, solitude and naturalness are important aspects of a wilderness experience, and it is likely that such an expectation would be compromised by any non-indigenous noise exposure.

Conversely, a wilderness experience is not necessarily limited to a single facet or interpretation, but rather a range of expectations. Individuals with their own personal perceptions may recognize or classify activities as wilderness experiences simply as a function of location (e.g., areas outside traditional urban settings) or according to the type and nature of the activity (e.g., activities undertaken for recreation or

social events by individuals or groups). Solitude or the total absence of civilization may be considered desirable but perhaps not practical in conjunction with many experiences. In these instances, non-indigenous noise exposure may not infringe upon wilderness experiences.

Any discussion of wilderness must distinguish between the management and protection of wilderness resources and character and the wilderness experience. There are directives to manage and preserve the wilderness. The wilderness experience on the other hand, is highly personal, it often varies based on expectations, and it is not limited to areas within the National Wilderness Preservation System. NPS responsibility is to preserve the wilderness character and wilderness resource so that the wilderness experience is intact, as well as to educate the visitor as to the nature of wilderness in order to help define the wilderness experience.

While there are no guidelines for use by NPS to evaluate impacts to wilderness resulting from external activities, there are guidelines under which NPS must judge its own proposals. In evaluating proposals having the potential to impact wilderness resources, NPS must take into consideration wilderness characteristics and values, including the primeval character and influence of the wilderness; the preservation of natural conditions (including the lack of human made noise); and assurances that there will be outstanding opportunities for solitude, that the public will be provided with a primitive and unconfined type of recreational experience, and that wilderness will be preserved and used in an unimpaired condition. The principle of non-degradation is applied to wilderness management, and the condition of a wilderness area is measured and assessed against its own unimpaired standard. Under this standard, increases in aircraft noise from the Proposed Action would be expected to degrade the wilderness resources. To date, no studies have been completed to quantify the effect of noise on wilderness characteristics.

Everglades NP has not planned a separate soundscape management plan but intends to address soundscape preservation in amendments to the park's General Management Plan. Depending on the goals incorporated in those amendments, the concerns of the Proposed Action could be similar to those at Biscayne NP.

Crocodile Lake National Wildlife Refuge. Overflight and SEL data are provided for one point (Hardwood Hammock) in Crocodile Lake (see Table 4.6-1). A total of 124 average daily operations are forecast to pass over the area. Like the points examined in Biscayne NP, the highest SEL is for the F-16. The loudest civil aircraft shown is the MD-80. Commercial turboprop and general aviation aircraft dominate the number of operations and have similar SELs ranging from about 45 to 68 dB. Crocodile Lake NWR is not open to visitors.

Big Cypress National Preserve. Noise levels over Big Cypress National Preserve would vary in relation to flight tracks. Noise levels would be similar to the western portion of Everglades NP in the areas closest to the flight tracks.

Florida Keys National Marine Sanctuary. Two points were examined within FKNMS to provide information on a range of potential noise levels under the Proposed Action. One point is proximate to grid A233 on the noise grid analysis (see Figure 3.5-8) and the other is proximate to grid D135 (see Figure 3.5-11). LAmax levels at those points were calculated to range from 52 to 65 dB under the Proposed Action at maximum use of one runway. DNL levels were calculated at 17–34 dB, and Leq(h) at 19–37 dB. Whether calculated in DNL or Leq(h), cumulative noise exposure is projected to remain well below the estimated traditional ambient sound level. TAamb estimates indicate 0–3 minutes of increase on an average day. These levels are relatively low and not anticipated to impair use or management of the sanctuary.

State Parks. DNL and LAmax were calculated for a point in John Pennekamp State Park and for Bill Baggs Cape Florida State Park under the Proposed Action at maximum use. DNL was modeled at 38 dB and LAmax at 79 dB in John Pennekamp State Park. Peak Leq(h) is estimated at 42 dB at maximum use. Cumulative noise levels are projected to remain below the estimated average traditional ambient level. TAamb could increase by 4–7 minutes on an average day.

At Bill Baggs Cape Florida State Park, DNL was calculated at 42 dB and LAmax at 70 dB. A peak Leq(h) increase from 41.5 to 41.8 dB would not be noticeable. Cumulative noise exposure from HST operations would remain below measured traditional ambient noise levels in nearby areas. Bill Baggs Cape Florida State Park is exposed to more noise from MIA than from current or projected operations at HST. It would experience no time above ambient due to the Proposed Action.

In summary, noise exposure from the Proposed Action, using any metric, is not anticipated to adversely affect the use or management of John Pennekamp or Bill Baggs State Parks.

South Florida Water Management District Lands. SFWMD owns lands between Everglades and Biscayne National Parks that provide a wildlife corridor between the two parks and offer a number of recreational opportunities. Development at former Homestead AFB is not anticipated to adversely affect these holdings. There would be increases in cumulative aircraft noise levels as evaluated in the Addendum to Appendix E and in Sections 4.5 and 4.14. LAmax levels are not projected to change in these areas. In 2015, Leq(h) levels are projected to range from a low of 34.6 dB in the southwest corner of the Southern Glades to a high of 57.9 dB in the Model Lands Basin south of the former base. (The higher number represents a 0.1 dB change from the projected baseline.) DNL levels in 2015 are projected to range from a low of 31.3 dB to a high of 53.3 dB, at the same locations. (See the Addendum to Appendix E for more detailed discussion of SFWMD lands.) The potential for aircraft noise to affect the wildlife in these areas is addressed in Section 4.11.

Prescribed burning is an important land management tool in some of these areas, especially the Southern Glades Wildlife and Environmental Area. As noted in Section 4.4, it is not anticipated that the Proposed Action would interfere with this practice, although coordination between the proposed airport and SFWMD managers would probably be needed.

Key Largo Hammocks State Botanical Site. Development at former Homestead AFB would not be expected to adversely affect this site through construction or site operation because of its distance from the site. The area would be overflown by civil aircraft. Minor increases in cumulative aircraft noise levels are evaluated in the Addendum to Appendix E and in Sections 4.5 and 4.14.

Cumulative Impacts

The implementation of the L-31E Flowway Distribution Project, other ecosystem restoration and Restudy initiatives, and Miami-Dade County's proposed STDA would be expected to benefit both Biscayne and Everglades NPs. Direct benefits could include improved surface water distribution and indirect benefits could include protection of certain lands from development, especially in the area between HST and Biscayne NP. Additional development associated with the Proposed Action could dampen these benefits to a small degree.

Population increases would affect land use in the ROI independent of reuse of former Homestead AFB. If a high rate of growth occurred, the national parks in the area could experience increased encroachment by urbanization. Existing protections of wetlands and environmentally sensitive areas limit the potential for urbanization to completely overtake adjacent lands.

The cumulative population growth in the ROI could result in increased visitation at local parks, preserves, and sanctuaries. This would increase pressures on the national and state parks to balance providing visitors with a quality recreation experience and preserving natural areas and habitats. With increased visitor pressures, this balance could shift toward fewer opportunities for wilderness experiences, increased visitor restrictions to preserve natural habitats, or, conversely, degradation of wildlife habitat and other natural resources. However, Biscayne NP and Everglades NP in particular attract visitors nationally and internationally, and it is not known to what extent local population increases would affect visitation to those parks. Section 4.1 indicates the Proposed Action's contribution to a high population growth would be relatively modest.

Mitigation Measures

A buffer between HST and Biscayne NP would be expected to have a beneficial effect on the park by preventing encroachment from development, especially if growth in south Florida were as high as projected in the Miami-Dade County high-growth forecasts. A significant portion of the area that might be considered for a buffer is already protected through restrictions on development of wetlands and the Model Lands program. A consolidated buffer would prevent scattered infill in areas not already protected.

A description of potential noise abatement flight paths and their effects is included in Section 4.5.2.2.

Possible Future Expansion

Future expansion of the airport to include a second runway would require acquisition of additional property to the south and east of the existing runway. While special use areas such as Biscayne and Everglades NPs have defined boundaries, increased urban encroachment could affect park resources. A second runway could exacerbate impacts from continued population growth. Potential noise effects from use of a second runway are discussed in Section 4.5.

4.6.3.2 Commercial Spaceport Alternative

The impacts from direct and secondary development associated with the Commercial Spaceport alternative would be similar to the Proposed Action. The amount of secondary growth projected for this alternative is less, but the difference to special use areas would not be measurable. Indirect effects from noise would differ in some areas.

Most areas within Biscayne and Everglades NPs, Big Cypress National Preserve, Crocodile Lake NWR, John Pennekamp State Park, and SFWMD lands currently overflown by military and other government aircraft operating from Homestead ARS would not experience any change in maximum sound levels or frequency of overflight. Changes in noise levels would be confined to areas directly under and near the flight paths of the commercial space vehicles, currently assumed to be primarily northeast of the runway. Unlike conventional commercial aircraft, the commercial space vehicles could be louder than the military aircraft, and the northernmost portion of Biscayne NP could experience an increase in maximum sound levels. As depicted in Figure 4.5-27, higher SELs from potential spacecraft could be expected to be concentrated in the northern portion of Biscayne NP. Bill Baggs Cape Florida State Park could experience SELs of over 100 dB during space vehicle operations, forecast to occur a few times per week at full buildout. Although noise levels could be louder in a narrow area, the frequency of events would be low and intermittent. Noise levels outside of Biscayne NP would be very similar to baseline conditions.

Combined Commercial Spaceport/Airport

The airport component of a combined Commercial Spaceport/Airport would be similar to the Proposed Action. The impacts of aircraft overflights would be somewhat less in 2015 and at full buildout because the growth of the airport is expected to be constrained by the presence of the spaceport. Some visitors to the national parks could still expect to be disturbed, and the increased aircraft noise could make it more difficult for the parks to achieve their soundscape preservation and enhancement goals.

Cumulative Impacts

The cumulative impacts from the Commercial Spaceport alternatives in combination with other projects and developments in the ROI would be similar to those described for the Proposed Action.

Mitigation Measures

The discussion of mitigation measures under the Proposed Action would generally be applicable to the Commercial Spaceport alternative as well. The noise abatement flight paths would only apply to a combined Commercial Spaceport/Airport. No other mitigation measures have been identified for this alternative.

4.6.3.3 Mixed Use Alternative

The Mixed Use alternative is not expected to noticeably affect special land use areas. Aircraft operations would remain the same as baseline, and secondary development is anticipated to be less than with the Proposed Action.

Cumulative Impacts

As noted for the Proposed Action, population growth and associated development in south Florida would affect land use in the ROI independent of the reuse of former Homestead AFB. The Mixed Use alternative is not anticipated to contribute measurably to cumulative impacts on special use areas as described above.

Mitigation Measures

A buffer between the former base and Biscayne NP would have the same beneficial effects under this alternative as described for the Proposed Action. The noise abatement flight paths would not apply to this alternative. No other mitigation measures have been identified for this alternative.

4.6.3.4 No Action Alternative

Under the No Action alternative, the effects of former Homestead AFB would not change from baseline conditions. Cumulatively, high population growth in the region would have essentially the same overall effects as described for the reuse alternatives.

4.6.3.5 Independent Land Use Concepts

It is not anticipated that the independent land use concepts uses would change the effects on special use areas described above for the reuse alternatives.

4.6.4 Agriculture

Agriculture is a land use of special interest to area residents. Miami-Dade County land use policies specifically address the preservation of agricultural lands. Agricultural lands in southern Miami-Dade County are superior for growing traditional and tropical vegetables, tree crops, and commercial ornamental horticulture. Impacts on agriculture were assessed according to whether the Proposed Action and alternatives could result in a reduction in agricultural lands.

4.6.4.1 Proposed Action

On-site development at HST would not directly affect agricultural lands. Related off-site development could encroach into agricultural lands, especially within the UDB. Agricultural lands are not expected to be substantially affected by the first phase of development (2000–2005), although normal variations in agricultural use may occur in response to market conditions, weather-related changes, and other factors independent of the Proposed Action.

By 2015, secondary development associated with the Proposed Action could begin to have more of an effect on agriculture in the surrounding area. This development would be expected to occur first on lands closest to the airport, including areas along SW 288th Street and SW 112th Street. It is possible that development pressures would result in conversion of agricultural lands to residential, commercial, and industrial uses. Beyond the immediate vicinity of the airport, it is less likely that lands designated in the CDMP for preservation as agricultural would be affected.

The CDMP was amended in July 1998 to modify some aspects of the development of former Homestead AFB. The amendments included two items related to agricultural lands: a program to acquire land or development rights in agricultural areas east and southeast of the former base, and a commitment to maintain the UDB consistent with agreed-upon requirements of the area-wide land use and water management plan. In addition, the CDMP is already based on an aggressive growth forecast that exceeds the projections for the Proposed Action and is assumed, therefore, to be able to accommodate the additional growth without requiring changes in planned land uses, at least until 2015. Additional residential development may occur on agricultural lands where the current zoning permits one dwelling unit per 5 acres.

There is a risk of introduction of agricultural pests into southern Miami-Dade County by the importation of infected or infested agricultural material by passengers or in cargo entering HST. This could occur despite the best efforts of the U.S. Department of Agriculture and Florida Department of Agriculture and Consumer Services' passenger and cargo inspection services, primarily because it is extraordinarily difficult to effectively inspect all arriving passengers' luggage and all arriving containers of agricultural products. The recent introduction of the Medfly and citrus canker underscores the potential magnitude of the risk.

While Medfly and citrus canker are generally accepted as the two greatest threats because of apparently new infestations in the 1990s, the recent eradication of Medfly from Miami-Dade County indicates that citrus canker, which has infected a wider area since 1996, is apparently the more potentially damaging. The introduction of a new locus of infestation at HST would not be expected to increase the affected area, which already extends to the southern end of Miami-Dade County, but it could make it more difficult to eliminate this pest. Although Medfly was eliminated from primarily residential areas in Miami in the recent past, its establishment in the more rural, agricultural south county could increase the difficulty with which it can be eradicated and increase the risk of substantial economic damage to the agriculture industry.

Cumulative Impacts

The implementation of the L-31E Flowway Redistribution Project and the STDA could affect agriculture both directly and indirectly. Direct effects could include removing agricultural lands from production in the areas used for the projects themselves. The STDA may be confined to lands currently owned by Miami-Dade County, in which case it would not affect agricultural use. The flowway redistribution project would eliminate any agricultural use of areas that would be inundated by sheet flow of stormwater runoff. Indirectly, the redistribution project, as well as other potential ecosystem restoration projects, is expected to raise the water table in the region, which could make some crops nonviable in certain areas.

Under the county's high-growth forecasts, the population of south Miami-Dade County could increase substantially over the baseline. If that occurred, the loss of agricultural lands through implementation of the Proposed Action and ecosystem restoration projects could be further exacerbated by a high level of population growth in the ROI. It is estimated this could result in development of almost 20,000 additional acres. The Proposed Action's contribution to this increased development would be about 10 percent.

It is estimated that there are about 31,000 acres of unprotected vacant land in all of south Miami-Dade County, 9,000 acres of which are within the UDB. This suggests that agricultural lands, especially those within the UDB, would likely be developed to accommodate some of the growth. There are an estimated 64,000 acres of agricultural land in the county south of Eureka Drive, about 10,000 of which are within the UDB. While it cannot be precisely determined how much of this land would be converted to development, it is reasonable to assume that, cumulatively, virtually all of the undeveloped land within the UDB will eventually be developed for residential, commercial, and industrial uses. Although development outside the UDB is currently restricted to residential uses at one residence per 5 acres, with increased population pressures, the UDB could be expected to expand, further exposing agricultural lands to development, unless incentives are implemented to increase density within urbanized areas of the UDB and inhibit expansion into agricultural areas.

Mitigation Measures

A buffer between HST and Biscayne NP would be expected to incorporate land currently used for agricultural production. Miami-Dade County has estimated that the buffer area analyzed by NPS (see Figure 2.9-1) contains about 4,900 acres that have recently been used for agriculture (**Miami-Dade County 2000c**). The impact of this action on agricultural lands would depend on how the buffer was implemented. A strategy designed to maintain agricultural use would have less impact than one that removed lands from agricultural production (e.g., through direct purchase).

Purchase of development rights is one implementation mechanism that has been mentioned. This could help maintain agricultural use in some cases, most likely among tropical fruit and nursery farmers who have significant investments in infrastructure and multi-year crops. The benefit would be less for row-crop farmers, who have expressed concern about adverse effects of loss of development potential on their ability to obtain loans to support their enterprises. Such potentially adverse effects could be offset by accompanying the purchase of development rights with other incentives and supports to farmers to help ensure the continued economic viability of agriculture in south Florida. This could be addressed in the county's agriculture retention policies currently under development.

Transfer of development rights is another mechanism that has been discussed. This approach, if implemented judiciously, could benefit agriculture by providing incentives both to maintain agricultural lands and to increase densities in urbanized areas. Increased densities within the UDB would help reduce the demand for land to accommodate increased growth and development. It would, however, have the effect of reducing the rural character of areas around Homestead that are within the UDB.

Possible Future Expansion

The possible future expansion of HST to add a second runway would involve removing existing agricultural lands from production for airport use. This would reduce the amount of agricultural land in southern Miami-Dade County to a minor degree. The entire area currently identified for the expansion is a little over 1,000 acres, which is less than 2 percent of the agricultural land in south Miami-Dade County.

4.6.4.2 Commercial Spaceport Alternative

The impacts of the Commercial Spaceport alternative on agriculture would be similar to those described for the Proposed Action, although secondary development is expected to be somewhat less.

Combined Commercial Spaceport/Airport

A combined Commercial Spaceport/Airport would result in off-site industrial and commercial development similar to but less intense than the Proposed Action. The potential consequences of pest introduction through HST would be the same as described for the Proposed Action. The risk of infestation would be lower, however, because the volume of passenger and cargo traffic from foreign lands would likely be substantially lower under this alternative than under the Proposed Action.

Cumulative Impacts

Cumulative impacts with the Commercial Spaceport alternative would be essentially the same as described for the Proposed Action. Although population growth and development would be less under this alternative, the reuse of former Homestead AFB is expected to be a minor contributor to growth in south Florida under any alternative, if high-growth forecasts are realized.

Mitigation Measures

The effects of the proposed buffer between former Homestead AFB and Biscayne NP would be the same under this alternative as under the Proposed Action. No other mitigation measures have been identified.

4.6.4.3 Mixed Use Alternative

Secondary development associated with the Mixed Use alternative could affect agricultural lands by converting them to development. The impact would be less than estimated for the Proposed Action.

Cumulative Impacts

The cumulative impacts of the Mixed Use alternative in combination with other projects and potential development in the ROI would be essentially the same as described for the Proposed Action. The contribution of reuse of former base property would be somewhat less under the Mixed Use alternative.

Mitigation Measures

If a buffer between the former base and Biscayne NP were implemented with the Mixed Use alternative, the effects would be essentially the same as described for the Proposed Action. No other mitigation measures are identified.

4.6.4.4 No Action Alternative

Under the No Action alternative, agriculture in the ROI would not be affected by reuse of former Homestead AFB, although other activities planned in the region, as well as general population growth and associated development, could continue to reduce the amount of agricultural lands.

4.6.4.5 Independent Land Use Concepts

One of the independent land use concepts identified is a plant nursery. The northwest area of the former base would be the logical location for such a use because of its separation from more developed areas. This land use would not be expected to affect overall agricultural activity in the area except to slightly increase the amount of land in agricultural use in south Miami-Dade County. The other independent land use concepts, developed individually or collectively, would not affect agricultural land uses.

4.6.5 Aesthetics

The primary potential sources of impacts on sensitive visual resources from reuse of former Homestead AFB are aircraft overflights during the day and at night and on-site lighting at night, especially from airport and major industrial activities.

4.6.5.1 Proposed Action

The areas in the ROI most sensitive to aesthetics impacts are the national parks, preserves, and sanctuaries. Biscayne NP would experience the greatest effects because of its close proximity to former Homestead AFB. The airfield is located about 2 miles from the visitor's center at Biscayne NP. Boaters and other visitors can see the control tower from Biscayne Bay and would see commercial aircraft arriving and departing on a regular basis. Visitors seeking a quiet experience would be more likely to be affected than other boaters who might not hear the aircraft over the motor of the boat. Without the attention-getting effect of the accompanying sound, the aircraft would be less noticeable.

Commercial and military aircraft overflights are transitory in a landscape. The nature of the impact depends on the sensitivity of the resource affected, the distance from which the aircraft are viewed and heard, and the length of time they are visible and audible. Altitude relative to the viewer also plays a role in determining impacts from aircraft overflights. People's eyes are typically drawn to the horizon more than overhead, and they are therefore less likely to notice aircraft at higher altitudes. In areas of heavy forest, vegetation would screen most views of the passing aircraft. In open areas where vegetation is low and visibility uninterrupted, aircraft would be more visible. The environment, including whether it is open water (which tends to amplify sound) or heavily vegetated, (which tends to absorb sound) can also affect the aesthetic impact of noise from overflying aircraft.

The projected frequency of aircraft operations was reviewed to assess potential impacts on visual resources. Under the Proposed Action, aircraft operations from HST are estimated to increase from about 54 per day currently to a total of about 200 a day by 2005, 400 a day by 2015, and over 600 a day at maximum use of the one runway. Most operations would be in east flow. East flow departure tracks include routes directly east, southeast, and northeast over Biscayne NP.

Departures and arrivals over Biscayne NP are estimated to increase to 83 per day in 2005 and about 350 per day at maximum use (**Landrum & Brown 1999b**). These operations would be distributed across multiple flight tracks passing over different parts of the park. The number of departing aircraft flying directly east over Biscayne NP is projected to increase from about 4 per day by 2005 to about 50 per day with maximum operations. The number of aircraft headed southeast over the bay could increase from less

then 3 per day in 2005 to 26 per day at maximum use. There could be an estimated increase from 1–2 aircraft per day in 2005 to 23–24 per day at maximum use along the flight track headed northeast over the bay. Aircraft headed northwest and southwest would also loop to the south around the western shoreline of Biscayne Bay.

The increase in flights per day could affect the scenic viewshed of the area. While some visitors may notice aircraft without the accompanying noise, most people's attention would likely be drawn skyward by the noise from aircraft operations. It is anticipated that departing commercial aircraft would be at altitudes above 1,500 feet as they entered the airspace over Biscayne NP and would exit the airspace at much higher altitudes. Arrivals would be at similar altitudes in reverse. This air traffic is projected to result in an increase in the time noise levels are above traditional ambient levels by less than 10 minutes per day in the eastern and central areas of Biscayne NP, between 10 and 30 minutes per day along the western shoreline, and between 1 and 2 hours per day in two areas of the park close to HST at maximum use of one runway under the Proposed Action. Therefore, visitors could expect to hear and see aircraft more frequently than they do currently.

During outdoor activities such as sailing, sea kayaking, nature viewing, and bone fishing, where the environmental setting is an important part of the experience, aircraft and the condensation trails could be perceived as intrusive. Except those who are indoors or underwater, visitors could regularly see aircraft as a part of their visit. That occurs currently because aircraft from various airports in the region fly over the park, but the frequency would increase with the Proposed Action.

HST would be about 2 miles from Biscayne NP at its closest location. The airfield is currently lit for military and government operations and there are other sources of lighting (e.g., industrial areas, commercial enterprises, and parking lots). The overall effect of additional on-site lighting on horizon views at night would likely be minimal. Lights from aircraft, particularly during the winter months, would be more readily seen and could affect visitors' enjoyment of night activities. The increase in aircraft overflight during hours of darkness would mean increased visibility of aircraft lights over certain areas of the parks, which may be perceived as intrusive by some park visitors and is regarded by NPS as a degradation of the night sky.

Most of Everglades NP and Big Cypress National Preserve are less likely to be affected because the aircraft overflights would be more dispersed and at higher altitudes over these areas. Big Cypress National Preserve in particular is forecast to experience relatively few overflights and at high altitudes. Aircraft overflights would be less noticeable in most of these areas. Exceptions would be along the eastern edge of Everglades NP and areas underlying approach paths that converged over the park. These areas could experience frequent overflights. The goal of in the National Park Service is to preserve and enhance the natural soundscape and night sky at all national park properties, and any intrusion could be viewed as incompatible with NPS plans and policies.

Crocodile Lake National Wildlife Refuge is not open to visitors. Therefore, the Proposed Action would not be expected to affect visitor views at this location.

Cumulative Impacts

Other projects and developments that could affect visual resources include the widening of U.S. Highway 1 and the potential for accelerated population growth under the high-growth forecasts. The ecosystem restoration initiatives would not affect the visual environment, although they could contribute to maintaining the existing natural and rural landscape in areas adjacent to the national parks.

The widening of U.S. Highway 1 would improve the level of service along the route. This could provide more opportunities for commercial development along portions of the highway corridor, although much of that area is unsuitable for development and currently protected. Therefore, this change is not expected to greatly affect the surrounding area, much of which is already commercially developed.

With population growth, the increase in residential, commercial, and industrial areas would cause the area to appear more developed and more urban. Most of the vacant unprotected lands could be expected to be developed. This type of development within the UDB is planned for within the CDMP. While the overall landscape would change from a rural to a more urbanized environment, no impacts on sensitive visual resources are expected. The Proposed Action would contribute marginally to this effect.

Mitigation Measures

Noise abatement flight paths that avoid overflight of areas most sensitive to visual impacts would reduce the potential for adverse impacts. At the same time, areas underlying the noise abatement paths would be exposed to more aircraft lights. Implementation of a buffer zone could reduce the potential for visual intrusions to encroach on Biscayne NP.

The Miami-Dade County Aviation Department could consider the effects of increased lighting at HST, especially in vehicle parking areas, in the design of the airport to identify potential measures to reduce visibility from Biscayne NP.

Possible Future Expansion

The development of a second runway at HST would increase overflights over visually sensitive areas of Biscayne and Everglades NPs. The number of overflights could nearly double. This increase would exacerbate impacts on visual resources. Effects at Big Cypress National Preserve and the western portions of Everglades NP would still likely be low due to the altitude of aircraft over those areas.

4.6.5.2 Commercial Spaceport Alternative

Under this alternative, fewer visually sensitive areas would be affected by aircraft overflights than under the Proposed Action. The flight tracks for the commercial spacecraft are anticipated to be concentrated over the northern portion of Biscayne NP and to a lesser extent the southern portion of Everglades NP. The noise levels generated by departing space vehicles could be louder than conventional aircraft, drawing more attention. However, the frequency of overflight would be much less than under the Proposed Action.

Combined Commercial Spaceport/Airport

A combined Commercial Spaceport/Airport could result in industrial and commercial development similar to but less intense than the Proposed Action. The flight tracks for conventional civil aircraft would be the same as under the Proposed Action. However, the number of overflights would be fewer and the opportunity for visual impacts would be less.

Cumulative Impacts

Cumulative impacts with this alternative would be essentially the same as the Proposed Action except that anticipated population growth and development would be slightly less.

Mitigation Measures

No mitigation measures have been identified to reduce aesthetics effects from the Commercial Spaceport alternative.

4.6.5.3 Mixed Use Alternative

The Mixed Use alternative is not expected to affect sensitive visual resources. Aircraft operations would remain the same as baseline; therefore, there would be no change in exposure to aircraft overflights at the national parks.

Cumulative Impacts

Cumulative aesthetics impacts under this alternative would be about the same as under the Proposed Action. Population growth and development would be slightly less.

Mitigation Measures

No mitigation measures are suggested to reduce effects of the Mixed Use alternative on aesthetics.

4.6.5.4 No Action Alternative

The No Action alternative assumes that the Air Force would retain ownership of all remaining property and 717 acres of surplus property would be maintained in caretaker status. The surplus property would remain primarily vacant open land. Weeds and overgrown vegetation could prevail in the vacant areas without regular landscape maintenance. However, the overall impact on the visual environment would be minor. Aircraft operations at Homestead ARS would not change from baseline conditions. Areas of Biscayne NP, Everglades NP, and Big Cypress National Preserve would continue to be overflown by aircraft from Homestead ARS and other airports in the region, which are currently part of the visual environment.

4.6.5.5 Independent Land Use Concepts

The independent land use concepts are generally similar to land uses contained in the Proposed Action and alternatives. These land uses would have no additional aesthetics impacts on sensitive resources.

4.7 HAZARDOUS MATERIALS, HAZARDOUS WASTE, AND PETROLEUM PRODUCTS

This section addresses the potential impacts associated with hazardous materials and waste management and existing contaminated sites at former Homestead AFB. Hazardous materials, hazardous wastes, and IRP sites are discussed in this section.

4.7.1 Introduction

Regulatory standards and guidelines have been applied in evaluating the potential impacts that may be caused by hazardous materials use and waste generation. The analysis considered the following:

- The potential for generation of 100 kg (or more) of hazardous waste or 1 kg (or more) of an acutely hazardous waste in a calendar month, resulting in increased regulatory requirements.
- The potential for a spill or release of a reportable quantity of a hazardous substance as defined by the USEPA in 40 CFR Part 302.
- Manufacturing, use, or storage of a compound that requires notification of the pertinent regulatory agency according to the Emergency Planning and Community Right-to-Know Act.
- Potential for exposure of the environment or public to any hazardous material and/or waste through release or disposal practices.

4.7.2 Hazardous Materials and Petroleum Products

Hazardous materials and petroleum products would be used in varying amounts under the Proposed Action and each of the alternatives. Estimates of the amounts and types of hazardous materials and their potential impacts are described below.

4.7.2.1 Proposed Action

The types of hazardous materials likely to be used for activities within each land use under the Proposed Action are identified in **Table 4.7-1**. The hazardous materials used in the airfield and aviation support area would be similar to those used at Homestead ARS for aircraft fueling and ground equipment maintenance.

If the Proposed Action were implemented, the airport owner/operator and any other users would be responsible for management of their hazardous materials according to applicable regulations, chiefly, those of the Occupational Safety and Health Act (OSHA) (29 CFR). Each user would have to comply with SARA, Section 311, Title III, which requires that local communities be informed of the use of hazardous materials. The AFRC will continue to be responsible for the management of hazardous materials on the retained areas.

The Environmental Management Information System, the Air Force tracking system currently used for managing hazardous materials at Homestead ARS, will continue to be used by the military. The non-military users would need to institute their own hazardous materials management systems.

It is estimated that aircraft operations associated with the Proposed Action could increase hazardous material use an estimated fourfold over the projected baseline in 2005, eightfold in 2015, and twelvefold at full buildout based on aircraft operations. The additional use of hazardous materials would increase the number of hazardous material transports in the surrounding area. Spills that occurred during

Table 4.7-1. Hazardous Materials Use—Proposed Action

Land Use	Operation Process	Hazardous Materials
Airfield	Aircraft refueling; use of runways, taxiways, airport terminal parking, administration offices, corporate and private aviation facilities, aircraft parking	Aviation fuels, propylene glycol, ethylene glycol, heating oils, pesticides
Aviation Support	Operations associated with aircraft maintenance and manufacturing, aeronautics research and development, air transportation-related industry and warehousing, law enforcement, airline maintenance, fire and emergency response services, other governmental administrative services	Fuels, solvents, paints, POL, hydraulic fluids, degreasers, corrosives, heavy metals, reactives, thinners, paints, glycols, ignitables, heating oils, plating chemicals, cyanides, laboratory chemicals, aerosols, pesticides
Industrial	Activities associated with light industry, research and development, warehousing, and manufacturing	Solvents, heavy metals, POL, corrosives, catalysts, aerosols, fuels, heating oils, ignitables, pesticides
Commercial	Activities associated with offices, light industry, research and development and higher value warehousing, retail, service industries, restaurants	Fuels, solvents, corrosives, POL, ignitables, heating oils, pesticides, dry cleaning chemicals
Recreation/Open Space	Maintenance of recreational facilities and grounds	Pesticides, fertilizers, chlorine, heating oils, paints, thinners, cleaners, solvents, aerosols, POL

Source: SAIC.
POL petroleum, oils, and lubricants

transportation would generally be contained with absorbents by the local fire department to prevent contaminants from reaching surrounding soils or the storm sewer. There could be some risk of soil or water contamination that would require clean up.

The handling of small volumes of hazardous materials (paints, solvents, and lubricants) poses the risk of spills and the potential for contamination of soils and surface or groundwater on the former base. Most of hazardous materials would likely be handled in less than five-gallon lots, so the potential for wide-spread contamination is limited should a spill occur. Small spills can usually be cleaned up quickly and relatively thoroughly without sophisticated equipment. By government regulation under OSHA, CAA, or RCRA, the use of large volumes of hazardous materials would generally be in buildings or spaces specifically designed to contain released materials and protect worker health. The potential for long-lasting contamination by large volumes of these materials would likely be small.

Fuels, on the other hand, are handled and stored in large volumes. By government regulation (40 CFR 112), facilities that handle large quantities of petroleum products are required to develop Spill Prevention, Control, and Countermeasure Plans. For large above-ground storage tanks, these plans must address controls such as berms enclosing an impervious area that would contain the entire volume of the tank were it to leak its entire contents. Contained liquids could then be pumped into tank trucks for relocation to on-site or off-site storage tanks. Leaks or catastrophic loss of fuel in tanks would generally have isolated localized impacts. Under certain circumstances, fire is possible when leaks occur, and with a large volume of spilled fuel, the fire could last several hours and emit substantial quantities of air pollutants. Off-site impacts of fires (smoke, elevated concentrations of air pollutants) are likely to be temporary, but they could also last several hours.

Spills are most likely to occur when the temporary connection between a tanker truck (or hydrant fueling system) and an aircraft fails during refueling. The result could be a small spray leak or the release of large amounts of fuel. Spray leaks would probably be much more frequent than large-volume leaks. These leaks would be most likely to occur at passenger gates, and the fuel would be released onto concrete. Cracked concrete would allow fuel to leak to the soil underneath, potentially contaminating groundwater as well. Most small-volume spills would probably evaporate within a relatively short period of time (within a few hours), but a residual could remain on the concrete and could be carried by stormwater runoff to the on-site canal system. Large-volume spills would most likely enter the canal system directly. See Section 4.10.1 for discussion of the fate of spilled fuels that enter the canal system.

Under extreme weather conditions (such as hurricanes), there is a potential for any aircraft that was not relocated to another airfield to be damaged in such a way that its fuel tanks would rupture, releasing all fuels on board. Such catastrophic releases would almost always be associated with very high seawater levels that could reach the base. See Section 4.11 for a discussion of the potential effects of such releases.

The Proposed Action could stimulate population in-migration in the surrounding area. This increased population could support additional service industries which use hazardous materials and petroleum products (e.g., gasoline stations, photography laboratories, and dry cleaners). Based on the current population-based densities of these service industries in Miami-Dade County, an estimate of the additional number of facilities that could exist in 2015 is shown in **Table 4.7-2**. The Proposed Action could also result in related secondary development outside the former base boundaries. Rental car maintenance and aviation support industries would be expected to use the most hazardous materials and petroleum products.

Table 4.7-2. Estimated Additional Off-Site Industrial Facilities to Support Reuse-Related Population Increases (2015)

Facility Type	Projected Baseline[1]	Alternative			
		Proposed Action[2]	Commercial Spaceport[3]	Mixed Use[4]	No Action
Automotive Service Centers	570	25	3–6	2–4	0
Photograph Lab	174	8	1–2	1	0
Paint Shops	102	5	0–1	0–1	0
Dry Cleaners	58	2	0–1	0	0
Print Shops	7	0	0	0	0
Metal Working Shops	1	0	0	0	0

Source: SAIC.
Notes: [1] Based on estimated population of 239,592 in south Miami-Dade County.
[2] Based on an estimated population in-migration of 10,597.
[3] Based on an estimated population in-migration between 1,153 (Commercial Spaceport) and 2,541 (combined Commercial Spaceport/Airport).
[4] Based on an estimated population in-migration between 1,023 (original Collier proposal) and 1,682 (original Hoover plan). Market-Driven development and Collier-Hoover proposal fall within this range.

Cumulative Impacts

The high level of population growth forecast by Miami-Dade County could also lead to additional service industries that use hazardous materials and petroleum products (e.g., gasoline stations, photography laboratories, and dry cleaners). An estimate of the additional hazardous materials facilities that could exist

in the southern part of the county in 2015 with the Proposed Action in combination with cumulative population growth is provided in **Table 4.7-3**.

Table 4.7-3. Estimated Additional Industrial Facilities Associated With Cumulative Growth (2015)

Facility Type	Projected Baseline[1]	Alternative			
		Proposed Action[2]	Commercial Spaceport[3]	Mixed Use[4]	No Action[5]
Automotive Service Centers	570	588	583-586	583-584	580
Photograph Lab	174	176	178-179	178	177
Paint Shops	102	105	104-105	104	104
Dry Cleaners	58	60	59	59	59
Print Shops	7	7	7	7	7
Metal Working Shops	1	1	1	0	1

Source: SAIC.
Notes:
1 Based on moderate-growth population of 239,592 in south Miami-Dade County.
2 Based on an estimated population in-migration of 3,156 in addition to high-growth population increase of 243,782 in south Miami-Dade County between 1995 and 2015.
3 Based on an estimated population in-migration between 1,153 (Commercial Spaceport) and 2,541 (combined Commercial Spaceport/Airport) in addition to high-growth population increase.
4 Based on an estimated population in-migration of between 1,023 (original Collier proposal) and 1,682 (original Hoover plan) in addition to high-growth population increase. Market-driven development and Collier-Hoover proposal fall within this range.
5 Based on an estimated population increase of 243,782.

Mitigation Measures

The careful implementation of controls on the use of hazardous materials as required by government regulation would minimize, but not prevent, the potential adverse effects of releases of hazardous materials. Effective training programs, spill/release response drills, and regular inspections of facilities where hazardous materials are stored or used could help reduce the probability of accidental spills or release. The use of best management practices during hazardous material transfers that ensure tight and secure connections or containment of accidentally released materials would also reduce the potential for soil or water contamination. These measures would need to be implemented by the airport operator, all on-site users, and transporters of hazardous materials that served the site. Although they should be effective in reducing risks, some level of risk would remain under the best of circumstances.

Possible Future Expansion

Based on estimated annual aircraft operations with the second runway at full capacity, a nineteenfold increase in the use of hazardous materials above current baseline levels could occur. This does not, however, account for potential decreases in the use of hazardous materials as technology evolves.

4.7.2.2 Commercial Spaceport Alternative

A Commercial Spaceport would be expected to use the same hazardous materials shown for the Proposed Action in Table 4.7-1. In addition, this alternative would involve some unique materials, including liquid hydrogen, liquid oxygen, and solid and liquid rocket propellants, including hydrazine and nitrogen tetroxide. The processing, handling, storage, and use of these substances is discussed in Section 2.3.1.1.

Although the projected aircraft operations in 2000, 2005, 2015, and full buildout would be less than under the Proposed Action, considerable amounts of fuel (e.g., liquid oxygen and hydrogen) would be used by the commercial space vehicles. These fuels are more of an explosive hazard than a soil/groundwater contamination hazard. Spaceport tenants in the aviation support and industrial areas would use hazardous materials and petroleum products for equipment repairs and fabrication. It is not currently envisioned that cryogenic fuels and propellants would be manufactured on the site. Therefore, they would need to be transported to the site. Regulatory requirements are in place for transport of these fuels to minimize the risk of mishap. However, some risk of a release during transport would remain.

Spacecraft fuels potentially used at the site include liquid gases (oxygen, hydrogen, air), hypergolic fuels (hydrazine and nitrogen tetroxide), and solid fuels (primarily aluminum and perchlorates in a binder). The liquid gases and other gases would be stored in pressure tanks. The risk of accidental release of these materials would be small, and large releases would probably involve a storage tank failure. Tank failures could also create a potentially explosive condition. Except for the solid fuels, all other fuels would be in a gaseous form if released to the environment.

Hydrogen would provide an explosion risk depending on how and how rapidly it was released. Explosions involving gases would probably have similar consequences as explosions generated by launch accidents for vertical space launch vehicles. A hydrogen explosion could result in a fireball that would rapidly rise and be dispersed. Since the combustion product would be water, there would be essentially no residual contamination other than the damage caused by the explosion itself.

Hydrazine and nitrogen tetroxide, if released together, could also pose an explosion risk because when mixed they spontaneously ignite. An explosion cloud involving hydrazine and nitrogen tetroxide would probably behave similarly to a hydrogen explosion cloud. Combustion products would probably be primarily carbon monoxide, carbon dioxide, and nitrogen oxides. If either hydrazine or nitrogen tetroxide were released separately, it would probably have a relatively small explosive risk and would be carried by winds and be dispersed. Because both chemicals are toxic, there could be a potential for human and animal impacts. Standard procedures, similar to those currently in place at Cape Canaveral Air Station and Vandenberg AFB for loading hypergolic fuels into space vehicles (double containment of potentially leaked fuels and worker protection) would minimize the potential risk.

Solid rocket fuels would be transported to the site contained in rocket motors and could pose an explosive risk. Should a rocket motor explode aluminum oxides and hydrogen chloride gas could be released. Because of the heat of the explosion cloud, most of the hydrogen chloride would rise rapidly and be dispersed. Rainfall during or shortly following an explosion could result in the deposition of hydrochloric acid under the explosion cloud. The size of solid rocket motors would generally be small, so the magnitude of hydrochloric acid deposition would also likely be small.

As with the Proposed Action, population in-migration stimulated by the Commercial Spaceport alternative could lead to a population increase in the surrounding area, supporting additional service industries that use hazardous materials and petroleum products (e.g., gasoline stations, photography laboratories, and dry cleaners). The estimated number of additional hazardous materials facilities is shown in Table 4.7-2.

Combined Commercial Spaceport/Airport

A combined Commercial Spaceport/Airport would involve additional amounts of aviation fuels and maintenance fluids in addition to the materials described above. Management issues and potential impacts would be as described for the Proposed Action. Additional population in-migration could also increase the number of industrial facilities in the area, as reflected in Table 4.7-2.

Cumulative Impacts

The high level of population growth forecast by Miami-Dade County could support additional service industries that use hazardous materials and petroleum products. The estimated additional number of facilities using hazardous materials in the southern part of the county is shown in Table 4.7-3.

Mitigation Measures

Mitigation measures for the Commercial Spaceport alternative would be essential the same as for the Proposed Action. The focus of spill response capabilities would be directed more toward reducing risks from explosion of pressurized tanks.

4.7.2.3 Mixed Use Alternative

The industrial and commercial activities that might locate at former Homestead AFB under the Mixed Use alternative would be expected to be similar to those shown for the Proposed Action in Table 4.7-1. The total volume of hazardous materials for the Mixed Use alternative would be significantly less than for the Proposed Action due to the absence of airfield and aviation support activities.

Use of hazardous materials and petroleum products in residential, commercial, and recreational areas is expected to be minimal. The volume of hazardous materials used in the industrial areas would depend upon the type of manufacturing facilities constructed. Under Market-Driven development, each parcel owner and operator would be responsible for managing its own hazardous material storage and use. Because hazardous material use is likely to be considerably smaller than under the Proposed Action or Commercial Spaceport alternative, the release of very large volumes of hazardous materials would be unlikely. Under Market-Driven development, the lack of a centralized management organization for hazardous materials could increase the frequency of small releases.

The Collier-Hoover proposal, as well as the original Collier proposal and original Hoover plan, could entail a centralized hazardous materials management program. The effectiveness of such a program would depend in part on the autonomy granted to individual industrial and commercial operations that might be associated with these plans and the similarity of hazardous materials stored or used. Coordinated spill/release responses would probably be more difficult to organize under any of the Mixed Use scenarios than under the Proposed Action or Commercial Spaceport alternative.

The Collier-Hoover proposal would entail use of pesticides and petroleum products in the maintenance of a proposed 273.7 acres of golf courses. Pesticide usage, in accordance with the Audubon International Signature Program, would be limited. A conservative (high) estimate of pesticide usage would be 6,843 pounds per year of non-persistent pesticides. A similarly conservative estimate of petroleum usage would be 65,700 gallons per year for mowing and other maintenance activities.

Considering the estimated increased generation of solid waste, the on-site use of hazardous materials with this alternative is estimated to increase by a factor of 1.5 in 2005, 2.5 in 2015, and 5 at full buildout.

The Mixed Use alternative could also stimulate population in-migration that could lead to an increase in population in the surrounding area, which could support additional service industries that use hazardous materials and petroleum products (e.g., gasoline stations, photography laboratories, and dry cleaners). The estimated number of additional hazardous materials facilities is shown in Table 4.7-2.

Cumulative Impacts

The high level of population growth forecast by Miami-Dade County could support additional service industries that use hazardous materials and petroleum products. The estimated number of additional hazardous materials facilities in the southern part of the county is shown in Table 4.7-3.

Mitigation Measures

A centralized hazardous materials management organization could provide a larger resource base for spill/release response actions, potentially reducing the impacts of a spill, and encouraging safe handling of hazardous materials, thereby reducing the risk of a spill. This could also reduce the costs of environmental and health and safety training.

4.7.2.4 No Action Alternative

Under this alternative, minimal preventive maintenance activities would be performed as needed on the land in caretaker status. The hazardous materials used would likely include small quantities of fuels, paints, and corrosives. The quantities of hazardous materials used for caretaker activities are expected to be less than that currently used by AFBCA to maintain the property.

If population grew at the high rate forecast by Miami-Dade County, additional service industries that use hazardous materials and petroleum products would still be expected to be established in the south county area, as shown in Table 4.7-3.

4.7.2.5 Independent Land Use Concepts

The Independent Land Use Concepts and their possible hazardous materials use are listed in **Table 4.7-4**. Quantifying the impact of any of the land use concepts is difficult because specific details are not available to allow estimates of the volume of hazardous materials. However, in general, the aircraft maintenance facility would use higher quantities of hazardous materials, while the other land use concepts would be expected to use minimal amounts of hazardous materials.

4.7.3 Hazardous and Petroleum Waste

Hazardous wastes would be generated in varying amounts under the Proposed Action and alternatives. Estimates of the amounts and types of hazardous wastes and their potential impacts are provided below.

4.7.3.1 Proposed Action

Under the Proposed Action, industrial areas would generate hazardous waste based on the types of industrial, manufacturing, or maintenance facilities operated. Warehousing would generate virtually no hazardous wastes, while some manufacturing processes could generate large quantities of hazardous wastes. Commercial and recreation uses are unlikely to produce significant quantities of hazardous wastes. However, operations such as maintenance and repair shops within large commercial establishments may produce sufficient quantities of hazardous waste to be subject to the RCRA regulations. Maintenance activities at a recreation area may involve waste solvents or pesticides that are considered hazardous wastes.

Table 4.7-4. Potential Hazardous Materials Use—Independent Land Use Concepts

Land Use	Operations Process	Hazardous Materials
Agriculture	Nursery operations	Pesticides, fertilizers, fuels
Aircraft Maintenance Facility	Repair and overhaul of aircraft components and systems; aircraft painting and refinishing; service and repair of electronic and hydraulic systems	Fuels, solvents, paints, POL, hydraulic fluids, degreasers, corrosives, heavy metals, reactives, thinners, paints, glycols, ignitables, heating oils, plating chemicals, cyanides, laboratory chemicals, aerosols, pesticides
Back Office Operations	Building maintenance	Paints, corrosives, pesticides
Cemetery	Grounds maintenance	Fuels, pesticides, fertilizers
Corrections Complex	Building and grounds maintenance	Fuels, pesticides, fertilizers, corrosives, paints
Education Complex	Building and grounds maintenance	Fuels, pesticides, fertilizers, corrosives, paints
Film/Television Production Studio	Building maintenance	Paints, corrosives, pesticides
Research Facilities	Variable, depending on type of research	Variable depending on type of research
Small Package and Mail Distribution Center	Building maintenance	Paints, corrosives, pesticides
Structural Insulated Panels Manufacturing	Insulated panel manufacturing	Glues, paints, corrosives, pesticides
Theme Park	Building and grounds maintenance	Fuels, pesticides, fertilizers, corrosives, paints, POL
World Teleconference Center	Building maintenance	Paints, corrosives, pesticides

Source: SAIC.
POL petroleum, oils, and lubricants

Hazardous waste management would become the responsibility of the new owners/operators. Proficiency in handling these wastes and spill response capabilities are required by RCRA (40 CFR 264–265), CERCLA, and OSHA (29 CFR 1910.120) regulations. Mutual aid agreements with surrounding communities may require additional scrutiny and training of emergency staff.

Airport operations under the Proposed Action would include shops for maintenance of aircraft and ground equipment. It is expected that the types of wastes generated by these activities would be similar to those generated when the base was fully functioning. Waste volumes would be expected to increase proportionally. In order to approximate the volume of hazardous waste generated at full buildout (231,274 aircraft operations per year), the Zurich Airport Authority in Switzerland was used as a comparison. The Zurich Airport had 276,131 airport operations in 1997 and has a similar mix of commercial passenger flights and air freight as the Proposed Action. Based on waste management studies at the airport, 16 percent of the total waste generated from the airfield and aviation support activities were classified as hazardous wastes (**Zurich Airport Authority 1998**). This value was also used to estimate hazardous waste generation at HST.

Hazardous waste generation is estimated to increase above baseline levels by 255 tons/year in 2005, 1,435 tons/year in 2015, and 2,490 tons/year at full buildout (**Table 4.7-5**). If the hazardous waste generated were similar to that currently generated at Homestead ARS, most of the solvents, fuels, and oils

would be expected to be recycled off site (95 percent of the total hazardous waste volume), while the remaining hazardous wastes, such as paint wastes, lithium batteries, and aerosols, would be disposed of off site (5 percent of the total hazardous waste volume).

Table 4.7-5. Estimated Increases in Hazardous Waste Generation at Former Homestead AFB

Year	Projected Baseline (tons/year)	Alternative (tons/year)		
		Proposed Action	Commercial Spaceport	Mixed Use
2005	6,445	255	187	20
2015	7,667	1,435	438	49
Full Buildout	NA	2,490	578	128

Source: SAIC.
NA Not available

Implementation of the Proposed Action could generate significant amounts of hazardous wastes (up to 70 times the current generation rates at full buildout). This amount could be reduced with future technological changes. Although most of the hazardous wastes could be expected to be recycled rather than disposed of, they would still have to be transported off site for processing. This would increase the traffic of commercial chemical tanker trucks and HAZMAT vehicles in the roads leading to and from the former base.

As noted in Section 4.7.2.1, population increases potentially associated with the Proposed Action could support additional service industries which generate small quantities of hazardous wastes (e.g., gasoline stations, photography laboratories, and dry cleaners). Each new resident is estimated to generate 39 pounds/year of hazardous waste indirectly (from service industries in the surrounding area) and 25 pounds/year of hazardous waste directly (from household hazardous materials use). The estimated quantities of additional wastes that could be generated by population in-migration attributable to the Proposed Action are shown in **Table 4.7-6**.

Cumulative Impacts

Under Miami-Dade County's high-growth population forecasts, the total hazardous waste generation south of Eureka Drive could increase by 9,337 tons/year by 2015 (see Table 4.7-6).

Mitigation Measures

Appropriate mitigation measures for hazardous waste include those described for hazardous materials in Section 4.7.2.1. In addition, an aggressive pollution prevention waste minimization program by the airport operator could reduce the quantity of hazardous waste generated.

To mitigate potential impacts from off-site development, collection days for hazardous household products, such as paints, pesticides, and cleaners, could be scheduled to reduce landfill and stormwater discharge concerns. Articles in the local newspapers and classes offered by community educational programs could increase public awareness of recycling, appropriate use of pesticides, waste minimization, and waste disposal.

Table 4.7-6. Estimated Additional Off-Site Hazardous Waste Generated by Reuse-Related and Cumulative Population Increases (2015)

	Projected Baseline[1] (tons/year)	Alternative (tons/year)			
		Proposed Action	Commercial Spaceport	Mixed Use	No Action
Reuse-Related Hazardous Waste	7,667	339[2]	37–81[3]	33–54[4]	0
Cumulative Increase in Hazardous Waste	7,667	9,337[5]	7,838–7,882[5]	7,834–7,854[5]	7,801[6]

Source: SAIC.
Notes: [1] Based on an estimated population of 239,592 in south Miami-Dade County.
[2] Based on an estimated population in-migration of 10,597.
[3] Based on an estimated population in-migration of between 1,153 (Commercial Spaceport) and 2,541 (combined Commercial Spaceport/Airport).
[4] Based on an estimated population in-migration of between 1,023 (original Collier proposal) and 1,682 (original Hoover plan). Market-Driven development and Collier-Hoover proposal fall within this range.
[5] Based on an estimated reuse-related in-migration in combination with high-growth population increase of 243,782 in south Miami-Dade County between 1995 and 2015.
[6] Based on an estimated population increase of 243,782.

Possible Future Expansion

Based on estimated annual aircraft operations with the second runway at full capacity, a 60 percent increase in the generation of hazardous wastes above the full capacity use of a single runway could occur (to 3,985 tons/year above baseline). This estimate does not account for potential reductions in hazardous waste generation likely with future technological changes.

4.7.3.2 Commercial Spaceport Alternative

The types of hazardous wastes generated by the Commercial Spaceport alternative would include the hazardous materials used for spaceport operations, described in Section 4.7.2.2. Most of the hazardous wastes would be generated from space vehicles, supporting aircraft, and ground equipment maintenance.

The exact amounts of hazardous wastes that would be generated under the Commercial Spaceport alternative are not known. However, if the hazardous waste generation rate is assumed to be similar to the aviation hazardous waste generation rate of 16 percent used for the Proposed Action, hazardous waste generation could increase above projected baseline levels by 578 tons/year at full buildout (see Table 4.7-5). If the hazardous wastes generated by the Commercial Spaceport alternative were similar to those currently generated, most of the solvents, fuels, and oils would be recycled off site (estimated at 95 percent of the total hazardous waste volume), while the remaining hazardous wastes, such as paint wastes, lithium batteries, and aerosols, would be disposed of off site.

Implementation of the Commercial Spaceport alternative would generate significant amounts of hazardous wastes (up to 17 times the current generation rates at full buildout). Although most of these wastes would be expected to be recycled rather than disposed of, they would still have to be transported off site for processing. This would greatly increase the traffic of commercial chemical tanker trucks and HAZMAT vehicles on the roads leading to the former base.

Population in-migration stimulated by the Commercial Spaceport alternative could support additional service industries that generate small quantities of hazardous wastes. Assuming that each new resident

generated, directly and indirectly, 64 pounds/year of hazardous waste, 37 tons/year could be generated south of Eureka Drive by 2015 (see Table 4.7-6).

Combined Commercial Spaceport/Airport

Commercial airlines generate hazardous wastes during aircraft and ground equipment maintenance. This hazardous waste generation rate is assumed to be similar to the aviation hazardous waste generation rate of 16 percent and would result in a combined generation of about 81 tons/year in 2015. If the hazardous wastes generated in the combined Commercial Spaceport/Airport option were similar to those currently generated, about 95 percent of the solvents, fuels, and oils would be recycled off site, while the remaining hazardous wastes, such as paint wastes, lithium batteries, and aerosols, would be disposed of off site.

Cumulative Impacts

Under Miami-Dade County's high-growth forecasts, the total hazardous waste generation south of Eureka Drive could be expected to increase by between 7,838 and 7,882 tons/year by 2015 (see Table 4.7-6).

Mitigation Measures

The mitigation measures described for the Proposed Action would also be appropriate for this alternative.

4.7.3.3 Mixed Use Alternative

The volume of hazardous wastes generated under the Mixed Use alternative would be expected to be substantially less than under the Proposed Action or Commercial Spaceport alternative. If the hazardous waste generation rate is assumed to be similar to the 1997 Miami-Dade County-wide hazardous waste generation rate per employee, hazardous waste generation could increase above projected baseline levels by an estimated 128 tons/year at full buildout for the Market-Driven scenario (see Table 4.7-5). No information is available on quantities of hazardous waste that might be generated by the Collier-Hoover proposal or the original Collier and Hoover plans. They are likely to be similar to the industrial, commercial, and recreation uses of the Proposed Action. Although the precise nature of the wastes is not known, it is expected that the majority would be disposed of off site, but some could be recycled. Nevertheless, all hazardous wastes would have to be transported off site for processing. This would increase the traffic of commercial chemical tanker trucks and HAZMAT vehicles on the roads leading to the former base.

Population in-migration stimulated by the Mixed Use alternative could support additional service industries that generate small quantities of hazardous wastes. Assuming that each new resident generated, directly and indirectly, 64 pounds per year of hazardous waste, between 33 and 54 tons/year of additional hazardous waste could be generated south of Eureka Drive by 2015 (see Table 4.7-6).

Cumulative Impacts

Under Miami-Dade County's high-growth forecasts, the total hazardous waste generation south of Eureka Drive could increase by between 7,834 and 7,854 tons/year by 2015 (see Table 4.7-6).

Mitigation Measures

The mitigation measures suggested for hazardous materials in Section 4.7.2.1 would also be appropriate for hazardous waste. In addition, a centralized hazardous waste management organization for the site could assist in the development of effective pollution prevention/waste minimization programs, provide a

larger resource base for spill/release response actions, and encourage the safe handling of hazardous wastes. All of these measures would help reduce the generation of hazardous waste and potentially reduce the adverse effects of a spill, should one occur. However, they would not completely eliminate the risk of a spill.

4.7.3.4 No Action Alternative

Under this alternative, minimal amounts of preventive maintenance activities would be performed. The hazardous wastes generated could include waste fuels, paints, and corrosives. The quantities of hazardous wastes generated by the caretaker activities would be less than that currently generated by the AFBCA to maintain the property.

The high level of population growth forecast by Miami-Dade County could still result in an increase in hazardous waste generation south of Eureka Drive, estimated at 7,801 tons/year in 2015 (see Table 4.7-6).

4.7.3.5 Independent Land Use Concepts

The hazardous wastes likely to be generated by the Independent Land Use Concepts would derive from the hazardous materials identified in Table 4.7-1. Sufficient information is not available to allow estimates of the volume of hazardous wastes that would be generated by any given use, but in general, the aircraft maintenance facility would be expected to generate the highest quantities of hazardous wastes, while the other land use concepts would be expected to generate minimal amounts of hazardous wastes.

4.7.4 Installation Restoration Program Sites

The management of the IRP sites will not vary among the reuse alternatives. However, continuing monitoring of some of the sites may affect implementation of reuse plans. IRP activities would continue to be coordinated by Air Force personnel. Proposed land uses could be affected by ongoing or future restoration activities.

Assessment activities are in various stages of completion, with some sites undergoing interim cleanup measures and remedial design, while other sites are still being investigated. Ongoing coordination between the Air Force and FDEP would continue to ensure that land development does not inhibit completion of environmental remedial activities. Most remedial actions should be complete by 2015.

4.7.4.1 Proposed Action

The IRP sites within each land use area of the Proposed Action are listed in **Table 4.7-7**. The location and extent of contamination associated with each IRP site is approximate, based on gross mapping. The IRP sites within each land use are briefly discussed below.

Eight IRP sites are located within the airfield, ten IRP sites are located within the proposed aviation support area, and two IRP sites are located within the proposed industrial area. OU-9, Boundary Canal, extends through both the aviation and industrial areas, and OU-18, landfill, is only partially located within the industrial area. There are no IRP sites in the proposed commercial or recreation/open space areas.

Table 4.7-7. IRP Sites Within Land Use Areas—Proposed Action

Land Use	IRP Sites
Airfield	OU-9 (partial), OU-10, OU-11, OU-16 SS-15B, SS-20 (Hardfill Area), SS-21 FT-09
Aviation Support	OU-6, OU-14, OU-20/21, OU-22, OU-26, OU-28, OU-30, OU-31 SS-15A, SS-20 (Buildings 711 & 766)
Industrial	OU-9 (partial), OU-18 (partial)
Commercial	None
Recreation/Open Space	None

Source: SAIC.

Airfield. Eight IRP sites (including portions of the Boundary Canal) are in the airfield area. Site SS-15B (Flightline Pumphouses) contains contaminants above the reference levels from a former leak of JP-4 in the underground pipelines. Currently, this area is under a remedial action (groundwater treatment) with long-term monitoring in the future. However, groundwater remediation efforts should not affect the continued use of the airfield. Site OU-11 (Military Canal) is undergoing a Feasibility Study to determine the appropriate remedial action. Because Military Canal is outside the former base boundaries, the remediation of the canal should not directly affect airfield operations. Remedial actions that may occur in the canal are not expected to substantially impact the operation of the airfield. The resolution of OU-9 is awaiting decisions concerning OU-11. The remaining five IRP sites have been investigated and/or remediated and are all recommended for no further action.

Aviation Support. Ten IRP sites are located in the proposed aviation support area. Sites OU-26 (Aviation Fabrication Shop), OU-28 (Propulsion Maintenance Facility), and SS-20 (Buildings 711 and 766) contain soil contaminants above reference levels. Remedial actions are ongoing at these sites. Remedial actions have already been completed at OU-6 (Oil Spills at Aircraft Wash Rack) and closeout is anticipated. Investigation has been completed at SS-15A (Apron) and remedial action is being implemented. Feasibility studies are ongoing at OU-20/21 (Hazardous Materials Storage Area), OU-30 (Former Contractor Storage Area), and OU-31 (Nondestructive Inspection Laboratory). These sites involve a relatively small portion of the proposed aviation support area and are not expected to substantially impact reuse. No further action has been recommended at sites OU-14 (Drum Storage Area) and OU-22 (AGE Maintenance).

Industrial. Portions of OU-9 (Boundary Canal) and OU-18 (Construction Debris Landfill) are located in the proposed industrial land use. Both sites were investigated and no contaminants were found above reference levels in OU-9, whereas contaminants were found above reference levels in the soils at OU-18. Remedial action is ongoing at the landfill. However, only a relatively small portion of the landfill is located within the proposed industrial area, and this is not expected to substantially impact reuse. The resolution of OU-9 is awaiting decisions concerning OU-11.

Existing infrastructure, such as remediation equipment, conveyance piping, and monitoring wells, could limit the type of development occurring on land parcels identified in the Proposed Action. Proposed demolition, renovation, and new construction activities would be closely coordinated and monitored to ensure existing environmental infrastructure is not damaged or access restricted.

The existence of IRP sites would typically not affect the reuse of existing facilities unless further assessment concludes that risks to the health of facility occupants would be unacceptable. New

construction activities, however, may be limited by the existence of IRP sites until the sites are sufficiently remediated. The potential for construction delays would tend to be greater for soils-related IRP sites than for groundwater-related sites. For example, new construction may be limited in areas involving soil contaminants (e.g., the OU-18 landfill). Limitations on new construction above a groundwater contamination plume (e.g., the SS-15B underground pipelines) would be necessary only if the construction involved exposure of groundwater-bearing strata or if cleanup activities could cause a change in subsurface physical characteristics that would render a location unsuitable as a building site.

Remedial activities associated with the contaminated groundwater plume at SS-15B in the vicinity of the runway are not expected to impact flightline operations. Remediation and long-term monitoring associated with this site would be the responsibility of the Air Force and should not result in long-term impacts to airfield use. Minor disruptions to daily activities could occur (e.g., short-term interruptions of activities to conduct monitoring).

Development in the surrounding area should not affect or be affected by the investigation or remediation of IRP sites at former Homestead AFB.

Cumulative Impacts

The Air Force is now conducting a Feasibility Study to determine the most appropriate method to use for the remediation of Military Canal (OU-11) sediments. Based on the outcome of this study and regulatory and public review, a remediation method will be selected and implemented. Remediation activities could start as early as fiscal year 2001.

The proposed filling of Military Canal from Biscayne Bay to approximately L-31E as part of the Flowway Distribution Project. This would eliminate direct contact between the canal and the bay.

Mitigation Measures

A proactive land use planning approach to reuse would require coordination and enforcement among all pertinent parties in order to reduce potential delays in development on the disposal property. Land use impacts could be mitigated by implementing a phased construction schedule. Such an approach would allow redevelopment to begin in areas without IRP sites, and areas with IRP sites could be developed in subsequent project phases. Active coordination between the Air Force and the Miami-Dade County Aviation Department would mitigate potential problems.

Possible Future Expansion

Based on possible expansion plans, the north end of the possible second runway would cut across a portion (approximately 1,000 feet) of Military Canal. This would require alteration of the canal to redirect the flow either around or underneath the runway. Any action taken on the canal sediments would be expected to be completed prior to the consideration of a second runway.

4.7.4.2 Commercial Spaceport Alternative

The IRP sites within each land use area of the Commercial Spaceport alternative are listed in **Table 4.7-8.** The boundaries of each land use are similar to those identified in the Proposed Action. The potential impacts and mitigation measures would be essentially the same as described for the Proposed Action.

Table 4.7-8. IRP Sites Within Land Use Areas—Commercial Spaceport Alternative

Land Use	IRP Sites
Airfield	OU-9 (partial), OU-10, OU-11, OU-16 SS-15B, SS-20 (Hardfill Area), SS-21 FT-09
Aviation Support	OU-6, OU-14, OU-20/21, OU-22, OU-26, OU-28, OU-30, OU-31 SS-15A, SS-20 (Buildings 711 & 766)
Industrial	OU-9 (partial), OU-18 (partial)
Commercial	None
Recreation/Open Space	None

Source: SAIC.

4.7.4.3 Mixed Use Alternative

The IRP sites within each land use area of the Market-Driven scenario of the Mixed Use alternative are listed in **Table 4.7-9**. The industrial/commercial area would contain the same IRP sites shown within the aviation support and industrial areas of the Proposed Action; no IRP sites would be present within the commercial or recreation/open space areas. Property transfer and reuse could be delayed in the areas affected by IRP investigation and remediation activities, as described for the Proposed Action.

Table 4.7-9. IRP Sites Within Land Use Areas—Market-Driven Development

Land Use	IRP Sites
Industrial/Commercial	OU-6, OU-9 (partial), OU-14, OU-18 (partial), OU-20/21, OU-22, OU-26, OU-28, OU-30, OU-31 SS-15A, SS-20 (Building 711 & 766)
Commercial	None
Recreation/Open Space	None

Source: SAIC.

The IRP sites within the commercial, commercial/industrial, and recreational land uses of the Collier-Hoover proposal are listed in **Table 4.7-10**. Property transfer and reuse could be delayed in the areas affected by IRP investigation and remediation activities, as described for the Proposed Action. In addition, the sites are being cleaned to certain land use standards that may be appropriate for industrial use but not for recreation or water use. This may require adjustments to the Collier-Hoover plan or changes in the remediation approach to certain sites. Based on the information furnished by the proponent, it appears there would be no land use conflicts, but the waterways included in the plan may need to be engineered to avoid certain IRP sites, and any sewage treatment facility would need to be sited to preclude conflict with clean-up standards.

4.7.4.4 No Action Alternative

The IRP would have no impact on caretaker operations under the No Action alternative.

Table 4.7-10. IRP Sites Within Land Use Areas—Collier-Hoover Proposal

Land Use	IRP Sites
Commercial	OU-29
Commercial/Industrial	OU-6, OU-9 (partial), OU-14, OU-20/21, OU-22 (partial), OU-30, OU-31, SS-15A (partial), SS-20 (Buildings 711 & 766)
Recreation/Open Space	OU-18, OU-22, OU-26, OU-28, SS-15A (partial)

Source: SAIC.

4.7.4.5 Independent Land Use Concepts

The impact of the Independent Land Use Concepts on any particular IRP site cannot be evaluated unless the location of the activity is known. For example, the land required for a theme park could involve most of the IRP sites, whereas a mail distribution center might avoid all of the IRP sites. Some land uses are incompatible for particular IRP sites. For example, the cemetery should not be located over the OU-18 landfill. IRP activities could delay property transfer and reuse in certain areas under consideration for the land use concepts.

4.8 AIR QUALITY

4.8.1 Introduction

Air emissions from the Proposed Action and reuse alternatives were evaluated in accordance with applicable air quality standards and regulations. The analysis determined air quality impacts from emissions estimated to be generated by both mobile and stationary sources during 2000, 2005, and 2015 for the Proposed Action and each of the reuse alternatives. Because Miami-Dade County is a maintenance area for ozone, the General Conformity Rule of the Clean Air Act applies to FAA actions and decisions concerning reuse of former Homestead AFB.

The analysis consisted of several parts: development of an emissions inventory, an air quality impact analysis, a roadway intersection analysis, and a determination of the impacts on nearby Everglades and Biscayne National Parks. The FAA's Emissions and Dispersion Modeling System (EDMS) air quality model was used to develop the operational emissions inventory and estimate the air quality impacts resulting from each alternative. EDMS was specifically designed for use in evaluating the air quality impacts of airports and Air Force bases and is a USEPA-approved air quality model required by FAA to be used in the analysis of air quality impacts associated with the development of airports. A second air quality model (CAL3HQC) was used to calculate potential worst-case carbon monoxide concentrations at several roadway intersections that are predicted to be highly congested in future years.

Emissions from construction activities associated with the Proposed Action were assessed for potential conformity issues. The Proposed Action represents the highest expected level of construction emissions for any of the alternatives. Emissions of volatile organic compounds, oxides of nitrogen, carbon monoxide, and respirable particulate matter less than 10 microns in diameter were calculated using emission factors from the *CEQA* [California Environmental Quality Act] *Air Quality Handbook* (**South Coast Air Quality Management District 1993**) for all airfield and aviation support construction activities over which FAA has some control as a federal agency subject to Clean Air Act conformity requirements. The emissions were divided between exhaust emissions (on-site construction equipment, material handling, and workers' travel) and fugitive dust emissions (e.g., from grading activities).

The exhaust emissions were calculated by using estimates of new facility construction during two phases of development (2000–2005 and 2005–2015) for each land use category (airfield, aviation support, industrial, commercial, institutional, open space, and retained and previously conveyed areas). Fugitive dust emissions were calculated based on the area of ground disturbance from demolition, removal of pavement, and site preparation for new facilities and pavement during the same phases of development.

A screening-level model was used to calculate atmospheric deposition rates to determine potential nitrogen loading at Everglades and Biscayne NPs due to the Proposed Action. The model used to calculate the atmospheric deposition of nitrogen provides very conservative results and probably overestimates deposition rates, by potentially an order of magnitude. To determine how the model results would likely compare to actual measured nitrogen deposition, the model was applied to current NO_x concentrations to predict nitrogen deposition in Everglades NP. The results were then compared to the annual average measured atmospheric deposition of nitrates at Everglades NP from 1994 through 1998 (**NADP 1998**). The model predicted rates that were 30 times greater than the measured rates.

Comments on the Draft SEIS raised concern about the potential for the deposition of soot and oily films from aircraft engine exhausts. This concern has also been raised at a number of other airports. The soot that is alleged to come from jet engine emissions is apparently more related to ground vehicles than aircraft. Recent studies have looked at this issue at Chicago's O'Hare Airport; at Boston's Logan Airport;

at the Charlotte, North Carolina Airport; and at the Fort Lauderdale Airport (**KM Chng Environmental 1999, KM Chng Environmental 1997, TRC 1997**). The most comprehensive of these studies compared the "chemical fingerprint" of ambient air samples taken near the airport with wipe samples from the exhaust of jet aircraft engines and with jet fuel. The deposited particles collected in ambient air samples near the airport bore little chemical resemblance to jet engine fuel or soot from the jet engine exhaust. It was concluded in all of these studies that the soot and oily deposits were chemically more closely related to motor vehicle exhaust and other urban sources than to aircraft emissions or fuels.

4.8.2 Air Pollutant Emissions

4.8.2.1 Proposed Action

Construction Emissions. Estimates of the potential exhaust and fugitive dust emissions resulting from construction activities of airfield and aviation support projects for the Proposed Action are presented in **Table 4.8-1**. The estimated construction emissions reflect the quantity of emissions expected to occur prior to each milestone year. The timing of these emissions is uncertain, but they would be spread over a number of years. The emissions would also be generated at different locations around the site. These estimated emissions do not take into consideration the reduction in NO_x emissions in future years resulting from the recently promulgated controls on heavy-duty diesel engines, which will take effect in 2004 (**McElveen 1999**). Construction CO and VOC emissions would represent less than 3 percent of total emissions of CO and VOC on the former base. NO_x emissions would represent between 11 and 16 percent of total NO_x emissions, and PM_{10} emissions would represent between 51 and 60 percent of total PM_{10} emissions.

Table 4.8-1. Total Estimated Proposed Action Construction Emissions by Phase of Development

Year	Pollutant Emissions (tons)			
	CO	VOC	NO_x	PM_{10}
Prior to 2005	19.9	6.2	91.3	9.6
2006–2015	54.4	17.0	250.0	20.7

Source: SAIC.

Operational Emissions. An emission inventory was developed for operations associated with the Proposed Action for 2000, 2005, and 2015. The emissions inventory included:

- Aircraft (military, U.S. Customs, commercial passenger, general aviation, cargo, and aircraft maintenance);
- Ground support equipment (GSE), aerospace ground equipment (AGE), and auxiliary power units (APUs);
- Roadways;
- Parking lots; and
- Stationary sources.

Emissions for all of these categories were calculated using the EDMS model, except for stationary sources. Stationary sources were assumed to be similar, on a floor area basis, to existing Homestead ARS stationary sources. Homestead ARS includes a range of office, accommodation, and maintenance areas

that would be reflective of similar facilities that would be built for the Proposed Action and other alternatives. An estimate of stationary source emissions in 2005 and 2015 was made by calculating a ratio of the expected increase in area of new and reused facilities divided by the area of existing facilities and multiplying that ratio by the current Homestead ARS stationary source emissions. For example, for the Proposed Action in 2005, new and reused facilities are projected to be 1.6 times the area of current Homestead ARS facilities (see Table 2.2-2), so the estimated stationary source emissions were assumed to be 1.6 times the current emissions at Homestead ARS (**AFRC 1998a**). One unusual stationary source currently in the Homestead ARS emission inventory, the hush house used for aircraft engine testing, was not included in this calculation because hush houses are specific to military installations and not expected to be representative of reuse activities.

Emissions for each aircraft type were based on the number of projected operations and emission factors for the engines used on the aircraft. For the Proposed Action, the expected types of aircraft and estimated number of operations for each aircraft are provided in Table 2.2-5 for 2000, 2005, and 2015. In some cases, several candidate aircraft are given within a category (e.g., narrowbody or widebody jets). The most modern and generally lowest-emitting aircraft were chosen within each category, because it is expected that aircraft emissions will decline for a given aircraft type over the next 20 years. This approach probably still overestimated the emissions from the next generation of aircraft engines which will come into use during this time period. GSE/AGE and APU are associated with specific aircraft types and have an operational period associated with each aircraft type. Emissions from this equipment are calculated by the EDMS model after the aircraft types and flight frequencies are specified.

Motor vehicle emissions for each year were also calculated in the EDMS model, based on USEPA's MOBILE5a emissions model. The primary input variable was the increase in the number of vehicle miles traveled (VMT). VMT was estimated by multiplying the expected population increase by a VMT/person factor, derived from a transportation modeling study conducted by the Miami-Dade County Metropolitan Planning Organization (**Dade County 1987**). It was assumed, as a worst-case analysis, that all of the estimated increase in VMT was due to airport-related trips. Additional trips to the airport that might occur were considered to be redirected trips from other destinations, such as Miami International Airport, and would not contribute to an increase in the VMT for Miami-Dade County. Because all vehicle travel by the existing and projected baseline population is already accounted for in the county's projected emissions, only the reuse-related increase in population would be additive. A summary of the operations emissions inventory for the Proposed Action is presented in **Table 4.8-2**.

Table 4.8-2. Operational Emissions Inventory for Disposal Property—Proposed Action

Year	Emissions (tons/year)				
	CO	VOC	NO_x	SO_2	PM_{10}
2000	344	9	4	0.2	<0.1
2005	629	27	45	2.1	0.8
2015	2,182	130	392	17.0	5.4

Source: SAIC.
< less than

These emissions include on-site emissions associated with the Proposed Action and transportation associated with reuse-related secondary development. They do not include air emissions from home-based activities conducted by employees at the airport (e.g., small two-cycle lawn mower engines,

barbecues, natural gas-fired water heaters), malls, fast food facilities, and light industry, but the relative contribution of these sources would be minor.

For each of the three analysis periods, aircraft-related emissions (aircraft and GSE/AGE/APU) were the largest contributor to the total emissions inventory. **Table 4.8-3** shows the percentage of the total emissions inventory estimated to be contributed by each source in 2015.

Table 4.8-3. Percentage of Operational Emissions by Major Source Category—Proposed Action (2015)

Source Category	Percent Contribution to Total Emissions Inventory				
	CO	VOC	NO_x	SO_2	PM_{10}
Aircraft	37.2	33.2	61.9	71.5	0.0
GSE/AGE/APU	39.3	16.1	19.7	11.4	49.8
Roadways	16.1	32.2	12.1	15.3	38.0
Parking Lots	7.2	5.2	1.7	1.4	4.7
Stationary Sources	0.02	5.2	4.4	0.1	7.5

Source: SAIC.

This emissions inventory takes into account expected future reductions in air emissions from motor vehicles, as determined by USEPA's current version of the MOBILE model, due to more restrictive regulations and better vehicle emission control systems. However, aircraft emissions are based on emission factors from existing engines, and it is possible that improvements in engine controls will reduce emissions from aircraft by 2015. Therefore, the aircraft emissions used in this analysis can be considered conservatively high.

Air Quality Impacts. The EDMS model was run for the Proposed Action in 2015, with each of the most recent five years of quality assured meteorological data (1991–1995), using a set of receptors expected to have the highest impact. The model used hourly meteorological data collected at the nearest National Weather Service station (Miami International Airport). Preliminary modeling runs were used to determine which year of meteorological data would produce the highest concentrations. This resulted in 1995 meteorological data being used for all subsequent air quality modeling runs.

The EDMS model was used to predict concentrations at 32 receptors: 25 receptors were located along the boundary of former Homestead AFB or within the public access areas on the former base, 3 receptors were located along the closest boundary of Everglades NP, and 4 receptors were located along the closest boundary of Biscayne NP. **Figures 4.8-1** and **4.8-2** show the locations of the receptors.

The model was used to calculate ambient concentrations for the four criteria pollutants predicted by the EDMS model (CO, SO_2, NO_2, and PM_{10}) and was run for three time periods (2000, 2005, and 2015). The low SO_2 and PM_{10} emissions projected for the Proposed Action would be expected to result in low ambient air quality impacts (a maximum increase of 8 percent of the NAAQS at the worst-case receptor). Therefore, the remainder of the analyses focused on the results of the CO and NO_2 estimates. The results of the EDMS model runs for the Proposed Action are presented in **Table 4.8-4**. The table shows that impacts of the Proposed Action are not expected to result in exceedances of the NAAQS at any time.

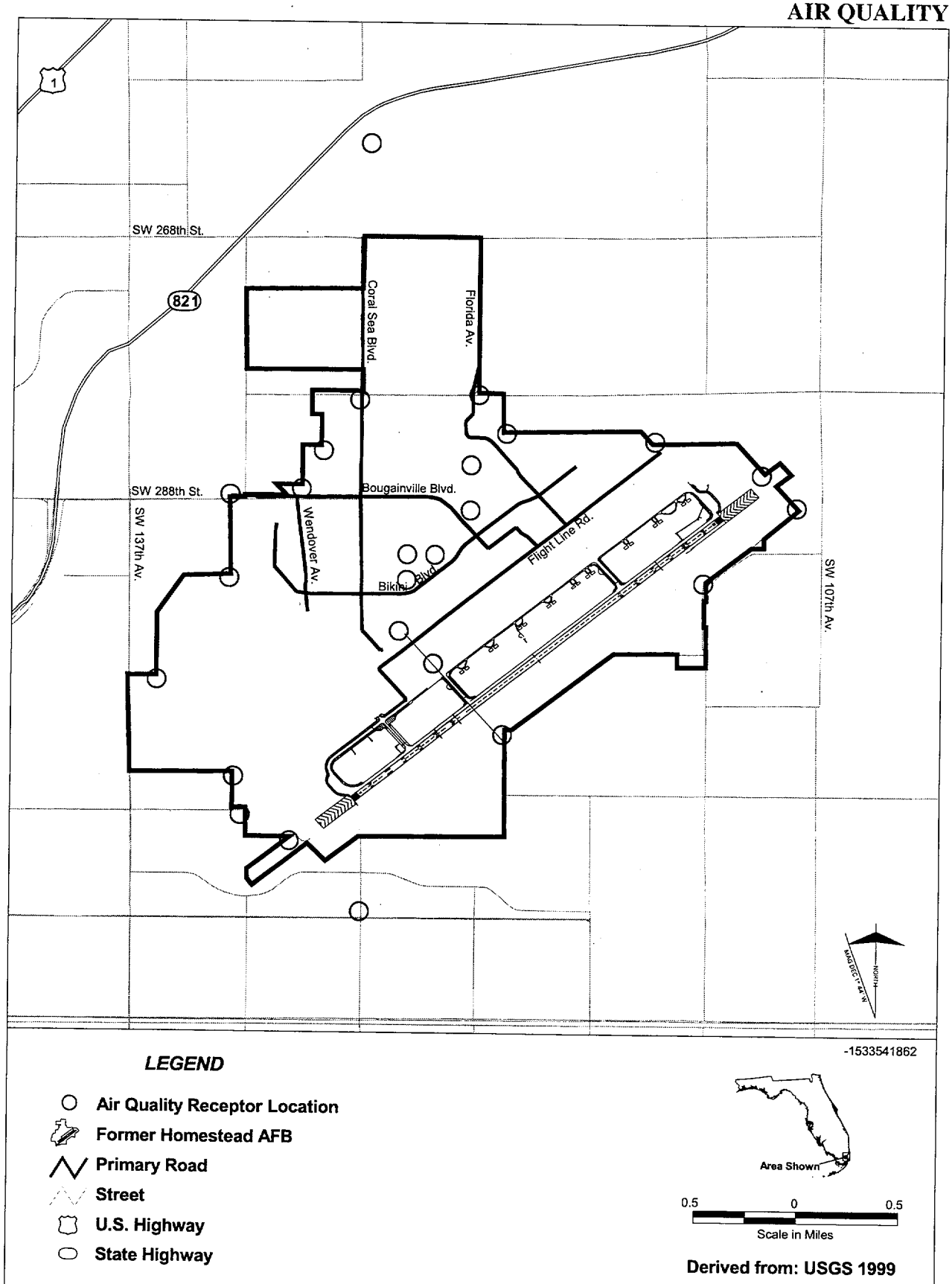
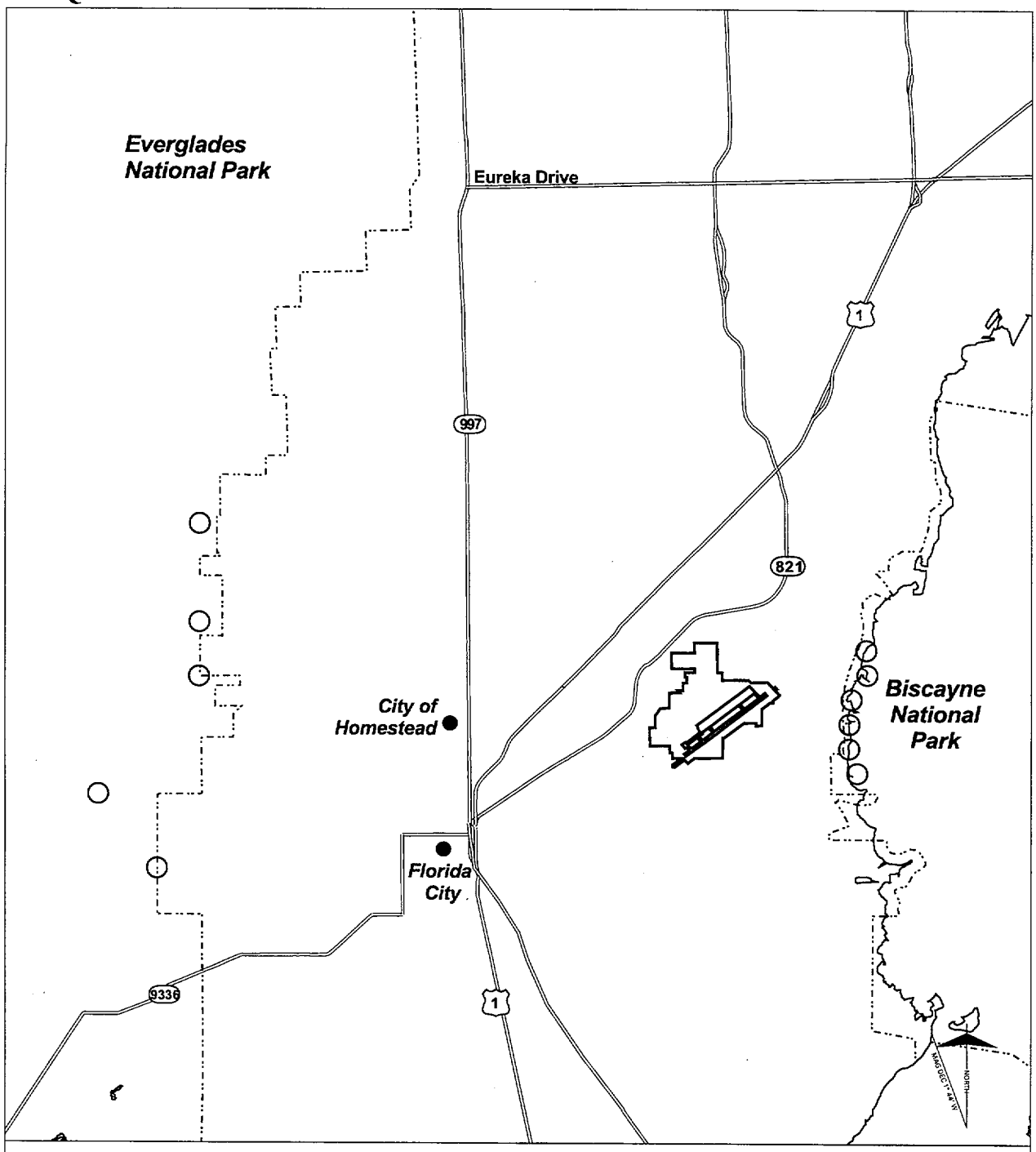
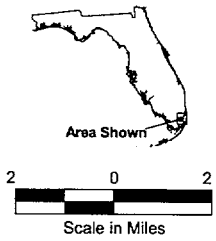


Figure 4.8-1
Locations of EDMS Model Receptors
On and Near Former Homestead AFB



LEGEND

- Air Quality Receptor Location
- Former Homestead AFB
- National Park Boundary
- Major Road
- U.S. Highway
- State Highway



Derived from: NPS 1999c

Figure 4.8-2
Locations of EDMS Model Receptors Along Boundaries of Everglades and Biscayne National Parks

Table 4.8-4. Increased Ambient Air Concentrations Resulting from Proposed Action Emissions

Year	Predicted Concentrations and National Ambient Air Quality Standards					
	CO (ppm)[1]				NO_2 ($\mu g/m^3$)[2]	
	Concentration (1 hour)	NAAQS (1 hour)	Concentration (8 hour)	NAAQS (8 hour)	Concentration (AAM)	NAAQS (AAM)
2000	2.2	35	2.1	9	10.1	100
2005	3.1	35	2.8	9	13.2	100
2015	3.3	35	3.2	9	27.6	100

Source: SAIC.
Notes: [1] CO predicted concentrations include an estimated 8 hour ambient background concentration of 2 ppm (**Dade County 1987**).
[2] NO_2 predicted concentrations include an ambient background concentration of 10 $\mu g/m^3$.
AAM Annual Arithmetic Mean
$\mu g/m^3$ micrograms per cubic meter
ppm parts per million

NO_x is the pollutant generated under the Proposed Action most likely to contribute to exceedance of the ozone NAAQS, because NO_x emissions generated by the Proposed Action would comprise a larger proportion of Miami-Dade County's mobile source emission budget than VOC emissions. Total NO_x emissions have been projected by Miami-Dade County only until 2005. Assuming that the countywide NO_x emissions in 2015 would be as high as the projected emissions in 2005, the Proposed Action (including construction and operations) is estimated to generate about 0.6 percent of countywide NO_x emissions in 2015.

Roadway Intersection Analysis. Because motor vehicles are a major source of air pollutants, a separate, more detailed air quality analysis was conducted for roadway intersections that are predicted to become the most highly congested. The roadway analysis focused on intersections because of the potentially high pollutant concentrations that result from motor vehicle exhaust in stopped and slow-moving traffic. Carbon monoxide is the pollutant of greatest concern because it is the pollutant emitted in the largest quantity by motor vehicles for which short-term health standards exist.

The CAL3HQC air dispersion computer model was used in the roadway analysis to estimate CO concentrations from motor vehicles. The CAL3HQC model is approved by USEPA for estimating CO concentrations at intersections. It evaluates the atmospheric dispersion of pollutants using a worst-case set of meteorological conditions. Model receptors were located around the intersections and roadways.

Emission factors for CO exhaust from idling motor vehicles were calculated with a USEPA-approved methodology for using MOBILE5a emission factors (**USEPA 1993b**). CO concentrations predicted by the CAL3HQC model were compared to 1 hour and 8 hour ambient air quality standards. A background CO concentration of 2.0 ppm was included in the impact analysis to represent the ambient background levels identified by Miami-Dade County for suburban areas (**Dade County 1987**). One hour concentrations were converted to 8 hour equivalents using a USEPA conversion factor (**USEPA 1977**).

The modeling evaluated two roadway intersections expected to be the most heavily congested, based on estimated motor vehicle traffic volumes and level of service: SW 288th Street between the former base and Florida's Turnpike and U.S. Highway 1 between SW 112th Avenue and SW 137th Avenue. If the NAAQS for CO would not be exceeded in the year with the highest traffic volume and level of service, then the other years and the intersections with lower volumes would also be expected to be within the

NAAQS. The year 2015 was identified in the transportation analysis as having the highest traffic volumes and poorest level of service.

The roadway intersection analysis did not identify any ground-level CO concentrations that exceeded either the 1 hour or the 8 hour ambient air quality standard at the intersections evaluated. The results are presented in **Table 4.8-5**.

Table 4.8-5. CO Concentrations Modeled at Roadway Intersections—Proposed Action (2015)

Intersection	Concentration 1 hour (ppm)	NAAQS 1 hour (ppm)	Concentration 8 hour (ppm)	NAAQS 8 hour (ppm)
SW 288th Street & SW 137th Avenue	12.1	35	7.3	9
U.S. Highway 1 & SW 112th Avenue	4.8	35	2.9	9

Source: SAIC.
ppm parts per million

Cumulative Impacts

FDEP has projected emissions rates for VOCs and NO_x through 2005. Emissions for 2015 have only been projected for motor vehicles (see Section 3.8.3.2). These projections are believed to be based on Miami-Dade County's high-growth population forecasts. Therefore, the air quality analysis in this section already incorporates cumulative impacts.

Mitigation Measures

The air quality mitigation measures described below would be in addition to the motor vehicle emission controls that USEPA will be phasing in over the next decade and potential emission reductions from more efficient and better controlled aircraft engines.

One of the major focal points in reducing air emissions from the Proposed Action would be to limit the increase in VMT from motor vehicles using the airport. The methods used to control VMT growth fall into the general category of Transportation Control Measures (TCM). TCM measures could include:

- Reducing single occupant vehicles by keeping airport parking rates high.
- Encouraging high occupancy vehicles by maintaining exclusive bus and carpool lanes and installing Park-and-Ride parking lots.
- Providing viable options for passengers using the airport, such as convenient bus service, parking shuttles, or a light rail line from Miami.

To reduce other traffic congestion in the vicinity of Homestead, additional TCM measures that could be implemented include:

- Installing bikeways.
- Improving roadways to speed traffic.
- Installing intelligent traffic signal systems.

Aircraft and related operations (GSE/AGE/APU) are expected to be a major source of air emissions from the Proposed Action. These emissions could be reduced by encouraging the use of larger aircraft (which may decrease emissions per passenger) and by using electric-powered GSE/AGE/APU equipment. Terminal development by Miami-Dade County could also provide central power and air conditioning at each gate to reduce the need to use aircraft APUs. Air quality monitoring could be performed by Miami-Dade County at HST during construction and operations to identify problem areas that may warrant further action.

Possible Future Expansion

The possible expansion of HST, including the addition of a second runway, would be expected to increase the total amount of air emissions by:

- Increasing the number of aircraft using the facility;
- Increasing the number of motor vehicles traveling to and from the airport to drop off and pickup passengers, take employees to and from work, and other work-related activities; and
- Increasing the number of businesses at the site.

It is not possible at this time to quantify the increases in emissions caused by the addition of a second runway because they would depend on the number and type of additional aircraft and motor vehicles using the expanded facility. Further analysis would have to be performed once estimates of air traffic and ground activity could be defined.

4.8.2.2 Commercial Spaceport Alternative

Construction Emissions. The impacts of construction activities on air quality would be similar to those described for the Proposed Action.

Operational Emissions. An emission inventory was developed for the Commercial Spaceport alternative for 2000, 2005, and 2015. Emissions factors for aircraft and motor vehicles were calculated as described for the Proposed Action. Emissions factors from the two proposed spacecraft types were not available, so their emissions were estimated by using the emission factors for a Boeing 747. In the case of the Eclipse Astroliner tow-launch system, the use of emission factors from a Boeing 747 should provide a good estimate of spacecraft emissions, because a Boeing 747 is planned for towing the Astroliner to the launch altitude of 20,000 feet. For the Space Access Aerospacecraft system, the use of emissions from a Boeing 747 provide a conservative estimate because the ASC engines are expected to be powered by engines using liquid hydrogen and liquid air or liquid oxygen, which burn much cleaner than kerosene-type jet fuels used by Boeing 747s. A summary of the emissions inventory for the Commercial Spaceport alternative is presented in **Table 4.8-6**.

These estimates include emissions from new activity associated with the Commercial Spaceport alternative and transportation associated with reuse-related secondary development. They do not include air emissions from home-based activities, malls, fast food facilities, and light industry, but the relative contribution of these sources is expected to be minor.

Table 4.8-6. Operational Emissions Inventory for Disposal Property—Commercial Spaceport Alternative

Year	Emissions (tons/year)				
	CO	VOC	NO_x	SO_2	PM_{10}
2000	1	1	2	<0.1	<0.1
2005	118	16	19	0.6	0.5
2015	241	30	59	2.2	1.2

Source: SAIC.
< less than

For each of the analysis periods, aircraft-related emissions were estimated to be the largest contributor to the total emissions inventory for NO_x and SO_2, while roadways dominated the emissions of CO, VOCs, and PM_{10}. **Table 4.8-7** shows the percentage of the total emissions inventory estimated to be contributed by each source in 2015.

Table 4.8-7. Percentage of Operational Emissions by Major Source Category—Commercial Spaceport Alternative (2015)

Source Category	Percent Contribution to Total Emissions Inventory				
	CO	VOC	NO_x	SO_2	PM_{10}
Spacecraft	5.6	3.6	45.5	45.5	0.0
GSE/AGE/APU	4.7	1.2	3.0	1.8	5.6
Roadways	53.2	51.6	29.5	44.6	64.5
Parking Lots	35.6	32.3	6.4	6.3	11.9
Stationary Sources	0.9	11.4	15.6	1.9	18.0

Source: SAIC.

Air Quality Impacts. The results of the EDMS model runs for the Commercial Spaceport alternative are presented in **Table 4.8-8**. The table shows that predicted concentrations would be less than with the Proposed Action, and impacts of the Commercial Spaceport alternative are not expected to result in exceedances of the NAAQS during any time period.

Like the Proposed Action, NO_x is the pollutant generated under the Commercial Spaceport alternative most likely to contribute to exceedance of the NAAQS. Total NO_x emissions have only been projected through 2005. Assuming countywide NO_x emissions in 2015 would be as high as the projected emissions in 2005, the Commercial Spaceport alternative (construction and operations) is estimated to generate about 0.12 percent of countywide NO_x emissions in 2015.

Table 4.8-8. Increased Ambient Air Concentrations Resulting from Commercial Spaceport Alternative Emissions

Year	Predicted Concentrations and National Ambient Air Quality Standards					
	CO (ppm)[1]				NO_2 ($\mu g/m^3$)[2]	
	Concentration (1 hour)	NAAQS (1 hour)	Concentration (8 hour)	NAAQS (8 hour)	Concentration (AAM)	NAAQS (AAM)
2000	2.0	35	2.0	9	10.0	100
2005	2.2	35	2.1	9	12.7	100
2015	2.3	35	2.2	9	14.3	100

Source: SAIC.
Notes: [1] CO predicted concentrations include an estimated 8 hour ambient background concentration of 2 ppm (**Dade County 1987**).
[2] NO_2 predicted concentrations include an ambient background concentration of 10 $\mu g/m^3$.
AAM Annual Arithmetic Mean
$\mu g/m^3$ micrograms per cubic meter
ppm parts per million

Roadway Intersection Analysis. The roadway intersection analysis for the Commercial Spaceport alternative used the approach described in the Proposed Action. No ground-level CO concentrations were calculated to exceed either the 1 hour or the 8 hour ambient air quality standard at the intersections evaluated. The results for the receptors showing the highest 1 hour and 8 hour CO concentrations are presented in **Table 4.8-9**.

Table 4.8-9. CO Concentrations Modeled at Roadway Intersections—Commercial Spaceport Alternative (2015)

Intersection	Concentration 1 hour (ppm)	NAAQS 1 hour (ppm)	Concentration 8 hour (ppm)	NAAQS 8 hour (ppm)
SW 288th Street & SW 137th Avenue	9.8	35	5.8	9
U.S. Highway 1 & SW 112th Avenue	4.7	35	2.8	9

Source: SAIC.
ppm parts per million

Combined Commercial Spaceport/Airport

An emissions inventory was developed for a combined Commercial Spaceport/Airport, using the same approach that was used for the Commercial Spaceport alternative. A summary of the emissions inventory is presented in **Table 4.8-10**. These estimates include the emissions estimated for the spaceport, plus additional conventional commercial aircraft.

Table 4.8-10. Operational Emissions Inventory for Disposal Property—Combined Commercial Spaceport/Airport

Year	Emissions (tons/year)				
	CO	VOC	NO_x	SO_2	PM_{10}
2000	1	1	2	<0.1	<0.1
2005	521	47	62	2.9	1.4
2015	812	81	144	6.4	2.8

Source: SAIC.
< less than

The results of the EDMS model runs for the combined Commercial Spaceport/Airport are presented in **Table 4.8-11**. The table shows that the impacts of a combined Commercial Spaceport/Airport would be less than the Proposed Action and are not expected to result in exceedances of the NAAQS during any of the time periods analyzed. NO_x emissions in 2015 are estimated to be about 0.23 percent of projected countywide NO_x, assuming countywide emissions in 2015 are the same as projected for 2005.

Table 4.8-11. Increased Ambient Air Concentrations Resulting From Combined Commercial Spaceport/Airport Emissions

Year	Predicted Concentrations and National Ambient Air Quality Standards					
	CO (ppm)[1]				NO_2 ($\mu g/m^3$)[2]	
	Concentration (1 hour)	NAAQS (1 hour)	Concentration (8 hour)	NAAQS (8 hour)	Concentration (AAM)	NAAQS (AAM)
2000	2.0	35	2.0	9	10.0	100
2005	2.4	35	2.3	9	17.1	100
2015	2.7	35	2.4	9	19.5	100

Source: SAIC.
Notes: [1] CO predicted concentrations include an estimated 8 hour ambient background concentration of 2 ppm (**Dade County 1987**).
[2] NO_2 predicted concentrations include an ambient background concentration of 10 $\mu g/m^3$.
AAM Annual Arithmetic Mean
$\mu g/m^3$ micrograms per cubic meter
ppm parts per million

The results of the roadway intersection analysis for a combined Commercial Spaceport/Airport estimated concentrations that would be higher than the spaceport alone, but lower than the Proposed Action. No ground-level CO concentrations would be expected to exceed either the 1 hour or the 8 hour ambient air quality standard at the intersections evaluated.

Cumulative Impacts

The FDEP emission projections for Miami-Dade County are believed to be based on the county's high-growth population forecasts, so the analysis in this section already incorporates cumulative impacts.

Mitigation Measures

Although the emissions associated with the Commercial Spaceport alternative would be less than the Proposed Action, many of the same mitigation measures could apply, particularly if a combined Commercial Spaceport/Airport were established.

4.8.2.3 Mixed Use Alternative

Construction Emissions. The impacts of construction activities associated with the Mixed Use alternative on air quality are assumed to be similar to those described for the Proposed Action. The type and intensity of construction might vary, but the general activities and equipment used would be the same.

Operational Emissions. An emissions inventory developed for the Mixed Use alternative is summarized in **Table 4.8-12**, based on the Market-Driven development scenario. Separate emissions inventories were not prepared for the Collier-Hoover proposal, the original Collier proposal, or the original Hoover plan. The land uses for those scenarios would be similar to the Market-Driven scenario, so the emissions would probably not differ substantially from the values in Table 4.8-12.

Table 4.8-12. Operational Emissions Inventory for Disposal Property—Mixed Use Alternative (Market-Driven)

Year	Emissions (tons/year)				
	CO	VOC	NO_x	SO_2	PM_{10}
2000	1	1	2	<0.1	<0.1
2005	105	16	17	0.4	0.6
2015	271	40	41	1.1	1.4

Source: SAIC.
< less than

These emissions include the emissions from activities on the disposal property and transportation associated with reuse-related secondary development. Emissions from home-based activities, malls, fast food facilities, and light industry were not included, but the relative contribution of these sources would be minor.

Air Quality Impacts. The results of the EDMS model runs for the Market-Driven scenario of the Mixed Use alternative are presented below in **Table 4.8-13**. The table shows that the impacts of the Market-Driven scenario are not expected to result in exceedances of the NAAQS during any of the time periods analyzed. Given that the emission sources associated with the other scenarios are expected to be similar, the impacts of other scenarios are also anticipated to be similar.

NO_x emissions for this alternative in 2015 are estimated to be 0.01 percent of countywide NO_x emissions, assuming countywide emissions in 2015 are the same as projected for 2005.

Table 4.8-13. Increased Ambient Air Concentrations from Mixed Use Alternative (Market-Driven) Emissions

Year	Predicted Concentrations and National Ambient Air Quality Standards					
	CO (ppm)[1]				NO_2 ($\mu g/m^3$)[2]	
	Concentration (1 hour)	NAAQS (1 hour)	Concentration (8 hour)	NAAQS (8 hour)	Concentration (AAM)	NAAQS (AAM)
2000	2.0	35	2.0	9	10.0	100
2005	2.4	35	2.3	9	14.4	100
2015	3.0	35	2.8	9	21.5	100

Source: SAIC.
Notes: [1] CO predicted concentrations include an estimated 8 hour ambient background concentration of 2 ppm (**Dade County 1987**).
[2] NO_2 predicted concentrations include an ambient background concentration of 10 $\mu g/m^3$.
AAM Annual Arithmetic Mean
$\mu g/m^3$ micrograms per cubic meter
ppm parts per million

Roadway Intersection Analysis. CO concentrations from ground vehicle traffic associated with the Mixed Use alternative could vary substantially based on the option implemented. **Table 4.8-14** shows the results for the Market-Driven development, and **Table 4.8-15** for the Collier-Hoover proposal. No calculated ground-level CO concentrations were found to exceed either the 1 hour or the 8 hour ambient air quality standard at the intersections evaluated.

Table 4.8-14. CO Concentrations Modeled at Roadway Intersections—Market-Driven Mixed Use Alternative (2015)

Intersection	Concentration 1 hour (ppm)	NAAQS 1 hour (ppm)	Concentration 8 hour (ppm)	NAAQS 8 hour (ppm)
SW 288th Street & SW 137th Avenue	9.7	35	5.8	9
U.S. Highway 1 & SW 112th Avenue	4.7	35	2.8	9

Source: SAIC.
ppm parts per million

Table 4.8-15. CO Concentrations Modeled at Roadway Intersections—Collier-Hoover Mixed Use Alternative (2015)

Intersection	Concentration 1 hour (ppm)	NAAQS 1 hour (ppm)	Concentration 8 hour (ppm)	NAAQS 8 hour (ppm)
SW 288th Street & SW 137th Avenue	8.8	35	5.3	9
U.S. Highway 1 & SW 112th Avenue	3.1	35	1.9	9

Source: SAIC.
ppm parts per million

Cumulative Impacts

The FDEP emissions projections for Miami-Dade County are believed to be based on the county's high-growth population forecasts, so the analysis in this section already incorporates cumulative impacts.

Mitigation Measures

The airport-related mitigation measures identified for the Proposed Action would not be applicable to the Mixed Use alternative, but the other measures could apply.

4.8.2.4 No Action Alternative

Air quality under the No Action alternative would remain the same as under projected baseline conditions. There would be no additional air pollutant emissions from reuse of the disposal property at former Homestead AFB.

4.8.2.5 Independent Land Use Concepts

Air quality impacts from the independent land use concepts could vary considerably, and it is not possible to quantify the air pollutant emissions without more detailed information. Agriculture operations or a cemetery would likely have a minimal air quality impact. A theme park could draw thousands of visitors and result in emissions comparable to or greater than the Proposed Action and other alternatives assessed. The other land use concepts would likely result in air quality impacts that would be similar to those identified for the other reuse alternatives.

4.8.3 Conformity With the Clean Air Act

4.8.3.1 Proposed Action

A federal agency proposing an action in a NAAQS nonattainment or maintenance area must ensure that the action conforms to the SIP's purpose of "eliminating or reducing the severity and number of violations of the ambient air quality standards and achieving expeditious attainment of such standards." Miami-Dade County is a maintenance area for ozone. Therefore, the General Conformity Rule potentially applies to FAA actions concerning the disposal property at former Homestead AFB. The determination of conformity is governed by the following principles:

- The action will not cause or contribute to any new violations of the NAAQS in the area;
- The action will not increase the frequency or severity of any existing violations of any NAAQS; and
- The action will not delay timely attainment of any air quality standard, required interim emission reductions, or milestones.

A conformity determination is also generally required if the estimated emissions of the action exceed 10 percent of the regional emissions budget. If the Proposed Action is selected, FAA would make the required conformity determination. To determine if USEPA's General Conformity Rule applies to an action, the estimated emission increases resulting from the action over the No Action alternative are compared with USEPA's *de minimis* exemption levels for conformity determinations. The emissions increases include both direct emissions (e.g., construction activities) and indirect emissions (e.g., increased aircraft operations in the future). In this case, the *de minimis* emission levels are 100 tons per year of the ozone precursors NO_x and VOCs. A conformity determination is required for the Proposed

Action because the estimated increase in NO_x emissions for 2015 (shown in Tables 4.8-1 and 4.8-2) over the No Action alternative would exceed the 100 tons per year *de minimis* level. The total emissions shown in Table 4.8-1 resulting from construction activities for a particular period, such as 2005 or 2015, were converted to an annual emissions rate by assuming that the construction activities were uniformly spread over the number of years in the period. NO_x emissions for operations are estimated to range from 45 tons per year in 2005 to 392 tons per year in 2015.

One method of demonstrating conformity would be to find offsetting emissions, but this is unlikely because the project-related direct and indirect NO_x emissions in 2015 (Tables 4.8-1 and 4.8-2) total about 417 tons per year. However, there may be another way of demonstrating that the Proposed Action would not cause or contribute to any new violations of the ozone NAAQS in Miami-Dade County. The county and the state established NO_x and VOC emissions budgets for mobile sources in Miami-Dade County as part of an ozone maintenance plan. This maintenance plan is designed to ensure that the county remains in attainment of the ozone NAAQS and has been incorporated into the Florida SIP. If the increased emissions of the Proposed Action can be added to the projected county NO_x and VOC mobile emissions without causing an exceedance of the county mobile-source emissions budgets and the state agrees to such an allocation of the SIP budget, then it will have been demonstrated that the Proposed Action would not contribute to new violations of the ozone NAAQS.

The NO_x and VOC mobile emissions budgets for Miami-Dade County, along with the projected countywide emissions for these pollutants for 2000, 2005, and 2015, are presented in **Tables 4.8-16** and **4.8-17**, respectively. The tables also show the estimated increase in direct and indirect NO_x and VOC emissions resulting from the Proposed Action for the same years.

Table 4.8-16 illustrates that through 2015, the projected NO_x emissions from the Proposed Action are estimated to consume a maximum of 13 percent of the available NO_x emissions in Miami-Dade County's mobile source emissions budget, after current projections are accounted for. Projected VOC emissions are estimated to consume less than 1 percent of the available VOC emissions budget. The Proposed Action would not be expected to prevent the county from meeting its NO_x or VOC emissions budgets or meeting the ozone NAAQS.

Table 4.8-16. Comparison of Proposed Action Emissions and Mobile NO_x Emissions Budget

Year	Annual NO_x Emissions (tons)				Proposed Action Percent of Available Mobile NO_x Emissions Budget
	Approved Mobile NO_x Emissions Budget	Projected County Mobile NO_x Emissions	Mobile NO_x Emissions Remaining in Budget	Projected NO_x Emissions from Proposed Action	
2000	40,814	39,654	1,160	4	0.3%
2005	40,814	37,712	3,102	45	2.0%
2015	40,814	37,588	3,226	392	12.2%

Source: SAIC.

Table 4.8-17. Comparison of Proposed Action Emissions and Mobile VOC Emissions Budget

Year	Annual VOC Emissions (tons)				Proposed Action Percent of Available Mobile VOC Emissions Budget
	Approved Mobile VOC Emissions Budget	Projected County Mobile VOC Emissions	Mobile VOC Emissions Remaining in Budget	Projected VOC Emissions from Proposed Action	
2000	54,301	28,127	26,174	9	0.03%
2005	54,301	27,280	27,021	27	0.10%
2015	54,301	30,021	24,280	130	0.54%

Source: SAIC.

It is very likely that the current projections of Miami-Dade County NO_x emissions in 2015 are actually overstated because of new mobile source emission control regulations that start to take effect in 2004 (**McElveen 1999**). These new controls include:

- USEPA regulations that would mandate the use of low-sulfur gasoline and reduce the sulfur content of gasoline from 300 to 30 ppm, expected to be finalized soon. The lowered sulfur content would reduce NO_x emissions from motor vehicles because the sulfur in current fuels gradually "poisons" the catalyst in a vehicle's catalytic converter so that it becomes less efficient at removing NO_x emissions.
- Another regulation that mandates NO_x emissions controls on heavy-duty diesel engines used in large trucks. This regulation has been promulgated and is scheduled for implementation in 2004.
- Tier 2 emission controls that would mandate tighter emission controls on passenger cars by 2004, expected to be promulgated by USEPA soon.

USEPA plans to release a new version of its mobile source model that would incorporate all of these added NO_x emission controls (Mobile 6) by the end of 1999. Until then, it is not possible to determine the reduction of NO_x emissions that these added controls would achieve. However, a senior staff member of the mobile sources section of FDEP has stated that he expects the new regulations will lower NO_x emissions dramatically in the 2015–2020 time frame (**McElveen 1999**).

As one example of the level of reductions expected from these new regulations, USEPA's Office of Mobile Sources has released on its Web site a computer model, called the "Complex Model," that estimates the reduction in NO_x emissions by the use of low-sulfur gasoline. The model estimates that low sulfur fuel would reduce NO_x emissions by 11.5 percent, which would be 11.8 tons of Miami-Dade County's projected 2015 NO_x emissions of 102.98 tons per day. These results substantiate the expectation that the new mobile source emission control regulations would result in dramatic reductions of NO_x emissions in the 2015–2020 time frame.

Miami-Dade County's emissions inventory also does not take into consideration advances in combustion technology and control systems for aircraft engines that could be introduced prior to 2015 and result in significant reductions of NO_x emissions from aircraft engines. This would supplement the emissions reductions for motor vehicles discussed above. In addition, it appears the county's emission inventory is based on the county's high growth population forecasts. Were more moderate growth to occur, the remaining emissions in the budget could be larger than shown in Table 4.8-16.

Therefore, this conformity analysis demonstrates that, through 2015, the Proposed Action would be expected to conform to the sections of the Florida SIP applicable to Miami-Dade County. The results of the conformity analysis provide the input for making a conformity determination. The determination requires certain documentation to be provided to USEPA, FDEP, and Miami-Dade County, as well as notification of the general public.

Cumulative Impacts

The SIP is cumulative in that it includes all reasonably foreseeable emission sources, except for sources that are specifically excluded because they will be accounted for elsewhere (e.g., major stationary sources that are required to get permits). The conformity analysis on the preceding pages thus already represents a cumulative analysis of all relevant mobile emissions sources in that area.

Staff of the Miami-Dade County Metropolitan Planning Organization (MPO) (**Roa 1999**) have indicated that the transportation growth projections made by the MPO had been criticized as being too high. Because the motor vehicle emissions used in the analysis of the Proposed Action were based on the MPO growth projections, which already reflect high-growth forecasts, they represent cumulative impacts for mobile sources, the only emissions projections available for Miami-Dade County.

Possible Future Expansion

Any possible expansion of HST to two runways would be expected to occur well after the last date that Miami-Dade County has projected emissions. Therefore, no conformity analysis could be conducted or is required at this time. An analysis of conformity with the Clean Air Act would have to be performed prior to construction if federal approval or funding is involved.

4.8.3.2 Commercial Spaceport Alternative

The NO_x and VOC emissions from the Commercial Spaceport alternative (Table 4.8-6) are projected to be lower than from the Proposed Action during each of the periods studied. The Commercial Spaceport alternative would conform to the SIP because the Proposed Action is projected to conform to the SIP, and emissions from the Commercial Spaceport alternative are projected to be a small fraction of the emissions from the Proposed Action.

Combined Commercial Spaceport/Airport

The NO_x and VOC emissions from a combined Commercial Spaceport/Airport (Table 4.8-10) are also projected to be lower than the Proposed Action in 2015. The Combined Commercial Spaceport/Airport alternative would conform to the SIP because the Proposed Action is projected to conform to the SIP, and emissions from the Combined Commercial Spaceport/Airport are projected to be less than the emissions from the Proposed Action.

Cumulative Impacts

As noted for the Proposed Action, the Miami-Dade County data on emissions for mobile sources is believed to already incorporate high population growth forecasts and therefore represents cumulative impacts.

4.8.3.3 Mixed Use Alternative

A conformity determination is not be required for the Mixed Use alternative because the development of the disposal property would not involve federal action, and the Air Force's disposal action is not subject to the General Conformity Rule. For comparison with the other reuse alternatives, however, the VOC and NO_x emissions from the Mixed Use alternative (Table 4.8-12) are projected to be lower than the Proposed Action during each of the periods studied. The Mixed Use alternative would conform to the SIP because the Proposed Action is projected to conform to the SIP, and emissions from the Mixed Use alternative are projected to be a fraction of the emissions from the Proposed Action.

Cumulative Impacts

As noted for the Proposed Action, the Miami-Dade County data on emissions for mobile sources is believed to already incorporate high population growth forecasts and therefore represents cumulative impacts.

4.8.3.4 No Action Alternative

A conformity determination is not required for the No Action alternative. Emissions from continued military and government use and use of conveyed property have already been incorporated into Miami-Dade County's emissions inventories by the Miami-Dade County Metropolitan Planning Organization.

4.8.3.5 Independent Land Use Concepts

The Proposed Action and alternatives have been shown to result in air quality impacts that would not exceed the NAAQS and would maintain the county's conformity with the Florida SIP. Consequently, it is unlikely that any of the independent land use concepts would cause unacceptable or adverse air quality impacts. The only possible exception would be a large, high-density, high-visitation rate theme park located at former Homestead AFB. If federal funds were used to enhance the road network associated with such a theme park, a transportation conformity determination addressing the impacts of additional traffic might be required.

4.8.4 Air Quality Impacts in Areas of Special Concern

The National Park Service has expressed concern that air pollutant emissions from reuse of former Homestead AFB could affect air quality in Biscayne and Everglades NPs, and that possible increases in nitrogen compounds and polycyclic aromatic hydrocarbons deposited in the parks could increase the rate of eutrophication and degrade water quality.

Everglades NP is also a Class I Prevention of Significant Deterioration area. PSD and New Source Review regulations for Class I areas only apply to stationary sources that emit 100 tons of criteria pollutants per year. No stationary sources identified in connection with the Proposed Action and alternatives are expected to exceed this level. However, air pollutant emissions associated with reuse of the disposal property at the former base could reduce the remaining PSD increments and make permitting of a future major stationary source more difficult.

4.8.4.1 Proposed Action

General air quality impacts from the Proposed Action are addressed in Section 4.8.2. That section concluded that reuse-related impacts would not result in exceedance of the NAAQS. Therefore, the Proposed Action is not anticipated to appreciably degrade air quality in Biscayne and Everglades NPs.

Table 4.8-18 presents the maximum ambient NO_2 concentrations that were predicted by the EDMS model at the highest receptors located in Everglades NP and Biscayne NP. The table shows that the ambient levels of NO_2 concentrations from the Proposed Action at both national parks are estimated to be a very small fraction of the NAAQS for NO_2.

Table 4.8-18. Maximum Predicted Increase in Ambient NO_2 Concentrations at Everglades and Biscayne NPs Resulting from the Proposed Action

Year	Concentration at Biscayne NP AAM (μg/m^3)	Concentration at Everglades NP AAM (μg/m^3)	NAAQS AAM (μg/m^3)
2000	0.007	0.002	100
2005	0.041	0.015	100
2015	0.335	0.089	100

Source: SAIC.
AAM Annual Arithmetic Mean
μg/m^3 micrograms per cubic meter

To address possible nitrogen deposition from the Proposed Action, the analytical approach recommended in a Phase I report by an Interagency Workgroup (USEPA, NPS, U.S. Forest Service, and USFWS) (**USEPA 1993a**) was used. Annual average NO_2 concentrations predicted by the EDMS model at the highest receptors located in each of the two parks were used to calculate a deposition rate for nitric acid (HNO_3), using an algorithm presented in the Interagency Workgroup report. The Phase II Interagency Workgroup report suggests that presenting the deposition rates in kilograms/hectare per year as nitrogen (N) is the preferred approach (**USEPA 1998a**). **Table 4.8-19** presents the maximum increases in deposition rates estimated to occur in each park in 2000, 2005, and 2015. Based on these estimates, in 2015, nitrogen deposition in Everglades NP could increase by a maximum of 6 percent over 1994–1998 deposition rates and by 23 percent in Biscayne NP, assuming no NO_x reductions in future aircraft.

Table 4.8-19. Estimated Increases in Maximum Atmospheric Nitrogen Deposition Rates at Closest Edges of Biscayne and Everglades NPs—Proposed Action

Year	Nitrogen Deposition Rate (kg/hectare-yr)	
	Biscayne NP	Everglades NP
2000	0.03	0.01
2005	0.20	0.07
2015	1.61	0.43

Source: SAIC.
kg/hectare-yr kilogram per hectare per year

The Phase II report indicated that this screening level calculation is extremely conservative, so deposition rates calculated using this approach should be high. As noted in Section 4.8.1, a comparison of model results for current deposition rates to measured rates in Everglades NP found the model's predictions to be 30 times greater than the measured results. In addition, discussions with NPS technical air quality staff (**Notar 1999**) indicated that acid deposition screening calculations are primarily intended for use in determining impacts at receptors located at extended distances (50 kilometers and beyond) from sources. Deposition values near a source should be much smaller than the screening-level calculations shown above, because it takes time to convert emissions (primarily nitric oxide or NO) into NO_2, combine with water vapor to become HNO_3, and then be deposited. At distances of a few miles, these reactions cannot be completed, so the values provided above are very conservative (yielding higher values than would actually be expected to occur). The potential effects of these levels of nitrogen deposition on water quality are addressed in Section 4.10.

Polycyclic aromatic hydrocarbons are toxic organic compounds that are found in petroleum products and are emitted in the exhaust from motor vehicles, aircraft, and industrial boilers. Data on PAHs are extremely limited, but it is expected that they are widely dispersed in the environments of all industrial countries, with higher concentrations of PAHs in soils and water body sediments near sources such as roadways, airports, and major industrial boilers. There are few data on the transport and fate of PAHs, but they apparently settle slowly in air, are very insoluble in water, and readily attach to particles such as soil and dust. It is assumed that emissions near the ground result in deposition on the land surface, and depending on the ability of the land surface to be moved by stormwater runoff (i.e., erosion potential or level of surface dust), they remain where they settle or are washed to nearby ditches, canals, streams, or rivers. In water bodies, PAHs tend to settle to bottom sediments and are not moved unless the sediment particles to which they are attached also move.

PAHs are considered hazardous air pollutants by USEPA, but emissions from aircraft engines are not regulated, and PAHs are not included in the NAAQS. The USEPA has developed water quality criteria for a few of the myriad PAH compounds now known, and the criteria fall in the thousandths of a microgram per liter (parts per trillion) range. Limited data indicate that water concentrations of PAHs do not often exceed these water quality criteria. The USEPA has been developing sediment quality criteria over the last few years, but no sediment quality criteria have yet been officially proposed. It is expected that PAH sediment quality criteria, when they are promulgated, would be in the parts per trillion range or lower and that more widespread measurements of PAHs in sediments would more frequently exceed sediment quality criteria than water column measurements exceed water quality criteria.

Increased activity of aircraft and other mobile sources associated with the Proposed Action would increase the generation of PAHs in the vicinity of former Homestead AFB. Emissions from ground level sources could settle to the ground and be carried in runoff to the drainage system on the former base. Emissions from aircraft after takeoff would be dispersed by winds above the earth's surface and would settle very slowly. The result is that any PAHs released from aircraft during flight would be widely distributed (e.g., over tens to hundreds of square miles) at extremely low concentrations before reaching the earth.

Emission rates of PAHs are rarely included in emissions inventories, so very few data are available to indicate the relative magnitudes of PAH emissions from potential sources. Assuming that NO_x, a pollutant also generated by the combustion of fossil fuels, is a reasonable surrogate for PAH generation, the Proposed Action would be responsible for the generation of less than 0.6 percent of the PAH emissions in Miami-Dade County in 2015. The proximity of Homestead to Biscayne Bay would cause the contribution of PAHs to the bay to be at a higher percentage than expressed as its share of the Miami-Dade County area.

Cumulative Impacts

A cumulative impact analysis of nitrogen deposition and PAHs in Biscayne and Everglades NPs could not be performed. The model used to predict nitrogen deposition associated with the Proposed Action requires data on the spatial distribution of emission sources in the specific area of analysis in order to predict the increase in ambient concentrations of NO_x at target receptors, such as at the western edge of Biscayne Bay. Because projected cumulative emissions data in the airshed are available only on a countywide basis, it is not possible to predict cumulative increases in nitrogen deposition at specific sub-county locations like Biscayne Bay and the Everglades. Given that the model prediction for the Proposed Action appears to be a substantial overestimation, it is not expected the cumulative deposition rate could exceed the estimated deposition rates.

Possible Future Expansion

Detailed information on operations and aircraft fleet mix is not available for a possible two-runway airport, so nitrogen deposition could not be calculated. Government and industry efforts to improve engine combustion have a goal to reduce emissions of NO_x, which should reduce future deposition rates.

4.8.4.2 Commercial Spaceport Alternative

Nitrogen deposition at Biscayne and Everglades NPs under the Commercial Spaceport alternative were estimated using the same approach described for the Proposed Action. **Table 4.8-20** presents the maximum estimated nitrogen deposition rates that would occur in each of the parks. The results presented in Table 4.8-20 represent very conservative (high) estimates of increases in nitrogen deposition at these locations. Even so, estimated nitrogen deposition would be very small for all periods. In 2015, nitrogen deposition in Everglades NP could increase by approximately 1 percent over 1994–1998 deposition rates and by 3 percent in Biscayne NP.

Table 4.8-20. Estimated Increases in Maximum Atmospheric Deposition Rates of Nitrogen at Closest Edges of Biscayne and Everglades NPs—Commercial Spaceport Alternative

Year	Nitrogen Deposition Rate (kg/hectare-yr)	
	Biscayne NP	Everglades NP
2000	0.01	0.00
2005	0.07	0.03
2015	0.22	0.07

Source: SAIC.
kg/hectare-yr kilogram per hectare per year

Mobile sources associated with the Commercial Spaceport alternative would increase the generation of PAHs in the vicinity of former Homestead AFB. The generation of PAHs under the Commercial Spaceport alternative is estimated to be about 15 percent of those generated under the Proposed Action. Assuming that NO_x emissions are a suitable surrogate for PAH emissions, the Commercial Spaceport alternative would be responsible for less than 0.12 percent of the PAH emissions in Miami-Dade County in 2015.

Combined Commercial Spaceport/Airport

Table 4.8-21 presents the maximum nitrogen deposition rates estimated to occur in the parks with a combined Commercial Spaceport/Airport. The results presented in Table 4.8-21, which represent very conservative (high) estimates of nitrogen deposition at these locations, indicate that estimated increases in nitrogen deposition would be very small for all periods. In 2015, nitrogen deposition in Everglades NP could increase by approximately 2.5 percent over 1994–1998 deposition rates and by 8.9 percent in Biscayne NP.

Table 4.8-21. Estimated Increases in Maximum Atmospheric Deposition Rates of Nitrogen at Closest Edges of Biscayne and Everglades NPs—Combined Commercial Spaceport/Airport

Year	Nitrogen Deposition Rate (kg/hectare-yr)	
	Biscayne NP	Everglades NP
2000	0.01	0.00
2005	0.27	0.09
2015	0.63	0.18

Source: SAIC.
kg/hectare-yr kilogram per hectare per year

Aircraft and other mobile sources associated with a combined Commercial Spaceport/Airport would increase the generation of PAHs in the vicinity of former Homestead AFB. The amount is estimated to be about 23 percent of PAHs generated under the Proposed Action. Assuming that NO_x emissions are a suitable surrogate for PAH emissions, the Combined Commercial Spaceport/Airport could be responsible for the generation of less than 0.24 percent of the Miami-Dade County PAH emissions in 2015.

Cumulative Impacts

As noted for the Proposed Action, a cumulative impacts analysis of nitrogen deposition and PAHs in Biscayne and Everglades NPs could not be performed.

4.8.4.3 Mixed Use Alternative

Although aircraft operations would not increase under this alternative, nitrogen deposition at Biscayne and Everglades NPs were estimated using the same approach described for the Proposed Action. **Table 4.8-22** presents the maximum estimated nitrogen deposition rates that would occur in the parks. The results represent very conservative (high) estimates, but increase in nitrogen deposition is nevertheless projected to be very small for all time periods. In 2015, nitrogen deposition in Everglades NP could increase by approximately 1.1 percent over 1994–1998 deposition rates and by 2.8 percent in Biscayne NP.

Mobile sources associated with the Mixed Use alternative would increase the generation of PAHs in the vicinity of former Homestead AFB. The generation of PAHs is estimated to be about 16 percent of those generated under the Proposed Action. The aircraft contribution to PAH emissions would be the same as that of the No Action alternative. Assuming that NO_x emissions are a suitable surrogate for PAH emissions, the Mixed Use alternative would be responsible for generating less than 0.1 percent of the PAH emissions in Miami-Dade County in 2015.

Table 4.8-22. Estimated Increases in Maximum Atmospheric Deposition Rates of Nitrogen at Closest Edges of Biscayne and Everglades NPs—Mixed Use Alternative

Year	Nitrogen Deposition Rate (kg/hectare-yr)	
	Biscayne NP	Everglades NP
2000	0.01	0.00
2005	0.08	0.04
2015	0.20	0.08

Source: SAIC.
kg/hectare-yr kilogram per hectare per year

Cumulative Impacts

As noted for the Proposed Action, a cumulative impacts analysis of nitrogen deposition and PAHs in Biscayne and Everglades NPs could not be performed.

4.8.4.4 No Action Alternative

Nitrogen deposition rates would not increase in either Biscayne or Everglades NP under the No Action alternative, because there would be no change in activity levels on the former base.

4.8.4.5 Independent Land Use Concepts

None of the independent land use concepts is expected to appreciably increase nitrogen deposition in the national parks or generation of PAHs.

4.9 EARTH RESOURCES

4.9.1 Introduction

This section describes the environmental consequences and cumulative effects on geology and soils that may occur as a result of implementing the Proposed Action and alternatives. These evaluations are qualitative, with consideration given to the number of acres disturbed for each alternative and the general location of earth disturbance estimated from the land use analysis. The projected land development was evaluated against existing resource conditions to identify what soil resources might be permanently altered in such a way as to prevent their use as cropland or wetland. Potential for erosion is increased as more soils are disturbed during earthmoving activities. Of special concern is the disturbance of canal banks which are then vulnerable to invasive plants (**Coffin 1999**).

Some construction activities, such as building and road construction, affect land in such a way as to preclude future agricultural use. Topsoil, and often subsoil, is removed during this type of construction. Not all development eliminates the possibility of future agricultural production. Parks and some types of parking areas may not permanently eliminate the potential for future agricultural land use.

4.9.2 Geology

No impacts to geology have been identified.

4.9.3 Soils

4.9.3.1 Proposed Action

Most of the land at former Homestead AFB has been disturbed, so the natural soil profiles and characteristics have changed. The only relatively undisturbed soils within the disposal property are approximately 200 acres of Biscayne marl soils located south, southeast, and northeast of the runway, most of which would not be affected by proposed construction.

Secondary development is anticipated to occur mostly within the UDB, on soils such as the Krome and Cardsound series. There are approximately 9,000 acres of vacant, unprotected land and 10,000 acres of agricultural land designated as unique farmland within the UDB. Parcels closest to existing utilities, roads, and services are most likely to be developed for commercial and residential uses. Secondary development associated with the Proposed Action could affect an estimated 2,000 acres of undeveloped land by 2015. Agricultural land, also identified as unique farmland, is estimated to comprise about 40 percent of the land that could be developed.

All unaltered soils in the ROI have severe limitations for building, but sites with deeper water tables that require less drainage and fill would be easier to develop. Soils such as Krome very gravelly loam, Cardsound-Rock outcrop complex, and Chekika very gravelly loam, which are most suited for building, are also some of the best cropland in the ROI. Some conversion of these soils outside the UDB for residential and commercial development can be expected and would result in a small reduction in the acreage of unique farmland. Commercial businesses stimulated by the proposed airport may develop in corridors along the main access roads and Turnpike interchanges serving the airport. Soils in these areas within the UDB include Krome very gravelly loam and drained Perrine and Biscayne marls. Construction in these areas has the potential to remove additional unique farmlands from agricultural production, as well as result in the drainage and fill of some wetland soils.

In the ROI as a whole, the projected secondary development associated with the Proposed Action is anticipated to result in less than a 1 percent reduction in the total acreage of unique farmlands and the conversion of a smaller amount of wetland soils by drainage or fill.

Cumulative Impacts

By 2015, the combined effects of implementing the Proposed Action, along with the effects of a high level of population growth, the Restudy, construction of the STDA, and widening of Highway 1, would be to decrease the amount of unique farmland in the ROI. A rough estimate of the amount of farmland that might be developed was generated based on forecasts of population growth and land use generated by Miami-Dade County. It is conceivable that almost half of the farmland within the UDB and between 5 and 10 percent of all the farmland in the south county could be converted to development by 2015.

Commercial, industrial, and residential construction would likely result in draining or filling in of some of the hydric soils, which are protected by federal laws and the focus of south Florida ecosystem initiatives. The extent to which wetlands could be affected is impossible to predict because it would depend on site-specific development plans. Implementation of the South Florida Ecosystem Restoration Project, the Restudy, and other similar programs would help preserve wetlands.

Mitigation Measures

The establishment of a buffer between the proposed airport and Biscayne NP could reduce the potential for conversion of agricultural land within the buffer. An agricultural land protection program could reduce the permanent conversion of unique farmlands to non-agricultural uses. There are many local, state, and federal programs across the country that could be used as models for such a program.

Possible Future Expansion

Future airport expansion could involve acquiring approximately 860 acres on the south/southeast side of the existing airfield for construction of a second runway and using about 200 acres on the northeast side of the existing property for parking. Portions of Boundary, Military, and Mowry Canals would need to be relocated to accommodate the expansion. The acreage to be acquired is located outside the UDB on drained Biscayne and Perrine soils that are currently in agricultural production. Airport expansion would be expected to remove about 1,060 acres of unique farmlands from agricultural production.

If Mowry, Boundary, and Military canals were relocated, best management practices for erosion control from the FDEP standards and specifications would need to be followed, including stabilizing and reseeding canal banks to reduce erosion and sedimentation in the surface water flowing to Biscayne Bay, and to reduce invasion by exotic plants (**Coffin 1999**). Other standards could also be in effect at that time.

4.9.3.2 Commercial Spaceport Alternative

The impacts on soil resources from on-site development for the Commercial Spaceport alternative would be less than under the Proposed Action. Fewer acres are expected to be disturbed on the disposal property. In general, since most of the soils have already been disturbed, there would be no impact from new construction.

Secondary development associated with this alternative would be less than estimated for the Proposed Action. Although there could be construction for industrial uses, the lower level of population in-migration would result in less commercial and residential development, which is likely to result in fewer acres of agricultural land being converted to nonagricultural uses.

Combined Commercial Spaceport/Airport

With a combined Commercial Spaceport/Airport, overall development would be more intensive than with a spaceport only, but the total amount of earth disturbance would still be expected to be less than for the Proposed Action. Secondary development could include increased residential development to accommodate in-migrants and possibly additional commercial properties. This could cause a small reduction of the overall amount of unique farmland.

Cumulative Impacts

The potential cumulative impacts of the Commercial Spaceport alternative would be similar to those described for the Proposed Action. The contribution of the Commercial Spaceport alternative to the cumulative conversion of farmland would be less because less secondary development is anticipated.

Mitigation Measures

Potential mitigation measures for the Commercial Spaceport alternative could be the same as discussed for the Proposed Action.

4.9.3.3 Mixed Use Alternative

The impacts to soil resources from on-site development for the Mixed Use alternative could range from less than to comparable to the Proposed Action. In general, since most of the soils have already been disturbed, there would be no impact from new construction. Secondary development associated with this alternative would be less than the Proposed Action but more than the Commercial Spaceport alternative.

The impacts of soil resources would be higher under the Collier-Hoover proposal than the Market-Driven scenario, due to the extent of earth disturbance and site development. Because the soils have been previously filled and disturbed, site-specific soil and geologic evaluations would be needed to verify the conditions and ensure that rock outcrops and solution cavities would not interfere with the proposed construction of lakes and waterways. Preliminary analysis has not identified any solution cavities that could be a problem, but if any were discovered during final siting and design, the layout of these features may need to be adjusted.

Cumulative Impacts

The potential cumulative impacts of the Mixed Use alternative would be similar to those described for the Proposed Action. The contribution of this alternative to the cumulative conversion of farmland would be less because less secondary development is anticipated.

Mitigation Measures

Potential mitigation measures for the Mixed Use alternative could be the same as discussed for the Proposed Action.

4.9.3.4 No Action Alternative

There would be no construction on the disposal property under the No Action alternative. Therefore, no additional agricultural land would be taken out of production and no hydric soils would be affected as a result of this alternative. Conversion of farmland would still be expected to occur due to ongoing population growth and development in the region.

4.9.3.5 Independent Land Use Concepts

Use of the surplus property as a plant nursery area could help preserve agricultural production in the ROI. Site-specific soil evaluations would be needed to determine the best areas for agricultural use because most of the soils on former Homestead AFB have been disturbed or filled. Natural soils adjacent to the northwest part of the base are mapped as Krome very gravelly loam, one of the best for agricultural production in the ROI.

The other independent land uses would be expected to involve minimal construction on already disturbed soils. These uses would have little impact on soil resources. No additional agricultural land would be taken out of production and no hydric soils would be affected as a result of these concepts.

4.10 WATER RESOURCES

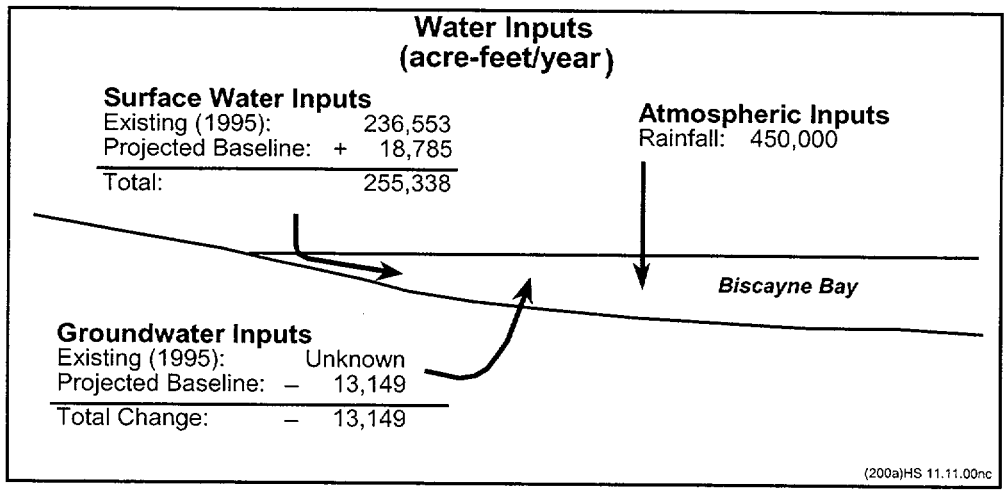
4.10.1 Introduction

The direct effects of the Proposed Action and alternatives on water resources were evaluated using numerical models. Each alternative was modeled for its anticipated effects on the surface water system using the Surface Water Management Model. The impacts on the groundwater system were then qualitatively evaluated based on baseline groundwater model results presented in Section 3.10 and the surface water model results for each alternative. The effects of increased drawdown associated with population growth in the area were also modeled. Indirect effects were evaluated by estimating changes in surface water and groundwater discharges and loadings associated with changes in impervious surface from secondary development in the area. The following sections discuss the anticipated effects of the Proposed Action and alternatives on surface water and groundwater.

The impacts of the Proposed Action and alternatives on water resources would be related to three factors: (1) proposed changes in the stormwater management system on the former base, (2) increased runoff associated with additional paving and buildings both on site (direct) and off site (secondary), and (3) increases in atmospheric nitrogen deposition from air emissions associated with the reuse of former Homestead AFB. The Proposed Action encompasses changes in aspects of the drainage system at the former base identified in the Surface Water Management Master Plan prepared by Miami-Dade County for the site. These changes are also assumed to occur in the Commercial Spaceport alternative. For modeling purposes, the drainage system under the Market-Driven scenario of the Mixed Use alternative and the No Action alternative is assumed to remain similar to or the same as currently exists. The Collier-Hoover proposal, as well as the original proposal from Collier Resources Company and the original Hoover plan, would be required to acquire a permit and implement a stormwater management system similar to the Proposed Action's. The estimated changes associated with the Collier-Hoover proposal are based on this assumption, as insufficient information was available about the proposal's stormwater management system to model it using SWMM.

As shown in Section 3.10, both surface water and groundwater in the vicinity of former Homestead AFB drain into Biscayne Bay. Biscayne Bay receives water from surface water, groundwater, and rainfall (**Figure 4.10-1**). Understanding the total effect of redevelopment of the former base on water quality in Biscayne Bay requires consideration of both on-site and off-site development. For most alternatives, on-site development is expected to involve implementation of a stormwater management plan designed to reduce surface water discharges to Biscayne Bay by retaining more of the stormwater runoff on the site. Retained stormwater percolates through the soil and becomes groundwater or evaporates. Therefore, reducing surface water discharges increases the amount of groundwater that enters the bay.

Conversely, secondary development off site is expected to be incremental and dispersed. It is not known what stormwater management systems may be implemented in connection with secondary development, so for analysis purposes, it was assumed no special management would be used. Because secondary development would increase the amount of impervious surface (through buildings and pavement), it would result in increased stormwater runoff and, consequently, in surface water discharges to Biscayne Bay. More rainfall would become runoff, reducing groundwater inputs into the bay.



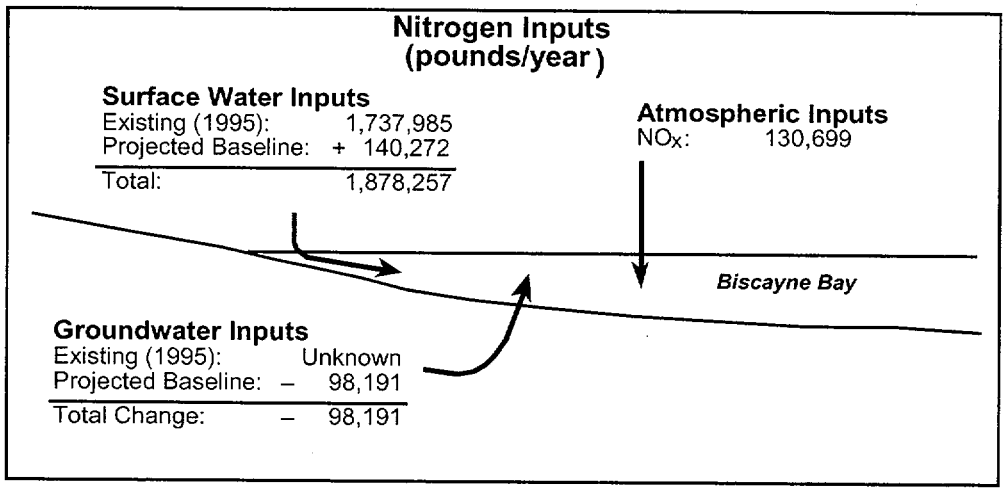


Figure 4.10-1
Existing and Projected Baseline Water and Nitrogen Inputs to Biscayne Bay by 2015

Thus, the on-site development (including a stormwater management system) and the secondary development (with no specific stormwater retention) would have opposite effects, with one decreasing surface water and increasing groundwater flows, and the other increasing surface water and decreasing groundwater flows. The analysis of resulting impacts on Biscayne Bay therefore considers the net effect of the two. **Table 4.10-1** presents the net effects of flows to Biscayne Bay for the Proposed Action and alternatives in 2015. These are added to projected baseline flows, which are estimated to change from current flows due to baseline growth and development (see Figure 4.10-1). The context for the baseline flows is the combined discharge from Military, Mowry, and Princeton Canals, which are estimated to comprise about 60 percent of total surface water discharges to southern Biscayne Bay.

Table 4.10-1. Net Changes in Water Flows to Biscayne Bay by 2015

Alternative	Surface Water (acre-feet/year)[1,2]	Groundwater (acre-feet/year)[1]	Net Change (acre-feet/year)	Percent Change[3]
Existing (1995)	236,553	NA		
Projected Baseline Change	18,785	(13,149)	5,636	2.4%
Projected Baseline	255,338	NA		
Proposed Action	5,108	(3,664)	1,445	0.6%[4]
Commercial Spaceport	346	(336)	9	<0.1%[4]
Market-Driven	2,439	(1,707)	732	0.3%[4]
Collier-Hoover	2,927	(1,627)	1,300	0.5%[4]

Source: SAIC.
Notes: [1] Includes direct on-site and secondary off-site development.
[2] Combined surface water flows from Military, Mowry, and Princeton Canals.
[3] Percent change in surface water flow from Military, Mowry, and Princeton Canals, which comprise approximately 60 percent of total surface water flows to southern Biscayne Bay.
[4] Percentage increase over projected baseline.
NA Not available

Table 4.10-1 shows the estimated increase in discharges from the three canals associated with baseline population growth between 1995 and 2015, assuming a moderate growth rate. The changes in surface water discharges estimated for the Proposed Action and alternatives are compared to this projected baseline. The increases associated with each alternative except the Market-Driven scenario are attributable to reuse-related secondary development. They can therefore be viewed, for comparison purposes, as equivalent to some level of baseline population growth.

Because the magnitude of current groundwater inputs to Biscayne Bay is not known, only changes can be presented; totals are not available. Therefore, the percentage changes in Table 4.10-1 are relative to surface water flows only; existing groundwater inputs are not factored into these calculations. The percentages of change are consequently higher than they would be if groundwater inputs were included.

The SWMM was also used to estimate changes in chemical loads in surface water discharges. These calculations were limited to chemicals, primarily metals, for which measured baseline data were available, as reported in Section 3.10.

Concerns have been expressed about the increase in nitrogen inputs to Biscayne Bay due to redevelopment of former Homestead AFB. Nitrogen inputs would come from three main sources: surface water discharges, groundwater discharges, and atmospheric deposition of air emissions. The changes in surface and groundwater flows described above would affect the amount and form of nitrogen inputs to the bay. In particular, nitrogen in groundwater generally takes the form of ammonia, and un-ionized ammonia (a fraction of total ammonia) is toxic. Figure 4.10-1 illustrates projected baseline inputs of nitrogen to Biscayne Bay in 2015.

Two methods were used to estimate the change in nitrogen loads in groundwater from the Proposed Action and alternatives. To estimate changes in direct inputs from the former base, nitrogen loads were calculated based on the SWMM results for the surface water modeling. The SWMM calculated both total nitrogen washoff and the estimated nitrogen loads that would be discharged through surface water. Groundwater loads were then calculated as the difference between the amount of nitrogen washed off impervious surface and the nitrogen discharged through surface water. This probably overestimates the

groundwater loads because some nitrogen would be taken up by plants. The extent to which this would occur is not known and would depend on the nature of the land surface in the drainages.

To estimate changes in nitrogen loads in groundwater from secondary development, it was assumed that the change in loads would be proportional to the change in groundwater flows. Secondary development associated with the Proposed Action and alternatives would consist of residential, commercial, and industrial land uses that are similar to existing development in the area; therefore, nitrogen loads, along with loads of other chemicals, can also be expected to be similar.

The net change in nitrogen loads in groundwater associated with each alternative is comprised of the changes in direct inputs and secondary inputs. Like the surface water inputs, these two sources tended to have opposite effects (except under the Market-Driven scenario), with increases in direct inputs and decreases in secondary inputs.

Table 4.10-2 presents estimated net changes in nitrogen inputs from all sources for the Proposed Action and alternatives in 2015. Airborne nitrogen inputs for the Proposed Action reflect increased aircraft emissions associated with a commercial airport (see Section 4.8). Like Table 4.10-1, the percent changes in Table 4.10-2 are relative to surface water loads only, since the magnitude of current groundwater loads is not known.

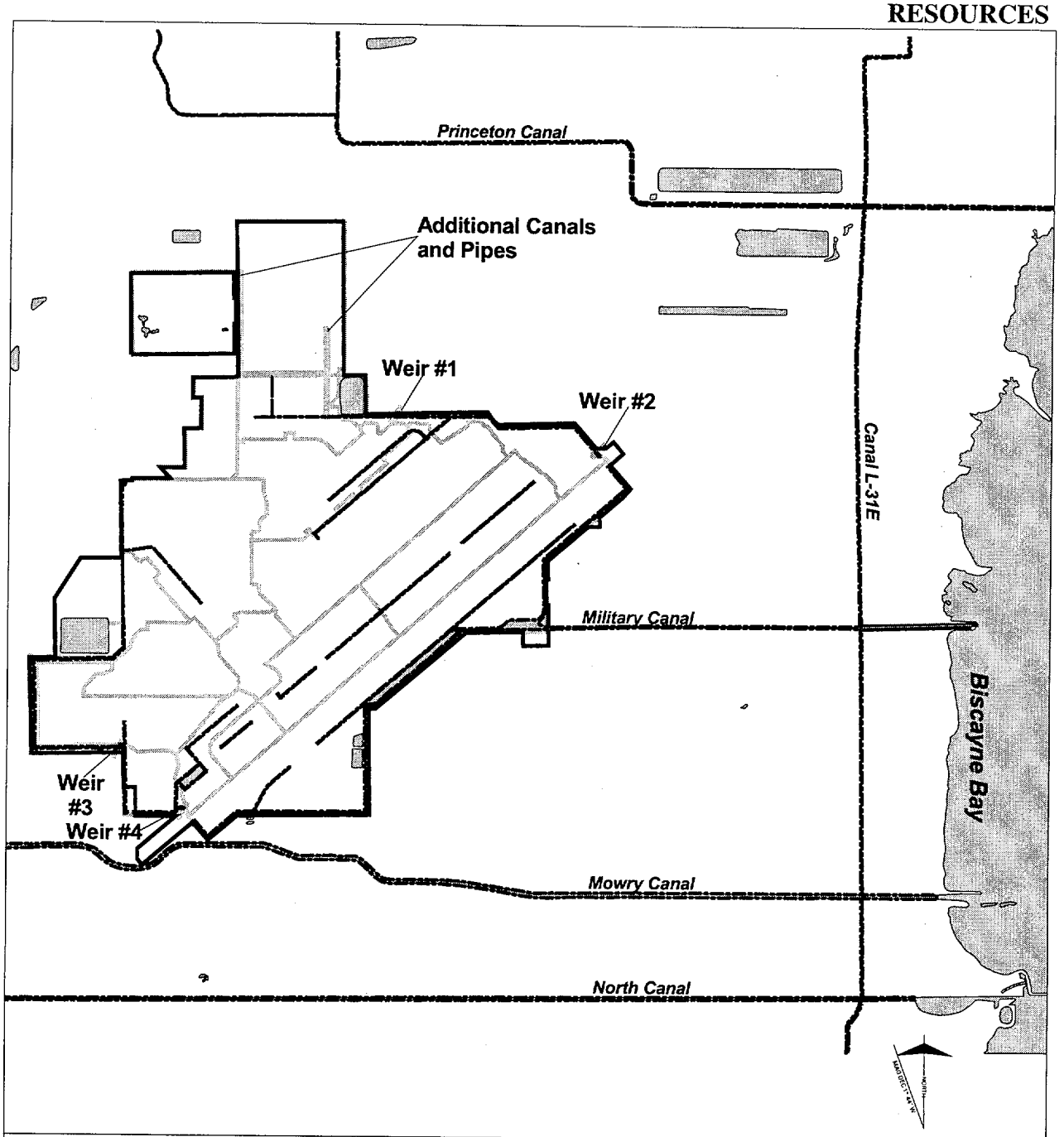
Table 4.10-2. Net Changes in Nitrogen Inputs to Biscayne Bay by 2015

Alternative	Surface Water (pounds/year)[1,2]	Groundwater (pounds/year)[1]	Atmospheric (pounds/year)	Net Change (pounds/year)	Percent Change[3]
Existing (1995)	1,737,985	NA	130,699		
Projected Baseline Change	140,272	(98,191)	—	42,081	2.4%
Projected Baseline	1,878,257	NA	130,699	NA	
Proposed Action	46,984	(9,792)	29,768	66,960	3.6%[4]
Commercial Spaceport	11,405	8,834	4,057	24,296	1.3%[4]
Market-Driven	22,590	(9,548)	3,693	16,735	0.9%[4]
Collier-Hoover	30,695	1,870	3,693	32,518	1.7%[4]

Source: SAIC.
Notes: [1] Includes direct on-site and secondary off-site development.
[2] Combined surface water loads from Military, Mowry, and Princeton Canals.
[3] Percent change in surface water load.
[4] Percentage change over projected baseline.
NA Not available

4.10.2 Surface Water

Figure 4.10-2 shows the 18 major drainage basins on the former base, indicating the location of major proposed modifications to the drainage system assumed to be incorporated into the Proposed Action. Within each drainage basin are a number of sub-basins and connections that control the discharge of surface water to the Boundary Canal system and subsequently discharge to Military Canal. **Table 4.10-3** identifies the assumptions and parameters used in the SWMM model for each modeled alternative.



LEGEND

- Former Homestead AFB
- Open Water
- Canal

-532337219

0.5 0 0.5
Scale in Miles

Derived from: PBS&J 1998a

Figure 4.10-2
Drainage System Modifications
for the Proposed Action

Table 4.10-3. Summary of SWMM Parameters for Each Modeled Alternative

SWMM Input	Proposed Action	Commercial Spaceport	Mixed Use (Market-Driven)	No Action
Hydraulic Characteristics	Percent impervious surface modified by projected land use.	Percent impervious surface modified by projected land use.	Percent impervious surface modified by projected land use.	Existing percent impervious surface.
Drainage Network	Inclusion of weirs in canals and increasing water storage capacity by 2005; connection of former golf course to canal system by 2015.	Inclusion of weirs in boundary canals and increasing water storage capacity by 2005; connection of former golf course to canal system by 2015.	Existing configuration.	Existing configuration.
Contaminant Loadings	Buildup of dust and dirt based on population/ employment density associated with alternative and no initial loading.	Buildup of dust and dirt based on population/ employment density associated with alternative and no initial loading.	Buildup of dust and dirt based on population/ employment density associated with alternative and no initial loading.	Buildup of dust and dirt based on existing situation.

Source: SAIC.

4.10.2.1 Proposed Action

The implementation of the Proposed Action would result in a net increase in surface water flows and loads to Biscayne Bay and a net decrease of groundwater flows and loads to the bay. As shown in Table 4.10-1, the Proposed Action would change water inputs to Biscayne Bay in 2015 by about 0.6 percent of projected baseline inputs through Military, Mowry, and Princeton Canals. Since these three canals comprise about 60 percent of surface water inputs to southern Biscayne Bay, the Proposed Action increase would comprise about 0.4 percent of total surface water discharges to the southern bay and a smaller percentage of all freshwater sources, including groundwater and rainfall.

The Proposed Action would change nitrogen inputs to Biscayne Bay by approximately 3.6 percent of projected baseline surface water discharges through Military, Mowry, and Princeton Canals, about 2.2 percent of total surface water nitrogen inputs to southern Biscayne Bay, and a smaller fraction of total nitrogen inputs including groundwater sources and existing atmospheric deposition. Details of the changes in surface water flows and loads are presented in the following paragraphs. Details of the changes in groundwater flows and loads are presented in Section 4.10.3.1.

The basis for the design of the stormwater management system was taken from the Homestead Regional Airport Surface Water Management Master Plan (**PBS&J 1998a**). This plan and a permit application for stormwater discharges would need to be submitted to, and approved by, SFWMD prior to implementation. During the approval process, substantial changes may be made to this plan, but it is expected that the performance of any approved stormwater management system would be similar to that described here. The plan developed by the county initially involves changes in the portion of the site drainage that discharges to the Boundary Canal, assumed to be in place by 2005. A portion of the disposal property, the site of the former golf course, currently does not drain into Boundary Canal but into Princeton Canal. Since this area is not programmed for development by the county until after 2005, it has been assumed that its drainage will not have changed by 2005. It is incorporated into the system

that discharges into Military Canal for the 2015 analysis. Thus, the estimated discharges from Military Canal to Biscayne Bay for that year introduce runoff from a new area not heretofore included in Military Canal discharges. This can, in turn, be expected to reduce discharges through Princeton Canal.

The results of the flow modeling (**Table 4.10-4**) indicate an increase in total runoff of 13 percent over baseline by 2005 and 43 percent by 2015, reflecting the increasing percentage of impervious area and the hydraulic connection to the former golf course by 2015. However, because of the construction of French drains, additional above-ground storage, and flow-controlling weirs, it is estimated that there would be a 31 percent reduction in the volume of water discharged to Military Canal in 2005, and total discharge is estimated to be approximately 28 percent below baseline levels in 2015.

Table 4.10-4. SWMM Flow and Discharge Results by Modeled Alternative

Alternative	Year	Acre-Feet/Year	
		On-Site Total Runoff	Discharge to Biscayne Bay
Projected Baseline/ No Action	2000	4,591	5,133
	2005	4,591	5,133
	2015	4,591	5,133
Proposed Action	2000	4,591	5,133
	2005	5,188	3,542
	2015	6,565[1]	3,696[1]
Commercial Spaceport	2000	4,591	5,133
	2005	4,912	3,542
	2015	5,968[1]	3,644[1]
Mixed Use (Market-Driven)[2]	2000	4,591	5,133
	2005	5,004	5,338
	2015	5,280	5,595

Source: SAIC.
Notes: [1] Includes runoff from former golf course newly connected to the stormwater management system.
[2] Assumes no stormwater management system. With a system, reductions in discharges to Biscayne Bay would be similar to the Proposed Action and Commercial Spaceport alternative.

The chemical loading per acre would increase under the Proposed Action because of proposed increases in the acreage of parking lots, roads, ramps, aprons, walkways, and buildings, but the loading to Military Canal would decrease because additional surface and subsurface storage would retain both water and contaminants. The SWMM modeling results of chemical loading to Military Canal from on-site runoff are shown in **Table 4.10-5** as "direct" inputs. The direct surface water loading of metals under the Proposed Action is projected to decrease 37 percent with the addition of the stormwater management system by 2005, and decrease 23 percent in 2015 with the addition of the former golf course to the stormwater management system, compared to baseline loadings. Similarly, nutrient loadings are estimated to decrease 34 percent in 2005 and 19 percent in 2015 relative to baseline conditions. Most of these contaminants would accumulate on the former base, but water-soluble chemicals such as ammonia, nitrates, and nitrites are likely to be transferred to groundwater.

Table 4.10-5. Changes in Surface Water Flows and Loads to Biscayne Bay Under the Proposed Action

Year		Flow (acre-feet/year)	Nitrogen (pounds/ year)	Phosphorus (pounds/ year)	Cadmium (pounds/ year)	Copper (pounds/ year)	Lead (pounds/ year)	Zinc (pounds/ year)
2000	Projected Baseline[1]	241,251	1,773,068	3,920	54	773	382	3,445
	Proposed Action							
	Direct	0	0	0	0	0	0	0
	Secondary	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0
	Percent Change[2]	0	0	0	0	0	0	0
2005	Projected Baseline[1]	245,945	1,808,121	3,995	55	788	390	3,512
	Proposed Action							
	Direct	(1,591)	(3,347)	(59)	(1)	(7)	(2)	(32)
	Secondary	789	5,891	13	0	3	1	11
	Total	(802)	2,543	(46)	(1)	(5)	(0)	(20)
	Percent Change[2]	(0.3)	0.1	(1.2)	(1.9)	(0.6)	(0.1)	(0.6)
2015	Projected Baseline[1]	255,338	1,878,257	4,144	57	818	405	3,645
	Proposed Action							
	Direct	(1,437)	(1,892)	(33)	(1)	(4)	(1)	(19)
	Secondary	6,545	48,876	104	1	21	10	93
	Total	5,108	46,984	71	1	16	9	74
	Percent Change[2]	2.0%	2.5%	1.7%	1.2%	2.0%	2.3%	2.0%

Source: SAIC.
Notes: [1] Includes Military, Mowry, and Princeton Canals.
[2] Percent change in inputs from Military, Mowry, and Princeton Canals, which comprise about 60 percent of total discharges to southern Biscayne Bay.
Some numbers not exact due to rounding.
< less than

Secondary development associated with reuse of former Homestead AFB would convert some existing off-site undeveloped and agricultural land to residential, commercial, and industrial uses. This would increase the amount of impervious surface in the area, thereby increasing the amount of rainwater runoff per storm event. Depending on how this stormwater is managed, some of it would be lost through evapotranspiration, and some of it would infiltrate to groundwater. The remainder would be discharged into Biscayne Bay.

Stormwater runoff from secondary development in the immediate vicinity of former Homestead AFB would be discharged to Biscayne Bay through Princeton and Mowry Canals. It is assumed that approximately 5 acre-feet of new runoff per year would be generated for each new impervious acre of secondary development. This results in conservatively high estimates because it is assumed that all rainfall on new impervious surfaces would be discharged into Biscayne Bay. Based on the estimated extent of secondary development associated with the Proposed Action, approximately 789 acre-feet of runoff could be generated by 2005 and 6,545 acre-feet by 2015. If all of the runoff were discharged into the bay, it could increase the combined discharge of Princeton, Mowry, and Military Canals over the projected baseline by 0.3 percent by 2005 and 2.6 percent by 2015. In 2015, the increase in the combined discharge of these canals would be 1.5 percent of total projected baseline surface water discharges to southern Biscayne Bay (assuming the three canals comprise 60 percent of the total discharges). This

discharge could increase the number of times that the salinity control structures would need to be opened on these canals and/or increase the volume of water released at each opening.

The net effect of both direct and secondary development is estimated to be a reduction of 802 acre-feet per year in surface water discharge by 2005 and an increase of 5,108 acre-feet per year by 2015. As Table 4.10-1 shows, baseline population growth (assuming a moderate growth rate), is anticipated to increase surface water discharges from Mowry and Princeton Canals by 18,784 acre-feet over the 20 years between 1995 and 2015, which is an average of 939 acre-feet per year. Based on this rate, the net increase in surface water discharge associated with the Proposed Action in 2015 would be equivalent to an additional 5.4 years of baseline population growth in the area.

The runoff from secondary development would also pick up nutrients and toxic chemicals as it flowed off of the newly developed land, increasing the discharge of nutrients and toxic chemicals to the bay. Estimates are included in Table 4.10-5. The estimates are conservative (high) and range from 1.7 to 2.5 percent of projected baseline loads from Military, Mowry, and Princeton Canals in 2015. If the other canals that discharge into southern Biscayne Bay are assumed to have similar chemical loads, this translates into 0.7 to 1.5 percent increases in total inputs to southern Biscayne Bay.

Fuel and other spills that occurred on the airport site generally would be expected to be contained within the confines of the former base for two reasons: first, a spill contingency plan would be in place designed to contain spills as quickly as possible after they occurred; and second, even if a spill were not rapidly contained and spilled material entered the stormwater management system, it would remain in the canals and reservoirs on and around the site. Most spills would be expected to be of small volume because only small volumes of hazardous material would be used at one time. Fuel, the only material likely to be used in large quantities, would float on the water in the stormwater management system where it could be cleaned up. Because water is pumped from below the surface of the reservoir into Military Canal, it is unlikely that spilled fuel would be discharged to Military Canal. Should a spill occur during (or because of) a hurricane, however, there is a possibility that Biscayne Bay water could reach at least the eastern portion of the airport, as occurred during Hurricane Andrew. Under these circumstances, the spilled fuel would be dispersed over a fairly wide area, including the land area east and southeast of the site and Biscayne Bay.

Aircraft air pollutant emissions include nitrogen oxides that could eventually settle to the surface. Total increased atmospheric nitrogen deposition into the Biscayne NP portion of Biscayne Bay due to the Proposed Action was estimated from predicted nitrogen deposition rates at the western edge of the bay. As discussed in Section 4.8.4.1, estimated deposition rates are very conservative (high by an order of magnitude). Atmospheric nitrogen concentrations would be expected to be highest nearest the airport and decrease with distance. The rate of decrease is assumed to be proportional to the decrease in atmospheric concentration of nitrogen oxides at greater distances from the site. Based on test model runs of atmospheric nitrogen concentrations proceeding eastward from the airport over the bay, the deposition rate averaged over the entire Biscayne NP portion of the bay is estimated to be about 23 percent of the shoreline deposition rate. Using an area of about 90,000 acres as the Biscayne NP part of the bay, total annual deposition is estimated to increase about 29,768 pounds per year by 2015 with the Proposed Action, averaging about 0.33 pound per acre (equivalent to about 0.37 kilograms per hectare) per year. This would be equivalent to about 1.6 percent of the combined projected baseline nitrogen input of Princeton, Mowry, and Military Canals, or about 1 percent of total existing water inputs to southern Biscayne Bay. Nearshore deposition rates are estimated to be about 4.3 times higher, at 1.43 pounds per acre (1.61 kilograms per hectare) per year.

Considering all sources of nitrogen inputs to Biscayne Bay from the Proposed Action (see Table 4.10-2), the net change in 2015 is estimated to be an increase of 66,960 pounds per year, or 3.6 percent of projected baseline loads from Military, Mowry, and Princeton Canals.

Aircraft also emit polycyclic aromatic hydrocarbons (see Section 4.8.4.1). PAH deposition would increase under the Proposed Action, but the location and rate of the deposition cannot be estimated with the current state of scientific knowledge and data. It is expected that there would be increased PAHs in surface water runoff from the former base associated with increased emissions from mobile sources. Because they sorb strongly to soils and sediments, PAHs in surface water would more than likely be retained in the Boundary Canal system on the former base.

Cumulative Impacts

Two potential future developments in south Miami-Dade County could combine with the Proposed Action to considerably alter the pattern of surface water flow to Biscayne Bay from land near the former base. If the county's high-growth population projections were realized, the associated development would substantially increase surface water discharges to the bay. If the L-31E Flowway Distribution and STDA projects were implemented, further substantial changes could occur. These changes, and the Proposed Action's contribution to future conditions, are discussed below.

A large increase in local population, as forecast in the high-growth projections, and the resulting conversion of undeveloped and agricultural land to a mixture of commercial, industrial, and residential uses, would increase stormwater runoff and associated pollutant loads. Depending on the methods used to manage stormwater, the acreage developed could generate an estimated 42,048 additional acre-feet of runoff by 2015. This is a conservative (high) estimate that assumes all rain falling on new impervious surface would be discharged to Biscayne Bay. Some of this runoff would actually infiltrate to groundwater and some would evaporate, but the remainder would be discharged. If all of the additional runoff were discharged as surface water, the surface water input through Military, Mowry, and Princeton Canals could increase to an estimated 302,494 acre-feet per year by 2015. The Proposed Action's contribution to the total discharge is estimated to be about 1.7 percent in 2015.

Estimated cumulative chemical loadings in 2015 are shown in **Table 4.10-6**. The Proposed Action's contribution to the estimated total chemical loads in 2015 would range from 1.0 to 2.1 percent.

Implementation of the proposed L-31E Flowway Redistribution Project and associated STDA would cause the greatest changes in the hydrologic regime east of former Homestead AFB. The flowway project would entail building a new canal between canal L-31E and former Homestead AFB, which would retain overland flow from upstream areas and receive additional flows from Princeton and Mowry Canals. High-quality sewage treatment plant wastewater would provide an additional water source to Princeton Canal. Inflows entering the new canal would raise the water table above the ground surface, causing overland sheet flow east of the canal toward L-31E and Biscayne Bay. Culverts would be built into the berm east of L-31E, as part of another project, to allow this surface flow to discharge to Biscayne Bay. At the same time, the end of Military Canal would be filled in, and the water currently being discharged from the canal would be routed through the new canal/treatment system. Similarly, the operating regimes for release of water from both Princeton and Mowry Canals to Biscayne Bay would be changed, retaining a greater amount of runoff for discharge to the new canal/treatment system or infiltration to groundwater. At the same time, however, the total volume of water that might be received by southern Miami-Dade County could be reduced by up to 40 percent, substantially reducing the freshwater surface water inflow to Biscayne Bay through Princeton and Mowry Canals.

Table 4.10-6. Cumulative Surface Water Flows and Loads to Biscayne Bay by 2015

Alternative[1]	Flow (acre-feet/year)	Nitrogen (pounds/ year)	Phosphorus (pounds/ year)	Cadmium (pounds/ year)	Copper (pounds/ year)	Lead (pounds/ year)	Zinc (pounds/ year)
High-Growth Increase Over Projected Baseline	42,048	313,987	667	9	134	67	598
High-Growth[2]	297,386	2,192,244	4,811	66	952	472	4,243
Proposed Action	302,494	2,239,228	4,882	67	969	481	4,317
Commercial Spaceport	297,732	2,203,649	4,800	66	953	474	4,247
Market-Driven	299,825	2,214,834	4,980	69	972	478	4,332
Collier-Hoover	300,313	2,222,939	4,847	66	962	478	4,286

Source: SAIC.
Notes: [1] Levels reported for each alternative include projected baseline, reuse-related direct and secondary development, and high growth increases.
[2] Without reuse of former Homestead AFB; same as No Action alternative.
All inputs are for Military, Mowry, and Princeton Canals.

If all components of the proposed L-31E project were implemented, the impact to Biscayne Bay would be a reduction in the volume of freshwater discharged through Princeton, Mowry, and Military Canals; enhancement of sheet flow to the bay; and general improvement in the quality of water being discharged. Estimates of the volume and quality of water that would enter the bay are not available, but overland sheet flow would remove a substantial fraction of metals, many hydrocarbons, PAHs, and some nutrients from the surface water discharge.

Mitigation Measures

Some mitigation measures that would reduce the discharge of pollutants in surface water have been assumed for the Proposed Action as Miami-Dade County has committed to them. The primary mitigation is the retention of as much surface water runoff as possible. Pollutants that sorb to soils and sediments, such as metals, many organics, and phosphorus, would be retained on or near the former base with the retained runoff, while water-soluble pollutants, such as ammonia, nitrates, and nitrites, would enter the groundwater.

Further reductions in pollutant loadings could be accomplished by incorporating a stormwater treatment and distribution area into the design of the stormwater management system for HST. The STDA could be on site or off site. An STDA would allow water to flow over a vegetated land surface, and nutrients (and some toxic chemicals) would be taken up by plants. Metals and other pollutants that sorb to soils would also be removed from the water to some extent. The amount would depend on the area used for the STDA. It is possible an STDA that covers most of the area east of the former base would be sufficiently effective in both evening out pulses of flow and removing nutrients and toxic chemicals that it could render an on-site stormwater management system unnecessary. Military Canal could be used to transport stormwater to the STDA, and keeping the flow control structure closed or backfilling the end of the canal would prevent direct discharge to Biscayne Bay. An off-site STDA could be designed to also receive inputs from Mowry and/or Princeton Canals, thereby also reducing the effects of secondary and cumulative development.

Aggressive pollution prevention and spill prevention and management programs, including reductions in the use of fertilizers on landscaped areas, could reduce nutrient inputs, particularly nitrogen species, to Biscayne Bay. An integrated pest management program and reductions in the use of conventionally fueled motor vehicles (e.g., alternatively fueled vehicles for on-site transportation) would also have some marginal benefits.

Possible Future Expansion

The development of a second runway at former Homestead AFB would convert approximately 1,060 acres of undeveloped land into airfield and aviation support facilities. It is expected that runoff from this area would be added to the on-site stormwater management system and discharged through Military Canal to Biscayne Bay. If all the additional runoff were discharged through Military Canal, discharges to the bay could increase by up to 2,700 acre-feet per year, or 59 percent, over current discharges from the former base. More precise discharge volumes would be determined in future environmental analysis that will be required if construction of a second runway is proposed.

4.10.2.2 Commercial Spaceport Alternative

As shown in Table 4.10-1, the Commercial Spaceport alternative is projected to change total water inputs to Biscayne Bay in 2015 by less than 0.004 percent of projected baseline inputs through Military, Mowry, and Princeton Canals. Table 4.10-2 shows that the Commercial Spaceport alternative is projected to change total nitrogen inputs to Biscayne Bay by approximately 1.3 percent of projected baseline surface water discharges through Military, Mowry, and Princeton Canals. This equates to about 0.8 percent of total surface water nitrogen inputs to southern Biscayne Bay, and a smaller fraction of total nitrogen inputs that include groundwater sources and existing atmospheric deposition. Details of the changes in surface water flows and loads are presented in the following paragraphs. Details of the changes in groundwater flows and loads are presented in Section 4.10.3.2. Changes in surface water flows and loads for this alternative are presented in **Table 4.10-7**.

The increase in impervious surface under the Commercial Spaceport alternative is estimated to result in an increase in direct runoff of 7 percent over baseline in 2005 and 30 percent in 2015, with the addition of runoff from the former golf course area to the canal system. Assuming that stormwater controls for this alternative would need to be as stringent as for the Proposed Action, it is estimated the volume of water discharged to Military Canal would decrease by 31 percent in 2005 and by 29 percent in 2015 because of the stormwater management system.

Estimated chemical transport in surface water to Biscayne Bay from the former base under this alternative is summarized in Table 4.10-7. The overall loading of metals is anticipated to decrease 29 percent with the addition of the stormwater management system in 2005 and 27 percent by 2015 with the addition of the former golf course to the stormwater system. Similarly, it is estimated that surface water nutrient loads would decrease 28 percent by 2005 and 23 percent by 2015.

Off-site secondary development and associated conversion of undeveloped land to residential, commercial, and industrial uses would increase the amount of surface runoff in the area around the spaceport. It is estimated that approximately 708 acre-feet of additional runoff could be generated by secondary development by 2005 and 1,835 acre-feet by 2015 under this alternative. If all the runoff were discharged into Biscayne Bay, the combined discharge of Princeton and Mowry Canals would increase by 0.3 percent by 2005 and 0.7 percent over the projected baseline by 2015. Considering both direct and

Table 4.10-7. Changes in Surface Water Flows and Loads to Biscayne Bay Under the Commercial Spaceport Alternative

Year		Flow (acre-feet/year)	Nitrogen (pounds/ year)	Phosphorus (pounds/ year)	Cadmium (pounds/ year)	Copper (pounds/ year)	Lead (pounds/ year)	Zinc (pounds/ year)
2000	Projected Baseline[1]	241,251	1,773,068	3,920	54	77	382	3,445
	Commercial Spaceport							
	Direct	0	0	0	0	0	0	0
	Secondary	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0
	Percent Change[2]	0	0	0	0	0	0	0
2005	Projected Baseline[1]	245,945	1,808,121	3,995	55	788	390	3,512
	Commercial Spaceport							
	Direct	(1,591)	(2,719)	(48)	(1)	(6)	(1)	(26)
	Secondary	708	5,286	11	0	2	1	10
	Total	(883)	2,567	(37)	(1)	(4)	(0)	16
	Percent Change[2]	(0.4)	0.1	(0.9)	(1.5)	(0.5)	(0.1)	(0.5)
2015	Projected Baseline[1]	255,338	1,878,257	4,144	57	818	405	3,645
	Commercial Spaceport							
	Direct	(1,489)	(2,294)	(40)	(1)	(5)	(1)	(23)
	Secondary	1,835	13,699	29	0	6	3	26
	Total	346	11,405	(11)	0	1	2	3
	Percent Change[2]	0.1	0.6	(0.3)	0.9	0.1	0.4	0.1

Source: SAIC.
Notes: [1] Includes Military, Mowry, and Princeton Canals.
[2] Percent change in inputs from Military, Mowry, and Princeton Canals, which comprise about 60 percent of total discharges to southern Biscayne Bay.
Some numbers not exact due to rounding.
< less than

secondary effects, it is estimated that the Commercial Spaceport would cause a slight (0.1 percent) net increase in surface water flows to Biscayne Bay by 2015. Changes in chemical loads would range from –0.3 to 0.9 percent of projected baseline loads from Military, Mowry, and Princeton Canals in 2015.

The net effect of both direct and secondary development is estimated to be a reduction in surface water discharge of 883 acre-feet per year by 2005 and an increase of 346 acre-feet per year by 2015. In 2015, this would be equivalent to an additional 0.4 year of baseline population growth in the area (assuming a moderate rate of growth).

Using the same assumptions as described for the Proposed Action, total increased atmospheric nitrogen deposition from the Commercial Spaceport alternative into the Biscayne NP portion of Biscayne Bay in 2015 is estimated to increase 4,057 pounds per year by 2015, or about 0.2 percent of the projected baseline nitrogen input from Mowry, Princeton, and Military Canals combined. This would result in an average deposition rate over Biscayne Bay of about 0.05 pounds per acre and a nearshore deposition rate of about 0.19 pounds per acre (0.22 kilograms per hectare) per year.

Considering all sources of nitrogen inputs to Biscayne Bay from the Commercial Spaceport alternative (see Table 4.10-2), the net change in 2015 is estimated to be an increase of 24,296 pounds per year, or 1.3 percent of projected baseline loads from the three canals.

While there would be some increase in the amount of PAHs generated under this alternative, the magnitude is estimated to be about 15 percent of those generated under the Proposed Action. Since most of the additional PAH generation would occur at or near ground level at the airport, most of the additional PAHs would probably remain on or near the former base because they probably would remain in sediments in the on-site canal system and would not likely be pumped into Military Canal.

Combined Commercial Spaceport/Airport

It is estimated a combined Commercial Spaceport/Airport would generate approximately 1,800 additional acre-feet of direct stormwater runoff by 2005 and 3,100 acre-feet by 2015. SWMM was not run for on-site changes in stormwater generation for the combined Commercial Spaceport/Airport, but direct discharges and chemical loads would be expected to be similar to those for the Commercial Spaceport alone because a similar on-site surface water management system would likely be implemented. Secondary development, however, would be higher than the spaceport alone and cause increases in surface water discharges and decreases in groundwater discharges. Secondary discharges are estimated to increase by 4,157 acre-feet per year by 2015. Assuming the direct discharges are the same as estimated for the Commercial Spaceport alone, the net change would be an increase of 2,668 acre-feet per year by 2015. Pollutant inputs to Biscayne Bay would be expected to increase in proportion to the increase in secondary surface water discharges.

The impacts from on-site spills of fuel and other hazardous materials would be the same as described for the Proposed Action.

Using the same assumptions as described for the Proposed Action, total increased atmospheric nitrogen deposition into the Biscayne NP portion of Biscayne Bay from a combined Commercial Spaceport/Airport in 2015 is estimated to be 11,633 pounds per year, or about 0.6 percent of the combined projected baseline nitrogen input from Mowry, Princeton, and Military Canals. Average deposition rates would be about 0.13 pounds per acre and nearshore rates about 0.56 pounds per acre (0.63 kilograms per hectare) per year.

The combined Commercial Spaceport/Airport would generate PAH emissions similar to the Proposed Action because of inclusion of aircraft activity. While the PAHs emitted at altitude would tend to be widely distributed, potentially over hundreds of square miles, the PAHs emitted at ground level would tend to remain at or near the site in the stormwater management system.

Cumulative Impacts

The consequences of the Commercial Spaceport alternative in conjunction with the high-growth forecasts for south Miami-Dade County are presented in Table 4.10-6. The Commercial Spaceport is estimated to change total flows and loads in southern Miami-Dade County by fractions of 1 percent.

The impacts of the L-31E Flowway Redistribution Project and STDA would be the same as described for the Proposed Action.

Mitigation Measures

Potential mitigation measures for the Commercial Spaceport alternative would be the same as described for the Proposed Action.

4.10.2.3 Mixed Use Alternative

The impacts of the Mixed Use alternative on water resources would be related primarily to increased runoff associated with additional paving and buildings on (direct) and off (secondary) the former base. Without an increase in aircraft operations, atmospheric nitrogen deposition would be a minor component. This would result in a net increase in surface water flows and loads to Biscayne Bay and a net decrease in groundwater flows and loads to the bay. A conservative (high) estimate of changes in flows by 2015 are shown in Table 4.10-1 for the Market-Driven and Collier-Hoover scenarios. Estimates of changes in nitrogen loads by 2015 are shown in Table 4.10-2. The Market-Driven scenario is estimated to change water inputs to Biscayne Bay in 2015 by less than 0.3 percent of projected baseline inputs through Military, Mowry, and Princeton Canals. Nitrogen inputs to Biscayne Bay would change by approximately 0.9 percent of projected baseline surface water discharges through Military, Mowry, and Princeton Canals (about 0.5 percent of total surface water nitrogen inputs to southern Biscayne Bay and a smaller fraction of total nitrogen inputs that include groundwater sources and existing atmospheric deposition). The Collier-Hoover proposal is estimated to change net flows by about 0.5 percent and nitrogen inputs by 1.7 percent of the combined projected baseline flows of the three canals (0.4 percent of total flows and 1 percent of total nitrogen inputs). Details of the changes in surface water flows and loads are presented in the following paragraphs. Details of the changes in groundwater flows and loads are presented in Section 4.10.3.3.

Market-Driven development could result in an estimated increase in total direct runoff of 9 percent by 2005 and 15 percent by 2015 over baseline, reflecting the increasing percent of impervious area associated with on-site development. Assuming there may be no site-wide stormwater management system, discharges to Biscayne Bay would also be expected to increase, unlike the Proposed Action and Commercial Spaceport alternative. Using this assumption, direct discharges to Military Canal would be estimated to increase by 4 percent in 2005 and 9 percent in 2015.

The amount of secondary development expected under this scenario would be less than with the Proposed Action. It is estimated that approximately 789 acre-feet of additional runoff could be generated by 2005 and 1,977 acre-feet by 2015.

If all of the additional direct and secondary runoff were discharged to Biscayne Bay, the total increase in stormwater generated by the Market-Driven scenario could increase the combined discharge of Military, Princeton, and Mowry Canals by 0.4 percent in 2005 and 0.9 percent in 2015. In 2015, this would be equivalent to the increase in surface water discharges associated with an additional 2.6 years of baseline population growth in the area, assuming a moderate growth rate.

Estimated chemical transport to Biscayne Bay under the Market-Driven scenario is summarized in **Table 4.10-8**. The overall loading of metals without a stormwater management system is estimated to increase by between 1.6 and 4.8 percent by 2015 compared to the projected baseline. Similarly, nutrient loadings, compared to baseline, could increase by 1.2 percent in 2015.

Table 4.10-8. Changes in Surface Water Flows and Loads to Biscayne Bay Under Market-Driven Development

Year		Flow (acre-feet/year)	Nitrogen (pounds/ year)	Phosphorus (pounds/ year)	Cadmium (pounds/ year)	Copper (pounds/ year)	Lead (pounds/ year)	Zinc (pounds/ year)
2000	Projected Baseline[1]	241,251	1,773,068	3,920	54	77	382	3,445
	Market-Driven							
	Direct	0	0	0	0	0	0	0
	Secondary	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0
	Percent Change[2]	0	0	0	0	0	0	0
2005	Projected Baseline[1]	245,945	1,808,121	3,995	55	788	390	3,512
	Market-Driven							
	Direct	205	3,529	62	1	6	1	25
	Secondary	789	5,889	13	0	3	1	11
	Total	994	9,418	78	1	8	3	36
	Percent Change[2]	0.4	0.5	1.9	2.1	1.0	0.7	1.0
2015	Projected Baseline[1]	255,338	1,878,257	4,144	57	818	405	3,645
	Market-Driven							
	Direct	462	7,830	137	2	14	3	60
	Secondary	1,977	14,760	31	<1	6	3	28
	Total	2,439	22,589	169	3	20	6	89
	Percent Change[2]	0.9	1.2	4.1	4.8	2.5	1.6	2.4

Source: SAIC.
Notes: [1] Includes Military, Mowry, and Princeton Canals.
[2] Percent change in inputs from Military, Mowry, and Princeton Canals, which comprise about 60 percent of total discharges to southern Biscayne Bay.
Some numbers not exact due to rounding.
< less than

The Collier-Hoover proposal, like the original Collier and Hoover plans, would require a stormwater management system. The Collier-Hoover proposal includes a plan to retain substantial amounts of stormwater on site and would use up to 379,465 gallons per day (510 acre-feet per year) of treated sewage for irrigation. Insufficient information is provided in the proposal to develop a SWMM configuration for the proposal, so approximations were used to estimate overall surface water flows and chemical loads.

The Collier-Hoover proposal provides for at least 720 acre-feet of water storage on the former base, the highest level of any alternative. Since some of this storage would be below the water table, it is not clear what the net storage would be. For purposes of analysis, it was assumed that water retention would be at least as high as the Proposed Action's, but it could be higher. The reclaimed wastewater that would be used for irrigation was assumed to enter groundwater, although a sizable fraction of it would evaporate, particularly if it were applied through spraying, the most common application method in southern Florida.

Chemical loads in direct surface water flows for the Collier-Hoover proposal (**Table 4.10-9**) were assumed to be the same as for the Proposed Action, although it is likely that vegetation in the wetlands and canals would remove some and, depending on retention times, perhaps most of the chemicals in the water. The overall impacts of the Collier-Hoover proposal are therefore overstated, but the extent to which they are overstated cannot be precisely calculated.

Table 4.10-9. Changes in Surface Water Flows and Loads to Biscayne Bay Under the Collier-Hoover Proposal

Year		Flow (acre-feet/year)	Nitrogen (pounds/ year)	Phosphorus (pounds/ year)	Cadmium (pounds/ year)	Copper (pounds/ year)	Lead (pounds/ year)	Zinc (pounds/ year)
2000	Projected Baseline[1]	241,251	1,773,068	3,920	54	77	382	3,445
	Collier-Hoover							
	Direct	0	0	0	0	0	0	0
	Secondary	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0
	Percent Change[2]	0	0	0	0	0	0	0
2005	Projected Baseline[1]	245,945	1,808,121	3,995	55	788	390	3,512
	Collier-Hoover							
	Direct[3]	(1,591)	(3,348)	(59)	(1)	(7)	(2)	(32)
	Secondary	3,049	22,771	48	1	10	5	43
	Total	1,458	19,424	(10)	(1)	3	3	12
	Percent Change[2]	0.6	1.1	(0.3)	(1.0)	0.3	0.8	0.3
2015	Projected Baseline[1]	255,338	1,878,257	4,144	57	818	405	3,645
	Collier-Hoover							
	Direct[3]	(1,437)	(1,892)	(33)	(1)	(4)	(1)	(19)
	Secondary	4,364	32,587	69	1	14	7	62
	Total	2,927	30,695	36	0	9	6	43
	Percent Change[2]	1.1	1.6	0.9	0.4	1.2	1.5	1.2

Source: SAIC.
Notes: [1] Includes Military, Mowry, and Princeton Canals.
[2] Percent change in inputs from Military, Mowry, and Princeton Canals, which comprise about 60 percent of total discharges to southern Biscayne Bay.
[3] Assumes same effects as the stormwater management system for the Proposed Action.
Some numbers not exact due to rounding.
< less than

The Collier-Hoover proposal is estimated to change net surface water inputs to Biscayne Bay in 2015 by 1.1 percent over projected baseline inputs through Military, Mowry, and Princeton Canals. This would be equivalent to the increase in surface water discharges associated with an additional 3.1 years of baseline population growth in the area, assuming a moderate growth rate.

Nitrogen inputs to Biscayne Bay would change by approximately 1.6 percent of projected baseline surface water discharges through Military, Mowry, and Princeton Canals (about 1.0 percent of total surface water nitrogen inputs to southern Biscayne Bay, and a smaller fraction of total nitrogen inputs that include groundwater sources and existing atmospheric deposition).

Atmospheric nitrogen deposition is assumed to be the same for the Market-Driven and Collier-Hoover scenarios. Using the same assumptions as described for the Proposed Action, total increased atmospheric nitrogen deposition into the Biscayne NP portion of Biscayne Bay from the Mixed Use alternative was estimated to increase 3,693 pounds per year by 2015, or about 0.2 percent of the combined projected baseline nitrogen input from Mowry, Princeton, and Military Canals. This would result in an average deposition rate of about 0.04 pounds per acre and a nearshore rate of about 0.18 pounds per acre (0.20 kilograms per hectare) per year.

Considering all sources of nitrogen inputs to Biscayne Bay from the Mixed Use alternative (see Table 4.10-2), the net change in 2015 is estimated to be an increase of 16,735 pounds per year for the Market-Driven scenario and 32,578 pounds per year for the Collier-Hoover scenario, or 0.9 to 1.7 percent of projected baseline loads from the three canals.

PAH generation under the Mixed Use alternative is estimated to be about 16 percent of the generation under the Proposed Action. The majority of the increased PAHs would be emitted at ground level and thus would tend to remain on or near the site in the stormwater canals.

Cumulative Impacts

The consequences of the Mixed Use alternative (Market-Driven and Collier-Hoover scenarios) in conjunction with the high-growth population forecasts for south Miami-Dade County by 2015 are presented in Table 4.10-6. The project's contribution to total stormwater flow in southern Miami-Dade County is estimated to be between 1.0 and 1.2 percent of the high-growth stormwater flows from Military, Mowry, and Princeton Canals. This equates to between 0.6 and 0.7 percent of total surface water discharges to southern Biscayne Bay.

The impacts of the L-31E Flowway Redistribution Project and STDA would be the same as described for the Proposed Action.

Mitigation Measures

It was assumed for this alternative that there might be no site-wide stormwater management system. As demonstrated for both the Proposed Action and Commercial Spaceport alternative, such a system would be effective in reducing pollutant loadings to Biscayne Bay. Absent a party that had responsibility for site-wide stormwater management, it would be up to the new land owners to maximize pollutant removal on their property by developing a stormwater management system on the former base. Miami-Dade County could require controls on small properties, but only by modifying existing ordinances which currently only require plans for developments of 100 acres or more. Additional potential mitigations that could be implemented by the new property owners and users include designing and implementing an aggressive pollution prevention program and reducing the use of fertilizers on landscaped areas.

4.10.2.4 No Action Alternative

Under the No Action alternative, surface water runoff and discharge would not change from the projected baseline, as shown in Table 4.10-4. The estimated runoff of 4,591 acre-feet represents the total annual runoff from all areas of the site. The discharge of 5,051 acre-feet represents the total volume of water that is discharged to Military Canal annually. Total discharge exceeds total runoff because of the water that is assumed to already be present in the canal. The runoff and discharge estimates are the same for all years because there would be little or no change to the drainage system or to impervious area under the No

Action alternative. The chemical loadings for the No Action alternative would also be the same as the projected baseline loadings.

The consequences of the No Action alternative (projected baseline) in conjunction with the high-growth forecasts for south Miami-Dade County are included in Table 4.10-6. There would be no increase in the contribution from the disposal property to total stormwater flow in southern Miami-Dade County in any year.

4.10.2.5 Independent Land Use Concepts

Each independent land use concept implies different construction requirements, and the impervious surface associated with each has not been determined. To the extent that a given land use concept would replace a lower-density land use, there would be increased runoff, increased discharges from Military Canal, increased inputs of pollutants to Biscayne Bay, and reduced inputs of groundwater to Biscayne Bay. To the extent that a given land use concept would replace a higher-density land use, all of the changes would be in the opposite direction. Changes associated with the implementation of most of the independent land use concepts are expected to be small, however, because they would occupy a relatively small portion of the disposal property. Uses such as agriculture, a cemetery, or a theme park have the potential to have smaller adverse water quantity and water quality impacts than the uses included as part of the Proposed Action and alternatives.

4.10.3 Groundwater

The hydrologic effects of each alternative on the groundwater system were qualitatively evaluated based on surface water modeling results. The amount of rainfall that reaches groundwater after overland flow, evapotranspiration, and soil moisture retention is the recharge that influences groundwater movement.

Table 4.10-10 presents estimated changes in groundwater inputs to Biscayne Bay from the Proposed Action and alternatives. **Table 4.10-11** presents estimated changes in nitrogen inputs through groundwater. Table 4.10-10 shows that, by 2015, all alternatives would result in a net reduction in groundwater inputs. Nitrogen loads would also decrease under the Proposed Action and Market-Driven scenario, but are estimated to increase under the Commercial Spaceport alternative and Collier-Hoover scenario (see Table 4.10-11). In the case of the Commercial Spaceport alternative, this is due to the increase in direct groundwater flows caused by on-site stormwater retention and the relatively smaller amount of secondary development associated with this alternative. In the case of the Collier-Hoover scenario, it is attributable to the proposed use of retained stormwater (and possibly wastewater) for irrigation, which further increases direct groundwater inputs.

Ammonia in groundwater is a documented problem in some areas of southeastern Florida, and particularly in the area of the Miami-Dade County landfill ("Mount Trashmore"). However, there are very few data that allow a technically defensible evaluation of the concentration of ammonia in groundwater in the vicinity of former Homestead AFB.

The Florida state freshwater standard for un-ionized ammonia in surface water is 0.02 milligrams per liter. There is no standard for groundwater, but groundwater can interact with surface water, and in those circumstances the surface water standards would be applicable. The few data available indicate that existing ammonia concentrations in nearshore groundwater beneath Biscayne Bay are on the order of 0.7 milligrams per liter (**Meeder et al. 1997**). Assuming un-ionized ammonia comprises 5 percent or more of total ammonia in common conditions, this level would already exceed Florida freshwater surface water standards.

Table 4.10-10. Estimated Changes in Groundwater Inputs to Biscayne Bay

Alternative	2000 (acre-feet/year)	2005 (acre-feet/year)	2015 (acre-feet/year)
Proposed Action			
Direct	0	941	918
Secondary	0	(552)	(4,582)
Total	0	389	(3,664)
Commercial Spaceport			
Direct	0	941	948
Secondary	0	(495)	(1,284)
Total	0	446	(336)
Market-Driven			
Direct	0	(215)	(323)
Secondary	0	(552)	(1,384)
Total	0	(767)	(1,707)
Collier-Hoover			
Direct	0	941	1,428
Secondary	0	(2,135)	(3,055)
Total	0	(1,194)	(1,627)

Table 4.10-11. Estimated Changes in Groundwater Nitrogen Inputs to Biscayne Bay

Alternative	2000 (pounds/year)	2005 (pounds/year)	2015 (pounds/year)
Proposed Action			
Direct	0	9,431	24,421
Secondary	0	(4,123)	(34,213)
Total	0	5,308	(9,792)
Commercial Spaceport			
Direct	0	9,691	18,423
Secondary	0	(3,700)	(9,589)
Total	0	5,991	8,834
Market-Driven			
Direct	0	519	784
Secondary	0	(4,123)	(10,332)
Total	0	(3,604)	(9,548)
Collier-Hoover			
Direct	0	9,691	24,681
Secondary	0	(15,940)	(22,811)
Total	0	(6,249)	1,870

These data, although the only available, are not a precise measurement of groundwater ammonia concentrations in the vicinity of former Homestead AFB. More precise calculations can only be obtained through groundwater sampling closer to the former base. There might be a potential for the Florida standard for un-ionized ammonia to be exceeded if groundwater becomes surface water prior to entering the bay and if the following are true: (1) groundwater nitrogen concentrations are the same as those for surface water on the former base, (2) all groundwater nitrogen concentrations are converted to ammonia by the time they are discharged to Biscayne Bay, and (3) there is no dilution of groundwater nitrogen concentrations from rainfall east of the former base. There is insufficient information to determine whether these conditions exist. Obtaining the information needed to make a more precise determination would require groundwater monitoring to assess both current and future concentrations of un-ionized ammonia.

However, monitoring in the vicinity of the former base without providing additional contextual data would be inconclusive. To ascertain the impact of redevelopment of the former base on concentrations of un-ionized ammonia in groundwater, monitoring data would need to be available for the region as a whole, as well as for the immediate vicinity of Homestead. It is suspected that if ammonia in groundwater were found to exceed the Florida freshwater quality standard in areas other than the immediate vicinity of the county landfill, exceedances would likely occur along most of the coast. A monitoring program throughout southeastern Florida would be necessary to obtain the information needed to determine the extent to which un-ionized ammonia is a regional problem. Such a program could be undertaken by the state or another agency responsible for water management in south Florida. Monitoring east of Homestead could be a part of that program. Engineering calculations were used to determine if a new water supply production well installed approximately one mile west of the base would influence the water table configuration and require an update of the groundwater flow model. Based on derived parameters and the Cooper Jacobs equation, the radial extent of a cone of depression of less than 0.25 feet in depth would extend approximately 2,652 feet from the production well. This change was deemed insufficient to affect the conclusions reached through the groundwater flow model.

4.10.3.1 Proposed Action

Although The Proposed Action could result in an increase in surface runoff at former Homestead AFB of up to 43 percent by 2015, the total discharge from Military Canal is estimated to decrease by about 28 percent from baseline levels because of the retention of stormwater in the modified canal system and in French drains. Stormwater retention would increase groundwater recharge, and the additional recharge would compensate for any deficit in groundwater recharge associated with increased runoff. The retention of runoff would also reduce the depth to the water table beneath the site and increase the frequency, duration, and/or area of standing water on the site. The system has been designed, however, to prevent any increased standing water from interfering with ongoing military or proposed commercial operation of the airfield by draining water from operations areas and holding it in surface and subsurface structures away from the operational areas.

Retained stormwater would be subject to evapotranspiration and soil moisture retention in the vadose zone above the water table, but soil moisture retention would be small because the water table is very close to the ground surface. Evapotranspiration accounts for the loss of about 36.5 percent of annual precipitation in south Florida, and it was assumed that 36.5 percent of the stored water on the former base would be lost through evapotranspiration. The remaining water would become groundwater recharge that would eventually flow into Biscayne Bay. Using these assumptions, the on-site retention of stormwater at the former base is estimated to increase annual groundwater flow into Biscayne Bay between Princeton and Mowry Canals to 8,115 acre-feet by 2005 and 8,092 acre-feet by 2015, an increase of 13 percent over

the 1995 groundwater discharge of 7,174 acre-feet per year. Overall changes in groundwater flows are shown in Table 4.10-10.

The increase in the amount of infiltration could potentially increase the concentrations of some pollutants (i.e., water soluble toxic chemicals) in the Biscayne Aquifer, a sole source aquifer, but there are essentially no data that can be used to assess their present occurrence in groundwater or how they are likely to change with airport development. Most toxic pollutants (most metals, PAHs, most pesticides) would probably sorb to soils and would likely not increase groundwater concentrations. In addition, the wells used for public drinking water supplies are west and north of the former base, and groundwater flow is to the east, so no impacts are expected on public drinking water supplies.

The decrease in surface water discharges and increases in groundwater discharges from the former base could change the form of the loadings to Biscayne Bay. The quantities of nitrogen entering the bay through direct surface water discharges would be reduced. At the same time, there is a potential for an increase in ammonia loadings through direct groundwater inputs. Nitrogen compounds tend to be converted to ammonia in groundwater, and more ammonia would be discharged to Biscayne Bay because of the increase in groundwater flow from the former base. Direct nitrogen loads in groundwater are estimated to increase by 9,431 pounds per year in 2005 and 24,421 pounds per year in 2015. Most of the nitrogen is likely to be ammonia, and un-ionized ammonia is estimated to be about 5–10 percent of the total.

Secondary development associated with the Proposed Action would result in an increase in impervious area in areas around former Homestead AFB. Surface runoff in the immediate vicinity of former Homestead AFB is estimated to increase, resulting in a reduction in groundwater recharge and a reduction in groundwater flow into Biscayne Bay. The reduction could be partially offset by landscape watering and other activities associated with increased population and development, but evapotranspiration and overland flow, not groundwater recharge, would account for the majority of the runoff associated with secondary development. It is estimated that secondary development in the vicinity of former Homestead AFB could reduce groundwater flow into Biscayne Bay in the area of the former base by approximately 4,582 acre-feet per year and reduce nitrogen loads by 34,213 pounds per year by 2015.

The net change in groundwater flows and nitrogen loads as a result of the Proposed Action (direct and secondary) would be a net reduction of 3,664 acre-feet of groundwater and 9,792 pounds of nitrogen per year by 2015.

The City of Homestead currently operates a local drinking water supply system that takes its water from the Biscayne Aquifer west of former Homestead AFB (see Section 3.3). Water withdrawals from the Biscayne Aquifer by the City of Homestead for increased population associated with the Proposed Action are estimated to cause a steady state (equilibrium) drop in the water table of no more than 0.5 feet for a radius of no more than 0.5 mile.

Fuel and other spills at HST would be more likely to occur in the impervious areas (pavements) than in pervious areas, so groundwater would generally not be affected by these spills. Should a spill occur on pervious ground, it could contaminate the near-surface groundwater. Although total groundwater flow is significant in the area, its movement is on the order of 100 feet per year, so there would be ample opportunity to clean up contaminated groundwater before it could reach Biscayne Bay. Cleanup procedures would be addressed in a Spill Prevention, Control, and Countermeasures Plan that the airport operator would be required by regulation to prepare.

Cumulative Impacts

If Miami-Dade County's high-growth population forecasts were realized, approximately 42,000 acre-feet per year of additional runoff could be generated by associated development south of Eureka Drive by 2015. Only part of this runoff (on the order of 30 percent) would be expected to become groundwater recharge; the remainder would evaporate or be transported to Biscayne Bay. This could mean a net loss to the groundwater system south of Eureka Drive of up to 29,434 acre-feet per year by 2015 (**Table 4.10-12**). The reduction in groundwater flow associated with high growth and the net reduction in groundwater as a result of the Proposed Action could cause a total reduction in groundwater flow into southern Biscayne Bay of approximately 33,098 acre-feet per year from the projected baseline in 2015. Similarly, there could be a reduction in total nitrogen discharged in groundwater to southern Biscayne Bay of about 229,583 pounds per year compared to the projected baseline in 2015.

Table 4.10-12. Cumulative Changes in Groundwater Inputs and Nitrogen Loads to Biscayne Bay by 2015

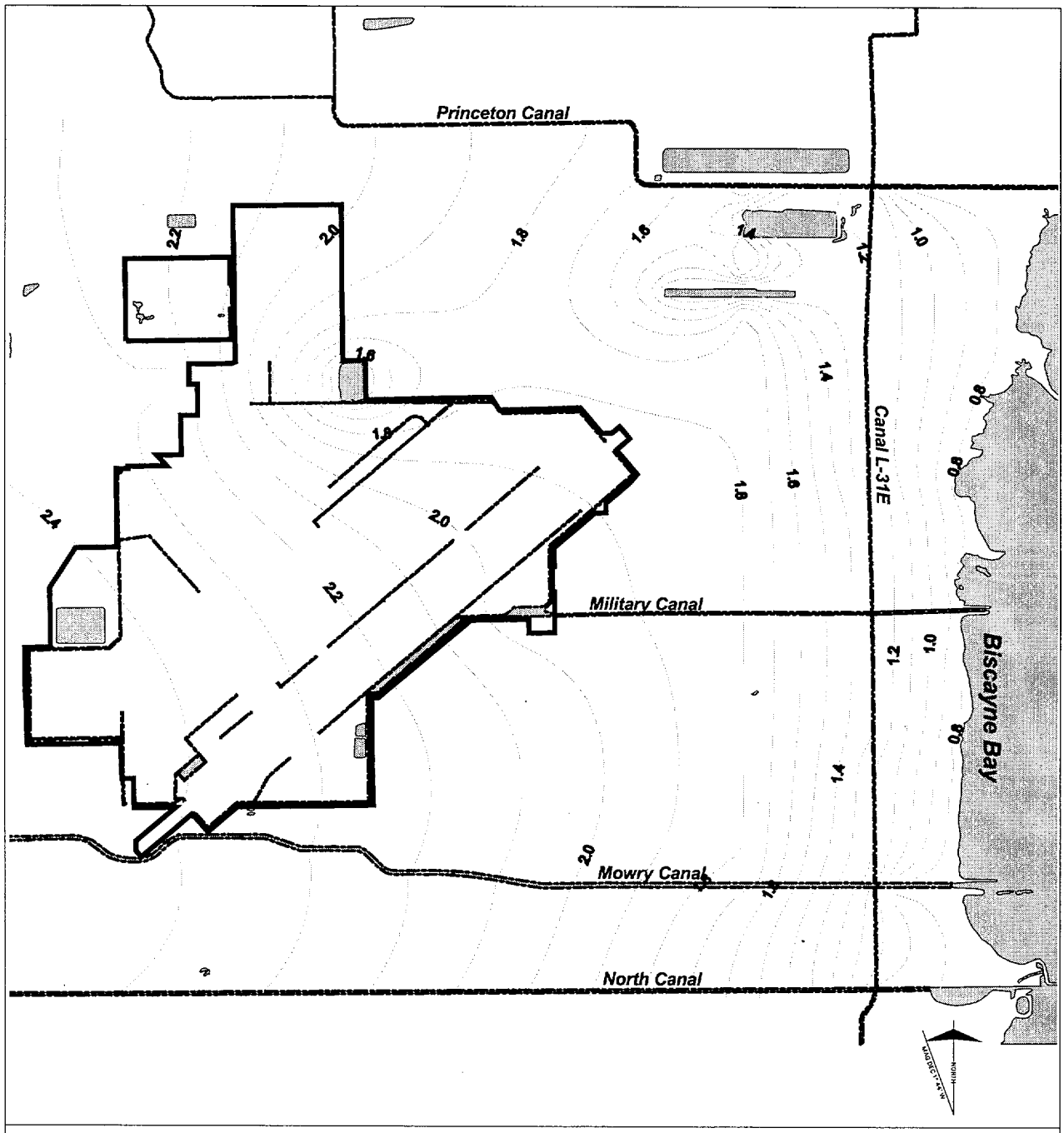
Alternative	Flow (acre-feet/year)	Nitrogen (pounds/year)
High-Growth Change	(29,434)	(219,791)
Proposed Action	(3,664)	(9,792)
Commercial Spaceport	(336)	8,834
Market-Driven	(1,707)	(9,458)
Collier-Hoover	(1,627)	1,870

The L-31E Flowway Redistribution Project and STDA could result in a higher hydraulic head east of the proposed canal, but possible reductions in the total amount of water that would be delivered to southern Biscayne Bay could eventually cause the hydraulic head to decrease. Although groundwater flow is generally toward Biscayne Bay (**Figure 4.10-3**) and an increased hydraulic head would increase groundwater flows, it is not now known whether implementation of Restudy projects would increase or decrease groundwater flows in this area.

Mitigation Measures

The major concern with the increased direct groundwater discharge to Biscayne Bay estimated for the Proposed Action is the potential for increasing pollutant inputs to the nearshore sediments. While many pollutants of concern (such as most metals, most pesticides, and many organics) sorb to sediments and soils and thus move only very slowly in groundwater (at rates a small fraction of the groundwater flow rate), nitrogen compounds, particularly ammonia, are very soluble and are transported at the same rate as the groundwater. One way to minimize potential groundwater contaminant impacts on Biscayne Bay is to reduce groundwater flow by routing runoff through an STDA located either on site or off site. An off-site STDA would apparently require a change in policy by the SFWMD, which has to date required maximum on-site retention of runoff.

A program that limited the use of fertilizer on landscaped areas would reduce potential runoff of nutrients. In addition, aggressive pollution prevention, spill management and control, and integrated pest management programs would help minimize soil and water contamination. Reductions in the use of conventionally fueled vehicles on site would also help to minimize the potential for groundwater contamination.



293656634

LEGEND

- Hydraulic Head Elevation (in feet above MSL)
- Former Homestead AFB
- Open Water
- Canal

0.5 0 0.5
Scale in Miles

Source: SAIC

Figure 4.10-3
Simulated Ambient Hydraulic Heads
with L-31E Flowway Redistribution Project

Possible Future Expansion

The addition of a second runway at HST would increase the amount of impervious area immediately east and southeast of the site. The runoff from the second runway would be discharged to a revised Boundary Canal system and ultimately would be discharged to Military Canal. Although some of the runoff would recharge groundwater, evapotranspiration and overland flow would be expected to account for the majority of the runoff associated with a second runway. As a result, groundwater recharge east of the former base could be reduced by up to 2,700 acre-feet per year with the construction of a second runway. More precise estimates would need to be determined in future environmental analysis that will be required if a second runway is proposed.

4.10.3.2 Commercial Spaceport Alternative

Although surface runoff is estimated to increase by up to 30 percent over baseline by 2015 under this alternative, the total discharge from Military Canal would be expected to decrease from baseline by about 29 percent with retention of stormwater on site. Stormwater retention would increase groundwater recharge, and the additional recharge would compensate for any deficit associated with increased runoff. Using the same assumptions that were described for the Proposed Action, it is estimated that annual direct groundwater flow into Biscayne Bay due to on-site retention of stormwater would increase 941 acre-feet by 2005 and 948 acre-feet by 2015. Changes in groundwater flows are presented in Table 4.10-10. The retention of stormwater on site would increase the height of the local water table and increase the frequency, duration, and/or area of standing water on the former base. It is assumed, however, that the design of the stormwater management system would include considerations of military and spaceport requirements in order to prevent adverse effects on their operations.

The resulting increase in the amount of infiltration on and near the site could potentially increase the concentrations of some pollutants in the Biscayne Aquifer, a sole source aquifer. As with the Proposed Action, however, no impacts are expected on public drinking water supplies. There is also the potential for increased input of ammonia to Biscayne Bay through groundwater. Using the same methodology applied to the Proposed Action, the increase in direct nitrogen loads is estimated to be about 18,423 pounds per year in 2015 (see Table 4.10-11).

Secondary development associated with the Commercial Spaceport alternative could increase surface runoff, resulting in a reduction in groundwater recharge and groundwater flow into Biscayne Bay. The reduction could be partially offset by landscape watering and other activities associated with increased population and development, but evapotranspiration and overland flow, not groundwater recharge, would account for the majority of the runoff. It is estimated that secondary development in the vicinity of former Homestead AFB could reduce groundwater flow into Biscayne Bay by up to 1,284 acre-feet per year by 2015 under this alternative. The decrease in groundwater inputs would reduce the amount of nitrogen being discharged to the bay by an estimated 9,589 pounds per year in 2015.

Considering both direct and secondary changes, there would be an estimated net decrease in groundwater inputs of 336 acre-feet per year and a net increase in nitrogen discharge through groundwater of 8,834 pounds per year in 2015. The increase in nitrogen loads compares to a net decrease estimated for the Proposed Action and is due to the relatively smaller secondary development projected for the Commercial Spaceport alternative. Most of the nitrogen is likely to be ammonia, with un-ionized ammonia comprising about 5–10 percent of the total.

Increased water withdrawals from the Biscayne Aquifer by the City of Homestead for increased population generated by the Commercial Spaceport alternative could cause a steady state (continuing) drop in the water table of no more than 0.5 feet for a radius of no more than 0.5 mile.

Combined Commercial Spaceport/Airport

The increased impervious surface associated with a combined Commercial Spaceport/Airport is estimated to increase direct runoff by 3,100 acre-feet per year by 2015. This increased runoff would reduce groundwater recharge. The majority of the additional runoff would be retained in the stormwater management system and would either evaporate or become groundwater recharge.

Secondary development associated with this alternative would also generate additional runoff. Some of the runoff would become groundwater recharge, but it is estimated that about 1,600 additional acre-feet per year of groundwater flow to Biscayne Bay could be lost by 2015. Ammonia loads to nearshore Biscayne Bay would probably decrease (compared to the Commercial Spaceport alone) in the same proportion as decreased groundwater flows.

The impacts of fuel and other spills on HST would be the same as described for the Proposed Action.

Cumulative Impacts

Development associated with Miami-Dade County's high-growth population forecasts would have the effect of reducing groundwater recharge to the area south of Eureka Drive by over 29,000 acre-feet per year by 2015. Combined with the increase in groundwater recharge at the spaceport and loss of recharge associated with secondary development, there could be a net reduction in groundwater recharge south of Eureka Drive of approximately 29,770 acre-feet per year, and a similar reduction in groundwater flow to Biscayne Bay. Nitrogen inputs to Biscayne Bay from groundwater are estimated to decrease by approximately 210,957 pounds per year by 2015 compared to the projected baseline (see Table 4.10-12).

The effects of the L-31E Flowway Redistribution Project and STDA would be the same as described under the Proposed Action.

Mitigation Measures

The mitigation measures described for the Proposed Action would also be appropriate for the Commercial Spaceport alternative.

4.10.3.3 Mixed Use Alternative

Under the Market-Driven scenario, it is assumed that the disposal land could be conveyed to a number of individual entities, and no single entity would necessarily have responsibility for a consolidated stormwater management program. In that case, runoff and discharges to Military Canal from the base would be estimated to increase 9 percent by 2015. This runoff would decrease direct groundwater inputs to Biscayne Bay by approximately 323 acre-feet per year by 2015 (see Table 4.10-10). Implementation of a stormwater management system on the site could result in an increase in groundwater flows similar to the Proposed Action and Commercial Spaceport alternative. Direct nitrogen loads in groundwater could increase by 784 pounds per year by 2015 (see Table 4.10-11).

Secondary development associated with Market-Driven development is also estimated to increase surface runoff, resulting in a reduction in groundwater recharge and a reduction in groundwater flow into

Biscayne Bay. The reduction could be partially offset by landscape watering and other activities associated with increased population and development, but evapotranspiration and overland flow would be expected to account for the majority of the runoff. Secondary development in the vicinity of former Homestead AFB could reduce groundwater flow into Biscayne Bay in the area of the former base by approximately 1,384 acre-feet per year by 2015. Secondary development is estimated to result in a decrease in nitrogen inputs in groundwater by 10,332 pounds per year by 2015.

The net effect of both direct and secondary development would be an estimated reduction in groundwater inputs of 1,707 acre-feet per year and a reduction in nitrogen loads of 9,548 pounds per year by 2015.

The Collier-Hoover proposal would entail the construction of a number of lakes, wetlands, and canals on the former base which would increase the storage of rainfall and reduce surface water discharges to Biscayne Bay through Military Canal. The result would be an increase in direct groundwater flow from the former base to the bay. In addition, about 510 acre-feet per year of treated sewage is proposed to be used to irrigate golf courses on the former base. For analysis purposes, it was estimated that all of the irrigation water would go to groundwater, although much of it would evaporate. The amount of water that would be retained by the canals and lakes has not yet been designed, and performance of the system is not known. It would likely perform at least as well as the stormwater management system for the Proposed Action and Commercial Spaceport, and it could retain substantially more water than estimated for those alternatives. Nevertheless, without a better developed design, it is not possible to model how such a system would operate, so on-site runoff and discharges from the Proposed Action have been assumed. This alternative is estimated to increase direct groundwater flows by 1,428 acre-feet per year by 2015 (see Table 4.10-10). Direct nitrogen inputs are estimated to increase by 24,681 pounds per year by 2015 (see Table 4.10-11). However, it is probably a considerable overestimation because it does not account for plant uptake, which is likely to be substantial under this proposal.

Secondary development associated with the Collier-Hoover proposal is estimated to increase surface water runoff and decrease groundwater flows to Biscayne Bay by approximately 3,055 acre-feet per year by 2015. This would result in a decrease in nitrogen inputs through groundwater by an estimated 22,811 pounds per year.

The net effect, considering both direct and secondary changes, would be estimated reductions in groundwater flow of 1,627 acre-feet per year and an increase of 1,870 pounds per year of nitrogen inputs through groundwater by 2015. Most of the nitrogen is likely to be ammonia, and un-ionized ammonia is estimated to be about 5–10 percent of the total.

Cumulative Impacts

Development associated with Miami-Dade County's high-growth population forecasts could result in a reduction in groundwater infiltration to the area south of Eureka Drive by over 29,000 acre-feet per year by 2015. There could, therefore, be a cumulative reduction in groundwater recharge south of Eureka Drive of approximately 31,141 acre-feet per year for the Market-Driven scenario and 31,061 acre-feet per year for the Collier-Hoover proposal compared to the projected baseline in 2015 (see Table 4.10-12). Nitrogen loads in groundwater could decrease by 229,249 pounds per year under the Market-Driven scenario and 217,921 pounds per year under the Collier-Hoover proposal.

The effects of the L-31E Flowway Redistribution Project and STDA would be the same as those described under the Proposed Action.

Mitigation Measures

Mitigation measures described for the Proposed Action would be appropriate for the Mixed Use alternative.

4.10.3.4 No Action Alternative

Under the No Action alternative, there would be no impacts to the groundwater system caused by on-site or reuse-related secondary development. The cumulative impacts if the high population growth forecasts were realized would still be essentially the same as described for the Proposed Action. Groundwater infiltration to the area south of Eureka Drive could be reduced by approximately 29,434 acre-feet per year by 2015, and there could be a net reduction in groundwater recharge south of Eureka Drive by approximately the same amount, with a similar reduction in groundwater flow to Biscayne Bay.

4.10.3.5 Independent Land Use Concepts

Each independent land use concept implies different construction requirements, and the impervious surface associated with each has not been determined. To the extent that a given land use concept would replace a lower-density land use, there would be a decrease in groundwater recharge and a consequent reduction in groundwater discharge to Biscayne Bay. If a given land use concept were to replace a higher-density land use, however, groundwater recharge would increase, and groundwater discharge to Biscayne Bay would also increase. Changes associated with the implementation of most of the independent land use concepts are expected to be small because they would occupy a relatively small portion of the disposal property. Agriculture, a cemetery, and a theme park would all be likely to increase infiltration to groundwater and increase groundwater flow to Biscayne Bay. Agriculture would also probably increase the amount of nitrogen in groundwater, differentially increasing the discharge of ammonia to nearshore Biscayne Bay sediments.

4.11 BIOLOGICAL RESOURCES

4.11.1 Introduction

A variety of methods were used to determine impacts to biological resources, depending on the resource. In general, if construction could occur on land occupied by a particular biological community or in part of the range occupied by a sensitive species, the extent of the potential loss of the community or range was determined. Greater importance was placed on more pristine communities and breeding ranges than on degraded or fragmented communities and foraging ranges.

While physical alteration of communities or ranges would be the most direct cause of permanent impacts, changes in the water balance of an area also would have an impact on wetland and aquatic communities. Water relationships in south Florida are determined primarily by flood control and stormwater management practices. Estimated changes in patterns of water flows caused by proposed changes in stormwater management practices were used to conduct a qualitative assessment of possible impacts to biological communities in given geographic areas. The location of water is also important in determining the suitability of foraging habitat for some sensitive species such as water birds. Pollutants in water, particularly in stormwater, affect the biota of aquatic communities and are a particular concern in Biscayne Bay. Although data on the biota of the bay and their relationship to pollutants are extremely limited, potential trends in those communities were surmised based on the estimated trend in pollutant discharges to the bay under different stormwater management options.

Although the risk of an aircraft mishap is very small (see Section 4.4), this section addresses the types and potential severity of impacts on biota from an accident, should one occur, and subsequent recovery operations. This analysis is of necessity qualitative because the actual consequences associated with any given mishap would depend on site-specific conditions and response actions.

The impacts of noise were determined by evaluating what species or communities would be exposed to different noise levels and comparing those noise levels with information on noise-related impacts published in the scientific literature for similar species or communities.

4.11.2 Biological Communities

This section addresses the anticipated impacts from the Proposed Action and alternatives on three types of biological communities: (1) estuarine and marine, (2) wetlands and freshwater, and (3) upland and disturbed. The discussions of noise impacts, which could affect wildlife in each of these communities, is consolidated in Section 4.11.3.1.

4.11.2.1 Proposed Action

Estuarine and Marine Communities. Although the nearshore area of Biscayne Bay was once substantially estuarine (lower salinity than seawater) in nature, the existing estuarine areas are limited to areas near the outfalls of canals and have salinities that vary widely on a daily basis because of the opening and closing of flow control structures at canal mouths. Estuarine species, such as oysters, do not thrive in this salinity regime, and the bay is essentially marine in character. While there would be no direct impacts to the bay from construction either on or off the former base, changes in stormwater management practices might influence the nearshore salinity regime.

The nearshore area is exposed to inputs of nutrients and toxic chemicals from both canal discharges and groundwater. Surface water contributes significant amounts of the nutrients nitrogen and phosphorus, but

groundwater is disproportionately rich in nitrogen compounds, primarily ammonia, compared to phosphorus. The ammonia in groundwater from the county landfill ("Mount Trashmore") is thought to be responsible for the greatest extent of sediment toxicity in the bay, but inputs of other toxic chemicals in both surface water and groundwater contribute to localized areas of sediment toxicity, particularly near canal mouths. Nutrient inputs have also led to the growth of epiphytes on the leaves of nearshore seagrasses, reducing the amount of light available to them for photosynthesis, their nearshore abundance, and the availability of this habitat for other biota. Because Biscayne Bay is shallow and plankton (open water) biota contribute a relatively small amount to overall bay productivity, the reduced density of seagrasses may have led to changes in the fauna of the bay as well. Few data exist to confirm this suspicion, however.

The majority of toxic chemicals other than ammonia are derived from surface water inputs, primarily from stormwater, but groundwater probably also contributes small amounts of soluble toxic chemicals. The effect of toxic chemicals depends on the levels at which biota would be exposed. At high concentrations, adverse biological effects, including death, could occur, but at low concentrations, there would likely be no effects. Florida water quality standards to protect aquatic life (Class III freshwater) are set at levels that ensure no adverse biological effects, so if chemical concentrations comply with water quality standards, no effects would be expected.

The effects of the Proposed Action on estuarine and marine environments would occur primarily through changes in water, nutrient, and toxic chemical loads to Biscayne Bay. On the whole, changes in these parameters caused by the Proposed Action are expected to be small, on the order of 1–3 percent of existing surface water discharges through Military, Mowry, and Princeton Canals, which contribute about 60 percent of the surface water flows to southern Biscayne Bay. As explained in Section 4.10, net changes in water inputs to southern Biscayne Bay by 2015 are expected to be about 0.6 percent of projected baseline surface water discharges from Military, Mowry, and Princeton Canals. This reflects an increase in surface water discharges of 5,108 acre-feet per year and a decrease in groundwater discharges of about 3,664 acre-feet per year. For comparison, year-to-year variations in surface water and groundwater flows are many times higher than the estimated reuse-related changes.

Nitrogen loads from the Proposed Action are projected to increase as a result of increases in water-borne and atmospheric inputs, despite a reduction in groundwater inputs. The increase by 2015 is estimated to be about 3.6 percent of the projected baseline inputs from Military, Mowry, and Princeton Canals, which is about 2.2 percent of total surface water inputs to southern Biscayne Bay. This would represent a 3.9 percent increase over estimated 1995 inputs from the three canals (estimated 2.3 percent increase over 1995 canal inputs). Phosphorous inputs are estimated to increase by less than 2 percent. The increased loads of nitrogen and phosphorus could encourage the growth of epiphytes on seagrasses, limiting their productivity. With sufficiently lowered productivity, the abundance of seagrasses in nearshore waters could decline, reducing the habitat that would be available for a variety of marine species that currently use the bay. Any effects are expected to be localized to the areas immediately around the canals. Once these inputs have been mixed with Biscayne Bay water, the potential stimulatory effects of phosphorus would be considerably reduced. The anticipated small change in discharge volumes indicate that discernible changes in nearshore Biscayne Bay would be unlikely.

Most nitrogen in groundwater becomes ammonia, and ammonia in its un-ionized form is toxic. Un-ionized ammonia varies from about 2 to 20 percent of total ammonia, depending on temperature and pH. Under conditions thought to exist near the former base, un-ionized ammonia is between 5 and 10 percent of total ammonia. Under the Proposed Action, net nitrogen (and ammonia) inputs to Biscayne Bay through groundwater are projected to increase about 5,308 pounds per year by 2005. By 2015, the

increase in secondary development is anticipated to result in a net decrease in nitrogen (and ammonia) inputs through groundwater of about 9,792 pounds per year.

The concentration of metals in surface water discharges is anticipated to comply with water quality standards designed to protect aquatic life. There are insufficient data to estimate concentrations of other toxic chemicals. Petroleum and other constituents typically associated with parking lots and roads (e.g., metals, oils, and PAHs) would increase the contaminant loading in surface water discharged through the canals. Therefore, the Proposed Action can be expected to slightly exacerbate the effects of discharge of contaminated fresh water to the bay. These inputs would continue to contribute to the sediment toxicity of nearshore areas and stress the marine species near the outfalls of Princeton and Mowry canals

Reductions in nearshore salinity, as well as pollutant inputs, might affect the nearshore area of the bay, especially between Princeton and Mowry Canals. Areas farther from shore than about one-half mile could be affected, but are unlikely to be appreciably impacted by reuse-related construction or changes in stormwater management practices on or off the former base. Thus, the coral reefs that border the keys near the outer boundary of Biscayne NP; the shallower, intertidal areas near the keys; and the major area of open water between the keys and the shore are unlikely to be affected by reuse-related activities on or off the former base.

The National Marine Fisheries Service (NMFS) has indicated that Biscayne Bay contains essential fish habitat comprising seagrasses, estuarine mangroves, intertidal flats, estuarine water column, live/hard bottoms, and coral reefs. As discussed above, impacts to these habitats are expected to be so small as to be indiscernible. An Essential Fish Habitat Assessment was prepared discussing the species that rely on these habitats in Biscayne Bay. This assessment appears in **Appendix J**. NMFS had no specific Essential Fish Habitat Conservation Recommendations (**NMFS 2000**).

Although low, the Proposed Action carries a statistical risk of aircraft accidents. If an accident occurred in the estuarine and marine environment east of former Homestead AFB, the impacts on the estuarine and marine communities would depend, at least in part, on the size of the aircraft. Larger aircraft, such as commercial passenger-carrying jets, have the potential to damage a greater area both through physical damage at impact and through release of fuels, oils, and hydraulic fluids.

In the immediate vicinity of impact, all biota would be immediately killed. Physical alteration of the environment would generally not inhibit recolonization of the area following removal of the wreckage, except if the crash occurred on a coral reef. On reefs, depending on the extent of the damage, recolonization could take as long as decades. If the impact area were contaminated by fuels, oils, or hydraulic fluids, recolonization could be delayed until these materials were substantially degraded and dispersed.

In general, fuels, oils, and hydraulic fluids are immiscible with water and float. Jet fuel, having both low viscosity and high volatility, would tend to disperse rapidly on the water surface and evaporate. A very small portion of the fuel (heavier petroleum fractions that were not refined out of the fuel) might sink. Oils and hydraulic fluids would be released in substantially lesser amounts than fuels, but would evaporate more slowly and have a higher proportion of fractions that might sink.

Fuels, oils, and hydraulic fluids are generally toxic to marine organisms and would kill most organisms with which they came in substantial contact. In general, however, contact would occur only along shorelines in intertidal areas. Coral reefs below the water surface would generally not be affected, but under meteorological conditions that caused spilled fuels or oils to remain over coral reefs for several days, light penetration could be reduced sufficiently to affect the viability of underlying corals by

reducing the productivity of the symbiotic algae that inhabit coral polyps. Emergent vegetation, such as mangroves, could be severely damaged with substantial exposure (contact with high concentrations over several hours). Unlike oil spills from ships, there is much lower likelihood of oil-damaged birds or marine mammals with aircraft accidents because most of the spilled fluids would be rapidly dispersed and because of the relatively small amounts of heavier oils and hydraulic fluids. Some birds and marine mammals could be killed by spilled fluids if contacted in very high concentrations over extended periods of time.

Investigation and recovery activities following a crash into estuarine or marine environments would probably be based from vessels, and additional impacts associated with these activities are expected to be minor. If the crash occurred in shallow areas, however, seagrass areas could be damaged by the scouring action of vessel props and prop wash and the placement of anchors.

Fuel spills at the airport itself would generally be localized because the bulk fuel storage areas would be surrounded by berms that could contain the fuel in an above-ground tank, and fuels spilled during fueling operations would be handled in accordance with a spill response plan that would contain the fuel to the extent feasible. Should fuels enter the Boundary Canal, they would be contained within the stormwater management system because water is pumped from mid-depth of the collection reservoir to Military Canal, and the fuel would float on the water. Should a spill occur during (or because of) a hurricane, however, Biscayne Bay water levels could rise to cover at least part of the former base, and fuels could be widely distributed to the east and southeast. It would be expected that the strong winds associated with hurricanes would rapidly disperse fuels so their impact on marine and estuarine biota would likely be small and of short duration.

Wetland and Freshwater Communities. The vast majority of southern Florida is wetland. Large expanses of wetlands occur in the Everglades west of the City of Homestead, to the south, and, to a lesser extent, east of former Homestead AFB. These wetlands could be affected by the reuse of Homestead AFB if the direct and/or secondary development changed the land use of these areas or altered their water balance. In general, little development would be expected to occur on wetlands because they are now protected (by Everglades and Biscayne NPs and the Environmentally Endangered Lands program), are slated for protection, or occur where development would be limited by zoning. The Miami-Dade County Comprehensive Development Master Plan limits most development to areas within the Urban Development Boundary. This boundary could, however, be changed by future amendments to the CDMP.

Given the general easterly/southeasterly surface water and groundwater flows from the Homestead area, water balances of areas west and south of the City of Homestead are unlikely to be affected by changes in stormwater management activities on the former base. Therefore, the Everglades would essentially not be affected by changes in land use and water balances associated with reuse of the former base. Impacts from these changes would be limited to areas east and southeast of the former base, and to a lesser extent, to the northeast.

Construction activities associated with the Proposed Action are not expected to alter the wetland and freshwater communities on former Homestead AFB because no construction is planned on existing wetlands, but the hydrologic relationships of wetlands and surface waters on the former base could be altered. The retention of stormwater by French drains and raising the height of canals and Mystic Lake would generally reduce the depth to the water table and potentially increase the area, frequency, or duration of standing water on the former base. The magnitude of these changes is expected to be small to prevent standing water from interfering with aircraft operation by flooding the runway or taxiways. Wetlands east of the former base could also have slightly increased areas, frequency, and durations of

standing water, but the percentage change at off-site wetlands would be considerably less than at on-site wetlands. An increase in the area of wetlands on the former base would provide additional habitat for wading birds, potentially increasing bird-airstrike hazard.

Freshwater communities on former Homestead AFB would be directly affected by proposed changes to Mystic Lake and the canal system. Raising the surface elevation of Mystic Lake to accommodate additional stormwater storage would likely result in the temporary loss of fringe freshwater emergent wetlands around the lake, although this habitat would be expected to reestablish through natural succession. No change in the area of freshwater habitat is expected from implementation of the Surface Water Management Master Plan, although the lakes and canals would be deeper than at present. Increases in depth are not expected to alter the freshwater communities in these water bodies, but emergent vegetation and vegetation growing on the sides of the canals may be temporarily disturbed. The drainage patterns that affect existing wetlands on the former base would not change, although flood levels might increase slightly. The raising of flood levels implies a raising of the water table, possibly increasing the suitability of wetland habitat on the former base for native wetland flora and fauna.

Spectacled caiman now residing in the canals and lakes on the former base may be forced to migrate to other areas as development proceeds. The number of caiman likely to migrate off the site may be fairly small, given that a large population existed when Homestead AFB was in full operation. If caiman did migrate off site, they would likely move to areas they currently occupy west of Canal L-31E. Procedures that could be established under Executive Order 13112 might involve programs for control or eradication of caiman on the former base if federal funds are used to assist development of the airport. Should such programs be implemented, the potential for off-site migration of caiman would probably be substantially reduced.

The caiman is essentially a freshwater species and would not be expected to move into American crocodile (mangrove) habitat east of Canal L-31E. Salinity in the mangroves can range from 14 to 45 parts per thousand, and the disappearance of brackish water species that require salinities of 5 to 25 parts per thousand (**USACE 1998**) indicate conditions are not favorable for caiman. In Venezuela, the caiman has established populations in most areas where crocodiles were over harvested, except in a brackish water habitat. Caiman failed to colonize the brackish area possibly because they do not have physiological adaptations to survive in such environments (**Seijas 1988**).

Construction associated with secondary development would probably have few impacts on wetlands or other aquatic habitats as these habitats are less likely to be developed because of government restrictions on development in wetlands. Increased runoff from land converted to residential, commercial, and industrial land uses could increase surface water flow and reduce groundwater flow, but the change caused by secondary development associated with the Proposed Action would be relatively small (estimated at less than 3 percent above 1995 surface water flow by 2015). Near the Biscayne Bay shoreline, the change could result in a small percentage reduction in the area, duration, or frequency of inundation of wetlands.

If an aircraft accident occurred in a wetland or freshwater community, biota in the impact area would be killed, and released fuels, oils, and hydraulic fluids, if not burned, would have the potential for coming in contact with a much greater percentage of nearby biota than in the marine environment. Biota that came in extensive contact with fuels would likely be killed or severely impaired. The evaporative loss of fuels would be slower than in a marine environment because the fuel would generally not be dispersed over as large an area, and some of the fuel could permeate through soils and substantially reduce the rate of recolonization in the impact area. If the fuel remained on the water surface of a lake or pond for several hours, aquatic organisms could be smothered. However, the impact would be limited to the immediate

vicinity of the crash. Investigation and recovery activities might require construction of temporary roads and placement of fill near the crash site. If circumstances made avoidance impossible, temporary roads and fill sites could end up eliminating existing wetlands.

Any fuel that might be spilled at the airport and that entered the Boundary Canal system would kill emergent vegetation and potentially smother aquatic biota in the canal by preventing oxygen diffusion through the water's surface. In addition, fuel that percolated through soils along the edge of the canal system could delay or prevent recolonization of the edges of the canals by emergent vegetation. No off-site impacts would be expected under most circumstances, however, because the fuel would be retained on site and not be pumped into Military Canal. Should a spill occur during (or because of) a hurricane, fuel could be transported by Biscayne Bay water over broad areas to the south and southeast of the former base. High winds would tend to disperse the fuel, limiting long-term impacts on wetlands and other freshwater environments.

Upland and Disturbed Communities. Upland and disturbed communities generally occur inland of wetland areas. Most of these communities occur on higher, drier ground, and some, such as hardwood hammocks, are limited to isolated patches of limestone outcrops. While isolated outcrops that occur in the Everglades and south of the City of Homestead have essentially native vegetation, the majority of the upland communities on land where development could occur have been highly degraded by invasion of exotic species and fragmentation. Most of the area within the UDB is now occupied by disturbed communities, largely comprising grasslands and agriculture. East of former Homestead AFB, areas once occupied by hardwood hammocks are now essentially occupied by the exotic Australian pine and Brazilian pepper. The loss of the native vegetation and invasion of these exotic species in this area are probably related to hurricane damage and lowering of the water table.

As with wetlands, the major areas off the former base that now contain native upland communities are not expected to be appreciably affected by construction related to reuse of the disposal property because they occur in areas where development would be limited or in areas slated for protection. No impacts would be associated with changes in stormwater management practices. The biological communities that occur in the Everglades and south of the City of Homestead would not be altered.

Upland areas on former Homestead AFB are essentially all disturbed communities composed of grasslands and agriculture, shrub and brushland, exotic plant, and urban community types. Eleven areas of remnant pine rocklands occur on the surplus property. Impacts in those areas are discussed in Section 4.11.3.1.

Under the Proposed Action, it is estimated that pavement and buildings could occupy up to 785 acres of the disposal property by full buildout, a substantial increase over the 469 acres of impervious area there now. Buildings and infrastructure would replace disturbed communities and some remnant pine rocklands. Construction and demolition could remove an estimated 710 acres of disturbed communities at full buildout, but the disturbed areas not ultimately covered by buildings or pavement would generally be landscaped (classified as a disturbed community). Areas disturbed by construction but not landscaped would be subject to invasion by exotic species. Procedures that could be established under Executive Order 13112 might involve actions such as revegetation with native species to prevent invasion by exotic species if federal funds are used to assist development of the airport.

Secondary development outside the former base could result in the disturbance of approximately 2,000 additional acres of land by 2015 and almost 3,000 acres by full buildout. This would be about 2–3 percent of unprotected vacant and agricultural land in Miami-Dade County south of Eureka Drive. Much of the land most likely to be developed contains disturbed communities (i.e., grasslands and

agriculture, exotics, or urban). Because of their location to the north, west, and southwest of former Homestead AFB, these habitats would generally be more affected by secondary development than the natural dry prairie and tropical hardwood hammock upland communities that occur south and southeast of the former base. In general, development can be expected to result in between 40 and 80 percent of any given land parcel becoming paved or occupied by buildings, with the remainder left as is or landscaped. Thus, secondary development could result in elimination of the habitat value of up to 3 percent of the upland and disturbed communities in south Miami-Dade County. Most of the upland communities within the Urban Development Boundary have been developed into small, isolated patches that fragment previously continuous upland habitat. Species that rely on larger areas of continuous habitat for their home range almost certainly have reduced population sizes because of this fragmentation. Further fragmentation could occur as the areas surrounding the former base become developed as a consequence of the Proposed Action.

An aircraft accident on upland and disturbed communities would kill all biota in the area of impact. Spilled fuels, oils, and hydraulic fluids that did not burn would permeate local soils, substantially extending the time required for recolonization by vegetation. The distribution of spilled fuels, oils, and hydraulic fluids would likely be much more localized than spills in marine or freshwater environments. The effects could be more severe, but the area affected would be less extensive than for other community types. Investigation and recovery activities could require clearing of vegetation near the site, and vegetation could also be destroyed if temporary roads were constructed to the crash site.

Spilled fuels on the airport itself would be unlikely to affect the upland and disturbed communities on site because fueling operations would not occur in the vicinity of these communities. Few off-site impacts on upland and disturbed communities would be expected because the spilled fuel would generally be retained in the stormwater management system. Should spilled fuel be carried off the site during very high water (i.e., during a hurricane), it would be dispersed over a wide area, and the impacts on upland and disturbed communities would probably be small in comparison to the effects from inundation by seawater.

Cumulative Impacts

Estuarine and Marine Communities. Were Miami-Dade County's high-growth forecasts to occur, population growth and associated development could result in an increase in the combined discharges from Military, Mowry, and Princeton Canals of about 26 percent above 1995 surface water flows by 2015. Combined with the Proposed Action, the total increase would be about 28 percent. The increased surface water input and reduced groundwater input would potentially increase nutrient and toxic loadings to Biscayne Bay and continue the historical trend of greater surficial freshwater inputs and higher contaminant loadings. Under high growth, nitrogen inputs in surface water could increase by about 26 percent (29 percent with the Proposed Action) by 2015 compared to 1995 levels. Nearshore biota would continue to be stressed by the increased nutrient and toxic loadings. The relatively large magnitude of the change indicates that there would probably be seagrass loss because of nutrient (phosphorus) stimulation of epiphyte growth, changing the nearshore habitat to be less productive. Biota that rely on seagrass habitat such as juvenile shrimp and fish would likely have reduced population sizes, although the magnitude of the changes cannot be quantified. It is estimated the Proposed Action's contribution to the change in surface water flow to southern Biscayne Bay by 2015 would be about 8 percent.

The L-31E Flowway Redistribution Project would reroute some of the surface water flow from Princeton and Mowry Canals and all of the flow from Military Canal to an STDA between Biscayne Bay and the former base. Water being discharged from the STDA to Biscayne Bay is expected to have lower

concentrations of toxic chemicals and nutrients, so the rerouted inputs to the bay could contribute to a more diverse, nearshore estuarine community. Given the uncertainties about the quantity and quality of water that would be delivered to the south bay under the Restudy, however, no firm statements can be made as to the combined effects of the flowway, population growth, and the Proposed Action.

Wetland and Freshwater Communities. Miami-Dade County's high-growth population forecasts could lead to reduction in groundwater flows and increases in channelized surface water discharges to Biscayne Bay. This could, in turn, lower the water table, reduce the area of wetland and aquatic habitats along the Biscayne Bay shoreline, and remove some of the filtering action of existing wetlands by bypassing them. The importance of these changes cannot be quantified, however, without more specific information about the locations of likely development and the stormwater management practices that might be associated with development. At this time, this information is not available. In any case, the Proposed Action's contribution to these effects would be small because the Proposed Action is anticipated to add about 8 percent to the increase in surface water flows by 2015.

The L-31E flowway project and STDA, if implemented, could restore degraded wetlands and create new wetlands and natural stream channels from just west of Canal L-31E to the mangrove fringe along Biscayne Bay. These projects could raise the water table and might encourage the development of more native vegetation, helping to restore the ecosystems that once occurred there. As groundwater levels and surface water sheet flows increased, however, the productivity of some agricultural lands could be reduced.

The widening of U.S. Highway 1 between the City of Homestead and Key Largo would fill wetlands along the corridor. The loss of these wetlands has already been offset by the construction of replacement wetlands in other, nearby locations.

Upland and Disturbed Communities. Under the Miami-Dade County high-growth population forecasts, about 20,000 acres of undeveloped land south of Eureka Drive could be converted to residential, commercial, and industrial use by 2015. This would represents about 20 percent of unprotected vacant and agricultural land in the south county. It is expected that most of the development would occur in disturbed biotic communities, although small areas of pine rockland and hardwood hammock communities may be interspersed throughout the area. Between 40 and 80 percent of the developed land could be expected to become pavement or buildings, depending on whether it is developed for residential or industrial use, and the remaining area would probably be landscaped. Therefore, between 8 and 16 percent of available land south of Eureka Drive could become covered over by 2015, predominantly in biological communities that have already been disturbed by human activity or invaded by exotic species. The Proposed Action's contribution to the increase in development would be about 10 percent.

The L-31E flowway project and the STDA, if built, would probably reduce the area of upland and disturbed communities east of the former base by encouraging their replacement with wetlands. A higher water table and more permanent freshwater inputs east of the former base could encourage the development of more water tolerant native species. The affected land would likely include all of the area east of the new canal proposed to be constructed as part of the flowway project.

The widening of U.S. Highway 1 would also eliminate or degrade upland and disturbed communities in the highway corridor between Florida City and Key Largo.

Mitigation Measures

Estuarine and Marine Communities. A number of entities have recommended that a buffer area be established between former Homestead AFB and Biscayne NP where development would be restricted or eliminated. Most of this area is already protected from intensive development, and, although further restricting development would prevent surface runoff from increasing and groundwater inputs to the Biscayne Bay from declining, these changes are likely to be very small. The buffer area is likely to generate little change in the existing estuarine and marine communities. The buffer would help preserve the present situation and prevent future degradation.

Appropriate mitigation measures to reduce impacts on estuarine and marine communities include practices, programs, and procedures that would minimize stormwater flows and minimize the possible contamination of stormwater. These would need to be implemented by property owners and users. Aggressive pollution prevention, spill prevention and control, integrated pest management, and fertilizer minimization programs would all reduce the probability (and total amount) of contaminants reaching Biscayne Bay. The impact of these programs if implemented only on the former base, however, would be small given the relative magnitude of inputs from the site in relation to other inputs to Biscayne Bay. Implementation of such programs outside of the former base would probably not be effective without changes in current Miami-Dade County and FDEP environmental regulations.

Additional stormwater treatment (an STDA) for Military, Mowry, and Princeton Canals would help reduce contaminants in runoff both from the former base and from the surrounding area.

Wetlands and Freshwater Communities. Creation of a buffer area would preclude development on wetlands in the area between the former base and Biscayne NP. Existing ordinances and regulations already discourage development on large wetlands, however, so the benefits to wetland communities would be in preserving the small, isolated wetlands which are widely distributed in this area. A buffer would substantially reduce the potential loss of these small wetlands.

The most direct mitigation for potential loss of wetlands in the area east of the former base would be the construction of an STDA to treat stormwater from the former base and the surrounding area. Construction of an STDA would increase the area of wetlands east of the former base. There is some concern that increasing wetlands near the former base could increase bird-airstrike hazards.

Aggressive pollution prevention, spill prevention and control, integrated pest management, and fertilizer minimization programs on the former base would all reduce the probability (and total amount) of contaminants reaching wetlands or an STDA. Overall impacts of pollution prevention and other programs would probably be small unless they were implemented over most of south Miami-Dade County.

The implementation of a program to control or eradicate caiman on the former base would minimize the potential for off-site migration as suitable habitat on site for caiman is eliminated by development.

Upland and Disturbed Communities. Although it would eliminate development east of the former base, the creation of a buffer area would be expected to have little impact on upland and disturbed communities. The great majority of the land east of the former base is occupied by agriculture, exotic vegetation, and wetlands. There may be small areas of native upland vegetation that could be preserved.

Some mitigation measures for upland and disturbed communities are included in the Wildlife/Habitat Management and Mitigation Plan as part of the Proposed Action. Implementation of this plan would protect at least four remnant pine rocklands on the former base, but would not protect other on-site and

off-site upland and disturbed communities. Preserving the other pine rocklands on the site would have some added benefit. The potential for adverse impact to off-site upland and disturbed communities is minimal, but identification, location, and regulatory protection of isolated, natural upland communities could help to reduce overall impacts in the region.

Requirements to revegetate disturbed areas with native vegetation following demolition or construction would minimize the potential for invasion of denuded areas by exotic species.

Possible Future Expansion

Estuarine and Marine Communities. The construction of a second runway at former Homestead AFB would create additional impervious surface on presently agricultural land east of the former base, resulting in up to an additional 2,700 acre-feet per year runoff. Most of the approximately 1,060 acres needed for the expansion would become runway, reducing groundwater recharge in this area. This additional surface water discharge and reduction of groundwater recharge would offset the potential benefits of the almost 30 percent reduction in Military Canal discharge estimated to be attained by the Proposed Action's Surface Water Management Master Plan. The net effect would be essentially no discernible change to the nearshore marine communities of Biscayne Bay from current conditions. More precise estimates would need to be determined in future environmental analysis that will be required if a second runway is proposed.

Wetland and Freshwater Communities. The addition of a second runway at HST would result in filling of several acres of wetlands along the southeastern boundary of the former base, filling of part of Boundary Canal, creation of a new Boundary Canal, and rerouting of both Mowry and Military canals. Filling wetlands would most likely require a Clean Water Act Section 404 permit. The resulting reduction in groundwater recharge would increase the depth to the water table, potentially decreasing the area of wetlands east of the former base or decreasing the duration or frequency of standing water in these wetlands. The change to wetlands as a result of decreases in groundwater flow would likely be small. More precise estimates would need to be determined in future environmental analysis that will be required if a second runway is proposed.

Upland and Disturbed Communities. The majority of the area that would be occupied by an airport expansion is currently agricultural land (disturbed community), and more than half of this land would be expected to be covered by pavement and buildings. The remainder would probably be maintained as grassland. Five pine rocklands along the southern and eastern part of the runway (about 17 acres) would probably be lost during construction unless specific conservation measures were taken to preserve them.

4.11.2.2 Commercial Spaceport Alternative

Estuarine and Marine Communities. It is assumed the Commercial Spaceport alternative would include stormwater management practices similar to and as stringent as those in the Surface Water Management Master Plan developed for the Proposed Action. Most or all of the disposal land would be controlled by a single developer, and because of this, the stormwater regulator (either SFWMD or Miami-Dade County) would probably require the same performance from the stormwater management system for the Commercial Spaceport as for the Proposed Action.

Because secondary development is projected to be less under the Commercial Spaceport alternative than the Proposed Action, net water flows are estimated to remain about the same as they are currently, and most chemical loadings are estimated to change by less than 1 percent. Net nitrogen inputs in 2015 are estimated to increase by about 1.3 percent over projected baseline inputs (1.4 percent over 1995 inputs)

from Military, Mowry, and Princeton Canals. Unlike the Proposed Action, the Commercial Spaceport alternative is projected to result in a net increase in nitrogen inputs (and therefore ammonia) through groundwater. The effects of this change on biota are anticipated to be minor.

Petroleum and other constituents typically associated with parking lots and roads would increase the contaminants in surface water discharged through the canals. This could be expected to slightly exacerbate the effects of surface water discharges to the bay. Toxic chemical inputs would continue to contribute to the sediment toxicity of nearshore areas, stress the marine species near the outfalls of Princeton and Mowry canals, and contribute nutrients that would probably maintain the reduced density of seagrasses in the nearshore environment. Discernible changes in nearshore Biscayne Bay biota are unlikely.

Accidents associated with spacecraft would have similar physical impacts to aircraft crashes, but the toxic impacts of fuel releases would be reduced or avoided. Some spacecraft fuels are highly explosive, and any accident (or intentional airborne destruct) would result in an immediate and intense fireball. In a fireball, all fuels would be completely consumed. If the explosion occurred in the air, pieces of the spacecraft could be distributed over a wide area, depending on the altitude of the explosion, but the size of the pieces would generally be smaller than a small jet aircraft. Nevertheless, biota hit by falling debris would probably be killed. If an intact spacecraft crashed into the earth, even just to the ocean surface, the fireball would consume essentially all of the fuel. Biota in the impact area would be killed, but debris would not be distributed over as wide an area as with an airborne destruction. Because toxic fuels would not be dispersed as in an aircraft crash, there would generally be little impediment to recolonization of the impacted area[1]. The impacts of investigation and recovery operations would be the same as described for the Proposed Action.

The impacts associated with spilled jet fuels at the spaceport itself would be the same as reported for the Proposed Action, but the probability of occurrence would be reduced because of the lower volumes of fuels being handled. Spilled rocket fuels (liquid oxygen and liquid hydrogen) would freeze (and probably kill) biota with which they came in contact, but the spilled fuels would quickly evaporate. In the long term, the area of the spill would be repopulated by natural succession.

Wetland and Freshwater Communities. Qualitatively, the impacts to wetland and freshwater communities from the Commercial Spaceport alternative would be the same as those described for the Proposed Action. Assuming that stormwater controls as stringent as those in the Proposed Action would be required, groundwater levels would likely increase slightly over current levels. The quantity of surface water discharged to Military Canal would be expected to decrease by as much as 30 percent as a result of stormwater controls. Wetland areas near the runway and east of the former base may have somewhat increased areas, frequencies, and durations of inundation. Changes in on-site wetlands are expected to be small, and changes would be even smaller in off-site wetlands.

If existing caiman on the former base were displaced by on-site development, they would probably migrate to areas they currently occupy off base, west of Canal L-31E. They would not be expected to migrate to brackish areas east of the canal. Procedures that could be established under Executive Order 13112 might involve programs for control or eradication of caiman on the former base if federal funds are used to assist development of the spaceport. Should such programs be implemented, the potential for off-site migration of caiman would probably be substantially reduced.

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[1] The combustion products of solid rocket fuels generally include hydrogen chloride gas. Although hydrogen chloride is highly acidic (and therefore toxic), the high buffering capacity of marine water would likely rapidly neutralize any adverse impact. Reductions in pH would be small and of short duration.

Secondary development associated with this alternative would probably not result in conversion of wetlands to residential, commercial, or industrial land. Increased runoff from secondary development could increase surface water flow and reduce groundwater flow, but by 2015, the change would be less than 1 percent of current surface water flow. Near the Biscayne Bay shoreline, the change could result in a very small percentage reduction in the area, duration, and frequency of inundation of wetlands.

If one occurred, a spacecraft accident, either airborne or on land, would kill biota impacted by the debris. In an on-earth accident, nearby biota would also be burned by the ensuing fire, and aquatic biota could be killed by the heat generated by the fireball. There would be no fuel remaining after the fireball, so recolonization of the affected area would likely be relatively rapid. The impacts of investigation and recovery operations would be the same as described for the Proposed Action.

The impacts associated with spilled aircraft fuels on the airport itself would be the same as described for the Proposed Action, but the probability of occurrence would be reduced because of the lower volumes of fuels being handled. If spacecraft fuels were spilled in wetlands or surface waters on the former base, localized freezing could occur, and some biota could be killed. With the rapid evaporation of the fuel, freezing effects would be likely to be short lived.

Upland and Disturbed Communities. By 2015, there could be an estimated 555 acres of impervious surface (buildings and pavement) on the disposal property under this alternative, which is 86 acres more than at present. At full buildout, impervious surface could occupy up to about 591 acres. The majority of new buildings and pavement would be built on land occupied by disturbed communities. During construction, up to about 289 acres of disturbed communities could be damaged or denuded by 2015 (estimated 370 acres by full buildout), but the disturbed area not ultimately covered by buildings or pavement would probably be landscaped. Those areas not landscaped following construction would be subject to invasion by exotic species. Procedures that could be established under Executive Order 13112 might involve actions such as revegetation with native species to prevent the invasion of exotic species if federal funds are used to assist development of the spaceport.

This alternative may not include plans for protecting the 16.7 acres of pine rocklands on the disposal property. Three of these remnant pine rocklands (15.9 acres) might be preserved through a deed covenant requested by U.S. Fish and Wildlife Service. Impacts on the remnant pine rocklands are discussed in Section 4.11.3.2.

Reuse-related secondary development could result in the disturbance of an additional 498 acres of disturbed communities by 2015, much less than 1 percent of the available vacant and agricultural land south of Eureka Drive. The qualitative impacts of this development would be the same as described for the Proposed Action, but the overall change would be quantitatively negligible.

An accident involving a spacecraft would kill biota impacted by the debris or burned in the ensuing fire, but recolonization would likely occur relatively rapidly. The impacts of investigation and recovery operations would be the same as described for the Proposed Action.

The impacts associated with on-site aircraft fuel spills would be the same as described for the Proposed Action, but the probability of occurrence would be less because of the lower volumes of fuels being handled. Spilled spacecraft fuels would kill biota with which they came in contact, but they would rapidly evaporate, and recolonization would occur through natural succession.

Combined Commercial Spaceport/Airport

The stormwater discharge to Military Canal from a combined Commercial Spaceport/Airport would be slightly higher than the Commercial Spaceport without a civil aviation component. Toxic chemical and nutrient discharges would also be slightly higher. Changes in the nearshore Biscayne Bay biota would be similar to those described for the Proposed Action. No construction is expected to occur on wetlands on the former base, and increases in surface water discharges from the former base would be small. Impacts on pine rocklands on the disposal property would also be the same as described above.

Secondary development associated with a combined Commercial Spaceport/Airport would be expected to increase surface water discharges from Princeton and Mowry Canals by less than 2 percent by 2015. Although increases in discharges would slightly increase the loads of nutrients and toxic chemicals to Biscayne Bay, the effects on nearshore biota are unlikely to be discernible. A less than 2 percent increase in surface water discharges from Mowry and Princeton Canals would result in a very small percentage reduction in the area, duration, or frequency of inundation of wetlands east of former Homestead AFB. In addition, about 1,100 acres of upland community could be converted to residential, commercial, or industrial land off of the former base.

The effects of aircraft accidents or fuel spills would be the same as described for the Proposed Action. The effects of spacecraft crashes would be the same as described above.

Cumulative Impacts

The increased canal discharges south of Eureka Drive caused by population growth and development should Miami-Dade County's high-growth forecast be realized would potentially increase nutrient and toxic loadings to Biscayne Bay and continue the historical trend of greater surficial freshwater inputs and higher contaminant loadings. Nearshore biota would continue to be stressed by the increased nutrient and toxic loadings. Increases in canal discharges would also lower the water table, reduce the area of wetland and aquatic habitats along the Biscayne Bay shoreline, and remove some of the filtering action of existing wetlands by bypassing them. The Commercial Spaceport alternative's contribution to cumulative surface water flow in southern Biscayne Bay is estimated to be less than 0.1 percent in 2015.

Development of vacant and agricultural lands under Miami-Dade County's high-growth population forecasts is estimated to affect about 20 percent of vacant and agricultural land in the south county. It is expected that most of the development would occur in disturbed biotic communities. It is estimated the Commercial Spaceport alternative would contribute about 2 percent of the increase in development by 2015. Under the combined Commercial Spaceport/Airport, the contribution would be about 5 percent.

The L-31E Flowway Redistribution Project, the STDA, and the widening of U.S. Highway 1 between the City of Homestead and Key Largo would have the same impacts as described for the Proposed Action.

Mitigation Measures

The effects of creating a buffer zone between the former base and Biscayne NP would be the same as described for the Proposed Action. USFWS has requested that a deed covenant requiring preservation of the pine rocklands on the former base that contain Small's milkpea be included in the property transfer. This would protect three of the areas (areas 1–3 on Figure 3.11-6) on the former base. Further measures could be implemented to protect the other pine rocklands on the former base.

The implementation of a program to control or eradicate caiman on the former base would minimize the potential for off-site migration as on-site habitat suitable for caiman is eliminated by development. Requirements to revegetate disturbed areas with native vegetation following demolition or construction would minimize the potential for invasion of denuded areas by exotic species.

4.11.2.3 Mixed Use Alternative

Estuarine and Marine Communities. The Market-Driven scenario of the Mixed Use alternative may not necessarily include implementation of a site-wide stormwater management system, so the increased runoff associated with increased impervious surface could become surface water discharge under that scenario. Without a stormwater management system, there could be an increase in surface water discharge to Biscayne Bay through Military Canal and a decrease in groundwater inputs to the bay. By 2015, net water flows are projected to increase by 0.3 percent over projected baseline discharges from Military, Mowry, and Princeton Canals. Qualitatively, these discharges would contribute to a continued trend of generally higher salinities, higher concentrations of toxic chemicals and nutrients in nearshore waters and sediments of Biscayne Bay, and reduced density of seagrasses through epiphytic growth. Because seagrasses are the dominant primary producers in the bay, overall bay productivity would be expected to suffer. Net nitrogen inputs are estimated to increase less than 1 percent of projected baseline inputs from the three canals.

Under the Collier-Hoover proposal, a stormwater management system would be implemented, and the impact of the increased surface water discharges and reduced groundwater discharges would be similar to those described for the Proposed Action. Overall, nitrogen inputs associated with the Collier-Hoover scenario are estimated to increase 1.7 percent above projected baseline inputs from Military, Mowry, and Princeton Canals by 2015 (1.8 percent above 1995 levels). This could slightly exacerbate the effects of discharges of stormwater to Biscayne Bay and could continue to contribute to the sediment toxicity of nearshore areas, stress the marine species near the outfalls of Princeton and Mowry Canals, and contribute nutrients that would help aggravate the reduced seagrass density of the nearshore environment.

Like the Commercial Spaceport alternative, this scenario is projected to result in an increase in nitrogen inputs through groundwater. While there is a potential for larger increases in ammonia inputs with the Collier-Hoover proposal, the proposed treatment of stormwater in on-site wetlands would be expected to reduce the ammonia levels. The impacts of increased ammonia discharges under this scenario are expected to be minor.

Wetland and Freshwater Communities. The Market-Driven scenario would not be expected to adversely affect existing wetlands and other aquatic habitat on the disposal property. All of the plans developed by Collier and Hoover involve development of ponds, which are estimated to increase on-site surface water. The Collier-Hoover proposal includes about 90 acres of lakes, canals, and wetlands.

In the absence of a stormwater management system under the Market-Driven scenario, the reduction in groundwater inputs to the area east of the former base could decrease the area, duration, and frequency of inundation of wetlands in this area, although changes would be expected to be small. The concentrations of nutrients and toxic chemicals in the Boundary Canal system of former Homestead AFB could increase under the Market-Driven scenario. The increased flow would not be expected to have appreciable impacts on biota, but the higher nutrient loads could lead to more rapid growth of aquatic vegetation on the sides and bottoms of canals and ponds and increase the possibility of algal blooms in the canal system. The higher levels of toxic chemicals could potentially reduce the diversity and abundance of freshwater animals, but the magnitude of the impacts are not quantifiable.

Under the Collier-Hoover proposal, the concentrations of nutrients and toxic chemicals in Boundary Canal are expected to decline because of the proposed use of Integrated Pest Management protocols and controlled fertilizer applications. With this approach, no adverse impacts on biota in on-site canals are expected.

Caiman might be displaced if the canals on the disposal property were altered or eliminated. This might result in small numbers migrating off base to areas they currently occupy west of canal L-31E. They would not be expected to inhabit brackish areas east of the canal. The Collier-Hoover proposal, like the original Collier and Hoover plans, would increase on-site surface waters and/or wetlands that would likely be inhabited by caiman. These proposals have the potential to result in an increase in the caiman population on the disposal property.

Upland and Disturbed Communities. The Mixed Use alternative is estimated to result in up to 536 acres of disposal property being covered with impervious surface by 2015, which would be 67 acres more than at present. By full buildout, impervious surface could cover up to 661 acres on the disposal property. In the first 15 years of development, the amount of impervious surface under the Collier-Hoover proposal (as well as the original Hoover plan) would be less than current conditions because of plans to use pervious pavements. The areas affected by development would be predominantly disturbed biological community types. Between 223 and 1,115 acres could be disturbed by construction by 2015 (633 to 1,215 acres by full buildout), and disturbed acres not ultimately covered by impervious surface would likely be landscaped or vulnerable to invasion by exotic species. The amount of land disturbed under any of the Collier and Hoover proposals is expected to be greater than for the Market-Driven scenario because those proposals would involve removal of existing pavement in the apron areas.

None of the scenarios of the Mixed Use alternative includes specific plans for protecting the 16.7 acres of pine rocklands that could be harmed by development on the disposal property, although USFWS has requested that three of the remnant pine rocklands (15.9 acres) be preserved through a deed covenant. Given protection by a deed covenant, less than 1 acre of pine rocklands on the former base would likely be lost through development. The original Hoover plan specified preservation of all the remnant pine rocklands on the disposal property, and the Collier-Hoover proposal includes a general commitment to incorporate those areas into the landscaping plan and preserve them. About 17 acres of pine rocklands located near the southern and southeastern boundary of the former base would be within the area retained by the Air Force and are unlikely to be disturbed.

Cumulative Impacts

The potential cumulative impacts of the Mixed Use alternative in combination with other projects and developments in the ROI would be qualitatively the same as described for the Proposed Action and Commercial Spaceport alternative. The reuse of former base property would be expected to contribute less than 5 percent to the increase in development south of Eureka Drive by 2015 and about 3.9 percent to the increase in surface water flows to Biscayne Bay under the high-growth population forecasts for Miami-Dade County.

Mitigation Measures

The establishment of a buffer between former Homestead AFB and Biscayne NP would have the same effects under this alternative as described under the Proposed Action. Other mitigation measures described for the Proposed Action would also be appropriate for the Mixed Use alternative. In addition, protecting some or all of the remnant pine rockland habitats through deed covenant, as requested by USFWS, would mitigate the potential loss of those areas.

The implementation of a program to control or eradicate caiman on the former base would minimize the potential for off-site migration as habitat suitable for caiman is eliminated by development. Similarly, requirements to revegetate disturbed areas with native vegetation following demolition or construction would minimize the potential for invasion of denuded areas by exotic species. These mitigation measures would be difficult to implement under the Market-Driven scenario, however, because no single entity would have responsibility of site-wide development.

4.11.2.4 No Action Alternative

Under the No Action alternative, there would be no effect on estuarine and marine, wetland and freshwater, and upland and disturbed communities from development on the disposal property at former Homestead AFB. The small amount of ongoing and projected development on retained and previously conveyed property at the former base would result in a minor increase in ground disturbance and impervious surface. The Surface Water Management Master Plan developed for the Proposed Action would not be implemented.

The realization of Miami-Dade County's high-growth forecasts would have the effect of increasing surface water flow to Biscayne Bay by up to 10 percent by 2015. About 20,000 acres of land, most of it already disturbed, would likely be converted to residential, commercial, or industrial use by 2015. The L-31E Flowway Redistribution Project and STDA would still have the same impacts as discussed under the Proposed Action.

4.11.2.5 Independent Land Use Concepts

Development of any of the independent land use concepts would not be expected to have appreciably different effects from those described for the Proposed Action and other reuse alternatives. Any effects would primarily be related to increased impervious surface. Ground disturbance and increases in impervious surface would have similar direct and indirect effects as described for the Proposed Action and other reuse alternatives.

4.11.3 Threatened, Endangered, and Other Special-Status Species

This section describes potential impacts on threatened, endangered, and other special-status species from construction activities associated with the reuse alternatives and from subsequent operations, including aircraft noise. The noise impact discussion is not confined to special-status species but has been consolidated in this section.

4.11.3.1 Proposed Action

Construction

On-site construction associated with the Proposed Action has the potential to disturb an estimated 144 acres by 2005 and 710 acres by full buildout. A total of 51 sensitive species occur or have the potential to occur on the disposal property at former Homestead AFB, including 5 federally listed species and 46 state-listed or sensitive species. The remaining sensitive species listed in Tables 3.11-3, 3.11-4, and 3.11-6 occur in the area of former Homestead AFB but not on the former base itself. Secondary development could disturb another 2,000-3,000 acres, expected to be primarily north, west, and southwest of the former base. This could affect sensitive plants and animals in the area.

Plants. Sensitive plant species have been observed in twelve areas on disposal property at former Homestead AFB (see Figure 3.11-6). Of the twelve areas, the federally endangered Small's milkpea occurs in three areas (areas 1–3 on Figure 3.11-6). Eleven areas are remnant pine rocklands identified as the most significant ecological communities of the former base (**PBS&J 1998b**). The twelfth area is the former golf course and housing area, which is heavily overgrown with exotic plants and weeds, but contains a few isolated sensitive plants. This area, area 8 on Figure 3.11-6, will not be protected under the Proposed Action (**PBS&J 1998b**).

Four remnant pine rocklands (areas 1–4) were identified in the Wildlife/Habitat Management and Mitigation Plan for preservation under the Proposed Action. These areas contain not only the largest numbers of sensitive plant species, but all areas where Small's milkpea is known to occur. Implementation of the plan would maintain and/or enhance the integrity of these areas by, at a minimum, controlling exotic plants and restricting human access.

Areas 11 and 12 have already been designated as preservation areas and are included in the Miami-Dade County Future Land Use Plan as Environmental Protection Areas (**PBS&J 1998b**). Although not addressed in the Wildlife/Habitat Management and Mitigation Plan, no development is planned to occur in these areas, and human interference is not expected. Thus, these areas are likely to remain unchanged.

Areas 9 and 10 would not be affected by construction activities but may attract wildlife (**PBS&J 1998b**). The potential bird-aircraft strike hazard of these sites is likely low, and it is assumed there is a low probability they will be altered. If, however, it is determined that they would pose a significant bird-aircraft strike hazard, they would be filled and graded, eliminating these habitats.

The remaining sites would not be protected under the Proposed Action and would likely be eliminated. The three remnant pine rocklands that would be destroyed are collectively very small (0.6 acre) and located very near existing buildings.

In summary, the Proposed Action would result in the preservation and management of at least 16.1 acres (areas 1–4) of remnant pine rocklands with their associated federally listed and state sensitive species, the probable preservation of two sites of unknown acreage (areas 11 and 12), the possible but unlikely loss of 14.1 acres (areas 9 and 10), and the destruction of 0.6 acre (areas 5–7). Area 8, the former golf course and housing area, would be developed and landscaped, although some isolated sensitive plants might be retained as part of the landscaping.

USFWS has indicated that the transfer of lands containing federally protected plants to a non-federal agency could result in adverse effects to those species and recommended that the Air Force include a preservation covenant in the transfer document for the protection and preservation of listed plant species. The Air Force has agreed to this recommendation. USFWS has concurred that this permits the Air Force to avoid any adverse effects on threatened or endangered species.

Sensitive plant surveys have not been conducted on land that may be subject to secondary development. Much of the undeveloped land in south Miami-Dade County has been disturbed for agriculture or other purposes, and the occurrence of intact remnant pine rocklands is unlikely. A few small remnant pine rocklands might occur on vacant land and could be affected by secondary development.

Reptiles. The federally threatened eastern indigo snake and state threatened rim rock crowned snake have the potential to occur on disposal property. However, these species were not observed on former Homestead AFB during biological surveys beginning in 1992, including surveys for these species in 1998 (**Hilsenbeck 1993**, **Denton and Godley 1999**, **Mazzotti 1999b**). Given that the eastern indigo snake and

rim rock crowned snake have not been observed on former Homestead AFB and the marginal habitat for these snakes on the disposal property and surrounding areas, it is unlikely that on-site development would affect these species.

The American crocodile is not known to occur on former Homestead AFB (**Mazzotti 1999b**), so on-site construction activities would not directly affect this species. Changes in stormwater runoff from the former base would have little potential to alter the aquatic habitat used by this species, so such small changes probably would not affect the distribution or abundance of the crocodile.

Agricultural and vacant land outside the former base could be converted to residential, commercial, or industrial land by secondary development under the Proposed Action. These lands may provide habitat for the eastern indigo snake. Agricultural lands are considered marginal habitat for this species (**Steiner et al. 1983**), while vacant land may be better habitat. Reuse-related, secondary development has the potential to result in the elimination and fragmentation of eastern indigo snake habitat, especially on vacant land and agricultural land that is near vacant land or canals. Fragmentation of habitat can result in apparently suitable habitat becoming unusable by making the habitat blocks too small to support species that have a large home range and/or by reducing the population of prey species. For example, the indigo snake, with a home range on the order of a few hundred acres, might require up to 10,000 acres of contiguous unaltered habitat to support a viable population (**USFWS 1998a**). The continued fragmentation of large areas by development associated with population growth in south Florida will eventually result in the reduction and then possible elimination of the indigo snake from the area, even though small pockets of suitable habitat remain. The former base property is marginal snake habitat, so its development is unlikely to contribute to habitat loss. Secondary development could contribute to habitat reduction, although some of the existing habitat in the area, such as agricultural land, is already marginal for the indigo snake. Agricultural fields are not considered rim rock crowned snake habitat (**Moler 1992**), but secondary development on vacant lands could affect this species. Secondary development could result in mortality of some individuals of both snake species.

Birds. The disposal property and other areas on the former base provide marginal foraging habitat for the federally listed wood stork and bald eagle. This marginal habitat would be eliminated by construction, and there would be a large increase in human activity that could further reduce the attractiveness of the land to these two species. The effect of eliminating this habitat would be negligible given infrequent use of the former base by these species and the large amount of good habitat to the east.

The impacts of development on state-listed bird species and species of special concern are likely to be small. The Antillean nighthawk nests in a variety of habitats, including flat-roofed buildings (**Rodgers et al. 1996**), and it is anticipated that on-site construction would have little impact on this species. The American redstart and Cooper's hawk are rare migrants on the former base, and the redstart is also a rare winter resident. Proposed Action construction would reduce the amount of available habitat, but it would have a negligible impact on these species given that they currently use the area infrequently. The osprey would be expected to continue its occasional use of the lakes on the former base, including Mystic Lake. This use would probably decrease under the Proposed Action. This impact is considered negligible because good osprey habitat is common east of the former base.

Various species of state sensitive wading birds forage in the shallow wetlands along the runway on former Homestead AFB, but on-site construction would not be expected to affect these areas. It has been recommended that these wetlands be studied to determine whether they should be eliminated or altered to lower potential bird-aircraft strike hazard (**PBS&J 1998b**). Their removal is considered to be unlikely and is not incorporated into the Proposed Action. If they are removed, a Clean Water Act Section 404 permit would be required. The removal of these wetlands could eliminate some foraging habitat on the

former base which, in turn, would result in reduced wading bird use of the area. This would represent a loss of foraging habitat that has been used consistently over the years by a small number of wading birds.

Surveys in 1998 documented the existence of three family groups of Florida burrowing owls along the runway on the former base (**Denton and Godley 1999**). The increase in air traffic that would occur under the Proposed Action is not expected to affect the burrowing owl. However, construction projects along the runway could disturb nest sites. Measures such as avoiding nest sites during construction or relocating the nest sites could be taken to protect the burrowing owl. The Southeastern American kestrel was not observed during surveys in 1998 (**Denton and Godley 1999**), and this species is not expected to occur on former Homestead AFB. Breeding bird surveys for the mangrove cuckoo, black-whiskered vireo, Florida prairie warbler, and Cuban yellow warbler were conducted on the former base and none were recorded. Their occurrence in the future is unlikely because of the lack of appropriate habitat.

Agricultural and vacant lands that may be impacted by secondary development associated with the Proposed Action do not provide suitable habitat for the bald eagle. There are approximately 1,270 acres of freshwater bodies within the UDB, including 639 acres of canals and rivers and 629 acres of other surface water bodies such as lakes, ponds, and borrow pits that are potential foraging habitat for the wood stork and state sensitive wading bird species. Secondary development could eliminate a small portion of these aquatic habitats, and other areas, such as roadside ditches, may be rendered unusable because of the increase in human activity. Migratory and wintering species, such as the Cooper's hawk and American redstart, are expected to make only minimal use of agricultural fields, and loss of agricultural land would not affect these species. The Florida burrowing owl may occur in the agricultural and vacant land that would be disturbed by secondary development and could be affected by potential loss of nesting sites.

Mammals. No federally or state-listed mammals are known to occur or have the potential to occur on former Homestead AFB. Potential habitat modifications caused by altered stormwater runoff are not expected to affect the distribution or abundance of the manatees that use Biscayne Bay. No federal or state sensitive mammal species are known to occur on the agricultural or vacant lands that may be affected by secondary development associated with the Proposed Action north and west of the former base. There is evidence that a Florida panther used the area south of the former base in the late 1980s (**Ferro 1999a**), and there have been recent unconfirmed reports of a panther near Palm Drive (**Wasilewski 1999a**). This species may still occur in this area, and secondary development could, but is unlikely to, affect its habitat.

Noise From Aircraft Operations

This section discusses the impacts of modeled changes in aircraft noise levels projected for the Proposed Action on resident biota, primarily sensitive species. The discussion begins with a general description of the changes in noise exposures over south Florida projected to occur under the Proposed Action, followed by a review of the literature on noise effects on various species. The findings of the literature review are then used to assess the potential impacts associated with changes in noise exposures due to the Proposed Action. Few existing studies involved the same species that could be affected by the Proposed Action and alternatives, so the analogies drawn in this discussion contain an element of uncertainty. Judgements on impacts were based on the available literature addressing similar species and on observations during surveys conducted on and near the former base.

Projected Changes in Noise Levels. Near Homestead ARS, military aircraft generate relatively high levels of single-event noise, so even with the addition of commercial aircraft, LAmax is not projected to appreciably change in the immediate vicinity of the proposed airport. The largest changes in LAmax

would occur to the south, west, and northwest of the former base at distances more than 10 miles from the airport (see Figure 4.5-12) where LAmax levels would be lower. The highest LAmax levels would be caused by continuing military aircraft operations within a few miles of the airport in areas already experiencing high noise levels from military aircraft (see Figure 4.5-13).

The frequency of occurrence of noise events is estimated by the TAamb metric, which could increase substantially by maximum use of the single runway at HST in some areas under the proposed flight tracks near the airport. Southwest of the airport, increases of more than two hours could occur in some places. Increases between one and two hours are estimated within a few miles east and south of the runway and in a broad area west-northwest of the runway (see Figure 4.5-16). Increases of 30 minutes or less are estimated over the western part of Biscayne Bay, over a broad area of Crocodile Lake NWR, and in a wide band extending to the Gulf of Mexico directly west of the former base.

A number of supplemental noise points along the Biscayne Bay shoreline were analyzed for various noise metrics (see Figure 3.5-13). These points were selected to cover the diverse habitats (aquatic, mangrove, and freshwater wetlands) that occur along the shoreline and that would lie beneath one or more flight tracks proposed to be used under the Proposed Action.

Noise data for these points are presented in **Table 4.11-1**. They include the maximum SEL value for military and commercial aircraft, LAmax, TAamb, and Leq(h) (for definitions of these terms, see Section 3.5). As can be seen from the table, military aircraft would have the highest noise levels at all the points, with commercial aircraft generating an average of 15 dB lower ground-level noise. Thus, the biota along the western shoreline of Biscayne Bay would not be exposed to any louder noise events than they are exposed to now, but, as indicated by TAamb, the frequency of noise events would increase. Noise levels are projected to be above traditional ambient levels more than two hours a day at three of the locations and more than one hour per day at the other two points analyzed. Leq(h) is projected to increase by less than 3.5 dB at three of the sites, by between 0.5 and 0.9 dB at five sites, and by 0.4 dB at two sites.

In general, peak noise levels (SEL, LAmax) are expected to be highest near the runway, but maximum noise levels over 80 dB have been predicted to occur over points as far south as the southern end of Biscayne Bay (SX10). These noise levels are also expected to occur fairly infrequently, generally less than once per day. On the other hand, noise levels approaching these values could be generated several times a day at all locations, with the highest frequencies of occurrence at locations nearest the airfield.

TAamb was modeled for only five of the ten points, but substantial increases in TAamb would be expected at all locations, because a large number of the proposed flight tracks that could be used by commercial aircraft would be directly over these sites. Locations like SX10, where a large number of flight tracks converge prior to arrival or prior to dispersal after departure, show a higher increase in TAamb than locations nearer the airport. TAamb values at all SX locations would be dominated by the changes that would occur with the addition of commercial traffic. Of the five points modeled, TAamb was calculated to increase by over 50 minutes at all of the supplemental points.

Existing Studies of Noise Effects on Wildlife. Studies and incidental observations have been made of the response of animals to noise and aircraft. Most studies focused on responses to exposures to loud noise events and the frequency of those events. In general, the long-term effects of aircraft overflights on wildlife are unclear. Reported animal responses vary greatly among species, as well as within species at different stages of their lives, and the ability of species to adapt to overflights also varies (**NPS 1995**). Many reported responses by wildlife to aircraft overflights appear to be temporary and do not affect

Table 4.11-1. Predicted Noise Exposures at Supplemental Locations Along the Biscayne Bay Shoreline (2015)

Location[1]	Military Aircraft			Commercial Aircraft			LAmax (dB)	TAamb (minutes)[4]		Leq(h) (dB)	
	Aircraft	Altitude[2] (feet)	Max SEL[3] (dB)	Aircraft	Altitude[2] (feet)	Max SEL[3] (dB)		Proposed Action	Change from Projected Baseline	Proposed Action	Change from Projected Baseline
SX1	F-16	2,797	106.8	MD83	3,119	87.4	100.3	88	60	60.6	1.9
SX2	F-16	3,137	105.4	MD83	2,694	89.0	93.2	130	89	65.7	0.5
SX3	F-15	1,229	92.5	P3A	1,064	90.0	98.4	74	50	52.8	0.8
SX4	F-16	3,148	104.9	P3A	3,294	80.1	87.9	NA	NA	56.7	0.4
SX5	F-16	2,396	108.4	MD83	2,655	90.4	102.8	NA	NA	63.2	0.8
SX6	F-16	4,000	102.6	S65	1,073	89.9	85.2	120	77	56.9	0.4
SX7	F-16	2,687	106.8	MD83	2,083	90.7	101.3	NA	NA	67.2	0.5
SX8	F-15	1,123	93.4	MD83	3,083	87.4	100.1	NA	NA	52.7	0.7
SX9	F-16	2,987	105.3	MD83	4,798	82.3	88.3	NA	NA	55.5	0.0
SX10	F-16	4,000	100.4	S65	1,091	88.3	83.9	149	105	58.1	0.6

Source: **Landrum & Brown 1999b.**

Notes:
1 See Figure 3.5-13.
2 Slant distances not presented because most aircraft would be directly overhead.
3 For days with at least one overflight. Differs from Peak Daily SELs in Landrum & Brown 1999b, which average lower in locations that would have less than one overflight per day.
4 Increases over both baseline and traditional ambient levels.

dB decibels
LAmax Maximum Sound Level
Leq(h) Peak Hour Equivalent Sound Level
NA Not available
SEL Sound Exposure Level
TAamb Time Above ambient

animal populations or long-term habitat use. The potential consequences from noise are thought to be greatest on breeding animals, although impacts also occur during the non-breeding season at some waterfowl concentration areas (**NPS 1995**, **Bélanger and Bédard 1989**, **Ward et al. 1999**).

Physiological and/or behavioral animal responses to noise have been reported in the literature (**Knight and Gutzwiller 1995**, **Manci et al. 1988**). Physiological effects include temporary or permanent hearing threshold shifts, masking of auditory signals, increased respiration and heart rate, and increased corticosteroid levels. Reported hearing threshold shifts were related to noise sources that were of much greater duration and intensity than would occur from aircraft overflights. Behavioral responses may include animals becoming alert and turning toward the sound source, running from the sound source, changing activity patterns (e.g., stop feeding), abandoning nests, or changing habitat use. If changes are sufficiently severe, the health and survival of an individual animal could be reduced. If a large number of animals were affected, then population declines could result.

The following sections summarize information on noise effects available in the literature for several groups of species and describe anticipated noise exposure changes associated with the Proposed Action. As each section indicates, the information is limited, and in many instances data are not available on the specific species that occur in the ROI. In those cases, available information on similar species is reported. The focus of the analysis is on species that reside outside the former base itself because sensitive species that use the former base, such as wading birds, have apparently acclimated to existing aircraft noise, and the Proposed Action would not result in an increase in maximum noise levels in the vicinity of the airfield.

The main area potentially affected by aircraft noise and overflights would be between the former base and the western shoreline of Biscayne NP. Other areas that contain sensitive wildlife species, including Everglades NP, the Everglades Water Conservation Areas outside the park, Crocodile Lake NWR, and Big Cypress National Preserve, were also examined.

Invertebrates. The Schaus swallowtail butterfly is the only sensitive invertebrate species that occurs in the Homestead area. Little information is available regarding possible noise impacts on invertebrates. The main population of this species occurs on Elliott Key and two nearby keys. An analysis of noise grid points covering these keys shows there would be a slight increase in maximum noise levels. The time noise levels would be above ambient levels would increase from an estimated 3.4 minutes per day under current conditions to 7.3 minutes under the Proposed Action. These slight increases in noise levels would not be expected to affect the Schaus swallowtail butterfly.

Reptiles. Limited information is available on the effects of short-duration noise events on reptiles. Dufour (**1980**) and Manci et al. (**1988**) summarized a few studies of reptile responses to noise. Some reptile species tested under laboratory conditions experienced at least temporary threshold shifts or hearing loss after exposure to 95 dB for several minutes. Crocodilians in general have the most highly developed hearing of all reptiles. Crocodile ears have lids that can be closed when the animal goes under water. These lids can reduce the noise intensity by 10 to 12 dB (**Wever and Vernon 1957**). No information was found on the American crocodile's response to noise. The American crocodile is repopulating the western shoreline of Biscayne Bay, and two related crocodilians (American alligator and spectacled caiman) now reside on former Homestead AFB.

The American crocodile occurs along the western shoreline of Biscayne Bay between Turkey Point and Matheson Hammock County Park, at Crocodile Lake NWR on Key Largo, and in the Little Madeira/Joe Bay areas in Florida Bay in Everglades NP. Maximum noise levels from military jets along the western shoreline of Biscayne Bay currently reach 95 to 103 dB from Black Point to south of Military Canal.

Maximum estimated noise levels at these points from commercial aircraft would be 76 to 91 dB, so the Proposed Action would not result in increased maximum noise levels in American crocodile habitat along the western shoreline of Biscayne Bay.

The average traditional ambient noise level at 11 points along the western shoreline of Biscayne Bay is estimated to be 49 dB, and noise levels are currently above ambient levels for an average of about 32 minutes per day. The time above traditional ambient would increase by an average of about 92 minutes under the Proposed Action at maximum use of one runway. This increase in time above traditional ambient would be greatest in the Finder Point and Military Canal area (102 to 154 minutes per day) and at Mangrove Point at the south end of the western shoreline of Biscayne Bay (144 minutes per day). The maximum noise levels at Mangrove Point (84 dB) would be less than in the Military Canal area.

An analysis of 53 noise grid locations at Crocodile Lake NWR indicates that there would be no increase in LAmax at any location as a result of the Proposed Action, and that the average LAmax would be 72.6 dB. The average traditional ambient noise level for 29 of these locations is 41 dB, and noise levels are above traditional ambient levels for an average of 6 minutes per day under current conditions. Under the Proposed Action at maximum use, the time above traditional ambient is estimated to increase by 27 minutes, with the greatest increase (approximately 40 to 60 minutes) in the northern half of Crocodile Lake NWR.

A total of 24 grid points were analyzed in eastern Florida Bay, including the American crocodile habitat. LAmax was estimated to increase by an average of 3.6 dB at 10 points to a maximum of 61.4 dB. The traditional ambient noise levels for 23 points in eastern Florida Bay is 46 dB, and the time above traditional ambient noise levels under current conditions averages 0.7 minutes per day. The time above traditional ambient would increase to 2.2 minutes per day under the Proposed Action with maximum use of one runway.

These results indicate that maximum noise levels would not substantially increase at these three locations. The highest noise levels are currently and would continue to be along the western shoreline of Biscayne Bay. Similarly, time above traditional ambient is currently highest in that area, which would also experience the largest increase under the Proposed Action. The next largest increase would occur at Crocodile Lake NWR, followed by Florida Bay. The western shoreline of Biscayne Bay is currently the noisiest part of the American crocodile range in southeastern Florida and would likely remain so under the Proposed Action.

The effects of noise on crocodilians is poorly understood. Circumstantial evidence from Homestead AFB and from along the western shoreline of Biscayne Bay indicated that the crocodilians inhabiting this area would probably be able to coexist with the increased noise that would result from the Proposed Action. Two crocodilians (the American alligator and spectacled caiman) currently reside in the wetlands and canals along the base runway. Further, these species have resided at the base for decades. The caiman first arrived in the mid-1970s (**Ellis 1980**) and an eradication program in the early 1980s resulted in the removal of 20 to 30 individuals from the base (**Mazzotti 1999c**). This indicates that these two crocodilians coexist with the current noise levels and resided on the base when it was under full operation in a much noisier environment.

The American crocodile established a breeding population at the Turkey Point Nuclear Power Plant cooling water canals shortly after they were constructed in the mid-1970s (**Brandt et al. 1995**). The population increased through the 1980s when Homestead AFB was in full operation. The DNL 85 dB noise contour was very close to this population during that period. Thus, the crocodile expanded its range

along the western shoreline of Biscayne Bay under past and current noise levels generated by aircraft from Homestead AFB. If it is as unaffected by aircraft noise as the American alligator and spectacled caiman appear to be, noise from the Proposed Action would likely not have a detrimental effect on this population. The same would hold true for the American crocodile populations at Crocodile Lake NWR and Florida Bay, where potential noise levels from the Proposed Action would be much less than along the western shoreline of Biscayne Bay.

Birds. Birds comprise the majority of special-status wildlife species that have the potential to be affected by aircraft noise from the Proposed Action. Most of these species can be found in the aquatic environments on the former base and between the former base and Biscayne Bay. There are limited data on the specific species that occur in south Florida, and information about similar species, particularly water birds, is used to assess potential impacts.

The available information on effects of aircraft noise on wading birds and other aquatic birds is based primarily on studies involving military jets, helicopters, and small fixed-wing propeller aircraft. The noise from military jets is generally louder than from commercial aircraft, but the frequency of military flights in some studies was less than the projected number of flights at Homestead ARS. Louder, less frequent (or less regular) noise events are considered more likely to elicit behavioral responses in animals than regular, less loud events. The results of noise studies involving other aquatic birds such as waterfowl are also discussed. Although wading birds and other aquatic birds may respond differently to noise than waterfowl, it is believed that the findings of waterfowl studies may apply to other groups of aquatic birds, particularly because waterfowl may be more responsive to noise and aircraft than other birds (**Knight and Gutzwiller 1995**).

The effects of aircraft activity on wading bird rookeries have been assessed for military aircraft and single-engine airplanes and helicopters (**Black et al. 1984**, **Kushlan 1979**). Based on indirect evidence, Black et al. (**1984**) found that low-flying military aircraft (at altitudes of 500 feet or less) had no affect on wading bird colony establishment or size in Florida. Colonies were found to be distributed randomly with respect to military routes and were more related to wetland types. These results indicated that wading birds were using wetland habitat for colonies as it became available, and this choice was not affected by low-level military overflights.

A detailed study to determine the effects of military overflights on nesting wading birds such as the great egret, snowy egret, tricolored heron, and little blue heron was conducted in central Florida (**Black et al. 1984**). The study examined a rookery subjected to overflights and a control site. Military jets flew over the colony at about 500 feet above the ground, and sound levels ranged from 55 to 100 dBA. The flight frequency was one to two flights per day, and each flight consisted of two to four aircraft. The behavior of breeding wading birds in the study colony included no response (48 percent of the time), looking up (34 percent of the time), or changing position (18 percent of the time). In the control rookery, birds looked up 1 percent of the time and changed position 3 percent of the time. While responses were significantly higher in the colony overflown, it was believed that the responses were not severe. More severe behavior, such as walking around on the nest or flushing, was not observed. Birds began looking up as noise levels reached 60 to 65 dBA and changed position at the 70 to 75 dBA range. Birds exhibited all three responses at the 75 to 100 dBA range. Birds typically resumed their pre-overflight behavior 1 to 2 minutes after the overflight, and there was no evidence of an increase in aggressive encounters after the overflight. Further, there was no evidence of the birds habituating to the overflights. Reproductive activity, such as nest success, nesting survival and mortality, and nesting chronology were not affected by the military jet overflights. It was noted that wading birds showed much more extreme behavior, such as flushing and panic, if humans entered the colony or if airboats went through or near the colony. The

responses observed in this study were similar to the responses of nesting great egrets and black-crowned under similar noise levels (61 to 110 dBA).

In a study designed to assess the impacts of wading bird colony census flights, the reaction of 220 wading birds to fixed-wing, single-engine airplane and helicopter overflights were measured (**Kushlan 1979**). The overflights consisted of the airplane and helicopter circling colonies at 120 and 60 meters above the ground. Seventy-one percent of the birds showed no reaction, 19 percent looked up, 6 percent stood up, 3 percent walked from the nest, and 2 percent flushed and returned within 5 minutes. The birds that flew were without active nests. It was concluded that the disturbances from the aircraft were minor and of short duration.

Studies regarding the effects of aircraft flights and noise on diurnal and nocturnal roost sites are limited. As indicated above, non-nesting wading birds at a rookery had a slightly higher chance of reacting to overflights than nesting birds (**Kushlan 1979**), and gulls roosting near a colony remained at the roost when subsonic aircraft flew overhead (**Burger 1981**). As indicated in Appendix G and shown on Figure G-15, there is a wading bird nocturnal roost site on the former base about 1,000 feet from the runway in an area where maximum noise levels commonly exceed 110 dB. This roost site was occupied in 1998 and 1999 (**Denton and Godley 1999**, **Peterla 1999c**) by 50 to 70 birds, mostly white ibis and cattle egrets, as well as a few other unidentified herons and egret species. Currently, most air operations at the former base take place during daylight hours, although some occur at dusk and shortly after when wading birds would be arriving at their roost sites. This indicates that, under current conditions, wading birds successfully roost near the runway and most likely at other roosts between the former base and Biscayne Bay. Under the Proposed Action, 6 to 10 percent of the commercial flights could occur at night, and it is not known if this increase in the number of night flights would affect this roost.

Burger (**1986**) studied the response of migrating shorebirds to human disturbance and found that shorebirds did not fly in response to aircraft overflights, but did flush in response to humans and their dogs on the beach. Burger (**1981**) studied the effects of noise from JFK airport in New York on herring gulls (*Larus argentatus*) that nested less than 1 kilometer from the airport. Noise levels over the nesting colony were 85 to 100 dBA on approach and 94 to 105 dBA on takeoff. No effects of subsonic aircraft on nesting were noted, although some birds flushed when supersonic aircraft flew overhead and, when they returned, they engaged in aggressive behavior. Groups of gulls tended to loaf in the area of the nesting colony, and these birds remained at the roost when subsonic aircraft flew overhead. Up to 208 of the loafing gulls flew when supersonic aircraft flew overhead. These birds would circle around and immediately land in the loafing flock.

The effects of military aircraft on wintering waterfowl were studied near Piney Island, North Carolina. The behavior of wintering ducks in relation to low-altitude (about 152 meters) flights was assessed, and sound levels were measured (**Conomy et al. 1998a**). Fifty-five hours of sound data were collected in 1991 and 1992, and noise levels equaled or exceeded 80 dBA was 1 to 44 times per hour. Sound levels averaged 85.1 dBA and ranged from 80 to 109 dBA. The 24 hour equivalent sound level averaged 63.2 dB. There was no relationship between the number of disturbance events and the response of four species of wintering waterfowl. Of the 672 observations, waterfowl spent 1.4 percent of their time or less responding to aircraft by flying, swimming, or alert behavior. These behavioral responses lasted only an average of 10 to 40 seconds for the four species. The number of behavioral reactions to aircraft disturbance was not related to the number (up to 44 flights per hour) and duration of sound levels equal to or greater than 80 dBA. The low reaction rate of wintering waterfowl to aircraft flights and noise indicates that these species can tolerate some level of noise on their wintering grounds and that they may have habituated to aircraft noise.

Habituation to aircraft noise of one of the species in this study, black duck (*Anus rubripes*), has been demonstrated (**Conomy et al. 1998b**). Previously unexposed ducks were exposed to 71 noise events per day that equaled or exceeded 80 dBA for a 24 hour equivalent sound level that averaged 63.2 dB. It was determined that the proportion of time black ducks reacted to aircraft activity and noise decreased from 38 percent to 6 percent in 17 days and remained stable at 5.8 percent thereafter. In the same study, the wood duck did not appear to habituate to aircraft disturbance. This suggests a species-specific reaction to aircraft disturbance.

Species-specific responses were observed for the Pacific brant (*Branta bernicla nigricans*) and Canada geese (*B. canadensis*) (**Ward et al. 1999**). Overall, brant flocks flushed 75 percent of the time and Canada geese 9 percent of the time in response to aircraft overflights. It was observed that the noise, rather than the sight, of the aircraft may have been more important because brant reacted more to high-noise aircraft (greater than 76 dBA). While there was some indication that brant may habituate to aircraft noise, the results were inconclusive. The study area, in southwestern Alaska, was subject to infrequent disturbance, and the geese may not have acclimated to the aircraft noise because it was sporadic and unpredictable.

Greater snow geese (*Chen caerulescens atlantica*) are apparently slow to habituate to human disturbance. In one study (**Bélanger and Bédard 1989**), low-level aircraft flights were the most common disturbance and generally resulted in the longest flights by the geese (66 to 110 seconds) and the longest time to resume feeding (8 to 22 minutes). It was recommended that low-level aircraft flights at altitudes below 500 meters be prohibited in snow goose staging areas.

The effects of aircraft activity on wading and other special-status bird species on and near former Homestead AFB have not been studied. There are also no historic data regarding aquatic bird use on and near the former base when it was in full operation. The wading birds and other special-status species on the former base and between the former base and Biscayne Bay forage under current noise levels from military aircraft operations. Noise produced by military aircraft is generally louder than commercial jets, so the maximum sound levels that occur under current conditions would generally not be exceeded under the Proposed Action in most places on and around the bay.

There would, however, be an increase in the frequency of aircraft operations over Biscayne National Park. The proposed departure flight paths under east flow include routes headed east, southeast, and northeast over Biscayne NP. The number of departing aircraft flying directly east over the park is projected to increase from about 4 per day in 2005 to about 50 per day at full buildout. The number of operations headed southeast over Biscayne Bay is estimated to increase from less than 3 per day in 2005 to 26 per day under maximum use. There would be an estimated increase of between 11 and 23 operations per day at maximum use along the flight path headed northeast over the bay. It is estimated that the east flow departures from former Homestead AFB would be at an altitude of approximately 1,500 to 5,000 feet as they entered the airspace over Biscayne NP and would exit the airspace at much higher altitudes.

Aircraft operations could affect sensitive species between the former base and the western shoreline of Biscayne Bay, particularly in areas where aircraft would be below an altitude of 2,000 feet. However, many of the bird species, including special-status species, that occur in this area may have acclimated to noise from aircraft, as evidenced by their present use of the area. Studies of wintering waterfowl in North Carolina support this conclusion (**Conomy et al. 1998a**). Waterfowl in the Conomy study were exposed to a maximum of 44 low-level flights per hour, yet they spent very little time responding to these flights. Wildlife are more likely to habituate to noise if it is produced on a regular and consistent basis rather than at irregular intervals (**NPS 1995**, **Dufour 1980**, **Ward et al. 1999**).

Wildlife in Biscayne NP currently live in an environment that contains regular aircraft traffic and, in some areas, high levels of human activity, especially on weekends. However, the western shoreline of Biscayne NP is a "Protected Natural Area Subzone" and human use is concentrated at Convoy Point and at the mouths of canals (**NPS 1983**). The remainder of the shoreline is used occasionally by visitors in shallow draft boats such as canoes. Many of the sensitive species at Biscayne NP occur along this shoreline, and while daily aircraft flights from Homestead ARS fly over this area, there is much less human recreational activity than in other sections of the park. Given the current levels of human activity even in the Protected Natural Area Subzone, it is believed that the reaction of special-status bird species to noise on and near the former base would be consistent with results of studies in other areas with high levels of human activity (**Conomy et al. 1998a**; **Burger 1981**, **1986**) rather than in areas where human activity is limited (**Ward et al. 1999**, **Bélanger and Bédard 1989**).

The wading bird rookeries and bald eagle nest sites nearest the former base are about 8 miles southeast, and the nearest osprey nests are about 10 miles east. The maximum noise levels at the bald eagle nest site and wading bird rookery would be about 84 dB and at the osprey nests, 66–77 dB. These are current LAmax levels that would not increase as a result of the Proposed Action. There would be an increase in flights over these locations, but commercial aircraft would be at altitudes of 3,000 to 5,000 feet. These altitudes are higher than have been recommended to minimize noise effects of fixed-wing aircraft on staging snow geese (500 meters, or 1,640 feet) or to have greatly-reduced effects on flocks of brant and Canada geese (600 to 915 meters, or 1,968 to 3,001 feet) not habituated to this disturbance (**Ward et al. 1999**, **Bélanger and Bédard 1989**). Therefore, aircraft operations associated with the Proposed Action would apparently not be expected to adversely affect nesting sites of special-status species.

Wading bird rookeries and bald eagles' nests occur in eastern Florida Bay. There would be a slight increase in maximum noise levels and an increase in time above traditional ambient of 2.2 minutes per day at maximum use of the Proposed Action. These small increases in noise levels in Florida Bay are not expected to affect nesting wading birds or bald eagles in this area.

The current breeding distribution of the Cape Sable seaside sparrow includes three populations. The eastern population is closest at about 12 miles west of former Homestead AFB, along the eastern boundary of Everglades NP and Southern Glades Wildlife and Environmental Area next to the park.

As indicated in Section 3.8.2, Regional Air Quality, the wind is predominantly out of the northwest from December through February, which is when the airport would most commonly operate in west flow. The Cape Sable seaside sparrow nesting season extends from March into August with the peak from mid-April through May. During the Cape Sable seaside sparrow breeding season, the wind is predominantly from the southeast, indicating that most air traffic would operate in east flow. Occasional west flow air traffic would be expected during the breeding season, and the west flow air traffic would fly over the southern portion of the eastern Cape Sable seaside sparrow population, including areas in the Southern Glades Wildlife and Environmental Area.

In general, departing aircraft produce more noise than arriving aircraft. However, the resulting noise level at the ground also depends on altitude. The noise levels from departing west flow aircraft would be relatively low over Cape Sable seaside sparrow habitat because the aircraft would be at altitudes between 7,500 and 17,000 feet. In general, east flow inbound traffic would be about 4,000 feet above Everglades NP at its eastern boundary. Therefore, given the relatively infrequent number of west flow departures during the Cape Sable seaside sparrow breeding season and the altitude of west flow departing aircraft, it is believed that west flow departing aircraft would not result in appreciably greater noise levels over the Cape Sable seaside sparrow habitat than the east flow arriving aircraft. The noise modeling

performed for this SEIS incorporated both the east flow and the west flow operations projected for the Proposed Action.

It is expected that the increases in LAmax in those areas would not result in the Cape Sable seaside sparrow abandoning its habitat or in other overt behavior. However, there is a concern that some of the noise levels generated from the Proposed Action could inhibit birds in these population from receiving sounds from their environment that are important for their survival (masking) such as, for example, territorial vocal displays. In addition, it is possible that increased noise could inhibit Cape Sable seaside sparrow researchers from hearing bird calls during breeding bird surveys and these surveys are an important part of the monitoring program for this species.

There is little information regarding the effects of masking on bird populations including inhibiting territorial males from hearing each other. Studies have shown that birds are less sensitive than humans to sounds in the higher and lower ranges, but in the intermediate range their sensitivity is equal to humans and mammals in general (**Farner et al. 1973**). The discrimination of sound frequencies within the range for birds seems to be about equal to humans (**Sturkie 1965**). This being the case, it may be assumed that the noise levels that begin to inhibit human communications may be the same levels that began to inhibit bird communication. As indicated in Section 3.5.1.1, disruption of communication between people standing three feet apart begins at about 65 dB. Birds, as well as researchers conducting breeding bird surveys, usually need to be able to communicate over larger distances. Therefore, in this analysis, it is assumed that 60 dB is a reasonable threshold for masking to begin, and the analysis focuses on areas where LAmax is projected to increase from below to above 60 dB.

Table 4.11-2 presents various noise metrics in grids overlapping Cape Sable seaside sparrow populations. Within the western population of the Cape Sable seaside sparrow, where data are available, LAmax and TAamb are calculated to increase in 50 and 92 percent of the grid cells, respectively, under the Proposed Action, and there is an average estimated increase of 64 flights per day at maximum use. The average increase in LAmax for all grid cells in the western population is estimated to be 4.7 dB. LAmax would be over 60 dB in six grid cells. Of those, five would experience no change from current LAmax levels. The only cell projected to experience an increase in LAmax and also be over 60 dB is A196. This area is already exposed to LAmax 71.3 dB under current conditions, and the Proposed Action would increase this by 1.8 dB, to 73.1 dB. TAamb was calculated to increase by an average of 10.8 minutes per day for 12 of 18 cells where data are available. This increase is estimated to range from none to 37.3 minutes per day. The maximum total TAamb under the Proposed Action is estimated to be 38 minutes in grid cell A196.

LAmax is projected to increase at one (A193) of eight cells in the Ingraham Population (40.5 to 41.7 dB). Three of the eight cells are estimated to have LAmax levels over 60 dB, but they would have no change from current LAmax levels. TAamb is projected to increase between zero and 2.2 minutes per day under the Proposed Action at maximum use. Therefore, it is assumed that the Proposed Action at maximum use would not have masking effects on the Cape Sable seaside sparrow and would not appreciably inhibit monitoring surveys in the western and Ingraham populations.

At maximum use of the Proposed Action, LAmax in the eastern population at Everglades NP may increase from below to above 60 dB in seven grid cells and at a Cape Sable seaside sparrow study plot. The average level in those cells is projected to be 62 dB, and no case exceeds 63 dB. LAmax is already above 60 dB in 19 cells, where it could increase up to 2.5 dB. TAamb at 25 grid cells is projected to increase by an average of 77.8 minutes per day from the current average of 31.2 minutes per day. The increases range from 4.2 to 193.0 minutes per day, resulting in total TAamb of between 4.5 and 225.1 minutes per day. These noise levels may result in masking effects on the Cape Sable seaside

Table 4.11-2. Projected Noise Levels at Grid Cells Overlapping Cape Sable Seaside Sparrow Populations for Proposed Action at Maximum Use

Grid Point[1]	Traditional Ambient Level (dB)	LAmax (dB)		TAamb (min)	
		Increase	Total	Increase	Total
Western Population					
A129	45	6.3	58.1	1.6	1.6
A130	45	21.5	58.5	14.6	14.6
A150	42	0.0	75.6	15.3	15.7
A151	45	0.0	76.0	23.5	24.0
A152	45	8.2	58.0	0.0	0.0
A153	NA	22.4	58.4	NA	NA
A173	45	0.0	73.3	24.1	24.5
A174	45	0.0	77.0	4.6	4.9
A175	NA	0.0	47.8	NA	NA
A176	NA	6.4	41.5	NA	NA
A196	40	1.8	73.1	37.3	38.0
A197	39	0.0	70.4	4.4	4.8
A198	NA	0.0	45.9	NA	NA
A199	NA	7.6	44.2	NA	NA
A200	NA	0.0	48.8	NA	NA
A221	40	3.9	48.2	0.7	0.7
A222	31	6.3	47.7	2.0	7.4
A223	41	0.0	53.4	1.0	4.7
Ingraham Population					
A192	47	0.0	52.1	0.0	0.0
A193	45	1.2	41.7	0.0	0.0
A215	45	0.0	64.3	0.0	0.5
A216	42	0.0	48.8	0.1	0.1
A217	40	0.0	49.9	0.6	0.7
A238	45	0.0	66.0	0.1	2.9
A239	40	0.0	61.4	0.7	1.9
A240	40	0.0	52.3	2.2	2.5
Eastern Population					
B7	40	0.0	51.7	4.2	4.5
B8	47	8.3	62.0	18.9	19.2
B9	40	8.7	62.5	40.3	41.0
B10	40	2.1	75.6	15.7	17.6
B26	40	0.7	52.9	10.5	10.8
B27	47	8.2	62.3	23.7	23.9
B28	31	7.0	61.8	109.3	122.5
B29	31	2.2	76.3	78.1	114.1
B30	31	2.1	76.1	47.7	86.9
B46	47	7.1	62.2	121.6	126.3

Grid Point[1]	Traditional Ambient Level (dB)	LAmax (dB)		TAamb (min)	
		Increase	Total	Increase	Total
B47	31	5.0	62.3	141.9	194.2
B48	31	2.1	76.6	97.6	161.0
B49	31	0.0	78.4	70.6	133.9
B50	31	8.4	62.8	76.2	135.0
B62	31	0.0	75.0	34.2	54.1
B63	31	0.0	77.6	75.3	101.6
B64	31	0.0	68.8	166.3	191.5
B65	31	0.0	72.8	193.0	225.1
B66	31	0.0	67.3	126.0	181.7
B67	31	2.5	76.8	95.4	166.2
B68	31	0.0	79.6	92.7	167.9
B69	31	2.1	63.3	112.0	207.6
B81	31	0.0	64.9	11.5	22.5
B82	31	0.0	80.9	NA	NA
B83	31	0.0	82.6	NA	NA
B84	31	0.0	72.1	NA	NA
B100	31	0.0	60.5	144.0	175.0
B101	NA	0.0	69.7	NA	NA
B102	NA	0.0	86.9	NA	NA
B119	45	0.0	74.2	39.5	43.2

Source: **Landrum & Brown 1999b**.
Notes: [1] See Figures 3.5-9 and 3.5-10 and Appendix E.
[2] Grids outside Everglades NP and over SFWMD lands.
NA Not available

sparrow and minor disruptions in breeding bird surveys. Thirteen grid cells are projected to have both LAmax levels above 60 dB and TAamb of more than two hours. Of those, nine are already exposed to LAmax levels above 60 dB. The remaining four cells (B28, B46, B47, and B50) are the areas where the Proposed Action is anticipated to have the greatest effects. TAamb is also projected to increase to more than two hours at B64, B65, B66, B67, B68, and B100, but LAmax at those locations would not change. TAamb at B69 is projected to increase to 207.6 minutes, and LAmax to increase from 61.2 to 63.3 dB. Potential masking effects in the other cells where LAmax would exceed 60 dB would be less because of lower TAamb values.

Eight noise grid points overlap the Southern Glades Wildlife and Environmental Area Cape Sable seaside sparrow population (points B81, B82, B83, B84, B100, B101, B102, and B119). None show an increase in LAmax as a result of the Proposed Action at maximum use. TAamb is available for only three of these points, where it is projected to increase by 11.5 (grid point B81), 39.5 (B119), and 144.0 (B100) minutes per day under the Proposed Action at maximum use. While the increase in TAamb is substantial at B100, this increase would probably not result in masking effects because the maximum noise levels at this point would be 60.5 dB.

In summary, individuals conducting breeding bird surveys may not be able to hear all the birds calling while aircraft are overhead. The projected increase in the average number of flights has the potential to

disrupt breeding bird census work. The largest number of flights would likely occur in grid cells with the highest change in TAamb. Therefore, there is the potential for the Proposed Action at maximum use to result in slight masking effects on the Cape Sable seaside sparrow and slight disruption of breeding bird surveys in certain locations, especially in the three grid cells where LAmax is currently below 60 dB, is projected to increase to 60 dB or more, and TAamb would be two hours or more.

Mammals. In a summary of the effects of noise on marine mammals (**NPS 1995**), it was determined that species such as the gray whale and harbor porpoise showed no obvious behavioral response to aircraft noise or overflights. Bottlenose dolphins showed no obvious reaction in a study involving helicopter overflights at 1,200 to 1,800 feet above the water. Nor did they show any reaction to survey aircraft unless the shadow of the aircraft passed over them, at which point they may dive (**Richardson et al. 1995**). Human-made noises in the marine environment from ships, pleasure craft, and other sources may have more of an effect on marine mammals than aircraft noise. It is believed that increased overflights by commercial aircraft would have little impact on the bottlenose dolphin population in Biscayne Bay.

Little is known about the importance of acoustic communication for manatees, although they are known to produce at least ten different types of sounds and are thought to have sensitive hearing. There is also little information regarding the effects of aircraft and aircraft noise on manatees (**Richardson et al. 1995**). The continued occupation of canals near Miami International Airport suggests that manatees in urban areas have become habituated to human disturbance and noise.

The area of Biscayne Bay that would be affected by the Proposed Action is non-urban, so an increase in the number of flights could result in disturbance of the manatee. However, several factors may indicate that this would not result in an adverse impact. First, the manatee that occur along the western shoreline of Biscayne Bay between Black Point and Turkey Point are currently exposed to jet aircraft flights and noise and, although the number of flights associated with the Proposed Action would increase substantially, the maximum noise levels would not. Second, commercial aircraft are projected to be 2,000 to 5,000 feet above sea level as they enter the airspace over Biscayne Bay. This is likely much higher than aircraft used to census manatees. In addition, some manatee surveys take place from helicopters, which have been shown in some cases to have a greater negative effect on wildlife than fixed-wing aircraft (**NPS 1995, Ward et al. 1999, Gladwin et al. 1988, Grubb and Bowerman 1997**). Third, it is expected that the manatee would habituate to the increased air traffic. This species is known to become tame after being exposed to boat traffic and tourists over a period of time (**Richardson et al. 1995**). In addition, the manatee regularly travels up the Miami River to areas near Miami International Airport, including such areas as Blue Lagoon Lake and canals on the airport property (**Metro-Dade County 1995b**). Apparently these animals have become habituated to noise from that airport as well as various other human noise sources. This information indicates that the manatee may have a minor short-term reaction to increased air traffic as a result of the Proposed Action but should habituate to this activity over time.

Studies of terrestrial mammals have shown that noise levels of 120 dBA can damage mammals' ears, and levels at 95 dBA can cause temporary loss of hearing acuity (**Dufour 1980**). No studies of the effects of noise on the Florida panther or any other large cat were found. Noise from aircraft has affected other large carnivores by causing changes in home ranges, foraging patterns, and breeding behavior. One study recommended that aircraft not be allowed to fly at altitudes below 2,000 feet over important grizzly and polar bear habitat (**Dufour 1980**). Wolves have been frightened by low-level flights that were 25 to 1,000 feet off the ground. However, wolves have been found to be able to adapt to aircraft overflights and noise as long as they are not being hunted from aircraft (**Dufour 1980, Mech 1970**).

The Florida panther has been observed about three-quarters of a mile south of the former base in the past. The Proposed Action would not result in an increase in the maximum noise levels in this area. There would, however, be a substantial increase in the number of flights, estimated to increase from an average of less than 4 per day in 2005 to 46 per day over potential Florida panther habitat at maximum use. Aircraft would be at altitudes of approximately 5,000 feet as they crossed Palm Drive and about 8,000 feet as they passed over the center of potential panther habitat in the Model Lands Basin. These altitudes are higher than the minimum 2,000 feet recommended for sensitive bear habitat (**Dufour 1980**). It is believed that the increased number of flights over potential Florida panther habitat would not affect any panthers that may reside in the area.

The Key Largo cotton mouse and Key Largo woodrat occur in tropical hardwood hammocks in north Key Largo, including Crocodile Lake NWR. The Proposed Action would not result in an increase in maximum noise levels in the habitat of these two species. The increase in time above traditional ambient at Crocodile Lake NWR would average about 22 minutes more per day than under current conditions. Commercial aircraft would be above 5,000 feet when they pass over Key Largo. Behaviorally, these two species would be in burrows of large stick nests resting during the day when most commercial flights would take place and active at night when fewer flights occur. Based on these factors, it is believed that the noise levels projected for north Key Largo would not have an effect on the Key Largo cotton mouse and Key Largo woodrat.

Cumulative Impacts

Realization of Miami-Dade County's high-growth population forecasts would result in the development of vacant and agricultural land south of Eureka Drive and could result in the loss of pine rocklands. The total area of pine rocklands in southern Miami-Dade County is unknown, so the potential loss cannot be quantified. The Proposed Action's potential contribution to loss of pine rocklands is believed to be minor because most of the pine rocklands on the disposal property would be preserved, and secondary development associated with the Proposed Action is estimated to contribute about 10 percent to cumulative development outside the former base.

Sensitive species could be affected by the increased development associated with high growth. The land most likely to be developed may be eastern indigo and rim rock crowned snake habitat. There are approximately 1,270 acres of freshwater bodies within the UDB in south Miami-Dade County, and some could be developed or be subject to increased human activity and rendered unusable by wood storks and state-listed wading birds. Development could also affect potential Florida panther habitat south of the former base.

The L-31E Flowway Redistribution Project and the county's proposed STDA, if implemented, could improve habitat for the American crocodile, wood stork, state-listed wading birds, bald eagle, and manatee by increasing the area of wetlands east of the former base and improving nearshore water quality in Biscayne Bay.

Miami-Dade County's Environmentally Endangered Lands program to purchase environmentally sensitive land includes five pine rocklands near the former base. Thirty acres of the pine rocklands have been acquired, and an additional 172 acres are on the acquisition list. The EEL program would also benefit the Florida panther because it could include purchase of over 40,600 acres of freshwater wetlands that could include panther habitat in the Model Lands Basin.

Widening of U.S. Highway 1 to a four-lane road from Florida City to Key Largo would result in the elimination and disturbance of wetlands and could reduce the area of appropriate habitat for sensitive

species. It would remove potential snake and wading bird habitat in the corridor between Florida City and Key Largo. However, these effects have been mitigated through the establishment of replacement wetlands.

Mitigation Measures

The establishment of a buffer between former Homestead AFB and Biscayne NP would prevent or reduce development within the protected area, which would reduce the potential loss of remnant pine rocklands in the region. It would also reduce the potential destruction and fragmentation of eastern indigo snake and rim rock crowned snake habitat. In addition, it would preserve foraging habitat for the wood stork and other wading birds.

The Air Force has determined that a preservation covenant would be included in the transfer of disposal property to Miami-Dade County to avoid adverse effects on the federally listed Small's milkpea.

If the wetlands near the runway were eliminated to reduce bird-aircraft strike hazards, wetlands replacement or enhancement would likely be required.

It is suggested that the eastern indigo and rim rock crowned snake habitat on the disposal property be resurveyed by the developer just prior to construction. If snakes are found, the USFWS and the Florida Game and Fresh Water Fish Commission should be consulted regarding potential measures to avoid negative impacts, if any, to these species. These measures might include relocating the snakes.

Possible Future Expansion

Most of the area that could be disturbed by development of a second runway at HST is currently used for agriculture, but there are wetlands on the land southeast of the former base which are dominated by exotic plants (**NPS 1997**). Biological surveys have not been performed on this land, so information on special-status species use is limited. There may be small remnant pine rocklands that could be affected by construction. Airport expansion could also result in destruction of more than 16 acres of remnant pine rocklands that apparently do not contain federally listed species at the southern end of the existing runway (groups B and E on Figure 3.11-6).

The area of the possible expansion includes marginal (agricultural lands) and good (exotic plant dominated wetlands and uplands) habitat for the eastern indigo snake. Much of the agricultural land in the area is adjacent to good habitat. It is probable that the eastern indigo snake occurs throughout the area. The likelihood of indigo snakes occurring on this land would increase near the outer boundaries of the expansion area, closer to good habitat. The rim rock crowned snake also has the potential to occur in this area, particularly on overgrown vacant land. Therefore, construction of a second runway has the potential to result in the elimination of eastern indigo and rim rock crowned snake habitat and in direct mortality of some individuals of these species.

Airport expansion could result in the elimination of wetlands adjacent to the existing runway, an existing roost site, and other aquatic habitats such as roadside drainage ditches and exotic plant dominated wetlands. Wood storks forage in roadside ditches and other aquatic habitats in this area during the winter. State sensitive wading bird species also forage in the aquatic habitats that could be affected, and roost sites may occur in the wetlands. Some species, such as the white ibis, forage in agricultural lands as well. With the loss of this habitat, wading birds, including the wood stork, would have to forage elsewhere.

The Florida burrowing owl may currently reside in the area of a possible second runway, with the potential for loss of nest sites. However, this species may also expand into areas developed for a new runway. Breeding birds associated with mangroves (such as the mangrove cuckoo, black-whiskered vireo, Florida prairie warbler, and Cuban yellow warbler) probably do not nest in this area because of the lack of appropriate habitat.

Tracking data in the late 1980s indicated the Florida panther occurred south of former Homestead AFB, with a home range that extended almost up to the area that would be affected by possible airport expansion (**Ferro 1999a**). There have been recent unconfirmed sightings of the panther near Palm Drive (**Wasilewski 1999a**). The potential impacts to this species would need to be assessed at the time of any future construction.

Operations at a second runway would result in increased aircraft flights and noise. The northeast end of the second runway may be about 0.7 mile closer to the western shoreline of Biscayne NP than the existing runway. New flight tracks might also be necessary to handle the increased number of flights safely. This could result in a broader area of increased noise exposure along this shoreline from both commercial and military aircraft than under current conditions or under the single-runway Proposed Action. In addition, the increase in the number of commercial flights would result in noise levels being above traditional ambient levels for greater periods of time. The increase in noise levels and time above ambient associated with a second runway are not known. The magnitude of potential noise effects on sensitive species and habitats cannot be determined at this time and would have to be assessed in a separate NEPA process if a second runway is proposed in the future.

4.11.3.2 Commercial Spaceport Alternative

Construction

Plants. Construction activities associated with this alternative would have the potential to impact the same sensitive plant species locations that could be affected by the Proposed Action. Although it is not known whether a plan similar to the Proposed Action's Wildlife/Habitat Management and Mitigation Plan would be implemented under this alternative, USFWS has requested that the Air Force include a preservation covenant in any deeds that transfer the three remnant pine rocklands containing the federally listed Small's milkpea to non-federal entities (areas 1–3 on Figure 3.11-6). This covenant would require the new land owner to protect and manage these remnant pine rocklands. A fourth pine rockland, which would be protected under the Proposed Action, may not be protected under the Commercial Spaceport alternative (area 4 on Figure 3.11-6).

Secondary development would have the same kinds of impacts that are described for the Proposed Action, but the magnitude of the impacts under this alternative would be less than under the Proposed Action because a smaller area would be affected.

Reptiles. Construction of the Commercial Spaceport alternative would not be expected to affect the American crocodile, eastern indigo snake, or the rim rock crowned snake for the reasons given under the Proposed Action.

Secondary development would have the same kinds of impacts that are described for the Proposed Action, but the magnitude of the impacts under this alternative would be less than under the Proposed Action because a smaller area would be affected.

Birds. The impacts of this alternative on birds would be similar to the Proposed Action. There would be essentially no impacts from on-site development on the bald eagle and the wood stork, because these species occur only sporadically on disposal property. The use of the wetlands near the runway by wading birds could be eliminated or reduced to avoid potential hazards from collisions between birds and aircraft or spacecraft. Use of the disposal property by other sensitive bird species such as the Cooper's hawk, osprey, and American redstart would be reduced because of development and increased human activity.

Secondary development would have the same kinds of impacts that are described for the Proposed Action, but the magnitude of the impacts under this alternative would be less than under the Proposed Action because a smaller area would be affected.

Mammals. Development associated with the Commercial Spaceport alternative would not be expected to have an impact on sensitive species of mammals for the reasons stated under the Proposed Action.

Secondary development would have the same kinds of impacts that are described for the Proposed Action, but the magnitude of the impacts under this alternative would be less than under the Proposed Action because a smaller area would be affected.

Noise From Spacecraft Operations

It is assumed that noise from commercial space vehicles would be concentrated principally northeast of former Homestead AFB. Spacecraft are expected to enter the airspace over Biscayne Bay in the Black Point area. These operations are projected to result in noise levels higher than current levels along the western shoreline of the bay directly under the flight path (location SX3 on Figure 3.5-13), where maximum sound levels are projected to increase from 98.4 dB to 102.2 dB. Sound levels over 100 dB currently occur elsewhere along and near the shoreline, including points SX1, SX5, and SX7. The largest increase in LAmax over baseline levels would occur at the northern boundary of Biscayne NP where an increase of 16.8 dB over a current level of 69.5 dB is projected. TAamb would be expected to increase slightly because of the low number of space-related operations projected for this alternative.

The assumed flight corridor for space vehicles is well north of special-status species habitat at Sands, Elliott, and West Arsenicker Keys and the special-status species on the keys are not anticipated to be affected. It is believed that operations associated with the Commercial Spaceport alternative would have a negligible impact on special-status species at Biscayne NP.

Combined Commercial Spaceport/Airport

A combined Commercial Spaceport/Airport would have the same direct effects as described above. Wildlife would be exposed to increased aircraft noise similar to the Proposed Action, but the maximum number of operations would be much less. The effects of reuse-related secondary development would be slightly greater in magnitude than with the spaceport alone, but the impacts would be small or negligible.

Cumulative Impacts

Cumulative impacts with this alternative would be slightly less than with the Proposed Action because of lower intensity development on the disposal property.

Mitigation Measures

As under the Proposed Action, the establishment of a buffer between the former base and Biscayne NP would be expected to have a positive effect on sensitive species.

A deed covenant as requested by USFWS to protect three remnant pine rocklands containing federally listed plant species would ensure the long-term preservation and management of at least three pine rockland sites on the former base. Developing a habitat management and mitigation plan similar to that for the Proposed Action would further offset potential impacts from development of a Commercial Spaceport. Surveys for the eastern indigo and rim rock crowned snakes are suggested before project-related construction proceeds. If snakes are found, appropriate mitigation measures would need to be developed in consultation with USFWS and the Florida Game and Fresh Water Fish Commission.

4.11.3.3 Mixed Use Alternative

Construction

Plants. The development of industrial, commercial, recreational, and residential land uses under this alternative could impact the remnant pine rocklands on the former base. USFWS has requested that the Air Force include a preservation covenant in any deeds transferring the three remnant pine rocklands containing the federally listed Small's milkpea (areas 1–3 on Figure 3.11-6) to a non-federal entity. Even with deed covenants, four small pine rocklands (areas 4–7) could be lost unless the property recipients undertook to preserve them. The original Hoover plan provided for preservation of these areas, and the Collier-Hoover proposal includes a general commitment to preserve these areas, but no specific plan was provided. The pine rocklands south and east of the runway (areas 9–12 on Figure 3.11-6) would be retained by the Air Force and would not be disturbed.

Secondary development would have the same kinds of impacts that are described for the Proposed Action, but the magnitude of the impacts under this alternative would be less than under the Proposed Action because a smaller area would be affected.

Reptiles. On-site development associated with the Mixed Use alternative would not be expected to affect the eastern indigo snake or the rim rock crowned snake for the same reasons given for the Proposed Action.

Secondary development would have the same kinds of impacts that are described for the Proposed Action, but the magnitude of the impacts under this alternative would be less than under the Proposed Action because a smaller area would be affected.

Birds. The Mixed Use alternative would be expected to have negligible impacts on foraging wood storks and bald eagles because the foraging habitat on former Homestead AFB for these species is marginal and there is a large amount of good habitat east of the former base. This alternative is not expected to affect state-listed wading bird foraging habitat in wetlands in the area of the runway. Construction activities would have little impact on state-listed wading birds because of the lack of foraging habitat on the land that would be developed. The Collier-Hoover proposal could involve creation of 90 additional acres of waterways, while the development of two golf courses would result in the establishment of an estimated 338 acres of grasslands. These additional habitat areas would attract foraging wading birds, including state-listed species recorded in the wetlands in the area of the runway. The number of wading birds would vary according to the type of wetlands that would be developed and the degree of human activity. For example, water bodies in areas frequently used by humans would be expected to attract fewer wading

birds than wetlands or grasslands away from human activity. Another consideration is the potential for increased bird-aircraft strike hazard, which could require measures to discourage birds from congregating in the new wetlands.

Development under this alternative could affect the burrowing owl because of construction and/or demolition activities near their nest sites. The occurrence of the osprey would be expected to remain the same on Homestead ARS but would likely be reduced on the disposal land because of increased human activity. The Collier-Hoover proposal would create increased aquatic habitat, but the level of human activity around these bodies of water would likely preclude osprey use.

Secondary development would have the same kinds of impacts that are described for the Proposed Action, but the magnitude of the impacts under this alternative would be less than under the Proposed Action because a smaller area would be affected.

Mammals. Development associated with the Mixed Use alternative would not be expected to affect sensitive species of mammals.

Secondary development would have the same kinds of impacts that are described for the Proposed Action, but the magnitude of the impacts under this alternative would be less than under the Proposed Action because a smaller area would be affected.

Cumulative Impacts

Cumulative impacts under this alternative would be similar to those described for the Proposed Action, although overall development and resulting habitat loss would be slightly less.

Mitigation Measures

The effects of establishing a buffer between former Homestead AFB and Biscayne NP with the Mixed Use alternative would be the same as described under the Proposed Action.

USFWS has requested that three remnant pine rocklands on the former base be preserved and managed through deed covenants. If adopted, deed covenants would prescribe preservation of at least a portion of this habitat.

4.11.3.4 No Action Alternative

Under the No Action alternative, seven remnant pine rocklands on the disposal property and the former golf course would not be physically disturbed, but without a wildlife/habitat management plan, exotic plants would continue to grow in these areas and elsewhere on the property. The growth of exotic plants in pine rocklands would threaten the continued existence of the sensitive plants in these areas if actions are not taken to discourage the spread of exotic species and provide for the preservation of these habitats (**Argonne National Laboratory 1997**).

The marginal habitat that exists on the former base for eastern indigo snake, rim rock crowned snake, wood stork, and bald eagle foraging would remain intact and be available for occasional use by these species. Other sensitive species, such as the Cooper's hawk, osprey, Antillean nighthawk, and American redstart, would continue to use the land from time to time, as they have in the past. The Florida burrowing owl would continue to nest near the runway. The wetlands near the runway would persist in their current form, and wading bird use of these wetlands would be expected to continue. The impacts

from other projects and developments in the ROI would be essentially the same as under the reuse alternatives.

4.11.3.5 Independent Land Use Concepts

The impacts of the independent land use concepts would be similar to those described for the Proposed Action and other reuse alternatives.

4.12 CULTURAL RESOURCES

4.12.1 Introduction

Impacts on cultural resources from the Proposed Action and alternatives were assessed by (1) identifying the nature and location of elements of the alternatives; (2) comparing those locations with identified cultural resource locations, areas considered sensitive, and surveyed locales; (3) determining the known or potential significance of cultural resources that could be affected; and (4) determining the extent, intensity, and context of the effects. The impact analysis process for cultural resources centers on the concept of cultural resource significance. Federal law protects cultural resources only if they are significant and usually only applies to undertakings that are federally funded or permitted.

The impact analysis for archaeological, architectural, and landscape resources employed the guidelines and standards set forth in Section 106 of the National Historic Preservation Act. This process has five steps. First, resources are identified and evaluated for eligibility to the National Register of Historic Places. Second, the effects of the Proposed Action and alternatives on eligible resources are assessed. Third, a determination is made, in consultation with the SHPO, as to whether the effects would be adverse, and, where appropriate, measures are identified to avoid, reduce, or otherwise mitigate those effects. In the fourth step, the Advisory Council on Historic Preservation (ACHP) comments on the determinations of effect. The fifth step consists of proceeding with the undertaking. This section focuses on an assessment of the potential effects of the Proposed Action and alternatives on resources listed, eligible, or potentially eligible for listing on the National Register.

An action results in adverse effects, or impacts, to a significant cultural resource when it alters the resource's characteristics, including relevant features of its environment or use, in a manner that affects its eligibility for inclusion on the National Register (36 CFR 800.9[b]). Potential impacts could include physical destruction, damage, or alteration; alteration of the character of the property's setting when the setting contributes to the property's National Register qualifications; introduction of visual, audible, or atmospheric elements that affect the property's National Register qualifications; neglect of a property so that it deteriorates or is destroyed; and transfer, lease, or sale of the property without provisions or covenants to protect it.

4.12.2 Archaeological, Architectural, and Landscape Resources

The potential for impacts on prehistoric and historic archaeological resources would not vary appreciably among the alternatives. Sites could be affected by actions associated with construction, maintenance, and operations. Such actions could inadvertently damage an undiscovered archaeological site. If the site is eligible for listing on the National Register, this would be an adverse impact.

Setting is rarely considered a contributing factor to an archaeological site's National Register eligibility status. Thus, archaeological sites are rarely considered to be adversely affected by noise or visual intrusions.

Architectural resources could be affected by construction, noise or vibration, or visual intrusion. Architectural resources generally must be at least 50 years old to be eligible for the National Register, but buildings that are not now eligible may become eligible by 2015.

In a letter dated March 6, 2000, the Florida State Historic Preservation Officer (Division of Historical Resources) stated that a review of the Draft SEIS, the Florida Site file, and the division's records indicated no significant archaeological or historical sites have been recorded or are likely to be present

within the project's area of potential effects. The letter further indicates that, because of the project location and/or nature, it is unlikely historic properties will be affected.

4.12.2.1 Proposed Action

Archaeological Resources. The disposal property has been previously surveyed, and no archaeological resources have been identified on former Homestead AFB. Existing facilities may sit on undisturbed sediments that could contain archaeological deposits. While the presence of such deposits is unlikely, it is possible that facility demolition and construction might disturb unanticipated archaeological resources. Once full buildout has occurred, the likelihood of finding additional archaeological resources would diminish from very low to almost non-existent. Given the low likelihood of archaeological resources on the disposal property, it is unlikely that the Proposed Action would affect significant archaeological resources.

Impacts on archaeological resources from secondary development associated with the Proposed Action could arise from off-site ground-disturbing activities such as construction. There are few known archaeological sites in the area around Homestead that could be affected by secondary development, but there are some eligible for listing on the National Register. Because secondary development would be expected to occur near the former base, and most of these archaeological sites are relatively far from the former base, the likelihood that a site would be affected is considered low.

Architectural Resources. A single architectural resource located on former Homestead AFB is potentially eligible for the National Register because of its association with the Cold War (**Patterson et al. 1997**). It was conveyed to the U.S. Department of Labor and is being rehabilitated for use as an Administrative Center. This building was an Air Force conference center and its location near an operational airport was important to its historic function. Airport operations, with the attendant noise, vibration, and visual intrusion from overflights, have always been part of its setting. Thus, its National Register eligibility would not be adversely impacted by continued use of the airport by either military, government, or civil aircraft. No other architectural resources have been identified as potentially significant on former Homestead AFB.

Because of the damage to former Homestead AFB caused by Hurricane Andrew, as well as the destructive hurricane that occurred in 1945, there is little likelihood that any additional buildings will be identified as eligible for the National Register. Thus, the Proposed Action is expected to have no impact on architectural resources on the former base.

Numerous National Register and National Register-eligible architectural resources have been identified in southern Miami-Dade County where most secondary development is anticipated to occur. These resources could be adversely affected if setting is an integral part of the resource's National Register eligibility and development altered the setting to such an extent that the structure were no longer eligible for the National Register. Adverse effects could also occur if development destroyed or degraded a National Register-eligible property. Eighty-nine historic architectural resources have been identified in the area around the former base. These include 28 National Register or National Register-eligible properties and 62 properties that have local historic importance. No specific locations for reuse-related secondary development have been identified. There is no reason to believe that any such development would adversely affect National Register or Register-eligible properties. However, it cannot be guaranteed that no impacts might occur.

Resources located within the area governed by the Miami-Dade County Historic Preservation Ordinance (**Metro-Dade County 1981**) would receive some protection from adverse impacts, as the ordinance is

intended for the "protection, enhancement and perpetuation of properties of historical, cultural, archaeological, aesthetic and architectural merit" (**Metro-Dade County 1981**). The City of Homestead also has historic preservation codes that enhance protection of architectural resources (**Research Atlantica 1994**). Most of the reuse-related off-site development would likely be funded by private or local government rather than federal sources. Any secondary development involving federal funding would be subject to the requirements of Section 106 of the National Historic Preservation Act. These and other regulations would reduce the potential for adverse impacts to architectural resources from secondary development.

Within Biscayne NP, one architectural site and two districts are on or eligible for listing on the National Register. Biscayne NP has expressed concern that vibrations and emissions from aircraft could adversely affect the buildings in the Boca Chita Key Historic District (Boca Chita Key is just north of Sands Key) (**NPS 1998b, 1999a**). Aircraft flying over Boca Chita Key are not likely to generate levels of noise or vibrations that could physically affect the structures within the historic district. Noise data (discussed in Section 4.5) indicate that LAmax, the measurement of the loudest single, instantaneous noise event, would not change over current conditions at Boca Chita Key, which is exposed to LAmax between 65 and 85 dB (refer to Figures 3.5-14, 4.5-12, and 4.5-13). Another noise measure is the time noise levels are above traditional ambient noise, or TAamb. Current TAamb at Boca Chita is estimated at 1 to 10 minutes per day (see Figure 3.5-16). Under the Proposed Action, this could change to up to 30 minutes per day (see Figures 4.5-16 and 4.5-17).

Historic Landscape. Identification and documentation of historic landscapes within Biscayne NP have not been completed, but the potential for such a resource has been described (**NPS 1998b, 1999a; Cordell 1997**). Increased aircraft operations over the park may have the potential to affect the integrity of a historic landscape's setting, depending on how that landscape is ultimately defined.

Cumulative Impacts

Archaeological Resources. Other future actions that could affect archaeological resources include widening of U.S. Highway 1, development of the STDA, and other development associated with population growth. Neither the SHPO nor Miami-Dade County has identified areas within the ROI that are sensitive for the presence of significant archaeological resources and would be affected by the widening of Highway 1 or construction of the STDA. Other development in the area does have the potential to disturb archaeological resources.

Activities planned by the South Florida Ecosystem Restoration Project and the Restudy also have the potential to impact archaeological sites by changing the hydrology in the area or by damaging resources while constructing project facilities. Although one of the objectives of the Restudy is to protect cultural and archaeological resources and values, this would not preclude the possibility of impacts to those resources. While these activities could affect archaeological resources, it is not anticipated that the Proposed Action would contribute to any effects.

Architectural Resources. Most future projects that could occur in the region would be expected to have little or no impact on architectural resources. It is possible that accelerated population growth, as reflected in Miami-Dade County's high-growth forecasts, could impact architectural resources by leading to the demolition or alteration of National Register-eligible properties. It is not anticipated that the Proposed Action would contribute to any adverse effects.

Historic Landscape. The STDA could benefit a historic landscape by enhancing the natural setting of the landscape. This could be offset by an increased use of the park due to population growth, which could result in damage to the sites.

Mitigation Measures

Impacts on cultural resources that are directly caused by federal undertakings can be mitigated by following Section 106 of the NHPA. Archaeological and architectural resources affected by activities not subject to federal regulations (e.g., most secondary development) would be protected to some degree by requirements of the Miami-Dade County and City of Homestead preservation ordinances.

During construction on the former base, procedures could be imposed to suspend construction if previously undiscovered archaeological resources are uncovered to allow the resource to be evaluated or recovered. No other mitigation measures are suggested.

Possible Future Expansion

The area south of the existing runway has not been surveyed for the presence of archaeological resources. Surveys in the vicinity of former Homestead AFB found no cultural resources. Although it is unlikely archaeological sites are present because of the terrain and what is known of the settlement patterns of both American Indians and early Euroamerican settlers, there remains a small potential for the presence of archaeological sites. Construction of a second runway at HST would likely involve federal funds and would therefore be considered a federal undertaking. Before construction could occur, the area of potential effect would need to be surveyed for cultural resources, as required by Section 106 of NHPA. Any site found during survey would need to be evaluated for National Register eligibility, and the Section 106 steps would be taken. There are no architectural resources in the area of the potential second runway and airport expansion. If construction of a second runway is proposed in the future, additional environmental analysis will be required to assess potential impacts on archaeological, architectural, and landscape resources.

4.12.2.2 Commercial Spaceport Alternative

The potential impacts of the Commercial Spaceport alternative on archaeological, architectural, and landscape resources would be essentially the same as described for the Proposed Action. With less secondary development, the potential for off-site impacts could be less. Noise effects at Boca Chita Key would be less than reported for the Proposed Action because the space launch vehicles are anticipated to depart farther north.

4.12.2.3 Mixed Use Alternative

The potential impacts of the Mixed Use alternative on archaeological and architectural resources would be essentially the same as described for the Proposed Action. With less secondary development, the potential for off-site impacts could be less. No potential impacts on Biscayne NP landscape or other cultural resources have been identified in connection with this alternative.

4.12.2.4 No Action Alternative

Since no archaeological or architectural resources are known to be present on the disposal property at former Homestead AFB, it is unlikely that reuse of this property would adversely affect those resources. There is a small chance that there are previously unknown buried archaeological resources that would

remain undisturbed under the No Action alternative. National Register-eligible properties outside of former Homestead AFB could still be affected by ongoing growth and development in the region.

4.12.2.5 Independent Land Use Concepts

The independent land use concepts would have the same potential for affecting previously undiscovered archaeological resources on former Homestead AFB as the Proposed Action and other reuse alternatives. There are no significant architectural resources on the property that could be affected.

4.12.3 Traditional Cultural Resources

4.12.3.1 Proposed Action

No traditional cultural resources have been identified on former Homestead AFB that could be affected by development of the disposal property or reuse-related secondary development. The potential historic landscape being documented by Biscayne NP could have a traditional cultural element (**NPS 1999a**). Such a historic landscape could have the potential to be affected by noise or visual impacts from aircraft overflights, depending on how it is ultimately defined.

The area south of the existing runway has not been surveyed for traditional cultural resources, but it is unlikely that any are there and could be affected by possible expansion of HST and construction of a second runway.

No traditional cultural resources have been identified within the region that could be affected by cumulative impacts, although it remains possible that some could exist. If any such resources do exist within the ROI, they would probably be related to plants, animals, and their habitats. If this is the case, then the habitat enhancements proposed by the South Florida Ecosystem Restoration Project and the Restudy could provide beneficial impacts to cultural resources by restoring habitats. The STDA could also enhance habitats within the ROI. In addition, the Restudy has preservation of cultural resources as one of its objectives.

4.12.3.2 Commercial Spaceport Alternative

The potential for impacts from the Commercial Spaceport alternative on traditional cultural resources would be essentially the same as with the Proposed Action.

4.12.3.3 Mixed Use Alternative

No potential impacts on traditional cultural resources from the Mixed Use alternative have been identified. Potential cumulative impacts would be the same as with the Proposed Action.

4.12.3.4 No Action Alternative

The No Action alternative would not differ from the reuse alternatives because, to date, no traditional cultural resources have been identified on former Homestead AFB or in the ROI that could be affected by reuse of the disposal property. The potential for impacts from other activities in the ROI would be the same as with the Proposed Action.

4.12.3.5 Independent Land Use Concepts

The potential for impacts on traditional cultural resources from the independent land use concepts would be essentially the same as from the Proposed Action and other reuse alternatives.

4.13 MINORITY AND LOW-INCOME POPULATIONS

4.13.1 Introduction

This section addresses the potential for the Proposed Action and alternatives to have disproportionately high and adverse environmental, safety, and health impacts on minority and low-income populations.

Several tasks were completed in performing this analysis. First, resource impacts described in other portions of the SEIS were reviewed to determine the location and level of reported impacts, as well as their potential for adverse environmental, safety, or health effects on nearby populations. That review identified areas in the vicinity of former Homestead AFB where sound levels are anticipated to exceed DNL 65 and 60 dB.

Second, results from a field survey of the areas surrounding the former base were used to update information on residential populations. Residential and demographic patterns in south Miami-Dade County have changed dramatically since Hurricane Andrew, and 1990 census data were not considered adequate for the analysis. The survey results are shown in Figure 3.6-4, which depicts dwelling units near Homestead ARS. The survey identified a number of residences that provide housing for farmworkers (South Dade Center). In addition, the Homeless Trust Center located on previously conveyed property at former Homestead AFB was considered. The analysis then examined whether minority and low-income populations would be exposed to increases in noise levels of DNL 1.5 dB or greater within the 65 dB contour and 3 dB or greater within the 60–65 dB contour, changes that have been recognized by FAA as warranting further consideration.

During preparation of the SEIS, contacts were made with non-profit providers of housing for the homeless and with the Homestead Housing Authority, which operates the farmworker housing, as well as with the Coalition of Florida Farmworker Organizations. Other public outreach activities were conducted, including bilingual public scoping meetings and public hearings, to describe the SEIS process and obtain public comments. In addition, public notices and outreach materials were distributed in both English and Spanish.

4.13.2 Proposed Action

Under the Proposed Action, an estimated 8,026 acres of land area would be located within the DNL 60 dB noise contour at maximum use of the one runway. This compares to 6,458 acres currently, for a total increase of about 1,568 acres (see Table 4.5-2).

Portions of both the Homeless Trust Center housing and the South Dade Center migrant farmworker housing are projected to be within the DNL 60 dB contour, and a portion of the South Dade Center housing is projected to be within the DNL 65 dB contour. As noted in Section 3.13, some of the South Dade Center housing is exposed to DNLs above 60 and 65 dB under current conditions. An estimated 297 units are currently within the DNL 60 dB contour, 95 of which are exposed to DNL 65–70 dB (see Table 4.5-3). This is projected to increase to an estimated 440 units within the DNL 60 dB contour under the Proposed Action at maximum use of the one runway at HST. Of that number, 124 units are estimated to be exposed to noise levels of DNL 65–70 dB, 53 to DNL 70–75 dB, and 1 to levels above 75 dB. An estimated 645 additional residents could be affected by DNL 60 dB and above.

Although more residents would be exposed to higher noise levels, in most areas, the change over current and projected baseline conditions would be less than 1.5 dB of DNL. As is shown in Figure 4.5-6, areas within the DNL 65 dB contour that would be expected to experience 1.5 dB and greater changes, a

significant noise increase according to FAA environmental guidance, are confined to the southwest end of the runway. This includes a portion of the South Dade Center housing. No residences have been identified in the area that would experience more than 3 dB increase within the DNL 60 dB contour.

Maximum use is not likely to occur for 30 years or more, and it is difficult to predict what the status of the existing housing will be at that time. Looking at a more immediate time frame, the analysis indicates that the changes in DNL contours from the Proposed Action in 2005 would be virtually undetectable. By that time, no residents within the 65 dB contour are anticipated to experience increases greater than 1.5 dB. By 2015, a small portion of South Dade Center could begin to experience changes of more than 1.5 dB.

Considering the information available, there appears to be a potential for minority and low-income populations to be disproportionately affected by noise from the Proposed Action because they appear to be the only residents that would be exposed to potentially incompatible noise levels. The South Dade Center farmworker housing is located in an area could experience increases in noise levels in future years which are considered incompatible for residential uses that are not sound insulated.

Secondary development associated with the Proposed Action could occur in the vicinity of the proposed airport. Any new residential developments would need to consider compatibility with aircraft operations and the associated noise. No disproportionately high and adverse impacts on minority or low-income populations have been identified in connection with reuse-related secondary development.

Cumulative Impacts

Accelerated population growth in the vicinity of HST could increase residential densities and the potential for encroachment into areas exposed to elevated noise levels. This would not necessarily affect minority and low-income populations disproportionately.

Mitigation Measures

The timing and selection of appropriate mitigation measures for the potential increase in noise exposure at the South Dade Center would depend in part on how quickly a commercial airport at HST grew and the rate at which aircraft operations increased. Based on current expectations used in the analysis, aircraft noise at HST would not be expected to increase significantly until some time between 2005 and 2015. The aircraft operations forecast for 2015 are considered optimistic, so it is more likely to be toward the end of the time period. Periodic noise evaluation could be done to identify the appropriate timing for mitigation actions.

Typical mitigation measures include structural sound attenuation or acquisition and relocation. Structural sound attenuation can be used to reduce indoor noise levels when outdoor levels are elevated. Noise measurements are taken inside and outside the house, and the existing level of noise reduction is determined. Depending on the effectiveness of the existing structure in attenuating noise, additional insulation and weather-stripping can increase the amount of attenuation. If sound attenuation is not found to be an effective mitigation, consideration can be given to acquiring the property and relocating residents to areas with lower noise exposure.

Possible Future Expansion

The possible future expansion of HST could incrementally increase noise exposure on residents but is not expected to markedly change the effects described above. The location of the second runway does not

currently contain any residences. The implementation of this possible expansion is so far in the future that the location and distribution of minority and low-income populations cannot be predicted.

4.13.3 Commercial Spaceport Alternative

Under the Commercial Spaceport alternative, an estimated 7,405 acres could be exposed to noise levels above DNL 60 dB in 2015, which is not expected to change at full buildout. This could be an increase of 947 acres over the current condition. It appears the area within the South Dade Center farmworker housing site that would be exposed to noise levels above DNL 60 dB and 65 dB would not change from current conditions. Therefore, it does not appear that the Commercial Spaceport alternative would create a disproportionately high and adverse impact on minority or low-income populations.

Secondary development associated with the Commercial Spaceport alternative could occur in the vicinity of the spaceport. Any new residential developments would need to consider compatibility with spaceport operations and associated noise. No disproportionately high or adverse impacts on minority or low-income populations have been identified in connection with reuse-related secondary development.

Combined Commercial Spaceport/Airport

The addition of commercial aviation at the spaceport would marginally increase DNL levels in the surrounding area, but no disproportionately adverse effects on minority or low-income populations have been identified. Any new residential developments in the vicinity of the spaceport/airport would need to consider compatibility with operations and associated noise.

Cumulative Impacts

Potential cumulative impacts would be similar to those described for the Proposed Action.

Mitigation Measures

Although reuse of former Homestead AFB under the Commercial Spaceport alternative would not increase the number of residents exposed to noise levels above DNL 65 dB, the City of Homestead, Miami-Dade County, or the spaceport developer/operator could consider structural sound attenuation or relocation of existing residences exposed to DNL 65 dB or higher due to ongoing military and government operations.

4.13.4 Mixed Use Alternative

Under this alternative, aircraft noise levels in the vicinity of Homestead ARS would be the same as under baseline conditions. No disproportionately high or adverse effects on minority or low-income populations have been identified.

Cumulative Impacts

No cumulative impacts on minority or low-income populations have been identified in connection with the Mixed Use alternative.

Mitigation Measures

Potential mitigation measures described for the Commercial Spaceport alternative could also be considered for the Mixed Use alternative.

4.13.5 No Action Alternative

Under the No Action alternative, approximately 6,458 acres of land area would continue to be exposed to noise levels exceeding DNL 60 dB through 2005, including portions of the South Dade Center residential area. A portion of this area would continue to be exposed to levels of 65 to 70 dB. The Homeless Trust Center on the former base would be exposed to DNLs between 60 and 65 dB. The area within the DNL 60 dB contour is projected to decline slightly to 6,445 acres by 2015.

4.13.6 Independent Land Use Concepts

The independent land use concepts would not be expected to create disproportionately high and adverse impacts on minority and low-income populations.

4.14 DEPARTMENT OF TRANSPORTATION ACT SECTION 4(F) LANDS

This section addresses the requirement under Section 4(f) of the Department of Transportation Act (now codified at 49 U.S.C. Section 303) to determine whether development of former Homestead AFB property for transportation purposes would require the use of publicly owned land of a public park, recreation area, wildlife or waterfowl refuge, or land of an historic site of national, state, or local significance. A transportation project that involves such a use can be approved by the Department of Transportation and its agencies (including the Federal Aviation Administration) only if (1) there is no prudent and feasible alternative to using that land, and (2) the project includes all possible planning to minimize harm to the affected land from the proposed use.

4.14.1 Section 4(f) Review

Section 4(f) applies exclusively to approvals of transportation projects by the U.S. Department of Transportation (DOT), including the modal administrations within DOT such as the FAA. Section 4(f) does not apply to approvals by other federal agencies, such as the Air Force, nor to state or local approvals. The FAA consults with the Department of the Interior concerning a finding that there is no feasible and prudent alternative to the use of Section 4(f) lands, but FAA is ultimately solely responsible for determining whether an airport project would constitute a use and thereby invoke Section 4(f). The evaluations and determinations in this Section 4(f) review are those of the FAA.

The two proposals for the reuse of Homestead to which a Section 4(f) review applies are the Proposed Action for a commercial airport and the Commercial Spaceport alternative, both of which would be "transportation projects" requiring specific approvals by FAA. Section 4(f) does not apply to projects that are not transportation projects, such as the Mixed Use alternative for Homestead, for which DOT/FAA approval is not required. Neither does Section 4(f) apply to the No Action alternative.

Section 4(f) requires the FAA to determine whether the Proposed Action and the Commercial Spaceport would "use" publicly owned land of a public park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance; or land (either publicly owned or privately owned) of an historic site of national, state, or local significance. A transportation "use" can occur in two ways: (1) an actual direct physical taking of property for a transportation project, such as to construct an airport on the property; or (2) a "constructive" use, where a transportation project does not directly use the property, but does impact it so adversely that it effectively uses it by substantially diminishing its activities, features, or attributes. Constructive use would result when the environmental impacts caused by the transportation project are so severe that the utility of the Section 4(f) resource in terms of its prior significance is substantially diminished or destroyed.

The resources in the Homestead region of influence that are subject to Section 4(f) protection are identified in Section 3.14 of this SEIS. Section 3.14 summarizes all Section 4(f) resources and includes references to other portions of the SEIS for greater detail on specific resources, e.g., national parks and refuges, state and local parks, historic sites. The potential environmental effects of the Proposed Action and of the Commercial Spaceport alternative are assessed under applicable resource categories in Chapter 4 of the SEIS. The FAA is relying on the data and analyses in the SEIS for its Section 4(f) determination. Data and analyses relevant to this determination have not substantially changed between the Draft and Final SEIS.

4.14.2 Proposed Action

The Proposed Action would not directly take any Section 4(f) resources. The development of a commercial airport would not require the actual physical use of property of any publicly owned land of a

public park, recreation area, wildlife or waterfowl refuge, or land of an historic site of national, state, or local significance.

The question of whether the Proposed Action would constructively use any Section 4(f) resources has been extensively reviewed by the FAA. In fact, this review is the most extensive ever performed for a proposed airport development project because of the environmental sensitivity and concerns related to the national parks and refuge. All potential impacts of the Proposed Action are analyzed and described in other sections of Chapter 4 of the SEIS. This Section 4(f) determination relies on the results of those analyses.

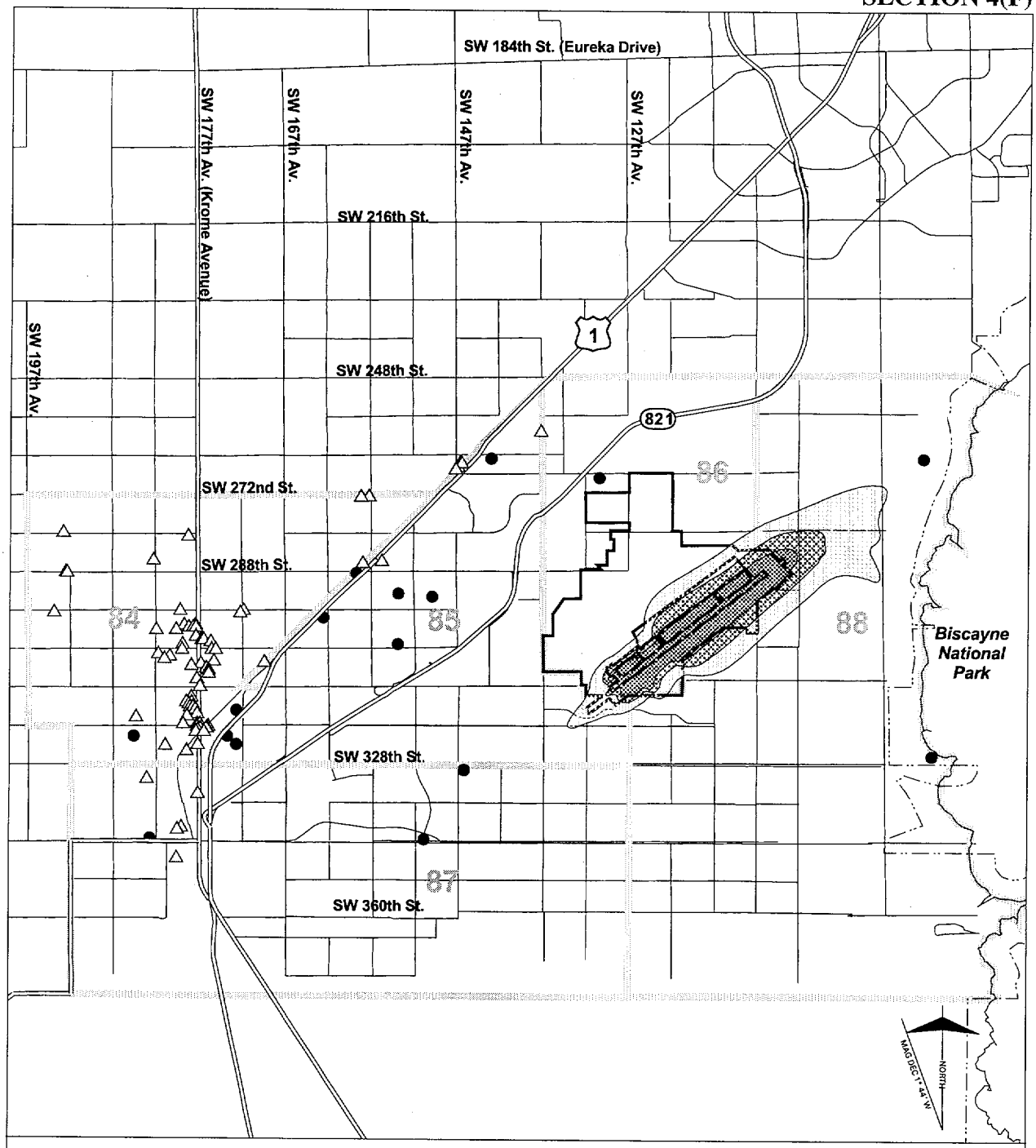
Aircraft Noise in Local Parks

Aircraft noise has been raised as the primary concern for Section 4(f) properties in the vicinity of Homestead. For most park and recreation areas, the FAA relies on the compatible land use guidelines in Federal Aviation Regulation Part 150 (see Table 4.5-4 in Section 4.5). These guidelines have been in existence and use for a number of years to determine noise impacts by relating land use type to certain airport noise levels. These guidelines are appropriate for use here to determine the compatibility of lands in the vicinity of Homestead that are devoted to traditional recreational uses, as categorized in Part 150. A constructive use due to aircraft noise over DOT Act Section 4(f) lands is considered not to occur when noise exposure levels due to the proposed project will not exceed these FAA compatible land use guidelines. There are a number of local parks serving traditional recreational uses in the general area of Homestead, as shown in Figure 3.14-2 in Section 3.14. All are located outside of the Proposed Action's DNL 65 dB noise contour at maximum airport use and are classified as compatible with aircraft noise levels, according to FAA's Part 150 guidelines (**Figure 4.14-1**). Accordingly, FAA has determined that the Proposed Action would not constructively use local parks based on aircraft noise.

Aircraft Noise in National Parks, Refuge, and Preserve

There are Section 4(f) properties of national importance and unique value in south Florida. These include Biscayne NP, Everglades NP, Crocodile Lake National Wildlife Refuge, and Big Cypress National Preserve. All are outside of the DNL 65 dB noise contour at maximum airport use and would be considered compatible with aircraft noise levels under FAA's Part 150 land use guidelines if their uses generally comported with the common recreational uses found in most parks. A number of common recreational uses do occur (e.g., boating, swimming, fishing, water skiing, hiking) that would be regarded by the FAA as within the scope of the Part 150 guidelines. However, these properties have unique value as special ecosystems and are important for the preservation of special species of plants and animals, whether officially designated as wildlife refuges or not, and for providing people an opportunity to visit and experience nationally designated special natural environments. More detailed descriptions of these properties are in Section 3.6. Because of the unique nature of these properties, FAA is supplementing its usual reliance on DNL and Part 150 compatible land use guidelines as the basis for its constructive use determination.

FAA has conducted supplemental, extensive grid point noise analyses using a variety of metrics to evaluate the Proposed Action's potential noise effects. Three noise metrics were primarily used for these properties. The Maximum Sound Level, LAmax, is a single-event metric that assesses the loudest aircraft noise. The Peak Hour Equivalent Sound Level, Leq(h), is a cumulative noise metric that assesses the total amount of aircraft noise (including loudness, duration of noise, and frequency of noise events) for the busiest hour of aircraft operations during an average day. Time Above Ambient, TAamb, assesses the amount of average daily time that aircraft noise would be above the average level of other non-aircraft sounds in the parks and refuge. TAamb was not calculated for the Big Cypress National Preserve because of the distance of this property from Homestead and the low aircraft noise levels at that distance.



LEGEND

- Former Homestead AFB
- 84 Transportation Analysis District
- Proposed Action Maximum Use Noise Contours
  - 65 - 70 db
  - 70 - 75 db
  - Greater than 75 db
- Street
- U.S. Highway
- State Highway
- Park
- Historic Site

1 0 1
Scale in Miles

Derived from:
Florida Bureau of Historical Research n.d.,
Metro-Dade County 1992b,
Landrum & Brown 1999b

Figure 4.14-1
Noise Contours and 4(f) Properties

The results of the grid point analyses are summarized below for each property. These results are reported for the noisiest situation analyzed: maximum capacity commercial use of the runway, no aircraft noise levels lower than current quietest Stage 3 aircraft, and no flight track noise mitigation.

Biscayne National Park. Military aircraft will continue to be the loudest aircraft, from 5 to over 20 dB more than civil aircraft. Cumulative noise levels of the Proposed Action (considering loudness, frequency, and duration of aircraft noise) would be below the average level of other non-aircraft sounds in most of the park. There could be some very small cumulative noise increases in Leq(h) of less than 3 dB above other sounds. (Increases of less than 5 dB are *de minimus* and are mapped as "no change.") At maximum runway use, the amount of total time, on an average day, that aircraft noise would be above the average level of other non-aircraft sounds could increase by less than 10 minutes in central and eastern areas of the park, by 10–30 minutes along the park's west shoreline, and by 1–2 hours in two areas closest to the runway. These are not all sequential minutes. TAamb would total up throughout the day as aircraft are heard.

Everglades National Park. Close to Homestead, military aircraft would continue to generate the highest maximum sound levels. Farther away, where military and civil flight tracks would diverge, civil aircraft could increase maximum sound levels by 5 to over 10 dB along corridors in north-central and southeastern park areas. However, aircraft would be at higher altitudes by the time military and civil flight tracks diverged, which means that maximum sound levels heard on the ground would be lower. Cumulative noise levels would be below the average level of other non-aircraft sounds in most of the park. Cumulative increases ranging from less than 5 to over 10 dB could occur under certain flight corridors; however, with a few exceptions at the eastern boundary of the park, cumulative noise levels would not exceed 45 dB, and would be below 30 dB in the bulk of the park. At maximum runway use, the amount of total daily time, on average, that aircraft noise would be above other non-aircraft sounds could increase by 1–30 minutes along a western approach corridor, by 10 minutes to over 2 hours along an eastern corridor, and over 2 hours closest to the runway approach. Other areas within Everglades NP would experience either no increases in the time aircraft noise would be above other sounds, or less than 1 minute a day.

Crocodile Lake National Wildlife Refuge. Military aircraft would continue to be the loudest aircraft. Cumulative noise levels of the Proposed Action would be below the average level of other non-aircraft sounds in most of the park. *De minimus* cumulative noise increases of 2.1 dB and less above other sounds are projected in some areas. Cumulative noise levels of the Proposed Action would be in the 40–43 dB range at the northern end of the refuge, and in the 34–39 dB range in the remainder of the refuge. The average measurements of all non-aircraft sounds range from 39.0 to 41.3 dB. At maximum runway use, the time that aircraft noise would be above other non-aircraft sounds could increase by 30–60 minutes in the northern part of the refuge, 10–30 minutes in the central and southwestern portions, and 1–10 minutes in the southern refuge. One area on the northwestern edge could increase by 1–2 hours. Crocodile Lake NWR is not open to visitors. The primary concern in the refuge is with the effects of noise on wildlife.

Big Cypress National Preserve. Civil and military flight tracks would have diverged at this distance from Homestead. Civil aircraft transiting the preserve along a northwesterly corridor would cause maximum sound levels to increase by more than 10 dB. However, at this distance from Homestead, aircraft would be at a higher altitude, and the highest maximum sound levels would still only be in the mid-40 to upper-50 dB range. Cumulative noise levels of the Proposed Action would be very low—ranging from 10.0 to 33.2 dB, but mostly in the mid-teen to mid-20 dB range. By comparison, average Leq(h) measurements of non-aircraft sounds are higher than predicted aircraft levels. Average measured traditional ambient sound levels in the Big Cypress range from 33.7 to 64.0 dB, with most being in the mid-30 to mid- and upper-40 dB range.

FAA Constructive Use Determination On Noise for the Four National Properties

The Air Force and FAA respect the views of agencies and individuals that regard aircraft noise in general and the Homestead airport proposal in particular as undesirable for the national parks. A commercial airport at Homestead would add aircraft noise to the national parks, refuge, and preserve. Reasonable people will probably continue to disagree on how much aircraft noise is too much based on various expressed or implicit noise tolerances. For DOT Act Section 4(f) purposes, in order to constructively use a property due to aircraft noise, the noise must be at levels high enough not only to be heard by people and animals, but also high enough to have negative consequences of a substantial nature—that is, to impair the attributes of the Section 4(f) resource so severely that it would interfere with the property's continued ability to serve its purposes.

As discussed in more detail below, under Other Environmental Impacts, the potential effects of aircraft noise on wildlife have been analyzed in Section 4.11, including a review of existing studies on wildlife responses to noise. None of the potential effects identified for the Proposed Action are anticipated to substantially diminish wildlife resources or affect the viability or success of any species or habitat within any of the national properties. The FAA relies on the biological resources analyses and conclusions in Section 4.11 to make the determination that there would not be constructive use of any Section 4(f) properties based on effects on wildlife. This determination includes property specifically designated as a wildlife refuge (i.e., Crocodile Lake NWR), as well as the other Section 4(f) properties where biological resources constitute important attributes.

With respect to people, aircraft noise resulting from the Proposed Action would not substantially change the noise environment experienced in the national properties. The noise environment is comprised of noise from military and other government aircraft operations at Homestead; aircraft noise from other airports in the region; and other human, mechanical, and natural levels of sounds in the national properties. Additional civil aircraft operations projected for the Proposed Action would result in incremental changes in noise at various locations, but would not significantly increase noise over existing conditions or forecast future no action conditions. The following paragraphs explain the basis for the FAA's conclusion regarding noise in the national properties. This does not mean that FAA has concluded that there would be no noise effects. There would be effects at some locations in the national properties, as assessed in Section 4.5 and Appendix E, and it is understood that a number of people find these effects unacceptable. However, the FAA's judgment is that, based on worst case maximum use conditions, predicted noise effects of the Proposed Action would not rise to the level of a DOT Act Section 4(f) use as further explained below.

The FAA uses sophisticated computer models to translate aircraft operational numbers, noise and performance characteristics, flight track and altitude information, and other relevant factors into noise contour and grid point analyses using various noise metrics. This information is then used by the FAA to make judgments about the Proposed Action's noise effects on DOT Act Section 4(f) resources.

When aircraft noise is evaluated from the standpoint of the loudest aircraft, using the LAmax metric, military aircraft (which will continue to use Homestead regardless of the disposal decision) are the loudest aircraft close to Homestead where aircraft are arriving and departing. It is only at farther distances from Homestead, where civil flight tracks diverge from military flight tracks, that civil aircraft would be the loudest aircraft. However, by the time flight tracks diverged, civil aircraft would be higher in the air and, therefore, the maximum noise level heard on the ground would be lower.

The loudness of aircraft provides an assessment of individual aircraft flyover noise. It does not measure the duration of noise. The Time Above metric specifically targets duration. The SEIS assesses the time that aircraft noise would be above the average level of other noises (both natural and man-made) in the

national parks and refuge, using TAamb. Agencies and individuals that have strong concerns about noise impacts on the parks have particularly focused on the results of the TAamb metric, and a number of them have concluded that these results indicate a significant noise impact, as well as a constructive use under DOT Act Section 4(f).

The Time Above results look high in certain areas of the parks and refuge (1–2 hours and more daily), although they also look low over large percentages of park and refuge geographic areas (less than 10 minutes a day). It should be kept in mind that Time Above results reflect total time during an average day, by adding non-consecutive durations of time from individual flyovers. It is also important to keep in mind that Time Above is only a time-based noise descriptor. It does not reflect noise energy or loudness of an aircraft—factors that have been shown to correlate closely with human reaction to noise. TAamb is only reporting durations of aircraft sound above other sounds. It is not reporting how loud aircraft sounds are in comparison to the other sounds (i.e., whether aircraft are a lot louder, or only a little louder, than other sounds). TAamb, therefore, does not provide an assessment of the extent to which aircraft noise would be high enough above other sounds to be substantially intrusive, annoying to people, or substantially change the overall noise environment.

The third noise metric primarily used for the noise assessment of the national properties is peak hour Leq—Leq(h). Leq(h) is a cumulative measure of noise, and it includes the number of aircraft, the loudness of aircraft, and the duration of aircraft noise. It is a better indicator than either LAmax or TAamb of overall changes in aircraft sound levels and the noise environment, and of how people respond to noise. The relationship between sound levels and community response to noise is well known and documented (**Report of Federal Interagency Committee on Noise, August 1992**). The nature of this relationship appears to be true in park environments also. In recent FAA research on national park visitor reaction to aircraft noise, the findings indicated that visitors were three times more likely to be annoyed by the level of sound heard than by the amount of time they heard aircraft, and visitors were four times more likely to be annoyed by the level of sound than by the number of aircraft they heard (**Fleming et al. 1998**).

In the SEIS, Leq(h) calculates the peak (i.e., busiest) hour cumulative noise, not the average hour, and indicates the extent to which the Proposed Action would increase Leq levels above the projected baseline/No Action alternative and average traditional ambient Leq levels (see Figure 4.5-14). There is no significant increase in cumulative noise in the national properties. At maximum use of the Proposed Action, only in a few grids in Everglades NP are Leq(h) levels predicted to increase by as much as 5 dB. (Less than a 5 dB increase is considered to be *de minimus* and falls within the "no change" category in Figure 4.5-14.) Biscayne NP, Crocodile Lake NWR, and Big Cypress National Preserve are not predicted to have any Leq(h) increases as much as 5 dB. There are no increases as much as 10 dB in any national property grids.

In addition to the increases in Leq(h) noted in the Everglades NP grids, it is also important to look at the absolute Leq(h) values in these same grids, which range from 36.0 to 43.8 dB. These values are categorized as low-level noise, rather than high or even moderate. (As a reference point, the performance goal for the interior of homes that are sound insulated is 45 dB.) These Proposed Action Leq(h) levels are also within the range of traditional ambient measurements in Everglades NP, which range from average Leqs of 31.2 to 54.9 dB. The grids also occur within the geographic area of Everglades NP that can benefit from noise abatement flight paths, which would somewhat lower Leq(h) increases.

Leq(h) increases, as well as TAamb increases, are in relation to average traditional ambient levels in the parks and refuge, as well as in relation to the noise of the projected baseline. NPS and a number of commentors on the Draft SEIS have recommended using natural ambient levels (sounds of nature only), instead of traditional ambient (all sounds—i.e., nature, people, boats, mechanical noise, etc.—except aircraft). NPS would use a natural ambient baseline as developed using the NPS/Wyle methodology

described in Appendix H. This methodology would produce a lower ambient baseline than used in the SEIS—perhaps as low as 33 dB in Biscayne NP, according to NPS indications. The obvious result of using a lower baseline is that the extent to which aircraft noise would be calculated above the ambient level would increase. Such an increase could be regarded as adding severity to the aircraft noise impact, although it should be noted that absolute LAmax and Leq(h) aircraft noise levels would remain the same. Single-event and cumulative aircraft noise would not be at higher levels than assessed in the SEIS. It is the ambient value that would be lowered, which would affect TAamb calculations. Any additional minutes per day that may be added to the TAamb, if a lower natural ambient threshold were used, would be from aircraft noise that is below the average level of other sounds (the traditional ambient) in the national parks and refuge.

The FAA has reviewed the NPS/Wyle methodology and has addressed in some detail in Appendix H the FAA's concerns with this methodology and reasons for not using it. It is worth summarizing key reasons why the FAA does not use natural ambient in general and the NPS/Wyle calculation of natural ambient in particular as a basis for assessing aircraft noise effects and for this Section 4(f) determination. The FAA has selected traditional ambient, rather than natural ambient, in order to account for all sounds except aircraft that are heard in particular park and refuge locations. In locations where human and mechanical sounds are few and low, the traditional ambient and natural ambient are essentially the same. In other park locations where human and mechanical sounds dominate and are louder than natural sounds, the traditional ambient is higher than the natural ambient.

There have been many studies performed on people's reactions to noise. People are physically capable of hearing noise at levels that do not annoy them, so whether or not people can hear aircraft noise does not provide a reliable threshold for potential adverse effects. Moreover, aircraft noise that is still relatively low in relation to other surrounding environmental sounds is not necessarily segregated out by people as an intrusive noise; it may not even be noticed unless a person is actively listening for it. For these reasons, the FAA regards it as essential to take into account all surrounding sounds when assessing the effects of aircraft noise in lower level noise environments. If some categories of sound that are heard are excluded from the ambient baseline simply because they are human-made, rather than natural sounds, one begins to calculate aircraft noise effects at levels that would not tend to be annoying or intrusive—and may even be below what people would hear to some extent because of the masking effects of other environmental sounds.

The FAA's concern with a natural ambient baseline for aircraft noise assessment is exacerbated by the NPS/Wyle methodology for deriving the natural ambient level. Under this methodology, the natural ambient level is based on the quietest 10 percent of noise data that is statistically derived from noise monitoring. This results in a very low ambient level, referred to as the L_{90}. Using the L_{90} as the natural ambient baseline, 90 percent of the sounds in the park—whether natural or man-made—are noisier than the natural ambient. Insect activity, bird calls, and waves lapping the hulls of boats at idle, for example, were measured in the national parks at higher noise levels than the L_{90}. While the NPS may find the L_{90} to be useful as a natural ambient baseline for park management purposes, FAA does not believe that its use is readily transferable to the evaluation of the extent to which aircraft noise affects national parks. Because the L_{90} is such a low level, it not only excludes many natural as well as human-made sounds that people actually hear in a park, but also the L_{90} could be below the level of hearing audibility of aircraft noise for appreciable periods of time.

The FAA has not found scientific support for the establishment of a threshold level for aircraft noise intrusions that is so low that aircraft sounds would not be heard by attentive listeners at times. The technical capability has been developed to calculate noise to such low levels that it can be meaningless in terms of assessing actual noise impact. (For example, at one location in Everglades NP, FAA's computer calculation indicated that the "loudest aircraft noise" at the location was from an aircraft on the ground at

Miami International Airport 50 miles away.) Aircraft noise should be at levels high enough not only to be heard, but also high enough to produce adverse annoyance reactions from park visitors or an adverse impact on fauna in order for the FAA to determine that there would be an adverse noise impact on a national park. The FAA does not believe there is reasonable technical support for assumptions that aircraft noise above an L_{90} level, but below levels detrimental to animals or annoying to visitors, would adversely affect national park resources.

A few studies have been done of people in park and wilderness settings (see Section 4.6). While statistics in these studies cannot be used to predict the percentage of visitors in the national parks near Homestead that would be annoyed by aircraft noise, the studies have not generally found substantial levels of visitor disturbance by aircraft noise. No specific surveys have been done for the SEIS of visitors in Biscayne NP and Everglades NP. (Crocodile Lake NWR is closed to the public.) In numerous comments on the Draft SEIS, people generally remarked favorably on the current quiet environment and natural sounds of the national parks. At the same time, one can see by looking at the noise maps of existing conditions in Section 3.5 that the national parks currently receive aircraft noise from Homestead and other south Florida airports. This is anecdotal evidence, of course, but one might expect more expressions of adverse reactions to existing aircraft noise if there were an extremely low threshold of sensitivity to aircraft noise on the part of park visitors. It is also informative that visitation and use patterns of Biscayne NP and Everglades NP were not markedly different when Homestead was a very active military base, producing higher Leq(h) and TAamb levels in park locations closest to Homestead than is the case today. The western portion of Biscayne NP was subjected to higher military aircraft Leq(h) and TAamb levels in 1987 than it is predicted to receive at maximum use of the Proposed Action.

The primary factor affecting the evaluation of noise effects of the Proposed Action is not the selection of the ambient baseline in the parks and refuge, but rather the noise of the projected No Action baseline. Section 3.5 includes noise contours and noise grid analyses for future No Action baseline conditions in the national properties, including military and other government aircraft that will continue to operate at Homestead under any future reuse option, as well as aircraft at other airports in the area. Military aircraft are noisier than civil aircraft, particularly since the completion of the transition to the current quietest generation of large civil aircraft, Stage 3 aircraft (which are expected to be replaced in the future by even quieter Stage 4 civil aircraft). Even though military aircraft are fewer in numbers than future predicted numbers of civil aircraft, their loudness makes them continue to dominate the noise environment in the national properties near Homestead. In addition, the national properties collectively occupy such large amounts of territory in south Florida that it is virtually impossible to serve Miami International, Fort Lauderdale International, and other Miami-Dade County airports without flying over some portions of the national properties. The additional civil aircraft noise that could be added at Homestead constitutes an incremental increase in noise rather than a substantial change in the noise environment above the future No Action baseline.

In addition to the potential effects on national park visitors and wildlife, the issue of "impairment" has been raised based on the view that aircraft noise will impair national park resources because it is human-made, rather than natural, and because it is not part of the natural soundscape. The SEIS acknowledges that the Proposed Action would add aircraft noise, which is contrary to NPS soundscape goals. However, the addition of aircraft noise to a national park that also experiences various other human and mechanical sounds is not per se equivalent to a substantial environmental change, a significant noise impact, or a constructive use under DOT Act Section 4(f). FAA does not find a basis for concluding that aircraft noise would impair the national properties in a way that would be independent of factors evaluated in the SEIS and previously addressed in this Section 4(f) review. The FAA does not subscribe to the concept that the presence of aircraft noise, absent predictive negative consequences based on hearing and reactions of people and animals, would constitute an impairment of resources.

Many people who commented on the Draft SEIS have made individual judgments on the Proposed Action's noise impact by counting numbers of aircraft at maximum use—either the total number of annual aircraft operations of 231,000 or the total daily average number of 634. Based on such numbers, many people have concluded that a commercial airport would be both much busier and much noisier than the former military air base and that it would be unacceptable in juxtaposition to the national parks and refuge on that basis. However, aircraft operational numbers alone do not provide a sufficient basis for evaluating aircraft noise and should not be substituted for the extensive SEIS noise contour and grid point analyses.

The Proposed Action would be both busier and noisier than the current and future operational status of Homestead as a military/government airfield. However, to provide some historical and relational context, when Homestead was an active military air base before Hurricane Andrew, it had about 525 military aircraft operations a day, five days a week. There were substantial numbers of high-performance, very noisy military aircraft—including the F-4, B-52, and F-15 aircraft that were noisier than the F-16 military aircraft presently operating at Homestead. High-performance military aircraft currently operating at Homestead remain noisier than large high-performance civil aircraft, whose noise has been reduced by federal law and regulation. Low-performance general aviation propeller aircraft are much less noisy. In 2015, a commercial airport at Homestead is predicted to result in about 125 civil jet aircraft operations and 175 civil propeller aircraft operations a day, seven days a week, allocated on various flight tracks over the national properties as indicated in the SEIS. At maximum use (estimated as a potential airport condition near the year 2038), these numbers are predicted to increase to about 340 civil jet aircraft operations and 220 civil propeller aircraft operations a day. (Additional numbers of military/government aircraft operations that currently occur at Homestead are projected to continue in the future.) At maximum use, the Proposed Action would still not generate as high a level of aircraft noise exposure over the nearby areas of the national properties as the military base generated during its active years prior to Hurricane Andrew.

In conclusion, the FAA does not predict that the reuse of former Homestead AFB for a commercial airport would significantly change the noise environment of the four national properties or constructively use the properties under DOT Act Section 4(f), based on the results of the extensive SEIS analysis done with a variety of metrics to examine different aspects of noise within the national properties and on information accumulated to date on human and animal reactions to noise.

FAA Constructive Use Determination on Noise for Marine Sanctuary and State Parks

Noise grid point analysis on a smaller scale has also been applied to Florida Keys National Marine Sanctuary, John Pennekamp Coral Reef State Park, Bill Baggs Cape Florida State Park, and Key Largo Hammocks State Botanical Site. All of these properties are well outside of the DNL 65 dB noise contour and are considered compatible under FAA's Part 150 guidelines. None are as close to Homestead as Biscayne NP. Because of their distance from Homestead, they would not normally have been subjected to special grid point analysis for either NEPA or DOT Act Section 4(f) purposes. However, because the geographic area of noise analysis was so extended in this SEIS to address national park and refuge concerns, other parks were included because similar concerns about them have been raised.

Based on noise analysis in the SEIS and summarized below, these properties are less affected by the Proposed Action than the national parks and refuge. Their noise environments would change very little, if at all, because of the Proposed Action. The analysis of biological resources in Section 4.11 has found no substantial adverse noise effects on wildlife. There would be no substantial diminishing of the use or value of these parks for people or wildlife. Based on Part 150 land use compatibility guidelines as supplemented by criteria used to evaluate the four national properties, FAA has determined that the

Proposed Action would not constructively use the marine sanctuary or any of these other parks based on aircraft noise effects.

Florida Keys National Marine Sanctuary. Florida Keys National Marine Sanctuary (FKNMS) is more distant from Homestead than the national parks. Two grid points were located in FKNMS—one about 8 miles east of Biscayne NP's Old Rhodes Key and the other just south of Everglades NP near Lower Matacumbe Key. Ambient noise measurements were not done in FKNMS, but reasonable estimates of TAamb were able to be made based on traditional ambient data for nearby park sites. At the FKNMS grid point east of Biscayne NP, there would be no change in maximum sound level from the Proposed Action. The peak hour Leq increase from 26.3 to 36.5 dB would be well below the level of other sounds based on an estimated traditional ambient level of 52 dB. The TAamb is not projected to be exceeded more than 3 minutes on an average day for any future condition of the Proposed Action. At the FKNMS site south of Everglades NP, the maximum sound level would increase with the Proposed Action at maximum use from 30 to 52 dB because of civil jet aircraft operations along the MNATE departure route from Homestead. This 52 dB maximum sound level is not regarded as a high single-event aircraft noise level and may occur only occasionally—not necessarily on a daily basis. Cumulative aircraft noise levels, measured in peak hour Leq, would be extremely low—increasing from 8.3 to 18.6 dB at maximum use, which is far below the estimated traditional ambient level of 46 dB. TAamb data in nearby grids indicates that there would be virtually no increases in TAamb on an average day.

John Pennekamp Coral Reef State Park. The maximum sound level would not change as a result of the Proposed Action. Cumulative noise levels are predicted to slightly increase, from 41.3 to 42.2 dB (an increase of slightly less than 1 dB) at maximum use of a commercial airport. Cumulative aircraft noise levels are projected to remain below the estimated traditional ambient level of 50 dB. Nearby sites indicate an expected increase in TAamb of 4 to 7 minutes per day on the average at the Proposed Action's maximum use. The highest TAamb for the Proposed Action calculated at any nearby grid is 13 minutes daily.

Bill Baggs Cape Florida State Park. This park is not far from the residential areas of Key Biscayne. It was primarily analyzed because of noise concern relative to the Commercial Spaceport Alternative, rather than the Proposed Action. The park is exposed to more noise from aircraft operations at Miami International Airport than from current or projected operations at Homestead. The traditional ambient noise level is estimated to be 55 dB based on the measured ambient levels in nearby areas of Biscayne NP. Neither the maximum sound level, cumulative noise, nor TAamb would be increased with the Proposed Action.

Key Largo Hammocks State Botanical Site. This park is adjacent to the northeast corner of Crocodile Lake NWR. Military aircraft using Homestead would continue to be the loudest aircraft. At maximum use of the Proposed Action, cumulative noise levels calculated in Leq(h) are projected to increase from 34.3 to 37.8 dB—remaining below the traditional ambient noise level of 41 dB. TAamb was not calculated for this park. In the nearest grid in Crocodile Lake NWR where TAamb was calculated, TAamb is predicted to increase by 58.1 minutes on an average day with the Proposed Action at maximum use. The TAamb increase at Key Largo Hammocks State Botanical Site would be less than this because both LAmax and Leq(h) levels are lower than in the Crocodile Lake NWR grid.

Noise in South Florida Water Management District Lands

It is debatable whether South Florida Water Management District (SFWMD) lands fall within the purview of DOT Act Section 4(f). They are not officially designated as public parks or wildlife refuges and do not specifically function as such. They are not in public ownership in entirety. Information provided by the SFWMD indicates that the Model Lands Basin is not fully in public ownership and is not yet open to the

public. Agricultural uses continue to function. However, the Southern Glades Wildlife and Environmental Area and the Model Lands Basin provide a wildlife corridor between the national parks and refuge, and the Southern Glades and Frog Pond lands allow various public recreational uses to the extent appropriate to the environmental sensitivity of the areas. The Model Lands Basin would provide opportunities for hiking and boating.

The SEIS's assessment of the potential effects of the Proposed Action on biological resources includes resources within the SFWMD lands, including potential effects on the Cape Sable seaside sparrow. The results of that assessment, which included but was not limited to noise effects, supports the determination that the Proposed Action would not constructively use the wildlife refuge aspects of the SFWMD lands.

All of the SFWMD lands are well outside of the DNL 65 dB noise contour. The recreational uses within these lands (e.g., hiking, boating, horseback riding, hunting, fishing) appear to fall within traditional recreational use categories in FAA's Part 150 compatible land use guidelines, and are considered compatible with the Proposed Action's predicted aircraft noise levels on that basis. In addition, a special noise grid analysis was performed at the request of the SFWMD and is in an Addendum to Appendix E of the SEIS. The lack of ambient noise measurement and mapping precludes the calculation of TAamb data. The grid analysis essentially shows, as elaborated on below for each area, that military aircraft using Homestead would continue to be the loudest aircraft in these lands and that cumulative levels of aircraft noise would not significantly change the current noise environment nor be high enough to substantially diminish or interfere with existing or planned public recreational uses of these areas. The FAA has determined that, if the SFWMD lands are subject to DOT Act Section 4(f), there would be no constructive use based on noise of the Proposed Action.

Southern Glades Wildlife and Environmental Area. Maximum sound levels from military aircraft currently using Homestead range from 64.9 to 86.9 dB. In all but one case, these levels would remain the same in the future with the Proposed Action. Only within one grid is the maximum sound level predicted to increase in 2015 because of the MD-80 civil aircraft. This increase only amounts to 2.1 dB. Between 2015 and maximum use of a commercial airport, MD-80 aircraft will have been phased out—again leaving military aircraft as the loudest aircraft throughout the Southern Glades. Cumulative aircraft noise levels calculated in Leq(h) currently range from 31.3 to 42.9 dB. At maximum use, the Proposed Action would increase aircraft Leq(h) values, so that they would range from 34.4 to 49.8 dB. In three grids, the Leq(h) increases are greater than 5 dB (increases of less than 5 dB are considered *de minimus*). The increases above 5 dB are 6.9, 7.6, and 11 dB. The grid showing the 11 dB increase is adjacent to U.S. Highway 1. Although ambient noise measurement was not specifically performed for the Southern Glades, there are select ambient data collected for nearby park areas and special noise assessments. Ambient measurements at three locations adjacent to U.S. Highway 1 resulted in traditional ambient values of 40, 45, and 47 dB. These ambient Leq levels would temper the Leq(h) increase in aircraft noise. Even untempered by ambient data, the Leq(h) values calculated for the Proposed Action at maximum use would not be high enough to interfere with or substantially diminish public use and enjoyment of the recreational opportunities in the Southern Glades.

Model Lands Basin. Military aircraft would continue to produce the highest maximum sound levels. Cumulative aircraft noise levels calculated in Leq(h) currently range from 29.1 to 57.8 dB throughout the Model Lands Basin. These Leq(h) values are only reporting aircraft noise. In the grid with the 29.1 dB of aircraft noise, the traditional ambient level measures much higher at 47 dB. This is a grid adjacent to U.S. Highway 1. With the Proposed Action at maximum use, aircraft noise levels calculated in Leq(h) would range from 36.3 to 57.9 dB. Leq(h) increases of over 5 dB would occur with the Proposed Action at maximum use in three grids within the Model Lands Basin. However, these cumulative increases in aircraft noise still result in relatively low Leq(h) values for aircraft noise that remain within the range of current aircraft Leq(h) levels within the Model Lands Basin. The grid analysis overall shows no

substantial change in the noise environment of the Model Lands Basin with the Proposed Action. Cumulative aircraft noise levels are considered to be compatible with public recreational uses.

Frog Pond. In Frog Pond, military aircraft would continue to produce the highest maximum sound levels. Cumulative aircraft noise levels calculated in Leq(h) currently range from 39 to 54.5 dB. With the Proposed Action at maximum use, aircraft Leq(h) values would range from 43.6 to 56 dB. There are no predicted Leq(h) increases as high as 5 dB. The noise environment in the Frog Pond lands would not substantially change with the Proposed Action, and no adverse effects on public use and enjoyment of recreational uses would occur.

Other Environmental Impacts

None of the other potential environmental impacts of the Proposed Action (e.g., air, water, land use and aesthetics) would substantially diminish the activities, features, or attributes of any Section 4(f) property identified in Section 3.14, based on the analysis in the SEIS of each of these impacts. For some impacts, there would be environmental changes in the Homestead vicinity that could either be noticed or measured, or both, at some of the nearby Section 4(f) properties. However, these changes would not approach a level of substantially altering the air quality, water quality, land use, aesthetics, or other activity, feature, or attribute of any Section 4(f) resource.

Visual intrusion of aircraft over the national properties is of concern. Under the Proposed Action more aircraft would be added to the south Florida airspace over the national properties along the proposed flight tracks delineated in the SEIS. These aircraft would be more visible at relatively lower altitudes nearer the runway, than at higher altitudes, and when they would be flying over areas of open vistas, such as open water in Biscayne NP, than over park areas with high vegetation. Aircraft lights at night would be visible. However, unless people's attention is attracted to aircraft because of high noise levels or people are otherwise looking up at the sky, aircraft are not necessarily noticed. Moreover, the visibility of aircraft from a national park location does not equate to a significant impact. It is very rare for the FAA to receive complaints from people about seeing aircraft unless the aircraft are extremely low (generating safety concerns), intrusive because of noise, or perceived by people to be deviating substantially from prescribed flight paths. Visitor survey information compiled by NPS from 39 different units of the National Park System reported that 18.8 percent of visitors reported seeing aircraft and that 3 percent of visitors were annoyed by seeing aircraft. Aircraft overflights from Homestead and other airports in the region currently occur over the national properties and have not generated a record of visual complaints. Aircraft from Homestead would be flying along different flight paths based on their origin/destination and performance characteristics, rather than concentrated over a single area. Visual sightings of aircraft would tend to be short and transitory. The FAA does not believe there is a sound basis for assuming that additional aircraft operations at Homestead would constructively use Section 4(f) resources based on visual effects.

Section 4.11 analyzes the potential effect of the Proposed Action on biological resources, including but not limited to biological resources within Section 4(f) properties. Included within this analysis are potential effects on biological resources of aircraft noise, as well as air quality, water quality and changes in patterns of water flows, land disturbance, secondary development, and other factors. None of the potential impacts on biological resources identified for the Proposed Action are anticipated to substantially diminish those resources or affect the viability or success of any species or habitat within any of the Section 4(f) properties. The FAA relies on the biological resources analyses and conclusions to make the determination that there would not be constructive use of any Section 4(f) properties based on substantial effects on their biological resources. This determination includes property specifically designated as Section 4(f) to protect wildlife, such as the Crocodile Lake Wildlife Refuge, as well as other Section 4(f) property where biological resources constitute important attributes, including national and

state parks, preserves, and sanctuaries, and the biological resources and wildlife corridors in the SFWMD lands.

Historic Sites

The FAA has determined that there would be no constructive use of historic sites based on the evaluation in Section 4.12. The Florida State Historic Preservation Officer has concurred in a no effect finding. In a letter dated March 6, 2000, the Florida SHPO (Division of Historical Resources) stated that a review of the Draft SEIS, the Florida Site file, and the division's records indicated that no significant archeological or historical sites have been recorded or are likely to be present within the Proposed Action's area of potential effects. The letter further indicates that, because of the project location and/or nature, it is unlikely that historic properties would be affected.

Section 4(f) Findings

If a proposed airport project involves the use of DOT Act Section 4(f) land, the FAA must make two findings in order to approve the project: (1) there is no prudent and feasible alternative to using the land, and (2) the project includes all possible planning to minimize harm to the land from the proposed use. The FAA normally relies on information in an EIS to support such findings and then makes the findings themselves in a NEPA Record of Decision. In this case, since the FAA has determined that the Proposed Action will not use Section 4(f) land, these findings do not need to be made. If these findings were required, the FAA believes there is sufficient supporting information in Appendix A regarding commercial airport need and alternatives to support the first finding and environmental mitigation in Chapter 4 to support the second finding.

4.14.3 Commercial Spaceport Alternative

The Commercial Spaceport Alternative would not directly take any Section 4(f) resources.

The concept of a Commercial Spaceport for reusable launch vehicles is an emerging idea. As of the publication of the Final SEIS, there are no existing commercial launch facilities for horizontally launched reusable launch vehicles. Operational, performance, and noise characteristics of such a commercial spaceport have been evaluated in the SEIS based on the best available information and estimates. However, there remains much environmental uncertainty about a Commercial Spaceport, to the extent that additional environmental review would be required by the FAA for licenses for site and launch operators. Given current uncertainties, the FAA is not in a position to make a definitive DOT Act Section 4(f) determination at this time on a Commercial Spaceport alternative.

4.14.4 Mixed Use Alternative

This alternative does not include a transportation project. Section 4(f) is not applicable.

4.14.5 No Action Alternative

The continuation of the status of Homestead as a military-owned airfield does not constitute a transportation project under the meaning of DOT Section 4(f). Section 4(f) is not applicable.

4.14.6 Independent Land Use Concepts

These uses do not include a transportation project. Section 4(f) is not applicable.

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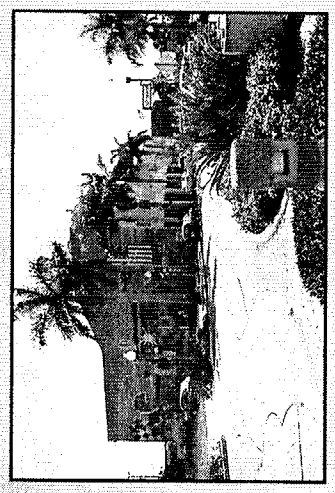
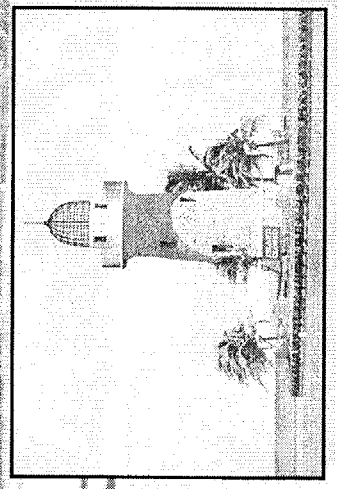
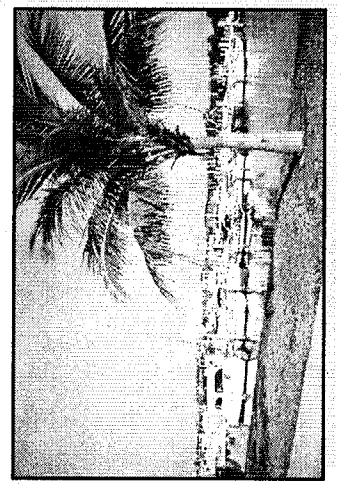
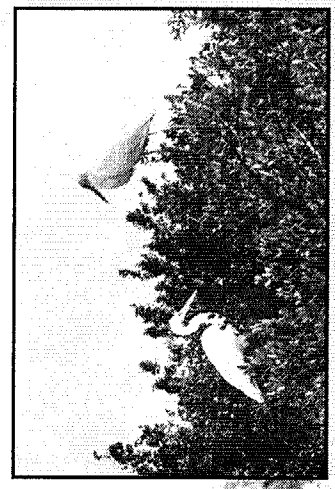
5.0 References









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Metro-Dade County 1998b	Metropolitan Dade County. 1998. *lbusstop.* Dade County bus stops. Miami, Florida. January 31.
Metro-Dade County 1998c	Metropolitan Dade County. 1998. *lu-94.* Metropolitan Dade County. Miami, Florida. March 5.
Metro-Dade County 1998d	Metropolitan Dade County. 1998. *pushouse.* U.S. House of Representatives. Miami, Florida. January 31.

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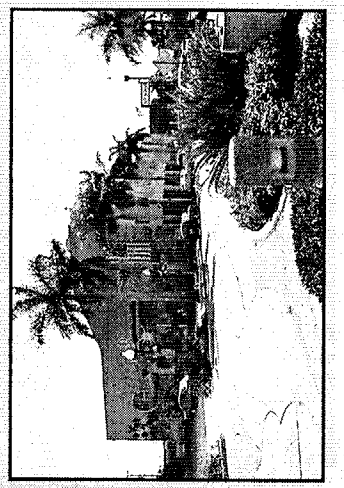

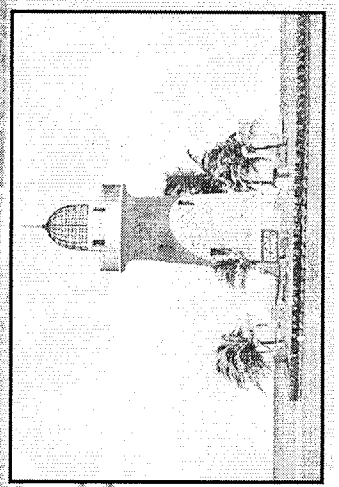

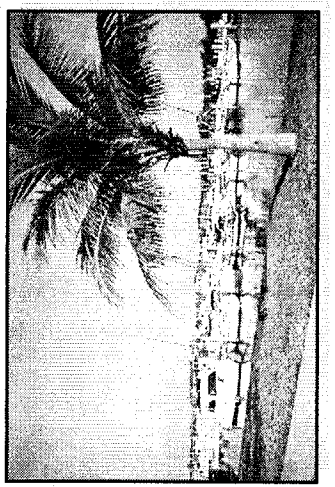

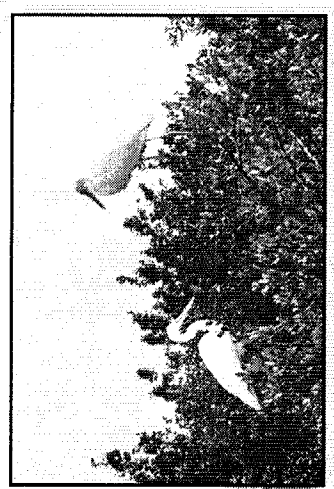

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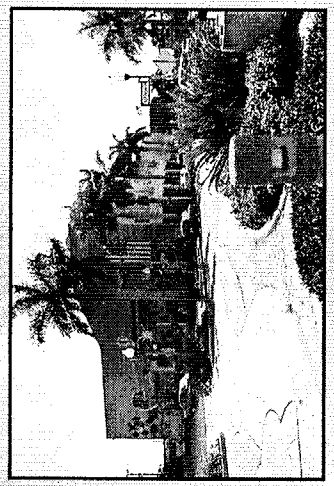

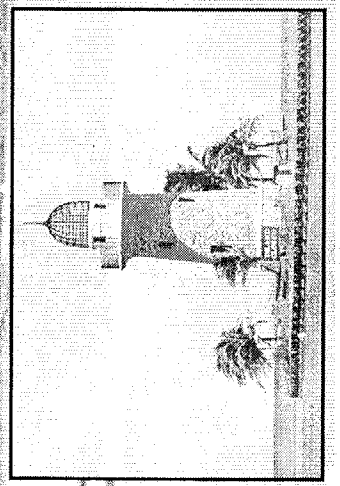

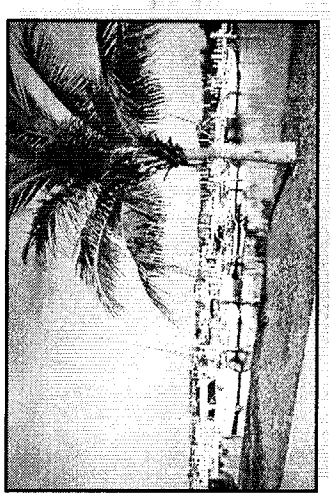

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Key Biscayne Branch Library
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Key Largo Branch Library
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Miami-Dade Community College
Homestead Campus Library
500 College Terrace, Bldg D
Homestead, FL 33030

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North Campus Library
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Miami, FL 33167

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Miami, FL 33149

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Opa-Locka, FL 33054

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South Miami Branch Library
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University of Miami
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1252 Memorial Drive
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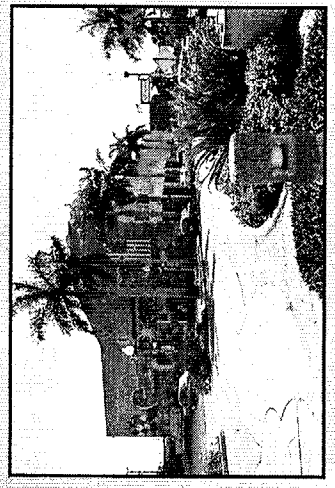

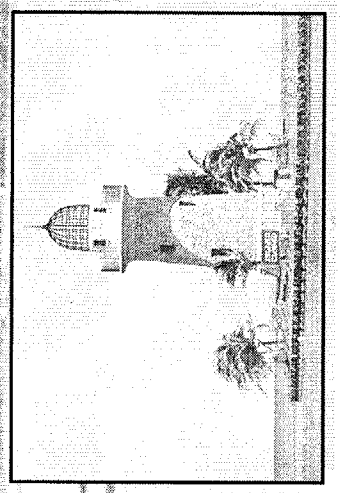

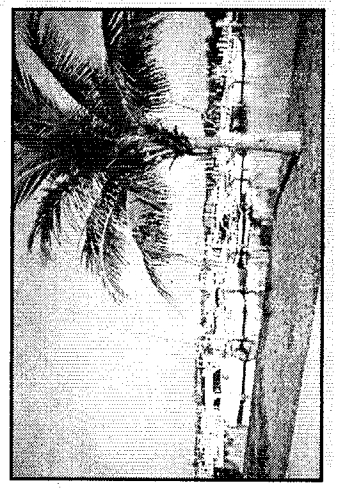

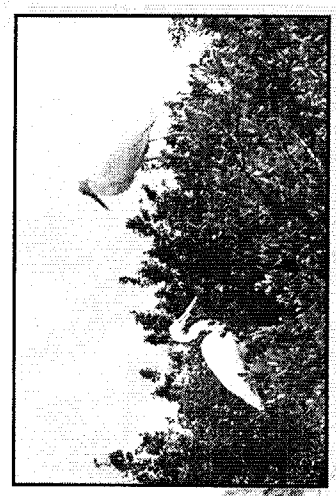

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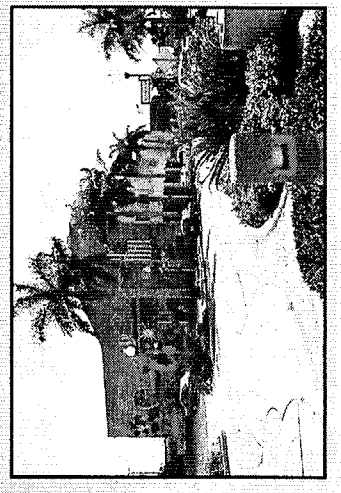

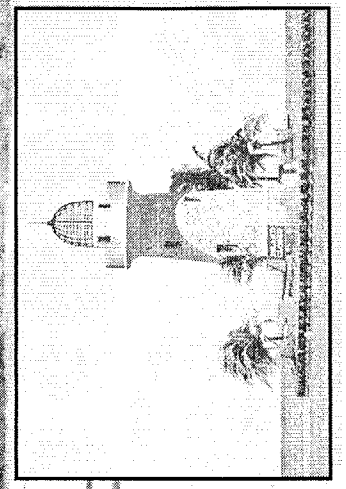

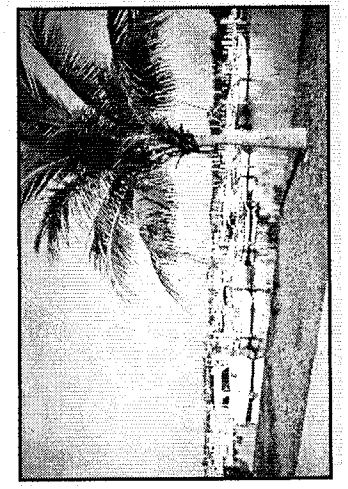

9.0 GLOSSARY

Accident Potential Zone (APZ). Areas immediately beyond the Clear Zone at each end of Department of Defense fixed-wing runways. APZs have a higher potential for aircraft accidents than other areas. APZs fall into two categories: APZ I is the area beyond the runway Clear Zone where there is a significant potential for accidents. APZ II is an area beyond APZ 1 that has a measurable potential for accidents.

Advisory Circular (AC). A document published by the Federal Aviation Administration (FAA) giving guidance on aviation issues.

Aircraft Operation. An aircraft arrival, departure, or closed pattern at an airport with FAA airport traffic control service. There are two types of operations: local and itinerant.

Air Installation Compatible Use Zone (AICUZ) Program. This program was developed by the Air Force to make recommendations to communities on land use compatibility with aviation operations. The AICUZ program provides recommendations to local governments on land uses compatible with exposure to aircraft noise and safety considerations.

Airport Layout Plan (ALP). A scaled drawing of existing and proposed land and facilities for the operation and development of an airport. The ALP shows boundaries and proposed additions to areas owned or controlled by the sponsor, the location and nature of existing and proposed airport facilities and structures, and the location on the airport of existing and proposed non-aviation areas and improvements.

Airport Operations. The total number of movements in landings (arrivals), takeoffs (departures), and closed patterns at an airport.

Airport Sponsor. A public agency or tax-supported organization, such as an airport authority, that is authorized to own and operate an airport, to obtain property interests, to obtain funds, and to legally, financially, and otherwise be able to meet all applicable requirements of current laws and regulations.

Air Route Traffic Control Center (ARTCC). A facility established to provide air traffic control services to aircraft operating on Instrument Flight Rules flight plans within controlled airspace and principally during the en-route phase of flight.

Air Traffic. Aircraft operating in the air or at an airport, excluding loading ramps and parking areas.

Air Traffic Control. Control of the airspace provided to promote the safe, orderly, and expeditious movement of terminal air traffic.

Alternatives. Potential uses for the disposal property considered in the SEIS.

Ambient Sound Level. The total amount of noise in a given place and time, which is usually a composite of sounds from varying sources. See Traditional Ambient Sound Level, Existing Ambient Sound Level, and Natural Ambient Sound Level.

Approach Control Area. Airspace of defined dimensions within which air traffic control services are normally provided by an approach control facility for arriving and departing aircraft at one or more airfields.

GLOSSARY

Appropriated Fund Personnel. On military installations, federal civilian personnel who are civil service employees paid from congressionally appropriated funds. Nonappropriated fund personnel are paid from funds allocated from the installation's nonappropriated fund activities, (e.g., golf course, bowling center) which raise funds by charging fees for goods and services.

Aquifer. A water-bearing bed or layer of earth comprised of permeable rock, sand, or gravel capable of supplying considerable quantities of water to wells or springs.

Average Annual Daily Traffic. For a one year period, the total number of vehicles passing a point or segment of a highway, in both directions, divided by 365.

Average Weekday Daily Traffic. The average number of vehicles using a roadway for any given weekday. The word "weekday" implies that counts were made on such a day, and the associated number does not reflect weekend variation in traffic. It is derived by counting traffic from Monday through Friday, and then dividing by five.

A-Weighted. A weighting methodology used to account for changes in human hearing sensitivity as a function of frequency. The A-weighting de-emphasizes the high (6.3 kilohertz [kHz] and above) and low (below 1 kHz) frequencies, and emphasizes the frequencies between 1 kHz and 6.3 kHz, in an effort to simulate the relative response of human hearing.

Backbone Flight Path. The centerline of a flight path or distribution of flight tracks. See also Flight Path.

Based Aircraft. An aircraft permanently stationed at an airport by agreement between the aircraft owner and the airport management.

Baseline. The existing (or projected) environmental conditions against which the impacts of the Proposed Action and alternatives are assessed.

Biodiversity. The variety and number of plant and animal species and their relative abundance in an area or habitat.

Cantonment. A separately enclosed or self-contained area assigned to a military unit.

Clear Zone. An area on either end of a runway where the aircraft accident risk is high enough that land use restrictions are used to prevent development that would place people at risk.

Closed Pattern. A short flight route around an airport runway, generally a circle or a rectangle, used by pilots to practice repetitive take-off and landing procedures without actually stopping the aircraft.

Commercial Launch Facility. A facility where commercial launch vehicles licensed by the Federal Aviation Administration may be launched and recovered.

Compatible Land Use. As defined in Federal Aviation Regulations Part 150: the use of land (e.g., commercial, industrial, agricultural) that is normally compatible with aircraft and airport operations, or sound insulated land uses (e.g., sound insulated homes, schools, nursing homes, hospitals, libraries) that would otherwise be considered incompatible with aircraft and airport operations.

Controlled Airspace. Airspace of defined dimensions within which air traffic control service is provided in accordance with airspace classification (Classes A–E).

Conveyed Property. Refers to surplus property at former Homestead AFB that has been or is proposed to be transferred to another federal, local, or private entity.

Cumulative Impact. The environmental or socioeconomic impact of the Proposed Action or an alternative in combination with other past, present, and future actions.

Day-Night Average Sound Level (DNL). A noise measure used to describe the average aircraft noise levels over a 24 hour period, typically an average day over the course of a year. DNL treats aircraft operations occurring between the hours of 10:00 p.m. and 7:00 a.m. as if they were 10 decibels louder than operations occurring between 7:00 am and 10:00 p.m., to account for increased annoyance when ambient noise levels are lower and residents are sleeping. DNL may be determined for individual locations or expressed in noise contours.

Decibel (dB). Sound is measured by its pressure or energy. The decibel scale is logarithmic; when the scale increases by ten, the perceived sound is two times as loud.

Disposal. Transferring ownership or selling surplus land currently owned by the Air Force to another public or private entity.

Disposal Property. As used in the SEIS, refers to the 1,632 acres that are available for disposal and the focus of the Homestead SEIS analysis.

Effluent. Treated liquid discharged from a wastewater treatment facility.

Enplanement. A passenger boarding of a commercial flight.

Environmental Protection Area. Geographic area considered environmentally sensitive and susceptible to environmental degradation, where degradation would adversely affect the supply of potable fresh water or environmental systems of county, regional, state, or national importance. These lands are characteristically high-quality marshes, swamps, and wet prairies, and are not suited for urban or agricultural development.

Equivalent Sound Level (Leq). The steady noise level (usually in A-weighted decibels) over a specified period time that contains the same amount of sound energy as the actual time-varying noise during the same time period.

Estuary. The location where a river, stream, or other body of fresh water meets with the open sea, where the sea water is measurably diluted with freshwater.

Existing Ambient Sound Level. The composite, all-inclusive cumulative sound from all sources at a given location.

Federal Aviation Regulations (FAR). Regulations established and administered by the Federal Aviation Administration that govern civil aviation and aviation-related activities.

Fixed-Base Operator (FBO). An airport facility that serves general aviation users by selling and repairing aircraft and parts, selling fuel, and providing flight and ground-school instruction.

Flightline. The ground parking or servicing area for airplanes, including hangars, operations buildings, and ramps but not including runways or taxiways.

Flight Path. A general corridor along which aircraft are routed by air traffic controllers to enter or exit an approach control area. Also describes flight corridors used by space launch vehicles. A flight path generally leads from an airport toward a navigational fix. See Navigational Fix.

Flight Track. A specific route taken by an aircraft. Flight tracks are generally distributed along and around flight paths.

General Aviation (GA). Refers to all civil aircraft and operations that are not classified as air carrier, commuter, or regional. The types of aircraft used in general aviation activities cover a wide spectrum, from corporate multi-engine jet aircraft piloted by professional crews to amateur-built single engine piston acrobatic planes, balloons, and dirigibles.

Grid Point. A specific point on the ground that is part of a rectangular grid system identified for noise computations by the Integrated Noise Model.

Groundwater. Water within the earth that supplies wells and springs.

Headway. The amount of time (in seconds) between one vehicle passing a point in space and the next vehicle passing that same point, measured from front bumper to front bumper. If one vehicle passes a point and two seconds later the following vehicles passes that same point, the headway is two seconds.

IFR Weather Conditions. Meteorological conditions defined by visibility, distance from clouds, and ceiling less than the minimum specified for flight under visual flight rules. IFR weather conditions are normally less than three miles visibility or less than a 1,000 foot cloud ceiling. See Instrument Flight Rules.

Impervious Surface. A surface that cannot be penetrated; for example, asphalt is impervious to water.

Incompatible Land Use. As defined in Federal Aviation Regulations Part 150: land use of that is normally incompatible with aircraft and airport operations (such as homes, schools, nursing homes, hospitals, and libraries).

Indirect Impact. An environmental impact that is not directly caused by a proposal but may occur as a result of the proposal. Examples of indirect impacts are impacts caused by population increases that occur when the employment opportunities offered by a project attract people to an area

Infiltration. Flow of groundwater into the wastewater collection system through breaks in the pipes, increasing the volume of the flow and the burden on the treatment plant.

Inflow. Water from old connections of stormwater drainage systems to a sanitary sewer system.

Infrastructure. The facilities and other structures that service a local community (e.g., roads, schools, power plants, water supply, sewerage, and communication systems).

In-migration. The number of people moving into a defined geographic area.

Instrument Approach. A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be made visually.

Instrument Flight Rules (IFR). Rules governing the procedure for conducting instrument flight. In addition, a term used by pilots and controllers to indicate a type of flight plan.

Instrument Route. Routes used by military aircraft for the purpose of conducting low-altitude navigation and tactical training in both IFR and VFR weather conditions at altitudes lower than 10,000 feet above mean sea level and at airspeeds over 250 knots.

Integrated Noise Model (INM). FAA's computer model used for evaluating aircraft noise impacts near airports. The INM uses a standard database of aircraft characteristics and applies them to an airport's average operational day to produce noise contours.

Itinerant Operation. Any aircraft arrival and/or departure other than a local operation.

LAmax. See Maximum Sound Level.

Land Use Controls. Measures established by state or local government for land use planning. They can include, among other measures, zoning, subdivision regulations, planned acquisition, easements, covenants or conditions in building codes, and capital improvement programs, such as establishment of sewer, water, utilities or their service facilities.

Leq(h). See Peak Hourly Equivalent Noise Level.

Level of Service (LOS). With regard to transportation, a qualitative measure describing conditions within a traffic stream and how they are perceived by motorists. Regarding public services, a measure describing the amount of public services (e.g., fire protection and law enforcement services) available to community residents, generally expressed as the number of personnel providing services for every 1,000 people.

Local Operation. Any operation performed by an aircraft that (a) operates in the local traffic pattern or within sight of the tower or airport; (b) is known to be departing for, or arriving from, flight in local practice areas located with a 20 mile radius of the control tower or airport; or (c) executes a simulated instrument approach or low pass at the airport.

Local Redevelopment Authority (LRA). The local entity formed by the affected community, recognized by the Department of Defense, and given the responsibility for developing a plan for the reuse of surplus base property. The LRA for former Homestead AFB is Miami-Dade County.

Maximum Sound Level (LAmax). The maximum A-weighted sound level associated with a given event.

Military Training Route (MTR). Airspace of defined vertical and lateral dimensions established for the conduct of military flight training at airspeeds above 250 knots indicated airspeed.

Mishap. An aircraft accident or incident. The Department of the Air Force defines four categories of aircraft mishaps:

- Class A mishaps result in a loss of life, permanent total disability, a total cost in excess of $1 million, destruction of an aircraft, or damage to an aircraft beyond economical repair. Class A mishaps include most aircraft crashes.
- Class B mishaps result in total costs of more than $200,000 but less than $1 million or result in permanent partial disability but do not result in fatalities. An example of a Class B mishap could be multiple avionics components being destroyed during a maintenance test run due to a failure or a maintenance error in connecting a wiring harness. Most Class B mishaps occur on the ground.
- Class C mishaps involve costs of more than $10,000 but less than $200,000 or a loss of worker productivity of more than 8 hours. An example of a Class C mishap could be a maintenance technician who lifts a heavy object and experiences back strain that forces the technician to miss a day or more of work.
- High Accident Potential mishaps are minor incidents not meeting any of the criteria for Class A, B, or C. Accidental superficial damage to a minor component that requires a small maintenance effort to repair it is an example of High Accident Potential.

Mitigation. Avoidance, minimization, reduction, or elimination of, or compensation for, adverse environmental effect.

Natural Ambient Sound Level. The natural sound conditions found in a given study area. Natural Ambient includes all sounds of nature, such as wind, streams, and wildlife. It does not include human or mechanical sounds.

Nautical Mile. A measure of distance equal to one minute of arc on the earth's surface, which is approximately 6,076 feet.

Navigation Aid (NAVAID). Any facility used by an aircraft for guiding or controlling flight in the air or for landing or take off.

Navigational Fix. A geographical position determined by reference to one or more radio navigational aids, by celestial plotting, or by another navigational devise.

Noise. Noise is typically defined as any unwanted or undesirable sound. Noise and sound are physically the same with the difference being in the subjective judgment of the receiver.

Noise Abatement Procedures. Changes in runway usage, flight approach and departure routes and procedures, and vehicle movement, such as ground maneuvers or other air traffic procedures that shift aviation impacts away from noise sensitive areas.

Noise Exposure Contours. Lines drawn around a noise source indicating constant energy levels of noise exposure. DNL is the measure used to describe community exposure to noise.

Noise Level Reduction (NLR). The amount of noise level reduction in decibels achieved through incorporation of noise attenuation (between outdoor and indoor levels) in the design and construction of a structure.

Noise-Sensitive Area. Area where aircraft noise may interfere with existing or planned use of the land. Whether noise interferes with a particular use depends upon the level of noise exposure and the types of activities that are involved. Residential neighborhoods, educational, health, and religious structures and sites, outdoor recreational, cultural and historic sites may be noise sensitive areas.

Off-Airport Property. Property that is beyond the boundary of land owned by the airport sponsor.

Off Site. In this SEIS, refers to activities outside the boundaries of former Homestead AFB.

On-Airport Property. Property that is within the boundary of land owned by the airport sponsor.

On Site. In this SEIS, refers to activities within the boundaries of former Homestead AFB.

Ordnance. Military supplies including weapons, ammunition, combat vehicles, and associated maintenance tools and equipment.

Part 150. Part 150 is the abbreviated name for the airport noise compatibility planning process outlined in Part 150 of the Federal Aviation Regulation that allows airport owners to voluntarily submit noise exposure maps and noise compatibility programs to the FAA for review and approval.

Peak Hourly Equivalent Sound Level (Leq(h)). The equivalent sound level that occurs as a result of a single hour of aircraft operations from the airport or airports of interest. The number of aircraft operations contributing to this value is the estimated peak hour of operations for each airport based on the assumption that the peak hour occurs simultaneously at each airport. See also Equivalent Sound Level.

Permeability. The rate at which a liquid or gas can pass through a substance, such as the ease with which water passes through porous rock or sediment.

Potable Water. Water from natural sources or treated water that is safe or suitable for human consumption.

Projected Baseline. Refers to how environmental conditions might change in the future without reuse of the disposal property. Because former Homestead AFB would be developed over many years, baseline conditions have been projected into the future to allow more accurate comparison with the Proposed Action and alternatives.

Proposed Action. The plan developed by the Local Redevelopment Authority, in this case a commercial airport.

Protected Vacant Land. Miami-Dade County's Environmentally Endangered Lands Program classifies open space as either protected or unprotected vacant lands. Protected vacant lands include wetlands, biologically sensitive lands, and other lands with valuable environmental characteristics, recreation uses, or scenic appeal.

Public Use Airport. A publicly or privately owned airport that offers the use of its facilities to the public without prior notice or special invitation or clearance.

Region of Influence (ROI). The geographic area where the greatest majority of environmental impacts from the Proposed Action and alternatives are expected to occur. The ROI can vary from resource to resource.

Reliever Airport. An airport that meets certain FAA criteria and relieves the aeronautical demand on a busier air carrier airport.

Relocating Population. Residents who already live in a jurisdiction (e.g., Miami-Dade County) and relocate from one part of the jurisdiction to another (e.g., north to south).

REM (roentgen equivalent man). The dosage of any ionizing radiation that will cause the same amount of biological injury to human tissue as one roentgen of X-ray or gamma-ray dosage.

Retained Property. Property at former Homestead AFB that was retained by the Air Force for use by the Air Force Reserve Command, Florida Air National Guard, and Army-Air Force Exchange Service.

Reusable Launch Vehicle. Launch vehicle with reusable stages or components that can return to Earth and be recovered.

Reuse-Related. Activity or impact that is directly or indirectly related to the reuse of the disposal property at former Homestead AFB.

Right-of-Way. A legal right of passage over another person's property. Often refers to a roadway or utility corridor.

Safety Zone. An area established around a location where a hazard to personnel or facilities is present.

Scoping. A public process at the beginning of the preparation of an environmental impact statement to identify potential alternatives and help determine the environmental issues the EIS should focus on. Scoping typically includes public meetings and other activities to solicit inputs from people who would be affected by the action(s) being analyzed.

Secondary Development. Development that is related to or stimulated by the reuse of the disposal property at former Homestead AFB, but that occurs outside the boundaries of the disposal property.

SEL. See Sound Exposure Level.

Site. In this SEIS, refers to the disposal property at former Homestead AFB.

Solid Waste. Discarded materials delivered to a landfill or other facility for disposal. May include semisolids and limited amounts of liquids. Materials classified as hazardous or toxic by the USEPA are not included under the definition of solid waste.

Sound. Sound is generally regarded as the sensation of hearing produced by pressure fluctuations in a fluid medium (air) within the audible range of amplitudes and frequencies.

Sound Attenuation. Acoustical phenomenon whereby a reduction of sound energy is experienced between the noise source and the receiver. This energy loss can be attributed to atmospheric conditions, terrain, vegetation, constructed features (e.g., sound insulation), and natural features.

Sound Exposure Level (SEL). A measure of sound energy (usually A-weighted) used to describe noise events such as the passing of a truck or an aircraft. It is the equivalent sound pressure level, which if occurring over a period of one second, would contain the same amount of sound energy as the actual event. As long as the actual event is longer than one second, the SEL will be higher than the average and the maximum noise levels. Consequently, in most cases people do not actually hear the SEL.

Soundscape. The natural or ambient sounds found in a particular area. Soundscapes encompass an entire area, not just a particular noise found in a specific location.

Special Use Airspace. Defined area of airspace with boundaries that are assigned for specific use and users. The FAA has jurisdiction over all airspace in the United States and has identified special airspace areas that may be used for military flight activity. Special use airspace consists of Restricted Areas, Prohibited Areas, Military Operations Areas, Alert Areas, Warning Areas, National Security Areas, and Controlled Firing Areas.

Stage 2 Aircraft. Aircraft that meet the noise levels prescribed by Federal Aviation Regulations Part 36 and are less stringent than noise levels established for the quieter designation Stage 3 aircraft. The Airport Noise and Capacity Act requires the phase-out of all Stage 2 aircraft by December 31, 1999, with case-by-case exceptions through 2003.

Stage 3 Aircraft. Aircraft that meet the most stringent noise levels in Federal Aviation Regulations Part 36.

Statute Mile. A measure of distance equal to 5,280 feet.

Stormwater Runoff. Rainwater not absorbed into the ground, which can pool as surface water and drain from land or impervious surfaces into adjacent canals, streams, or other water bodies.

Surplus Land. Air Force land that is no longer needed by the federal government and is made available for disposal.

TAamb. See Time Above Ambient.

Terminal Area. A general term used to describe airspace in which airport traffic control or approach control service is provided.

Terminal Radar Approach Control (TRACON). A terminal air traffic control facility that uses radar and non-radar capabilities to provide approach control services to aircraft arriving, departing, or transiting the airspace controlled by the facility.

Time Above Ambient (TAamb). The amount of time, in minutes per average day, that a given location is exposed to noise in excess of the Traditional Ambient Sound Level associated with the location.

Traditional Ambient Sound Level. The composite, all-inclusive sound associated with a given environment, except aircraft noise.

Transportation Analysis District (TAD). Specific geographic area to focus analysis for identifying and assessing impacts to resources such as public parks, recreation areas, refuges, and historic sites of local significance that could result from growth and development. TADs are comprised of multiple Transportation Analysis Zones.

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MTR	military training route
NA	not available or not applicable
NAAQS	National Ambient Air Quality Standards
NADP	noise abatement departure procedure
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NAVAID	navigational aid
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NLR	Noise Level Reduction
NMFS	National Marine Fisheries Service
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NORTS	Notice of Required Testing and Sampling
NP	National Park
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NSR	New Source Review
N+VSN	Noise Plus Visitor Self-Noise
NWI	National Wetland Inventory
NWR	National Wildlife Refuge
OSHA	Occupational Safety and Health Act
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PFC	Passenger Facility Charge
pH	hydrogen-ion concentration potential
P.L.	Public Law
POL	petroleum, oils, lubricants
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
RI/BRA	Remedial Investigation/Baseline Risk Assessment
RIMS	Regional Input-Output Modeling System
RLV	Reusable Launch Vehicle
ROC	reusable orbital transfer craft
ROD	Record of Decision
ROI	region of influence
RNAV	area navigation system
RSC	reusable spacecraft
RV	recreational vehicle
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act
SEIS	Supplemental Environmental Impact Statement
SFWMD	South Florida Water Management District
SHPO	State Historic Preservation Office
SID	Sanchez Industrial Design, Inc.
SIP	State Implementation Plan
SR	State Road
SRP	Standard Review Plan
STDA	stormwater treatment and distribution area
SWIM	Surface Water Improvement and Management
SWMM	Surface Water Management Model
SWMU	solid waste management unit
TAD	Traffic Analysis District
TAZ	Traffic Analysis Zone
TCM	Transportation Control Measures
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TRACON	Terminal Radar Approach Control
TSS	total suspended solids
UDB	Urban Development Boundary
UEA	Urban Expansion Area
UIA	Urban Infill Area
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
VAQ	Visiting Airmen's Quarters
VFR	Visual Flight Rules
VMT	vehicle miles traveled
VNP	Vertical Navigational Performance
VOC	volatile organic compound
VOQ	Visiting Officers' Quarters
WASD	Water and Sewer Department

MEASUREMENTS

AAM	annual arithmetic mean
cfs	cubic feet per second
dB	decibel(s)
DNL	Day-Night Average Sound Level
F	Fahrenheit
gpd	gallons per day
gpm	gallons per minute
Hz	hertz
kg	kilogram(s)
km	kilometer(s)
kV	kilovolt(s)
Leq(h)	Peak Hour Equivalent Sound Level
LAmax	Maximum Sound Level
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
mgd	million gallons per day
mg/L	milligrams per liter
MW	megawatt(s)
MWh	megawatt hour(s)
ppm	parts per million
ppt	parts per thousand
SEL	Sound Exposure Level
SF	square feet
TAamb	Time Above ambient
tpd	tons per day
tpy	tons per year