# Biological Opinion for Issuance of an Incidental Take Permit Under Section 10 (a)(1)(B) for the Perdido Key Programmatic Habitat Conservation Plan in Escambia County, Florida

**Prepared by:**
**U.S. Fish and Wildlife Service**
**Panama City Field Office, Florida**
**October 28, 2014**

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**ABBREVIATIONS**

| | |
|---|---|
| ABM | Alabama Beach Mouse |
| BMP | Best Management Practices |
| BO | Biological Opinion |
| BOCC | Escambia County Board of County Commissioners |
| CCCL | Coastal Construction Control Line |
| CFR | Code of Federal Regulations |
| CMF | Conservation Management Fund |
| Comp Plan | Escambia County Comprehensive Plan |
| DPS | Distinct Population Segment |
| DRC | Escambia County Development and Review Committee |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| ESA | Endangered Species Act |
| FEMA | Federal Emergency Management Agency |
| FFWCC | Florida Fish and Wildlife Conservation Commission |
| FNAI | Florida Natural Areas Inventory |
| FPS | Florida Park Service |
| FS | Florida Statutes |
| Fund | PKBM Fund |
| FWHA | Federal Highway Administration |
| FY | Fiscal Year |
| GPS | Global Positioning System |
| GSP | Gulf State Park, Alabama |
| GINS | Gulf Islands National Seashore |
| HCP | Habitat Conservation Plan |
| ITP | Incidental Take Permit |
| LDC | Escambia Land Development Code |
| MHWL | Mean High Water Line |
| NEPA | National Environmental Policy Act |
| NESD | Neighborhood and Environmental Services Department |
| PCE | Primary Constituent Elements |
| PD&E | Project Development and Environmental Study |
| PIT | Passive Integrated Transponder |
| PKBM | Perdido Key Beach Mouse |
| PKSP | Perdido Key State Park |
| PVA | Population Viability Analysis |
| ROW | Right of Way |
| SEIR | State Environmental Impact Report |
| SSC | Species of Special Concern |
| USFWS | United States Fish and Wildlife Service |

United States Department of the Interior

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November 14, 2014

Memorandum

To: Assistant Regional Director, Ecological Services, FWS, Atlanta, GA

From: Field Supervisor, FWS, Panama City Field Office, Panama City, FL

Subject: Biological Opinion: Incidental Take Permit for the Perdido Key Beach Mouse, Piping Plover, and Nesting Sea Turtles for the Perdido Key Programmatic Habitat Conservation Plan in Escambia County, Florida

This document represents the Fish and Wildlife Service's (Service) biological opinion (BO) based on our review of the proposed Perdido Key Programmatic Habitat Conservation Plan (HCP) application for Incidental Take Permit (ITP) by Escambia County (County/Applicant). This includes the proposed projects' effects on the Perdido Key beach mice (*Peromyscus polionotus trissyllepsis*) (PKBM), Piping plover (*Charadrius melodus*), Loggerhead sea turtle (*Caretta caretta*), Green sea turtle (*Chelonia mydas*), Leatherback sea turtle (*Dermochelys coriacea*), Kemp's ridley sea turtle (*Lepidochelys kempii*) and any designated critical habitat per section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). The Service's approval of an ITP is a Federal action subject to consultation under section 7(a)(2) of the Act.

The Service has determined that the project would not likely adversely affect nesting sea turtles and piping plover and would not likely adversely modify critical habitat designated for the piping plover based on the inclusion of conservation measures in the HCP. These conservation measures can be found in Appendix A as well as the HCP.

This biological opinion does not rely on the regulatory definition of destruction or adverse modification of critical habitat at 50 Code of Federal Regulations [C.F.R.] 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

This biological opinion is based on information from the HCP provided by the Applicant and their consultants, Adkins (formerly PBS&J) and Wetland Sciences, Inc., and from

meetings, discussions, correspondence, and project site inspections. This biological opinion is also based on the experience of Service biologists and an extensive literature search on beach mice, other *Peromyscus* species, and other small mammals. A complete administrative record is on file in the Panama City Field Office, Florida.

Activities covered under this BO include residential and commercial development on private and Escambia County owned lands, County authorized activities (i.e. beach driving for vendors, beach cleanup, use of recreational beach equipment, special beach events, beach concessions), utility infrastructure improvements, and other public infrastructure/transportation improvements to meet the community needs of Perdido Key, Florida.

The HCP and BO does not cover or include improvements to State Road 292 except for impacts directly associated with developments adjacent to State Road 292, i.e. turn lanes and driveways. Nor does it include Federal Emergency Management Agency (FEMA) funded (or other federally funded coastal projects) activities such as beach renourishment, beach berm construction, dune restoration; or approved temporary emergency shoreline protection measures.

**Table 1. Species and critical habitat evaluated for effects from the proposed action but not discussed further in this biological opinion.**

| SPECIES OR CRITICAL HABITAT | PRESENT IN ACTION AREA | PRESENT IN ACTION AREA BUT "NOT LIKELY TO ADVERSELY AFFECT" |
|---|---|---|
| Loggerhead sea turtle (*Caretta caretta*) | Yes | Yes |
| Green sea turtle (*Chelonia mydas)* | Yes | Yes |
| Leatherback sea turtle (*Dermochelys coriacea*) | Yes | Yes |
| Kemp's ridley sea turtle (*Lepidochelys kempii*) | Yes | Yes |
| Piping plover (*Charadrius melodus*) | Yes | Yes |

## CONSULTATION HISTORY

September 6, 2007 — The Escambia County Board of County Commissioners agreed to partner with the Florida Fish and Wildlife Conservation Commission (FWC) and accept a $492,000 grant from the Service to develop a multi-species Habitat Conservation Plan (HCP) for Perdido Key in Escambia County, Florida.

| | |
|---|---|
| December 13, 2007 | The Escambia County HCP technical advisory committee kick-off meeting was held. The committee included staff from the Service, FWC, Florida Department of Environmental Protection – Park Service, Gulf Islands National Seashore, and Escambia County Neighborhood and Environmental Services Department and PBS&J, their consultants. |
| March 19, 2008 | Quarterly meeting of the technical advisory committee was held. |
| June 25, 2008 | Quarterly meeting of the technical advisory committee was held. |
| August 7, 2008 | Quarterly meeting of the technical advisory committee was held. |
| September 24, 2008 | Quarterly meeting of the technical advisory committee was held. |
| January 28, 2009 | Quarterly meeting of the technical advisory committee was held. |
| February 6, 2009 | Quarterly meeting of the technical advisory committee was held. |
| April 22, 2009 | Quarterly meeting of the technical advisory committee was held. |
| August 12, 2009 | Quarterly meeting of the technical advisory committee was held. |
| September 30, 2009 | The final technical advisory committee meeting was held. |
| January 8, 2010 | The final draft HCP/EA was completed and submitted to the Service's Panama City Field Office with the signed Incidental Take Permit Application for review. |
| April 20, 2010 | The Deepwater Horizon oil rig exploded in the Gulf of Mexico. This emergency event diverted substantial Service staff time over the following year. |
| June 23, 2011 | The Panama City Field Office completed their review of the final draft HCP/EA and provided the Section 10(a)(1)(B) Permit Application with supporting documents to the Service's Southeast Regional Office. |

| | |
|---|---|
| November 23, 2011 | Escambia County requested minor modifications to the final draft HCP/EA and provided a revised document to the Panama City Field Office. |
| November 28, 2011 | A modified final draft HCP/ EA was reviewed by the Panama city Field Office and provided to the Southeast Regional Office. |
| August 30, 2012 | The Service provided notice of the proposed Programmatic Incidental Take Permit and Environmental Assessment for Development Activities, Perdido Key, Escambia County, FL in the Federal Register (77 FR 52755). |
| October 29, 2012 | The public comment period closed. The Service received a few written comments. |

## BIOLOGICAL OPINION

### DESRIPTION OF THE PROPOSED ACTION

#### Proposed Action

Escambia County (County/Applicant) has applied to the Service for an incidental take permit (ITP) pursuant to Section 10(a)(1)(B) of the U.S. Endangered Species Act (ESA) of 1973, as amended. If issued, the ITP will authorize the "take" of PKBM indirectly impacted by development on private and Escambia County owned lands and public infrastructure improvements on Perdido Key, Escambia County, Florida (Figure 1).

Approximately 274 acres of PKBM habitat on private and County-owned properties has been identified by photo interpretation and limited ground truthing to exist on Perdido Key in Escambia County, Florida from the Florida/Alabama State line east. Additionally, approximately 20 acres of PKBM habitat has been identified by photo interpretation within the State Road (SR) 292 (Perdido Key Drive) right-of-way, which may be relevant for possible future utility infrastructure improvements, turn lanes, and driveway approaches for private development. These acreage estimates do not include PKBM habitat within Perdido Key State Park (PKSP) or Gulf Islands National Seashore (GINS). Habitat impacts from residential, commercial, and resort based development continues on Perdido Key. Areas available for development have been considered in preparing this BO to encompass a landscape level approach to listed species habitat conservation; emphasizing habitat corridors, connectivity, and restoration opportunities.

The Applicants' objectives are to allow County permitted development activities on Perdido Key (Florida portion) in conjunction with current zoning restrictions and

Comprehensive Plan (Comp Plan) mandates, which will satisfy safety, functional, and recreational needs of the Perdido Key community, while maintaining the long-term viability of covered species and their habitat. Through the implementation of the mandates within the HCP, the County will implement a multi-faceted program to conserve and manage PKBM habitat along with beach and dune habitats associated with sea turtles and shorebird ecosystems in a manner that accommodates site-specific and landscape approach conditions.

Perdido Key, Florida encompasses the historic range of the PKBM and important habitat for nesting for sea turtles, non-breeding piping plover, and breeding and non-breeding shorebirds. Designated critical habitat has been established for the PKBM by the Service. Utilizing designated critical habitat data along with photo-interpreted habitat, approximately 274 acres of PKBM habitat exists on private and County owned lands on Perdido Key, Florida, with an additional estimated 20 acres of PKBM habitat within the SR 292 (Perdido Key Drive) right-of-way. Additionally, in 2014, the Service and the County's consultant identified 60 additional acres of PKBM habitat not previously included due to its disturbed nature. These 60 acres have reverted back to suitable habitat and are likely used by PKBM during their lifecycle. This additional 60 acres will not be included in the original calculations submitted by Escambia County in the HCP, but will be tracked and reviewed in the same manner for avoidance, minimization, and mitigation. As development continues on Perdido Key, the importance to maintain/improve the quality and connectivity of PKBM habitat has established a need for an ITP associated with listed species habitat on Perdido Key.

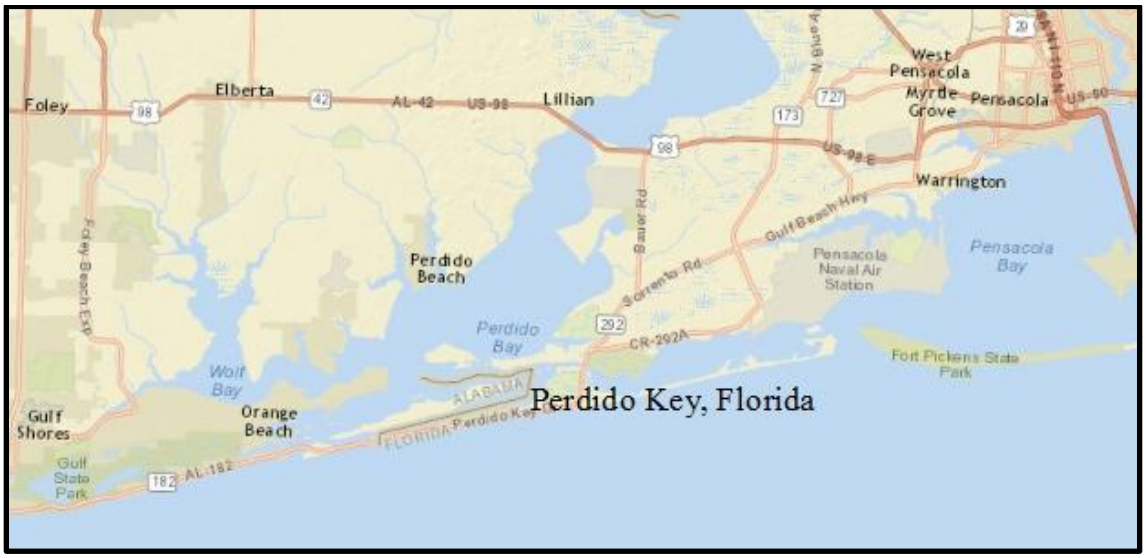

**Figure 1. Location of Perdido Key, Florida.**

## Action Area

The Action Area is defined at 50 CFR 402 to mean "all areas affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." Therefore, the action area may be larger than the construction limits of a

particular project (Figure 2). In this case the action area considers the entire critical, suitable, and potentially suitable PKBM habitat.

The action area boundaries include private and Escambia County owned lands on Perdido Key, Florida. The western boundary is located at the Florida/Alabama state line. The eastern boundary limit is the western limits of GINS. The north-south boundary includes land from the mean high water line (MHWL) of the northern shore of Perdido Key (Old River) south towards the MHWL of the Gulf of Mexico. The HCP Plan Area boundary excludes Perdido Key State Park (PKSP) and Gulf Islands National Seashore (GINS) and does not include impacts to habitat within these parks.

Because the proposed activity involves three PKBM critical habitat units and may cause broad-scale landscape effects of habitat fragmentation and isolation, the boundaries of the Action Area includes the area between the shoreline of the Gulf of Mexico and Old River for the entire extent of these units.


**Figure 2. Location of Action Area for Escambia County BO.**

Beach mouse habitat in the Action Area consists of primary, secondary, and scrub dune habitat. Habitat fragmentation due to development exists to varying degrees in the Action Area. The Action Area encompasses approximately 3,050 acres and is the entire Perdido Key. It contains approximately 1,711 acres of PKBM habitat. This acreage was calculated from the Services' Habitat Characterization Tool developed using Ecognition, which is an object-based image analysis software. The HCP Area is approximately 1,700 acres and consists of approximately 274 acres of PKBM habitat at risk for development as determined in the applicant's HCP at the time of submittal.

Prior to 2003, PKBM population estimates have never numbered more than 400 to 500 individuals, since its listing in 1985 (Loggins et. al. 2008). The 2003 population estimate (pre- Hurricane Ivan) was between 500 to 800 PKBM divided among two populations: the Johnson Beach Unit of GINS and PKSP (Service 2004). Newer population estimates are set to be collected during the spring of 2015 over the entire range, including the Action Area.

The Action Area provides essential connectivity between three populations on public lands (GSP, PKSP and GINS) and provides habitat for use on a permanent basis, natural movements and behaviors, and recolonization. The Action Area is located on the widest portion of Perdido Key, making it less susceptible to storm overwash thereby providing more refuge habitat during and after hurricanes.

**Project Plan Conservation Measures**

1. Include covenants or deed restrictions to prohibit ownership of cats or ferrets (ferrets included as per pers. comm. Dr. John Himes, FWC) on Perdido Key for those requesting coverage under the County's ITP.
2. The County will enhance animal control enforcement efforts by dedicating more County staff (i.e. animal control officers) to provide patrol and ensure compliance for animals that are not under the direct control of their owners. As per County Ordinance Chapter 10 Section 10-3 (Code 1985, § 1-4-3), *Direct control* means immediate, continuous physical control of an animal at all times such as by means of a fence, leash, cord, or chain of such strength to restrain the same. In the case of specifically trained or hunting animals which immediately respond to such commands, direct control shall also include aural and/or oral control, if the controlling person is at all times clearly and fully within unobstructed sight and hearing of the animal.
3. The County will also increase fines for free roaming pets through a separate fee table established for the barrier islands of Escambia County (i.e. Perdido Key and Pensacola Beach). Chapter 10 of the Escambia County Ordinances addresses fees (Section 10-6) and animal control (Section 10-11 and Section 10-12) in relation to defining free roaming animals.
4. The site design will include proper siting of developments and structures to preserve and maximize the continuity of dune habitat within each project site and with adjacent habitat. No walls or fences that preclude PKBM movement or dune development shall be allowed.
5. To the maximum extent practicable, areas maintained as habitat corridors shall have widths at least 10% of the corridor length (i.e. if a corridor is 200 ft. long (N-S) its width should be 20 ft.). This would be applicable to all corridors 500 feet or less in length. This HCP is structured to allow adaptive changes in response to new information derived from monitoring programs. This is a feature that will be monitored in the future to determine if these corridor widths are usable to PKBM. If corridor widths are found to be insufficient to maintain the ecological function and connectivity of these areas, wider corridors will be proposed for future projects as a measure to meet the success criteria of the phased take acreage.
6. Provide variance for building height increase if parking is provided under the building.
7. Parking spots shall not exceed 1.5 spots per unit for multifamily structures.
8. Pools shall be elevated to second story or higher when possible to maximize remaining habitat within the project site. As an incentive, the incorporation of elevated pools will not count as habitat impact if habitat is restored and maintained underneath.

9. All private property owners receiving coverage within the area covered by the HCP shall contribute to the fund by paying the annual fee of $201.00 on their property tax ($6,000 over the life of the ITP)[1].
10. No transfer of zoning densities in the PR PK zoning district shall be allowed.
11. Removal of debris deposited on project sites as a result of past and future hurricanes.
12. Use of pervious surface for driveways, such as plastic geo-grid or concrete grid pavement (not rock), is suggested as PKBM can continue to use the surface once covered with sand. Use of such products will not count as impacts as an incentive.
13. No heavy construction equipment will be stored on the beach overnight or outside of areas designated by the County for each project.

This HCP/ITP will incorporate a phased impact release schedule as a conservation measure, which will extend availability of open space for potential use by PKBM, minimize direct and indirect impacts to habitat, and allow restored habitat to recover while other phases are constructed. The phased approach for take is based on: 1) the current status of the PKBM, 2) the time needed for the County to implement the HCP/ITP conditions successfully, and 3) the lag time for the HCP conservation measures to provide functional habitat for beach mouse recovery.

14. The proposed action would permanently impact 66 acres of beach mouse habitat within the HCP Area representing, 26% of the habitat within the Action Area. After complete project development, 208 acres of PKBM habitat would be placed in a conservation easement, thereby reducing future threats to those areas. Permanent protection of these acres, in addition to the provisions of the other conservation measures, will minimize the effects on PKBM habitat and preserve the ecological functions required for the long term persistence of PKBM. Incorporation of this conservation measure will minimize the effects on the ecological functions represented by PCEs 1, 2, 3, and 4. Overall, the loss of PKBM habitat would adversely affect, but not eliminate, the ecological needs represented by PCE 2 (primary and secondary dunes) and PCE 3 (scrub dunes) within the Action Area. Calculation of acres included in the timing of the phased take and total take acres authorized:
    a. Take that is authorized by separate Service action will deduct acreage from the total 66 acres. However, this acreage will not be counted towards the phased take calculations. Improvements within the Perdido Key Drive right-of-way associated with the proposed road widening are not included in either of the calculations and considered under an entirely separate federal authorization.
    b. If additional suitable habitat is identified in the action area beyond the 274 acres (i.e. pre-Hurricane Ivan development footprints), then those impacts may be authorized under the HCP/ITP, however this acreage will not deduct from either the 66 acres or phased take calculations. These acreages have been calculated at the time of this review. These parcels largely include sites with prior development that were destroyed during past hurricanes and not rebuilt during the emergency time period. Parcels included in this calculation have had no previous

permit from the Service for impacts to PKBM. The acreage calculated by the Service and the County for additional PKBM habitat not included in the original calculation is 60 acres (Figure 3). This is only calculated for the HCP covered area in Florida.

c. The additional incidental take of the additional habitat will not exceed 26%. This will be tracked by separate ledger by the County and the Service to provide accurate representation.


**Figure 3**. **Parcels depicting PKBM habitat (60 acres) not previously accounted for.**

The phased take approach and associated zoning districts represented over the life of the permit is as follows and in Figure 4. More detailed figures can be found in the HCP.

Years 1 to 5 of ITP – 10.9 acres

| **Zoning District** | **Acres of PKBM Habitat Impacted** |
|---|---|
| R-1 PK | 0.2 |
| R-2 PK | 0.8 |
| R-3 PK | 2.0 |
| PR PK | 5.6 |
| C-1 PK | 0.9 |
| CC PK | 1.4 |
| CG PK | 0.0 |
| Total | 10.9 |

The impact to PKBM habitat may be accelerated to twelve acres within the first five years provided: 1) PKBM are documented on at least one existing ITP or section 7 covered property, 2) feral and free-ranging cats are effectively controlled as evidenced by the lack of cat tracks over 90% of PKSP at the end of year one and maintained throughout the five years, and three acres of PKBM habitat acquired and rezoned to S1-PK.

Years 1 to 10 of ITP – 21.9 acres (cumulative including acres taken in years 1 to 5)

| Zoning District | Acres of PKBM Habitat Impacted |
|---|---|
| R-1 PK | 0.4 |
| R-2 PK | 1.5 |
| R-3 PK | 4.1 |
| PR PK | 11.2 |
| C-1 PK | 1.8 |
| CC PK | 2.9 |
| CG PK | 0.0 |
| Total | 21.9 |

At the end of ten years the following must have been documented or completed:

- Documentation of PKBM throughout suitable PKBM habitat in PKSP as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- Documentation of PKBM throughout 75% of the acreage of suitable PKBM habitat in GINS as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- Documentation of PKBM east & west of PKSP as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- PKBM habitat impact (acres) in each zoning area restricted as shown.
- The impact to PKBM habitat may be accelerated to 25 acres within years five to ten provided: 1) PKBM are documented on at least one existing ITP or section 7 covered property both east and west of PKSP; and 2) feral and free-ranging cats are effectively controlled as evidenced by the lack of cat tracks over 90% of PKSP and 90% of GINS between the PKSP's west boundary and the eastern edge of the parking lot at Johnson Beach at the end of year one and maintained throughout the five years; and five acres of PKBM habitat acquired and rezoned to S1 – PK.

Years 1 to 15 of ITP – 32.9 acres (cumulative including acres taken in Years 1 to 10)

| Zoning District | Acres of PKBM Habitat Impacted |
|---|---|
| R-1 PK | 0.6 |
| R-2 PK | 2.3 |
| R-3 PK | 6.1 |
| PR PK | 16.8 |
| C-1 PK | 2.7 |
| CC PK | 4.3 |
| CG PK | 0.1 |
| Total | 32.9 |

At the end of 15 years the following must have been documented or completed:

- Documentation of PKBM throughout PKSP suitable PKBM habitat in PKSP as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- Documentation of PKBM throughout 75% of the acreage of suitable PKBM habitat in GINS as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- Documentation of PKBM east & west of PKSP as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- PKBM habitat impact (acres) in each zoning area restricted as shown.
- The impact to PKBM habitat may be accelerated to 35 acres within years ten to fifteen provided: 1) PKBM are documented on at least three existing ITP or section 7 covered properties both east and west of PKSP; and 2) feral and free-ranging cats are effectively controlled as evidenced by the lack of cat tracks over 90% of PKSP and 90% of GINS between the Park's west boundary and the eastern edge of the parking lot at Johnson Beach at the end of year one and maintained throughout the five years; and five acres of PKBM habitat acquired and rezoned to S1 – PK.

Years 1 to 20 of ITP – 44.1 acres (cumulative including acres taken in years 1 to 15)

| Zoning District | Acres of PKBM Habitat Impacted |
|---|---|
| R-1 PK | 0.9 |
| R-2 PK | 3.0 |
| R-3 PK | 8.2 |
| PR PK | 22.5 |
| C-1 PK | 3.6 |
| CC PK | 5.8 |
| CG PK | 0.1 |
| Total | 44.1 |

At the end of 20 years the following must have been documented or completed:

- Documentation of PKBM throughout suitable PKBM habitat in PKSP as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- Documentation of PKBM throughout 80% of the acreage of suitable PKBM habitat in GINS as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County documentation of PKBM west of PKSP and between PKSP and GINS as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- PKBM habitat impact (acres) in each zoning area restricted as shown.
- The impact to PKBM habitat may be accelerated to 45 acres within years fifteen to twenty provided: 1) PKBM are documented on at least 25% of existing ITP or section 7 covered property both east and west of PKSP on both the north and south sides of Florida 292; and 2) feral and free-ranging cats are effectively controlled as evidenced by the lack of cat tracks over 90% of PKSP and 90% of GINS between the Park's west boundary and the eastern edge of the parking lot at Johnson Beach at the end of year one and maintained throughout the five years; and six acres of PKBM habitat acquired and rezoned to S1 – PK.

Years 1 to 25 of ITP – 55 acres (cumulative including acres taken in years 1 to 20)

| Zoning District | Acres of PKBM Habitat Impacted |
|---|---|
| R-1 PK | 1.1 |
| R-2 PK | 3.8 |
| R-3 PK | 10.2 |
| PR PK | 28.1 |
| C-1 PK | 4.5 |
| CC PK | 7.2 |
| CG PK | 0.1 |
| Total | 55 |

At the end of 25 years the following must have been documented or completed:

- Documentation of PKBM throughout suitable PKBM habitat in PKSP as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- Documentation of PKBM throughout 80% of the acreage of suitable PKBM habitat in GINS as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- Documentation of PKBM west of PKSP and between PKSP and GINS.
- PKBM habitat impact (acres) in each zoning area restricted as shown.
- The impact to PKBM habitat may be accelerated to 57 acres within years twenty to twenty-five provided: 1) PKBM are documented on at least 35% of existing ITP or section 7 covered property east and west of PKSP on both the north and south sides of Florida 292; and 2) feral and free-ranging cats are effectively controlled as evidenced by the lack of cat tracks over 90% of PKSP and 90% of GINS, as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County; and ten acres of PKBM habitat acquired and rezoned to S1 – PK.

Years 1 to 30 of ITP – 66 acres (cumulative including acres taken in years 1 to 25)

| Zoning District | Acres of PKBM Habitat Impacted |
|---|---|
| R-1 PK | 1.3 |
| R-2 PK | 4.5 |
| R-3 PK | 12.3 |
| PR PK | 33.7 |
| C-1 PK | 5.4 |
| CC PK | 8.7 |
| CG PK | 0.1 |
| Total | 66 |

At the end of 30 years the following must have been documented or completed:

- Documentation of PKBM throughout PKSP suitable PKBM habitat in PKSP as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- Documentation of PKBM throughout 80% of the acreage of suitable PKBM habitat in GINS as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- Documentation of PKBM east & west of PKSP and between PKSP and GINS as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- PKBM habitat impact (acres) in each zoning area restricted as shown

| Zoning District | PKBM habitat acres lost for the 30-yr ITP if based only on 2004-2008 actions | Final PKBM habitat acres lost for the 30-yr ITP based on 2004-2008 actions, maintaining baseline habitat percentage within zoning districts, and requests for determination of ITP coverage needs |
|---|---|---|
| R-1 PK | 1.3 | 1.3 |
| R-2 PK | 0.0 | 4.5 |
| R-3 PK | 13.1 | 12.3 |
| PR PK | 36.0 | 33.7 |
| C-1 PK | 6.0 | 5.4 |
| CC PK | 9.2 | 8.7 |
| CG PK | 0.0 | 0.1 |
| Total | 65.6 | 66* |

**Final calculation of PKBM habitat to be lost during the 30-year ITP.**

*An additional five% of take may be administratively authorized with concurrence by the Service as a contingency for unforeseen circumstances. This administrative authorization will constitute up to 3.3 acres. Prior to receiving Service concurrence, the County will create, enhance, and commit to maintain at least 6.6 acres of PKBM habitat.


**Figure 4. Zoning Districts on Perdido Key, Florida.**

## Additional Site Specific Conservation Measures

15. Silt fencing will be used to minimize impacts. Silt fencing will be used to cordon off each approved impact areas within the subject parcel. The purpose of such is the delineation of construction zones and to restrict construction activity, vehicle and equipment parking, and building material storage from areas not needed for construction at the time. Silt fencing also will be used to cordon off 25-foot buffers around vertical construction and 25-foot buffers around roads, walkways, and surfaced parking lots within parcels while under construction to further minimize impacts to areas outside buffers within those parcels. Silt fence should be placed four inches off the ground to allow PKBM to pass through the site during the night. A qualified environmental professional will inspect all installed silt fences prior to onset of construction within each phase or parcel.

16. The Applicant also will conduct weekly monitoring of each parcel to inspect, repair, and maintain silt fences during construction to assure the purposes of the silt fences are not being compromised.

*Project construction measures to minimize impacts during construction of each development*

17. The developer would provide a summary of the issued permit requirements to the general contractor. This summary would also be included in all sub-contracts for the project. The construction contract documents would include a stipulation that conservation objectives be communicated to and agreed upon by all sub-contractors. Limits of construction would be clearly marked on all construction plans and would be clearly indicated onsite with silt fence or other barrier fence for the project.
18. No permanent barriers which would limit wildlife movement to and from adjacent properties would be placed on the property. Contractors should understand the elevated placement of silt fence to allow PKBM to pass through.
19. Construction staging will occur, to the maximum extent possible, within the footprint of the proposed development or previously constructed areas within the project site. Parking of construction vehicles will occur only within the footprint of the proposed Project.
20. Construction activities will be prohibited from the adjacent unimpacted preserved habitat. Encroachment into preserve areas will require immediate restoration plus additional work to repair the functional aspect of the habitat.

*Operation and management of the development*

These conservation measures will be incorporated in the project operation and management. Where relevant operation policies would be included in condominium documents provided to each unit owner. The condominium documents would contain provisions, which provide for the following:

21. The number of waste receptacles will be minimized in outdoor common areas in any project. Any outdoor receptacles would be animal/wildlife-proof.
22. Use or disposal of herbicides or pesticides that are harmful to native plants or rodents are prohibited within all developments on Perdido Key.
23. Access to the preserved and/or restored areas within the project site impressed with a conservation easement as provided for herein, will be granted to the Service, FWC, Escambia County, and U.S. Department of Agriculture Wildlife Services (USDA Wildlife Services) to conduct population monitoring, habitat restoration, PKBM capture and/or release, and predator control. Such access will be subject to reasonable notice and coordination with each Applicant or their designee prior to conducting such activities and conditioned upon terms otherwise mutually agreeable between the parties.
24. General guidance provided in the covenants and restrictions for each project will provide information about the ESA and the presence of the endangered PKBM, prohibit littering in common areas, and prohibit access to the conservation easement

and other natural areas on the site. Except as provided in marked boardwalks or walkways.

25. Educational materials will be made available to inform Project residents and guests of the ecology and history of Perdido Key, the biology and status of beach mice, and the importance of natural areas to wildlife and human quality of life.
26. Covenants and restrictions for the residences will include a provision restricting cats from all properties. Dogs will be restricted to the inside of residences or on hand held leash at all times. Dogs are not permitted within PKBM habitat and conservation areas. Adherence to rules associated with public lands providing PKBM habitat (GINS, PKSP, and GSP) regarding dogs shall be followed. Solid waste shall be disposed of properly by the pet owner.

*Compensation to address unavoidable impacts*

Contributions to the PKBM Conservation Fund would be provided in accordance with the Intergovernmental Agreement among the Service, FWC, and Escambia County. The agreement is to implement the Conservation Strategy for the Perdido Key Beach Mouse (2005), Business Plan for the Perdido Key Beach Mouse Conservation Fund (2005), and the Escambia County 1975 Coastal Construction Control Line prohibitions ordinance (2005-56; 2006-02). The Business Plan and subsequent agreements to implement the Conservation Strategy were developed based on the annual contributions of 4200 development units (density cap minus previously permitted units) with the annual assessment portion of this compensation option for units inside of PKBM habitat, but not those outside PKBM habitat.

Monies deposited into the Conservation Fund will be used to carry out the goals and objectives outlined in the Conservation Strategy for the Perdido Key Beach Mouse (2005). It is important to note that $2.6 million proposed as a contribution to offset impacts from the proposed project could not be used to purchase PKBM habitat equal or similar to the size and ecological importance of the habitat on the project site. Such land is not available or would otherwise be limited in quantity due to the expected land values. Furthermore, the business plan, on which the fund is based, includes funds for less than 15 acres of land acquisition based on land prices in 2005.

27. Each project Permittee shall pay $100,000 for each acre of permanent impacts to designated PKBM critical or suitable habitat to the Conservation Fund held by Escambia County, Florida or such other entity as is designated by the Service for such purpose. The project residents will pay a fee of $201.00 per unit per year which will be deposited in the Conservation Fund. Hotel development will follow the same per unit per year fee of $201.00. Commercial developments shall contribute $201.00 per designated parking space per year.

*Other Measures to be incorporated for each individual project*

28. The owner will implement a plan to accelerate temporary impacts and or restoration opportunities where available within the subject parcel.

a. In addition to the installation of xeric/native dune grasses the installation of signs and other measures (i.e. planted vegetative barriers) to control trespass; and 2) planting selected areas to accelerate restoration of plant cover.
b. To ensure perpetual maintenance of the beach mouse habitat on the properties, each applicant will record a conservation easement on the portion of undeveloped beach mouse habitat. This measure ensures that all undeveloped land would remain in its natural state in perpetuity.
c. The owner will establish a condition in the covenants and restrictions of the project site that require beach mouse habitat restoration after a storm event that has degraded or denuded the vegetation of the preserved or previously restored areas. This compensation measure provides legal assurance that restoration after future habitat losses would occur. Beach mouse habitat on the property would be revegetated with native plants.
d. Escambia County Escambia County will restore (i.e., nourish) coastal dunes south of SR 292, occurring as a result of storm damage.
e. No sod or rock material will be used on any project site.

All plantings and coastal dune habitat restoration will be accomplished with proven techniques and with plants as provided from the approved list for installation. Applicants shall use the Services' most up to data dune restoration guidelines throughout the life of this permit.

On Gulf front parcels, Escambia County may choose to address the restoration of the beach berm south of SR 292 that slopes down to the water's edge. If restored by the County, the Applicant will implement measures to accommodate PKBM dune use such as minimizing the number of dune walkovers, native dune vegetation planting, restricting foot traffic to walkovers, and maintaining corridors from the dune to the northern portion of each property.

## STATUS OF THE SPECIES/CRITICAL HABITAT

### Species/critical habitat description

The formal taxonomic classification of beach mouse subspecies follows the geographic variation in pelage and skeletal measurements documented by Bowen (1968). This peer-reviewed, published classification was also accepted by Hall (1981). The taxonomic validity of the beach mouse subspecies came into question when three of the Gulf Coast subspecies, PKBM, Alabama Beach Mouse (ABM), and Choctawhatchee Beach Mouse (CBM) were proposed for listing (1984-1985). Two unpublished letters (Dawson 1983; Griswold undated) were submitted to the Service for consideration in response to the proposed listing. The conclusion reached by these authors was that three of the beach mouse subspecies did not differ sufficiently from inland populations to warrant their recognition as subspecies. Close consideration of the Dawson and Griswold unpublished papers by Service biologists determined that neither paper constituted completed studies.

Furthermore, Dawson clearly expressed the need for further taxonomic studies to adequately answer the questions concerning subspecific taxonomy of beach mice. To date, Bowen's work is the latest published comprehensive review of beach mice and is the taxonomy on which the Service continues to rely.

Since the listing of the beach mice, further research concerning the taxonomic validity of the subspecific classification of beach mice has been initiated and/or conducted. Preliminary results from these studies support the separation of beach mice from inland forms, and support the currently accepted taxonomy (Bowen 1968). Recent research using mitochondrial DNA data illustrates that Gulf Coast beach mouse subspecies form a well-supported and independent evolutionary cluster within the global population of the mainland or inland old field mice (Van Zant 2006).

The old-field mouse (*Peromyscus polionotus)* is different in form and structure as well as being genetically diverse throughout its range in the southeastern United States (Bowen 1968; Selander et al. 1971). Currently there are sixteen recognized subspecies of old-field mice (Hall 1981). Eight subspecies of the old-field mouse occupy coastal rather than inland habitat and are referred to as beach mice (Bowen 1968). Two existing subspecies of beach mouse and one extinct subspecies are known from the Atlantic coast of Florida. Five subspecies of the beach mice live along the Gulf coast of Alabama and northwestern Florida.

Rivers and various inlets bisect the Gulf and Atlantic beaches and isolate habitats in which the beach mice live. Where populations are not separated by water, human development may have fragmented the ranges of the subspecies. The outer coastline and barrier islands are typically separated from the mainland by lagoons, swamps, tidal marshes, and flatwood areas with hardpan soil conditions. However, these dispersal barriers are not absolute; sections of sand peninsulas may from time to time be cut off by storms and shift over time due to wind and current action. A consequence of coastal development and the dynamic nature of the coastal environment, beach mouse populations are generally comprised of various disjunct populations.

The PKBM was listed with the CBM and ABM as endangered species under the Act in 1985 (50 FR 23872). The PKBM is also listed protected under Florida Rule 68A-27.0001-27.007, Florida Administrative Code, as a federally designated as an endangered species Critical habitat was designated for the PKBM, CBM, and the ABM at the time of listing (50 Code of Federal Regulations [CFR] § 17.95, 50 FR 23872), and revised October 12, 2006 (71 FR 60238). The proposed project is within the area designated as critical habitat for the PKBM.

Since the listing of the PKBM, research has refined our knowledge of beach mouse habitat requirements and factors that influence their use of habitat. The findings most pertinent to the revision of critical habitat and determination (prudency) to revise the current critical habitat designation involve the role of scrub dune habitat. Coastal dune habitat is generally categorized as: primary dunes (characterized by sea oats [*Uniola paniculata*] and other grasses), secondary dunes (similar to primary dunes but also

frequently include such plants as woody goldenrod [*Chrysoma pauciflosculo]),* false rosemary (*Conradina canescens*), and interior or scrub dunes (often dominated by scrub oaks [*Quercus geminata* spp.] and yaupon holly [*Ilex vomitoria*]).

The transition from scrub habitat to maritime forest, which is characterized by large trees (pines and oaks), thick leaf litter and dense understory, frequently serves to delineate the northern or landward extent of suitable beach mouse habitat.

The primary and secondary dunes (frontal dunes) were previously considered optimal beach mouse habitat since it is where the mice were thought to reach their highest densities (Blair 1951; Meyers 1983; Holler 1992). Because the scrub dunes appeared to support lower densities of beach mice, this habitat was believed to be of lower quality (Blair 1951; Bowen 1968). As a result, the scrub dunes were not considered to be of great importance to beach mice (Swilling 2000), and little attention was paid to this habitat (Sneckenberger 2001). Recent evidence, however, has indicated that scrub dunes are an important component of beach mouse habitat (Swilling 2000; Sneckenberger 2001). Furthermore, the scrub dunes appear to serve as refugia for beach mice during and after a tropical storm event (Holliman 1983; Swilling et al. 1998), from which recolonization of the frontal dunes takes place (Swilling et al. 1998; Sneckenberger 2001). In addition to providing burrow sites, food resources, and cover, scrub dune habitat also serves as a high-elevation refuge during storm events and as a population source as the frontal and secondary dunes recover (Swilling et al. 1998; Sneckenberger 2001).

Hurricanes can severely affect beach mice and their habitat, as tidal surge and wave action overwash habitat, leaving a flat sand surface denuded of vegetation; sand is deposited inland, completely or partially covering vegetation; blowouts between the Gulf of Mexico, bays, and lagoons leave patchy landscapes of bare sand; primary dunes are sheared or eroded; and habitat is completely breached, creating channels from the Gulf of Mexico to bays and lagoons. Until frontal dune topography and vegetation redevelop, scrub habitat maintains beach mice populations and provides the majority of food resources and potential burrow sites (Lynn 2000; Sneckenberger 2001). While storms temporarily reduce population densities (often severely), this disturbance regime maintains open habitat and retards plant succession, yielding a habitat more suitable for beach mice than one lacking disturbance. The low-nutrient soil of the coastal dune ecosystem often receives a pulse of nutrients from the deposition of vegetative debris along the coastline (Lomascolo and Aide 2001). Therefore, as the primary and secondary dunes recover, beach mice recolonize this habitat readily as food plants develop to take advantage of the newly available nutrients. Recovery times vary depending upon factors such as hurricane characteristics (i.e., severity, amount of associated rain, directional movement of the storm eye, storm speed), successional stage of habitat prior to hurricane, elevation, and restorative actions post hurricane. Depending on these factors, recovery of habitat may take from one year to over 50 years (Johnson 1997).

In addition to habitat needs, beach mouse populations at GINS, PKSP, and GSP are vulnerable to natural and anthropogenic factors that may directly reduce beach mouse populations. When mice are forced to repopulate after a population crash, the

populations at GINS, PKSP, and GSP are isolated until their numbers are high enough to expand out and find connectivity. Maximizing the number of independent self-sustaining populations is critical to species survival. Protection of only a single, isolated, minimally viable population would risk the extirpation or extinction of a species as a result of harsh environmental conditions, catastrophic events, or genetic deterioration over several generations (Kautz and Cox 2001). To reduce the risk of extinction through these processes, it is important to establish multiple protected populations across the landscape (Soule and Simberloff 1986; Wiens 1996).

Based on our current knowledge of the life history, biology, and ecology of the species and the requirements of the habitat to sustain the essential life history functions of the species, we have determined that the PKBM critical habitat primary constituent elements (PCE) include:

1. A contiguous mosaic of primary, secondary, and scrub vegetation and dune structure, with a balanced level of competition and predation and few or no competitive or predaceous nonnative species present, that collectively provide foraging opportunities, cover, and burrow sites.
2. Primary and secondary dunes, generally dominated by sea oats, that, despite occasional temporary impacts and reconfiguration from tropical storms and hurricanes, provide abundant food resources, burrow sites, and protection from predators.
3. Scrub dunes, generally dominated by scrub oaks, that provide food resources and burrow sites, and provide elevated refugia during and after intense flooding due to rainfall and/or hurricane induced storm surge.
4. Functional, unobstructed habitat connections that facilitate genetic exchange, dispersal, natural exploratory movements, and recolonization of locally extirpated areas.
5. A natural light regime within the coastal dune ecosystem, compatible with the nocturnal activity of beach mice, necessary for normal behavior, growth and viability of all life stages.

Critical habitat has been designated on lands that have been determined to be essential to the conservation of the PKBM. An area is considered essential if it possesses one or more of the primary constituent elements and the following characteristics: (1) supports a core population of beach mice; (2) was occupied by PKBM at the time of listing; (3) is currently occupied by the beach mouse and is an area essential to the conservation of the species because it represents an existing population needed for conservation.

Five units were designated for the PKBM spaced throughout its historic range, depending on the relative fragmentation, size, and health of habitat, as well as availability of areas with beach mouse PCEs. The five units are: (1) Gulf State Park Unit (PKBM-1), (2) West Perdido Key Unit (PKBM-2), (3) Perdido Key State Park Unit (PKBM-3), (4) Gulf Beach Unit (PKBM-4), and (5) Gulf Islands National Seashore Unit (PKBM-5) (Table 2 and Figure 5). The proposed HCP covered area includes lands identified as PKBM habitat within the Gulf Beach Unit (PKBM-4), and West Perdido Key Unit (PKBM-2).

The Action Area for this BO includes the entire range for the PKBM and contains critical habitat PCEs throughout.

**Table 2. Designated Critical Habitat for the Perdido Key Beach Mouse.**

| Critical Habitat Unit | Federal Acres | State Acres | Local and Private Acres | Total Acres |
|---|---|---|---|---|
| 1. Gulf State Park Unit (PKBM-1) | 0 | 115 | 0 | 115 |
| 2. West Perdido Key Unit (PKBM-2) | 0 | 0 | 147 | 147 |
| 3. Perdido Key State Park Unit (PKBM-3) | 0 | 238 | 0 | 238 |
| 4. Gulf Beach Unit (PKBM-4) | 0 | 0 | 162 | 162 |
| 5. Gulf Islands National Seashore Unit (PKBM-5) | 638 | 0 | 0 | 638 |
| Total | 638 | 353 | 309 | 1300 |

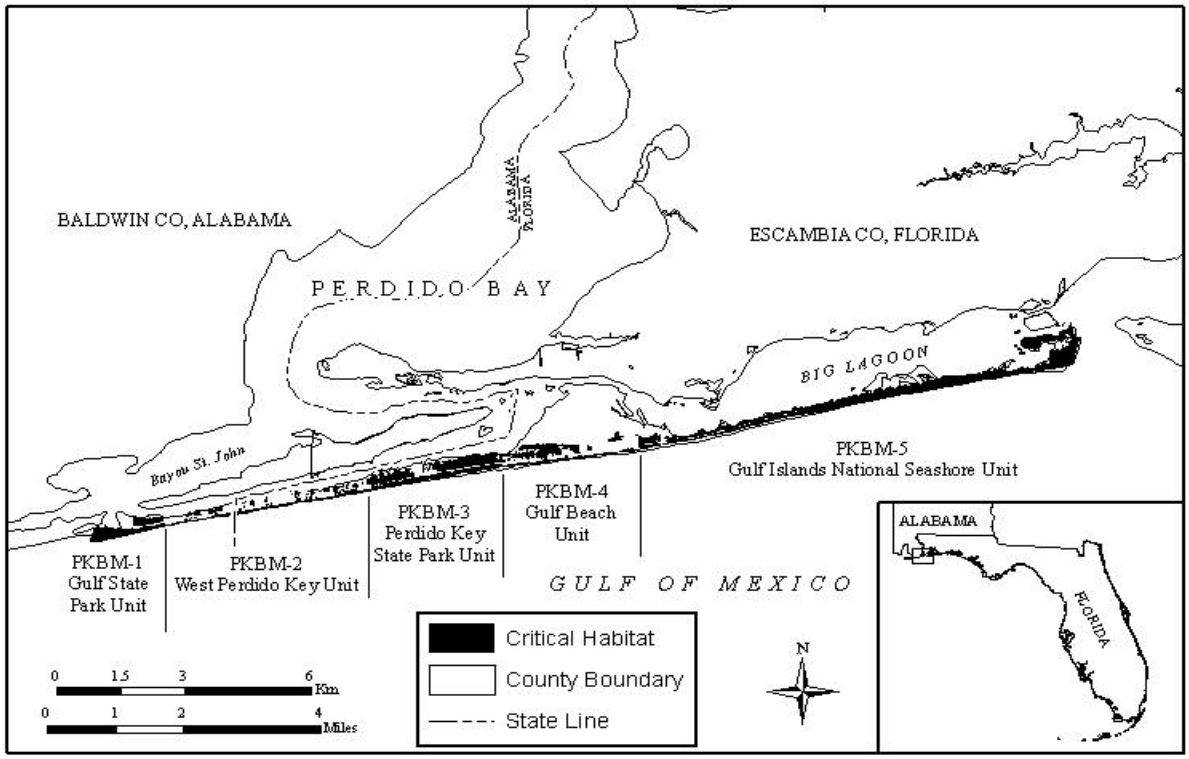


**Figure 5. Designated Critical Habitat Units for the Perdido Key Beach Mouse.**

The Gulf State Park Unit (PKBM-1) consists of 115 acres in southern Baldwin County, Alabama, on the westernmost region of Perdido Key. This unit encompasses essential features of beach mouse habitat within the boundary of Gulf State Park (GSP) between the west tip of Perdido Key at Perdido Pass east to approximately 1.0 mile west of where the Alabama–Florida State line bisects Perdido Key and the area from the mean high water line (MHWL) north to the seaward extent of the maritime forest. This unit was occupied by the species at the time of listing. PKBM were known to inhabit this unit

during surveys in 1979 and 1982, and by 1986 this was the only known existing population of the subspecies (Humphrey and Barbour 1981; Holler et al.1989). This population was a core population and was the donor site for the reestablishment of PKBM into GINS in 1986. This project ultimately saved Perdido Key beach mice from extinction as the population at GSP was considered extirpated in 1998 due to tropical storms and predators (Moyers et al. 1999). A re-introduction in March 2010 was deemed successful (See "*Status*" for more explanation) and this unit is once again confirmed as occupied.

Beach mouse habitat in this unit consists of primary, secondary, and scrub dune habitat. Because scrub habitat is separated from the frontal dunes by a highway in some areas, the population inhabiting this unit can be especially vulnerable to hurricane impacts, and therefore further linkage to scrub habitat and/or habitat management would improve connectivity. This unit is managed by the Alabama Department of Conservation and Natural Resources and provides primary constituent elements (PCEs) 2, 3, 4, and 5. Threats specific to this unit that may require special management considerations include artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high recreational use that may result in soil compaction, damage to dunes, and/or a decrease in habitat quality. This unit, which contains interior scrub habitat as well as primary and secondary dunes, serves as a re-designation and expansion of the original critical habitat designation (50 FR 23872). The original designation did not include scrub habitat which we now know is necessary for the long-term persistence of beach mouse populations.

The Unit was overwashed and inundated by storm surge several times during the 2004 and 2005 storm seasons. Dune vegetation was washed away or covered with sand. Habitat recovery efforts continue and include natural and human facilitated dune restoration (sand replacement, sand fence installation, and vegetation planting) and dune protection (walkovers and pedestrian trails).

The West Perdido Key Unit (PKBM-2) consists of 114 acres in southern Escambia County, Florida, and 33 acres in southern Baldwin County, Alabama. This unit encompasses essential features of beach mouse habitat from approximately 1.0 mile west of where the Alabama-Florida State line bisects Perdido Key east to 2.0 miles east of the State line and areas from the MHWL north to the seaward extent of human development or maritime forest. This unit consists of private lands and ultimately includes essential features of beach mouse habitat between PKSP (PKBM-3) and GSP (PKBM-1). Beach mouse habitat in this unit consists of primary, secondary, and scrub dune habitat and provides PCEs 2, 3, and 4.

Habitat fragmentation and other threats specific to this unit are mainly due to development. Consequently, threats to this unit that may require special management considerations include habitat fragmentation and habitat loss, artificial lighting, presence of feral cats as well as other predators at unnatural levels, excessive foot traffic and soil compaction, and damage to dune vegetation and structure. This area was not known to be occupied at the time of listing. While no trapping has been conducted on these private

lands to determine presence, sign of beach mouse presence was confirmed in 2005 and in recent years through observations of beach mouse burrows and tracks (Sneckenberger 2005 pers. comm.), and this unit is contiguous with two occupied units. Therefore, we have determined this unit to be currently occupied. This unit provides essential connectivity between two core population areas (PKBM- 3 and PKBM--1), provides habitat for expansion, natural movements, and re-colonization, and is therefore essential to the conservation of the species. Specifically, this unit may have historically provided for the re-colonization of GSP (PKBM-1) and/or may facilitate similar re-colonization in the future as the habitat recovers from hurricane events.

The Unit was overwashed and inundated by storm surge several times during the 2004 and 2005 storm seasons. Structures were destroyed or severely damaged. Dune vegetation was washed away or covered with sand. Habitat recovery efforts continue and include natural and human facilitated dune restoration by property owners and local governments and include creation of a sand berm with vegetation planting. The berm has been designed to simulate a natural dune formation.

The Perdido Key State Park Unit (PKBM-3) consists of 238 acres in southern Escambia County, Florida. This unit encompasses essential features of beach mouse habitat within the boundary of PKSP from approximately 2.0 miles east of the Alabama–Florida State line to 4.0 mile east of the State line and the area from the MHWL north to the seaward extent of the maritime forest. Beach mouse habitat in this unit consists of primary, secondary, and scrub dune habitat. This unit provides PCEs 2, 3, 4, and 5 and is essential to the conservation of the species. Improving and/or restoring habitat connections would increase habitat quality and provide more functional connectivity for dispersal, exploratory movements, and population expansion. This unit is managed by the Florida Park Service. Threats specific to this unit that may require special management considerations include artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high recreational use that may result in soil compaction, damage to dunes, and/or a decrease in habitat quality. This unit serves as a redesignation and expansion of a zone included in the initial critical habitat designation (50 FR 23872); however, the zone did not include scrub habitat, which we now know is necessary for the long-term persistence of beach mouse populations.

There were effects to the Unit resulting from the overwash and inundation by storm surge that occurred several times during the 2004 and 2005 storm seasons. Blow outs occurred on the west and east portions of PKSP. Two sections of the Hwy 292 were washed out. Park facilities were destroyed. Dune vegetation was significantly impacted, but has been restored passively and actively. Park facilities have been reconstructed in accordance with protected species guidelines.

The Gulf Beach Unit (PKBM-4) consists of 162 acres in southern Escambia County, Florida. This unit includes essential features of beach mouse habitat between GINS and PKSP from approximately 4.0 miles east of the Alabama–Florida State line to 6.0 miles east of the State line and areas from the MHWL north to the seaward extent of human development or maritime forest. This unit consists of private lands. Beach mouse habitat

in this unit consists of primary, secondary, and scrub dune habitat. Habitat fragmentation and other threats specific to this unit are mainly due to development. Consequently, threats to this unit that may require special management considerations include habitat fragmentation and habitat loss, artificial lighting, presence of feral cats as well as other predators at unnatural levels, excessive foot traffic and soil compaction, and damage to dune vegetation and structure. While not known to be occupied at the time of listing, a single beach mouse was trapped within the unit as a result of trapping efforts in 2004 (Service 2004). There have been limited data collected within this unit to confirm presence since that time. However, Service staff regularly see tracks and borrows within this Unit. This unit provides PCEs 2, 3, and 4 and is essential to the conservation of the species. This unit includes high-elevation scrub habitat and serves as a refuge during storm events and as an important repopulation source if storms extirpate or greatly reduce local populations. This unit currently provides essential connectivity between two core populations (PKBM-5) and PKBM-3) and provides essential habitat for expansion, natural movements, and recolonization (PCE 4).

The Unit was overwashed and inundated by storm surge several times during the 2004 and 2005 storm seasons. Structures were destroyed or severely damaged. Dune vegetation was washed away or covered with sand. Habitat recovery efforts continue and include natural and human facilitated dune restoration by property owners and local governments and include creation of a sand berm with vegetation planting. The berm has been designed to simulate a natural dune formation.

The Gulf Islands National Seashore Unit (PKBM-5) consists of 638 acres in southern Escambia County, Florida, on the easternmost region of Perdido Key. This unit encompasses essential features of beach mouse habitat within the boundary of Gulf Islands National Seashore–Perdido Key Area (also referred to as Johnson Beach) from approximately 6.0 miles east of the Alabama–Florida State line to the eastern tip of Perdido Key at Pensacola Bay and the area from the MHWL north to the seaward extent of the maritime forest. Beach mouse habitat in this unit consists mainly of primary and secondary dune habitat, but provides the longest contiguous expanse of frontal dune habitat within the historic range of the PKBM. PBKM were known to inhabit this unit in 1979. No beach mice were captured during surveys in 1982 and 1986 (Humphrey and Barbour 1981; Holler et al. 1989). However the population was impacted by Hurricane Frederic (1979), and considered unoccupied at the time of listing. In 1986, PKBM were re-established at this Unit as part of FWC and Service recovery efforts. This reestablishment project was identified as the most urgent recovery need for the mouse (Service 1987; Holler et al. 1989). The project is considered a success, and the population inhabiting this Unit is now considered a core population. In 2000 and 2001, PKBM captured from this site served as donors to re-establish beach mice at PKSP (PKBM-3).

PKBM-5, in its entirety, possesses all five PCEs and is essential to the conservation of the species. However, most of this unit consists of frontal dunes, making the population inhabiting this unit particularly threatened by storm events. Threats specific to this unit that may require special management considerations include artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high recreational use that

may result in soil compaction, damage to dunes, and/or a decrease in habitat quality. This unit is managed by the National Park Service–Gulf Islands National Seashore. This unit was included in the initial critical habitat designation (50 FR 23872) as well as the 2006 revision (71 FR 60238). The majority of this unit was overwashed and inundated by storm surge several times during the 2004 and 2005 storm seasons. Park facilities were destroyed and most of the Park road was destroyed. Dune vegetation was washed away or covered with sand. Habitat recovery efforts continue and include natural and human facilitated dune restoration by GINS staff. Park structures were reconstructed landward of their former locations and in accordance with protected species guidelines.

## Historic Range

Historically, PKBM occurred on Perdido Key in coastal dune habitat between Perdido Bay, Alabama and Pensacola Bay, Florida (50 CFR 23872; Bowen 1968) (Figure 6). Historical information indicates that both Pensacola Pass and Perdido Pass were natural inlets. The existing navigation channel project at Pensacola Pass (east end of Perdido Key) was authorized in 1962 and the Perdido Pass navigation channel project was authorized in 1971 (U.S. Army Corps of Engineers 1976; Browder and Dean 1999).

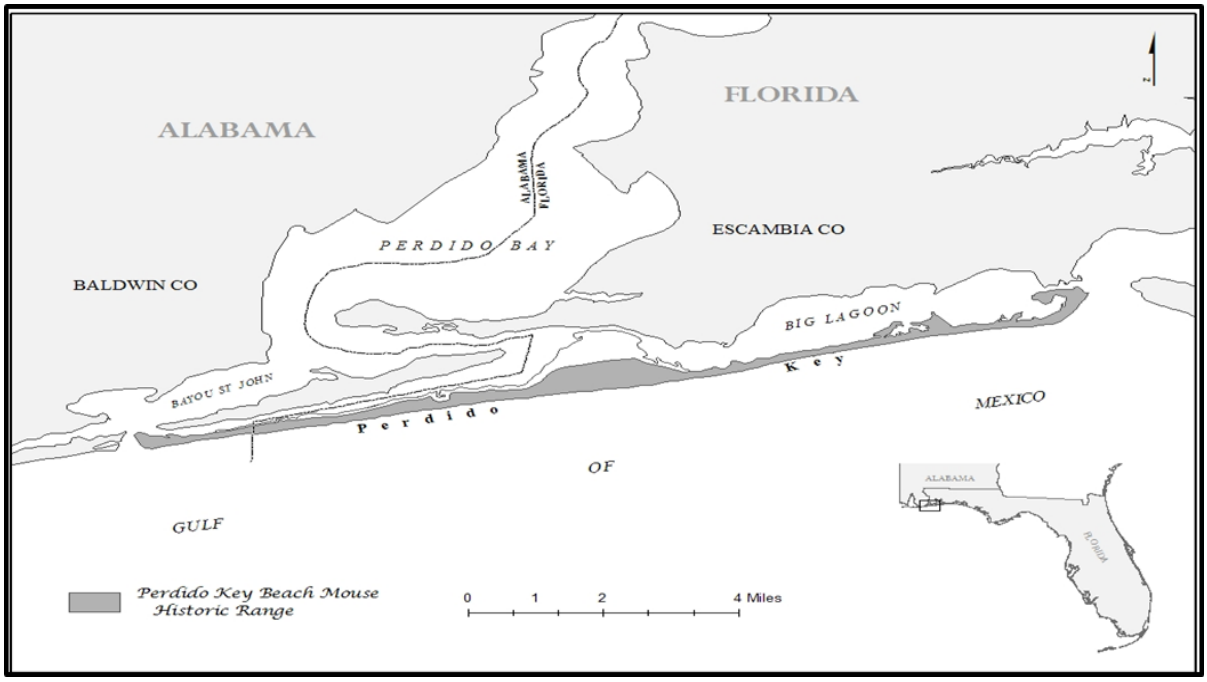


**Figure 6. Historic range of the Perdido Key Beach Mouse.**

## Life history

*Behavior*

*Peromyscus polionotus* is the only member of the genus that digs an extensive burrow. Beach mice are semifossorial, using their complex burrows as a place to rest during the day and between nightly foraging bouts, escape from predators, have and care for young, and hold limited food caches. Burrows of *P. polionotus* generally consist of an entrance tunnel, nest chamber, and escape tunnel. Burrow entrances are frequently placed on the

sloping side of a dune at the base of a shrub or clump of grass. The nest chamber is formed at the end of the level portion of the entrance tunnel at a depth of 24 to 35 inches (60 cm to 90 cm), and the escape tunnel rises from the nest chamber to within 9.8 inches (2.5 cm) of the surface (Blair 1951). Nests of beach mice are constructed within a 4 to 6 cm diameter, spherical nest chamber. The nest comprises about one fourth of the size of the cavity and is composed of sea oat roots, stems, leaves and the chaffy parts of the panicles (Ivey 1949). Beach mice select burrow sites based on a suite of biotic and abiotic features including dune slope, soil compaction, vegetative cover, and height above sea level (Lynn 2000; Sneckenberger 2001). Potential burrow sites are considered to be a possible limiting resource.

Like other beach mice, PKBM are nocturnal and forage for food throughout the dune system. Beach mice feed primarily upon seeds, fruits, and insects (Moyers 1996). Seeds and fruits consumed by PKBM are commonly produced by low-growing, prostrate plants, or become available as fallen seeds (Moyers 1996). Beach mice appear to forage on food items based on availability and have shown no preferences for particular seeds or fruits (Moyers 1996). Research suggests that the availability of food resources fluctuates seasonally in Gulf Coast coastal dune habitat. The frontal dunes appear to have more species of high quality foods, but these sources are primarily grasses and annuals that produce large quantities of small seeds in a short period. Foods available in the scrub consist of larger seeds and fruits that are produced throughout a greater length of time and linger in the landscape (Sneckenberger 2001). Nutritional analysis of foods available in each habitat revealed that seeds of plant species in both habitats provide a similar range of nutritional quality.

Reproduction and Demography

Studies on *Peromyscus* species in peninsular Florida suggest that these species may achieve greater densities and undergo more significant population fluctuations than their temperate relatives, partially because of their extended reproductive season (Bigler and Jenkins 1975). Subtropical beach mice can reproduce throughout the year; however their peak reproductive activity is generally during late summer, fall, and early winter.

Sex ratios in beach mouse populations are generally 1:1 (Extine 1980; Rave and Holler 1992). Beach mice are generally monogamous (Smith 1966; Foltz 1981; Lynn 2000). While a majority of individuals appear to pair for life, paired males may sire extra litters with unpaired females. Beach mice are sexually mature at about 55 days of age; however, some are capable of breeding earlier (Weston 2007). Gestation averages 28 to 30 days (Weston 2007) and the average litter size is four pups (Kaufman and Kaufman 1987). Littering intervals may be as short as 26 days (Bowen 1968). Peak breeding season for beach mice is autumn and winter, declining in spring, and falling to low levels in summer (Blair 1951). However, pregnant and lactating beach mice have been observed in all seasons (Moyers et al. 1999).

Apparent survival rate estimates (products of true survival and site fidelity) of beach mice along the Gulf Coasts of Florida and Alabama suggested that their average life span is about nine months (Swilling 2000). Other research indicates that 63% of Alabama beach

mice lived (or remained in the trapping area) for four months or less, 37% lived five months or greater, and 2% lived 12 to 20 months (Rave and Holler 1992). Less than half (44 %) of beach mice captured for the first time were recaptured the next season (Holler et al. 1997). Greater than 10% of mice were recaptured three seasons after first capture, and 4% to 8% were recaptured more than one year after initial capture. According to Kathy Russell (PKBM captive breeding program Studbook keeper) with Santa Fe Teach Zoo, PKBM held in captivity can live up to five years.

Habitat and Movement

Beach mice inhabit coastal dune ecosystems on the Atlantic and Gulf Coasts of Florida and the Gulf Coast of Alabama. The dune habitat is generally categorized as: primary dunes (characterized by sea oats and other grasses), secondary dunes (similar to primary dunes but also frequently include such plants as woody goldenrod, false rosemary), and interior or scrub dunes (often dominated by scrub oaks and yaupon holly). Contrary to the early belief that beach mice were restricted to (Howell 1909, 1921; Ivey 1949), or preferred the frontal dunes (Blair 1951; Pournelle and Barrington 1953; Bowen 1968), more recent research has shown that scrub habitat serves an invaluable role in the persistence of beach mouse populations (Swilling et al. 1998; Sneckenberger 2001). Beach mice occupy scrub dunes on a permanent basis and studies have found no detectable differences between scrub and frontal dunes in beach mouse body mass, home range size, dispersal, reproduction, survival, food quality, and burrow site availability (Swilling et al. 1998; Swilling 2000; Sneckenberger 2001). While seasonally abundant, the availability of food resources in the primary and secondary dunes fluctuates (Sneckenberger 2001). In contrast, the scrub habitat provides a more stable level of food resources, which becomes crucial when food is scarce or nonexistent in the primary and secondary dunes. This suggests that access to primary, secondary and scrub dune habitat is essential to beach mice at the individual level. Not only is scrub habitat necessary for food and burrow sites when resources are scarce in the frontal dunes, this higher elevation habitat provides refuge from storm surge during hurricanes. Trapping data suggests that beach mice persisting in the scrub following hurricanes recolonize the frontal dunes once vegetation and some dune structure have recovered (Swilling et al. 1998; Sneckenberger 2001).

Two main types of movement described for small mammals are within home-range activity and long-range dispersal. Such movements are influenced by a suite of factors, such as availability of mates, predation risk, and habitat quality. Movement and home range studies have been conducted for most beach mouse subspecies, but are limited to natural habitat (*e.g.* research has been conducted on public lands within contiguous beach mouse habitat, not within a development or in a fragmented landscape). Studies of the home range size of beach mice (using trapping and telemetry data) have been estimated at 1 to 5 acres (Novak 1997; Lynn 2000). Individual beach mice travel extensive distances (several hundreds to thousands of feet up to a mile) during one night (Swilling et al. 1998; Lynn 2000; Moyers and Shea 2002). Beach mice have also been documented crossing two-lane roads within public lands (Gore and Schaefer 1993; Service 2004).

Significant seasonal differences in the movement of ABM have been found, which may be a result of seasonal fluctuations in food availability, food quality, and nutritional needs (Sneckenberger 2001). Santa Rosa beach mice increased movements as habitat isolation increased suggesting that longer travel distances were needed to obtain necessary resources (Smith 2003). Santa Rosa beach mice also preferred vegetative cover and connectivity, which is likely a behavioral response to increased predation risk in open areas. Thus, while beach mice are able to travel great distances, the travel pathways have vegetated cover and only a few large gaps or large open areas. Previous connectivity research suggests critical thresholds exist for species persistence in fragmented landscapes (With and Crist 1995). As connectivity decreases, species ability to move through and between habitats is reduced in a nonlinear fashion.

**Population dynamics**

Population size

Estimating animal abundance or population size is an important and challenging scientific issue in wildlife biology (Otis et al. 1978; Pollock et al. 1990). A number of different census methods are available to estimate wildlife populations, each with particular benefits and biases. Beach mouse surveys involve relatively standardized scientific methods, common to the study of small mammals. The basic census method for beach mice involves mark-recapture by live trapping. Mice are captured at night in live traps placed along lines or grids. Each captured animal is checked to determine if it has been captured for the first time (unmarked) or if it is a recapture (marked). A five-night minimum trapping period has been standard practice since 1987 for Gulf Coast beach mice. Data from such surveys have been analyzed using various methods with differing degrees of accuracy and bias, as number of individuals captured, minimum number known alive, number captured per 100 trap nights, or a mathematically modeled statistical population estimate (program CAPTURE). Additionally, tracking tubes have recently been used to estimate the distribution of beach mice within an area.

Since its listing in 1985, PKBM population estimates have never numbered more than 400 to 500 individuals until 2003. Population estimates for trapping efforts yielding captures were generated using Program CAPTURE (Otis et al. 1978). The 2003 population estimate (pre-Hurricane Ivan) was between 500 to 800 PKBM divided among two populations: GINS and PKSP (Service 2004b). Tracking and trapping surveys have been conducted on PKSP and small sections of GINS since the passage of Hurricane Ivan in 2004 to determine presence or absence of beach mice. In October 2005, a trapping effort of less than one-third of the habitat available on public lands yielded captures of less than 30 individuals. Tracking data from June 2006 indicated that about 25% and 32% of the available habitat was occupied at PKSP and GINS, respectively (FFWCC 2007). Tracking data from March 2007 indicated that less than 10% and approximately 28% of the available habitat was occupied at PKSP and GINS, respectively (FFWCC 2007). In 2008, the tracking efforts found no detections of beach mice in PKSP for approximately a year. It wasn't until May and July of 2009 that detections started to appear. These detections were few and sporadic. Towards the end of 2009 and the beginning of 2010,

beach mouse detections started to increase at a fairly steady rate to present day. These mice were moving expanding from GINS to PKSP. Current data from 2013 and 2014 track tube monitoring suggests beach mouse detections ranging from 93% to 98% distributed evenly over PKSP (FWC 2013a, FWC 2013b, and FWC 2014). Tracking results for GINS from 2011-2012 indicate beach mice detections across the landscape, with the majority of tracking tubes having 100% detection over the two year span (FFWCC 2012). Current track tube data suggests the beach mouse detections at GINS range from 86% to 94% across the landscape (FWC 2013a, FWC 2013b, and FWC 2014).

Population variability

Population density of beach mice typically reaches peak numbers in the late autumn into spring (Rave and Holler 1992; Holler et al. 1997). Peak breeding period occurs in fall and winter, apparently coinciding with the increased availability of seeds and fruits from the previous growing season. Seasonal and annual variation in size of individual populations may be great (Rave and Holler 1992; Holler et al. 1997). Food supplementation studies showed that *P. polionotus* mouse populations increased when foods were abundant; thus, populations of *P. polionotus* and beach mice appear to be food-limited (Smith 1971; Galindo-Leal and Krebs 1998).

Beach mouse populations fluctuate on a seasonal and annual basis. Attempts to explain population dynamics have revealed an incomplete understanding of the species and its population cycles. It is clear that beach mice, like all rodents, are known for high reproductive rates and experience extreme highs and lows in population numbers. Tropical storms and drought may be associated with depressed beach mouse populations, perhaps resulting from elimination of habitat and food supply reduction. These fluctuations in beach mice populations can be a result of altered reproduction rates, food availability, habitat quality and quantity, catastrophic events, disease, and predation (Blair 1951; Bowen 1968; Smith 1971; Hill 1989; Rave and Holler 1992; Swilling et al. 1998).

Population stability

Population viability analysis (PVA) is essentially a demographic modeling exercise to predict the likelihood a population will continue to exist over time (Groom and Pascual 1997). The true value in using this analytical approach is not to determine the probability of a species' extinction, but to clarify factors that have the most influence on a species' persistence. From 1996 to 1999, the Service's Panama City Florida Field Office funded Auburn University to develop PVAs for two PKBM and two ABM subpopulations (Holler et al. 1999; Oli et al. 2001). The subpopulations modeled consisted of two subpopulations of PKBM, one at GINS-Perdido Key Area and one at Gulf State Park - Florida Point, and two subpopulations of ABM, one at Bon Secour NWR and one at Ft. Morgan State Park. They used a stochastic (random) differential equation (Wiener-drift) model, applied to long term demographic data. The model is "stochastic" because it

incorporates the variable effects of the environment upon population change. However, it did not model the effects of hurricanes on the habitat or population of beach mice.

The Oli et al. (2001) analyses indicated that all four subpopulations were at risk of extinction, with habitat fragmentation as the most influential factor. The GINS-Perdido Key Area has the highest risk for extinction; the PKBM had a 100% chance of reaching one individual (becoming functionally extinct) within 21 (mode) or 45 (median) years. At Gulf State Park - Florida Point, the PKBM had a low risk of becoming functionally extinct (1.3%) within 13 to 20 years. However, following Hurricane Opal in 1995 and subsequent predation pressure, the PKBM population at Florida Point was believed to be extirpated in 1998. This localized extirpation clearly demonstrates that while PVAs are useful in determining factors significant to species survival, they have limited use in predicting the time to species extinction.

More recently, the Conservation Breeding Specialist Group (Traylor-Holzer 2004, 2005, 2006) was contracted by the Service to conduct a population and habitat viability analysis (PHVA) on ABM using the Vortex population simulation model (Lacy 1993). The goal was to develop an ABM population model and use the model to assess the status of the ABM habitat and populations and projections for continued existence. This model, unlike the earlier one, includes the potential effects of hurricanes. The PHVA results project the ABM to have a 26.8% ± 1.0% likelihood of extinction over the next 100 years. Much of this risk is due to hurricane impacts on ABM populations and habitat which can result in population declines. The model suggests that hurricanes are a driving force for ABM populations, both directly and also indirectly as their impacts interact with other factors, including development of higher elevation (scrub) habitat and predation by cats. Due to the similarities in the subspecies and proximal location, it can be inferred that these factors also have a strong influence on the persistence of PKBM populations. (Again, when reviewing PHVA results, it is crucial that the actual values for the risk of extinction are not the focus of the interpretation. The true value of a PHVA is the ability to compare management strategies and development scenarios, run sensitivity analyses, and determine the main influence(s) on population persistence. However, it is notable that a 5% to 10% chance of extinction in 100 years is considered high to very high (Shaffer 1981; IUCN 2001).

Similar to the land use arrangement on Perdido Key, the Fort Morgan Peninsula (occupied by ABM) consists of three areas of public lands separated by two areas of private lands (Figure 7) which allow for limited (varied) dispersal between the public lands. The current level of dispersal between public lands through private lands is unknown, and due to development and habitat degradation, dispersal between public lands may not occur in the future. Without dispersal between public lands through private lands, the PHVA results project the ABM to have a 41.2% ± 1.1% likelihood of extinction. If all privately-owned habitat between the public lands is lost, the likelihood of extinction increases to 46.8% ± 1.1%. Again, it can be inferred that a similar increase in risk of extinction would occur with the PKBM if dispersal could not occur through private lands.

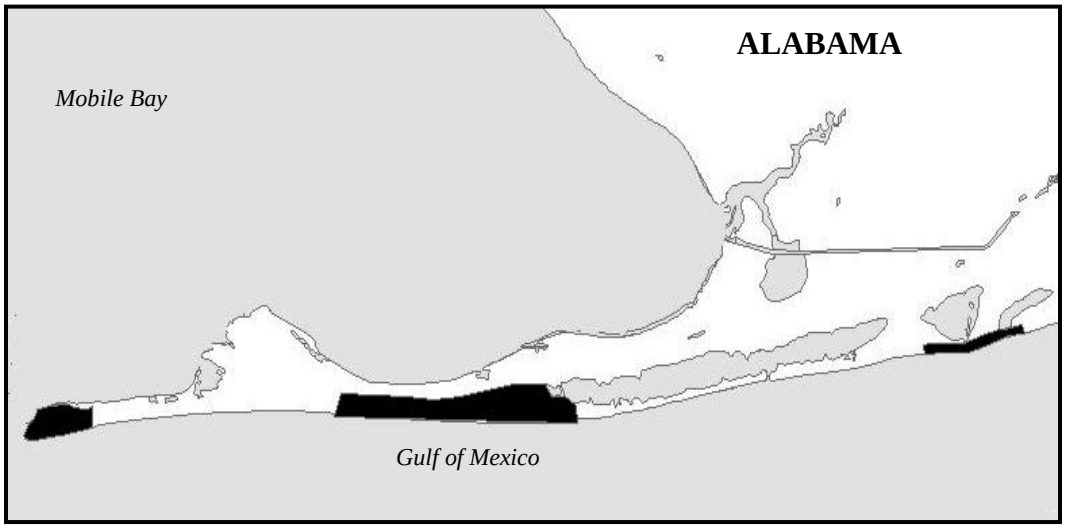


**Figure 7. Public lands on the Fort Morgan Peninsula, Baldwin County, Alabama.**

Despite the similarities in the subspecies, it is important to note that carrying capacity (K), which was found to be a strong influence on the model, would be different in PKBM. For ABM, K was estimated using maximum ABM density estimates (4.5 to 11.6 ABM per acre) and acres of habitat (2697 acres). Based on current trapping and habitat quality, density estimates for PKBM would likely be lower and remaining PKBM habitat consists of less than 1300 acres, the Vortex model for PKBM would likely project a greater likelihood of extinction.

The Service contracted with The Georgia Cooperative Fish and Wildlife Research Unit to critique the PVAs for the ABM accomplished by Oli et al. (2001) and Conservation Breeding Specialist Group (Traylor-Holzer 2005). Conroy and Runge (2006) indicate that neither PVA provide reliable estimates of extinction probability for ABM. They recommended that future PVA work should incorporate sampling, temporal, and possibly spatial variance for input variables and should clearly and explicitly express uncertainty in extinction output. Until this can be done, reliable estimates of extinction probability for the ABM (and other beach mouse subspecies such as PKBM) cannot be estimated.

Species which are protected across their ranges have lower probabilities of extinction (Soulé and Wilcox 1980). Beach mouse populations naturally persist through local extirpations due to storm events or the harsh, stochastic nature of coastal ecosystems. Historically, these areas would be recolonized as population densities increase and dispersal occurs from adjacent populated areas. From a genetic perspective, beach mice recover well from population size reductions (Wooten 1994), given sufficient habitat is available for population expansion after the bottleneck occurs. As human development has fragmented the coastal dune landscape, beach mice can no longer recolonize along these areas as they did in the past (Holliman 1983). As a continuous presence of beach mice or suitable habitat along the coastline is no longer possible and any hurricane can impact the entire range of each subspecies, the probability of beach mice persisting would be enhanced by the presence of contiguous tracts of suitable habitat occupied by multiple independent populations (Danielson 2005). The history of the PKBM illustrates the need

for multiple populations (GSP was the source for the populations at PKSP and GINS, then was extirpated, and only recently was repopulated with captive-bred mice) (Holler et al. 1989; Service 2006a). While maintaining multiple populations of beach mouse subspecies provides protection from total loss (extinction), especially when migration and relocations are possible (Oli et al. 2001), conservation of each subspecies necessitates protection of genetic variability throughout their ranges (Ehrlich 1988). Preservation of natural populations is therefore crucial, as the loss of a population of beach mice can result in a permanent loss of genetic diversity (Wooten and Holler 1999). This loss of genetic variability cannot be regained through translocations or other efforts.

**Status and distribution**

Reasons for Federal listing as an endangered species

The PKBM was listed as an endangered species primarily because of fragmentation, adverse alteration, and loss of habitat due to coastal development. This subspecies is assigned a high recovery priority because the degree of threat to its persistence is high, it is a subspecies with a high level of taxonomic distinctness, and its potential for recovery is great if threats can be eliminated or minimized. Recovery of the PKBM often conflicts with certain economic objectives, a factor which further elevates its priority ranking.

The threat of development-related habitat loss continues to increase on less than 300 acres of remaining habitat on private lands that connect the habitat on public lands. Additional contributing threats include low population numbers at times, habitat loss from other causes (including hurricanes), predation (fox, coyotes, and cats), potential competition by animals associated with human development (house mice), and regulatory weaknesses regarding coastal development.

Coastal development

Coastal development contributes to habitat loss and fragmentation pressures imposed on all beach mice subspecies. Beachfront development along the Gulf Coast of Florida began in the 1950s and continues to this day. Coastal development has fragmented all the subspecies into disjunct populations. Isolation of habitats by imposing barriers to species movement is an effect of fragmentation that equates to reduction in total habitat (Noss and Csuti 1997). These factors, along with the influx of development-related predators such as the domestic cat and competition with house mice, probably caused the extinction of the Pallid beach mouse (Humphrey 1992).

Isolation of small populations of beach mice reduces or precludes gene flow between populations and can result in the loss of genetic diversity. Demographic factors such as predation (especially by domestic cats), diseases, and potential competition with house mice, are intensified in small, isolated populations, which may be rapidly extirpated by these pressures. Especially when coupled with events such as storms, reduced food availability, and/or reduced reproductive success, isolated or fragmented populations may experience severe declines or extirpation (Caughley and Gunn 1996). Contiguous tracts

or functionally connected patches of suitable habitat are essential to the long-term conservation of beach mice.

Along with the rest of northwest Florida, economics promote increased recreation and tourism, as well as real estate development on Perdido Key. By the late 1990s distinct patterns of development had emerged on Perdido Key. Several areas consisted primarily of single family houses - the waterfront lots on Old River Road, the interior portion of the Key, the northeast section of the Key, and Pirates Cove in the center portion of PKSP. The area near the "curve" on SR 292 (Perdido Key Drive) had developed at higher densities and heights with a mix of commercial, multi-family residential and some single-family detached houses. The dominant residential development in this area was low-rise (up to four stories). The far west portion of the Key has single-family and low-rise multi-family structures as well as some of the largest (and tallest) multi-family developments. Most of the development on the Key occurred prior to 1990. Between 1990 and 1994, the majority of development was single-family dwellings. Since 1995, there has been an increase in the number of multi-family developments on the Key, typically being developed at the maximum density allowed. Into the early 2000's development or re-development continued. Single-family residences and small multi-family complexes sold for construction of high-rise/high density complexes (PKNP 1997 as referenced in Escambia County 2003) and this trend continued into 2010. More recently, construction has been slow because of the existing economic situation, however this is starting to change.

Following the documentation of PKBM on private lands in 2004, an interagency working group formed to address the new and re-development that was ongoing at Perdido Key. The Service, FWC, and Escambia County worked together to create further options to offset impacts to PKBM and their habitats from the development. A Conservation Strategy for the PKBM outlined the measures needed to conserve the subspecies (FWC et al. 2005a). A Business Plan (RCF 2005) described the funding needed to implement the Conservation Strategy (Conservation Fund). Finally, an Intergovernmental Agreement between the three levels of government was signed in December of 2005 (FWC et al. 2005b). The agreement establishes the Conservation Fund for implementing PKBM conservation activities and outlines the coordination and processes by which the Conservation Fund will be managed.

The Conservation Strategy outlines the goals and objectives specific to the PKBM. The conservation objectives for the strategy are to create, enhance, and maintain Perdido Key beach mice and habitats in PKSP, GINS, and GSP; and restore, enhance, and maintain beach mice and contiguous PKBM habitat in the primary, interdunal, secondary, and scrub dune systems within and between GINS, PKSP, and GSP.

Specific strategies that address the objectives are:

1) **Conduct surveys to determine the current status and distribution of PKBM.** This strategy provides baseline information needed to determine priorities and actions required to address the other conservation strategies.

2) **Restore and maintain the dune ecosystem within GINS, PKSP, and GSP, and the areas between.** This strategy seeks to re-establish, enhance, and maintain contiguous PKBM habitat in the primary, interdunal, secondary, and scrub dune systems that have been degraded through human actions or natural disasters.

   a) Emphasize re-establishment of the dune ecosystem.

   b) Establish dune building devices (*e.g.* fencing) to encourage dune growth.

   c) Restore the topography of the primary dune system.

   d) Plant the rebuilt dunes with appropriate vegetation.

   e) Plan for and provide, appropriate beach access that is consistent with protection of the dune ecosystem.

3) **Minimize the impacts of development and use of PKBM habitat.**
This strategy seeks to maintain the best possible conditions for beach mice in an area being impacted by development.

   a) Maintain beach mouse habitat in a natural state (*e.g.* minimize the development footprint habitat).

   b) Maintain remaining beach mouse habitat in blocks (*e.g.* patches) as large and contiguous as possible, and in areas to maximize connections or potential connections with beach mouse habitat on adjoining properties.

   c) Place remaining beach mouse habitat on each project site in a permanent conservation easement..

   d) Use dune topography and plants native to beach mouse habitat as the primary landscaping features.

   e) Have covenants, deed restrictions, or similar permanent instruments established for properties developed in beach mouse habitat that would be designed to reduce mortality or other negative impacts to occupied beach mouse areas. Such instruments would:

      i) Prohibit free-ranging pets outdoors.

      ii) Require the use of animal-proof garbage containers to prevent attracting house mice and beach mouse predators.

      iii) Require outdoor lighting that meets the criteria of the International Dark-Sky Association to reduce the impacts of development lighting.

iv) Prohibit use of pesticides or pest control in outside areas.

v) Limit the use of herbicides or fertilizers in beach mouse habitat.

vi) Require boardwalks or similar dune walkover structures for beach access across the dune habitat.

vii) Require predator control when necessary.

4) **Compensate for negative impacts from development and disturbance of PKBM habitat.** This strategy seeks an overall enhancement in the beach mouse's probability of survival as required for some permitting actions for the take of beach mice.

a) Create, and place into permanent conservation easements, beach mouse habitat in areas to maximize connections or potential connections with beach mouse habitat on adjoining properties. (In order to provide continuity and stability for the east-west connection along the beach front primary dune system, the County has adopted an ordinance requiring construction set-backs based on the state-determined 1975 set back line, and prohibiting side yard set-back variances south of SR 292. The requirements of this ordinance would be in addition to permanent protection provided by permit applicants.)

b) Establish education programs to inform users (residents, guests, etc.) of the status and biology of beach mice, the importance of dune habitats for beach mice, and the importance of the dune ecosystem to human safety.

c) Fund a predator control program that specifically targets beach mouse predators.

d) Seek opportunities for beach mouse habitat restoration funding. This could include efforts to restore dune habitat, efforts to restrict inappropriate dune crossings, efforts to stop inappropriate parking that facilitates inappropriate dune crossings, etc.

5) **Maintain the long term viability of the wild populations and the genetic integrity of PKBM.** This strategy seeks to assure that isolation of areas occupied by beach mice does not occur. Absence of gene flow can impair reproduction or other vital population functions. Unexpectedly high or increased rates of disease or mortality also could threaten population viability. Further, the status of the PKBM as a distinct, genetically unique entity should be maintained.

Distribution

Since the late 1970s, PKBM have existed as isolated populations along its historic range (16.9 miles). The effects of Hurricane Frederic (1979) coupled with increased habitat fragmentation due to human development led to the extirpation of all but one population

of PKBM. The less than 30 individuals at GSP –Florida Point were once the only known existing population of PKBM (Holler et al. 1989). Beach mice from this site were used to re-establish PKBM at GINS between 1986 and 1988; (Holler et al. 1989). Then in 1999 the population at GSP was considered extirpated (Moyers et al. 1999). In 2000, ten PKBM (5 pairs) were relocated from GINS to PKSP. In February of 2001, this relocation was supplemented with an additional 32 PKBM (16 pairs). The PKBM were released on both the north and south sides of SR 292 in suitable habitat. Two years of quarterly survey trapping indicated that the relocations of PKBM to PKSP were successful and this was considered an established population (Service 2004). PKBM were also trapped on private land between GINS and PKSP in 2004, increasing documentation of occurrences of the mouse (Lynn 2004). Based on the similarity of habitat between these areas and the rest of Perdido Key, as well as the continuity of the habitat, the mouse is believed to inhabit other private properties where suitable habitat exists north and south of SR 292. Based on 2013 aerials, the PKBM was considered to occur on 56% (1,711 of 3,050 acres) of Perdido Key (the Action Area) (Table 3).

Table 3. Areas and acreages of Perdido Key and PKBM habitat in Florida and Alabama.

| Area | Total in AL & FL | | Total in Florida | | Total in Alabama | |
|---|---|---|---|---|---|---|
| | Acres | Percent | Acres | Percent | Acres | Percent |
| Perdido Key total | 3,050 | 100% | 2,714 | 89% | 336 | 11% |
| PKBM habitat | 1,711 | 100% | 1,518 | 89% | 192 | 11% |
| | | | | | | |
| Private lands total | 1,539 | 51% | 1,379 | 45% | 160 | 5% |
| PKBM habitat | 303 | 23% | 270 | 24% | 33 | 3% |
| | | | | | | |
| Public lands total | 1,512 | 50% | 1,337 | 44% | 175 | 6% |
| GINS | | | 937 | | | |
| PKSP | | | 325 | | | |
| GSP | | | | | 162 | |
| FDOT | | | 32 | | | |
| ALDOT | | | | | 13 | |
| COUNTY | | | 43 | | | |
| | | | | | | |
| PKBM habitat within Public lands | 1134 | 66% | 1006 | 59% | 128 | 7% |
| GINS | | | 753 | | | |
| PKSP | | | 248 | | | |
| GSP | | | | | 128 | |
| COUNTY | | | 5 | | | |

Data calculated by U.S. Fish and Wildlife Service Panama City, Florida using Habitat Characterization Tool developed with Ecognition software using 2013 State of DOQQ aerial photography.

## Status

The listing of PKBM was based on data collected in 1983 to 1984, and at that time beach mice were recovering from the effects of Hurricane Frederick in 1979. Following Hurricane Frederick estimated population numbers based on trapping were 13 PKBM found at one location (GSP). Just prior to listing, only one PKBM was captured in trapping surveys, this again being at GSP. The effects of Hurricane Frederic (1979)

coupled with increased habitat fragmentation due to human development led to the extirpation of all but one population of PKBM.

Since listing, all populations of PKBM have been extirpated. Through translocation efforts, at least one population has remained viable to present day. Less than 30 individuals at GSP were once the only known existing population of PKBM (Holler et al. 1989). Beach mice from this site were used to re-establish PKBM at GINS between 1986 and 1988; (Holler et al. 1989), and PKBM from GINS were translocated to PKSP in 2000. By that time, the GSP population was considered extirpated (Moyers et al. 1999). The Perdido Key-wide population estimate of PKBM just prior to Hurricane Ivan in 2004 was between 500 and 800 individuals.

The status of current PKBM populations is thought to be higher than in the past according to track tube monitoring data. However, a Key-wide population estimate has not been conducted since 2004. The PKBM population numbers are at a suspected all time high (since monitoring began) largely due to the absence of recent hurricanes. The recent slump in development within the PKBM range has lessened the continual pressure from development and habitat loss. Additionally, current feral and outdoor cats appear to be minimized from past predator control efforts. However, these threats still remain relevant.

Tracking and trapping surveys from 2004 to 2009 at PKSP and GINS documented the presence of beach mice (GINS 2004, 2005; FWC 2004, 2005, 2006, 2007). In October 2005, following the active hurricane seasons of 2004 and 2005, a trapping effort of less than one-third of the habitat available on public lands yielded captures of less than 30 individuals. Tracking data from June 2006 indicated that about 25% and 32% of the available habitat was occupied at PKSP and GINS, respectively (FWC 2007). Trapping at PKSP and GINS in March 2007 was cancelled after one night after the capture of only one mouse (a fatality) and very limited sightings of beach mouse sign (tracks, burrows) (FWC 2007). Trapping conducted in April of 2008 was more encouraging with the capture of 35 mice at GINS (Sneckenberger 2008 pers. comm.). Tracking data from summer of 2009 suggested population abundance and distribution was increasing within GINS and PKSP (FWC 2010a). Trapping at GINS and PKSP in spring 2010 generally confirmed this with PKBM widely distributed at both public lands. This is the first known natural recolonization of a park since monitoring began. From 2010 to 2014, the track tube detection occurrences have continued to increase and stabilize in each of the three public lands (FWC 2014, FWC 2012a, FWC 2012b, FWC 2012c, FWC 2013a, and FWC 2013b, FWC 2014).

**Table 4**. **Percentage of PKBM occurrences in track tubes within the three public lands.**

| | GSP | PKSP | GINS |
|---|---|---|---|
| 2009 | NA | 2.9% | 48% |
| 2010 | 48% | 55% | 84% |
| 2011 | 88% | 96% | 94% |
| 2012 | NA | 99% | 95% |
| 2013 | 93% | 97% | 94% |

| | | | |
|---|---|---|---|
| 2014 (half year) | 97% | 93% | 89% |

In the spring of 2010 PKBM were released at GSP. The source population was captive mice from Brevard and Palm Beach Zoos. A total of 48 PKBM were released in the southwestern portion of GSP and were fitted with radio transmitters. Within a few days, most of the transmitters were found in a red fox den near the Carib condominiums to the north of the bridge. By the time two adults and five red fox pups were removed by USDA Wildlife Services, 13 mice remained. Monitoring continued daily for the life of the transmitters (3 weeks) and monthly trapping continued over the summer and fall. A 3-day trapping effort at the end of September 2010 yielded 51 individual PKBM, including 8 of the originally released mice. Mice were found throughout the habitat at GSP south of Highway 182 (FWC 2010b). A 3-day trapping effort in May 2012, continued to find PKBM distributed throughout the habitat south of Highway 182. Two reproductively-active male PKBM were found north of Highway 182 (Gore pers. comm. 2012). The release appears to have been a success and PKBM are occupying all three public lands for the first time since being listed as endangered.

No trapping of the public lands on Perdido Key has occurred since May 2012 with the exception of a current project funded by FDOT that began trapping earlier this year. Data has not yet been compiled from this project. However, we do have current tracking tube data reflected in Table 4 above.

When suitable beach mouse habitat is available and located near an existing population, data suggests beach mice will readily re-establish unoccupied habitat. However, the current amount of available suitable habitat has been reduced and habitat fragmentation has increased due to development since the time of listing in 1985.

**Recovery Criteria**

The currently approved Recovery Plan for the three beach mouse Gulf Coast subspecies was published in 1987 (Service 1987). The primary recovery objectives identified in the Recovery Plan are: 1) stabilization of populations by preventing further habitat deterioration, and 2) reestablishment of populations in areas where they were extirpated. For each of the subspecies to be considered for re-classification to threatened, there must be a minimum of at least three distinct self-sustaining populations in designated critical habitat with at least 50% of the critical habitat being protected and occupied by beach mice. Recovery actions or "tasks" from the Recovery Plan are provided below.

**Task 1213** – Maintain predator control programs focused on feral cats and red foxes, where needed.

**Task 1216** – Install additional boardwalks as needed to protect habitat from pedestrian traffic.

**Task 1217** – Evaluate location of parking areas and access trails to beaches, and relocate them if advantageous to preservation of beach mouse habitat.

**Task 1218** – Install scavenger-proof receptacles in heavily used areas, and ensure frequent trash pickup service.

**Task 131** – Obtain easements to allow beach habitat to be preserved wherever possible.

**Task 1311** – Encourage private landowners to maintain habitat.

**Task 1312** – Negotiate to protect intervening habitat on privately-owned lands between inhabited beach mouse areas.

**Task 131** – Encourage property owners to include restrictive agreements in sales and rental contracts requiring house cats to be confined.

**Task 31** – Provide public with information about life history and distribution of beach mice.

**Task 32** – Inform public about need for careful sanitation around dwellings to reduce beach mouse predators.

The approved recovery plan for the Perdido Key beach mouse is not up-to-date in regard to species status and threats, and as PKBM critical habitat has been revised, the criterion involving a percentage of occupied and protected critical habitat may also warrant modification. Since the Recovery Plan was completed, all populations of PKBM have been extirpated at some time. Through translocation efforts, at least one population has remained viable through time. Currently, PKBM are present on all three public land areas. The second criterion (minimum of 50% of critical is protected and occupied by mice) has not been met for either the original critical habitat or the recently revised critical habitat.

An updated five-year status review of the PKBM was completed by the Service at the end of 2014. Recommendations from this five-year status review included the following actions:

1. Fill a second biologist position to aid in the identified recovery actions and increased workload.
2. Revise the Recovery Plan.
3. Continue the population and habitat assessment and monitoring program.
4. Finalize and implement the emergency response plan associated with the PKBM captive breeding program.
5. Land acquisition.
6. Conduct research including -corridor size persistence, HCP success, and genetic studies.
7. Continue to conduct translocations when needed.
8. Prepare materials and conduct outreach and education.
9. Conduct PKBM response to hurricane investigation.

10. Develop a protocol to inform the public of sustainable dune restoration practices.
11. Additional research on the effects of artificial lighting on beach mice.
12. Continue to coordinate with stakeholders and partners.

In 2011, Escambia County and FWC applied for and received a Section 6 Recovery Land Acquisition Grant of $2,967,022 from the Service to acquire and manage a private parcel strategic to the conservation of the PKBM. The acquisition has been finalized and the County currently owns the parcel and will manage for PKBM conservation with limited public access on non-habitat areas.

**Threats to Perdido Key beach mice**

*Coastal Development on Perdido Key*

The Florida Legislature enacted the Local Government Comprehensive Planning and Land Development Regulation Act (Florida Statute Chapter (F.S. Ch.) 163, pt. II) which mandated the preparation of comprehensive plans and unified land development codes for all units of local government. The intent was to provide orderly growth management rules and regulations. As part of the Comprehensive Plan, density or dwelling caps were established for certain areas including Perdido Key.

According to the Escambia County, Florida Comprehensive Plan, the land use on Perdido Key is designated as mixed use (MU-4). This category provides for a complimentary mix of residential, commercial and tourism (resort) related uses. Approximately 16% of the land may be developed in resort/tourism related uses and in small scale commercial uses. Site specific densities are pursuant to the requirements of the zoning districts where a site is located (R1PK, R2PK, R3PK, C1PK, CCPK, CGPK, and PRPK). Each zoning district has its own height and building footprint limitations, which vary from one zoning district to the next. Density transfers may not be transferred to parcels south of Perdido Key Drive (SR 292) unless otherwise approved by the County and consistent with their HCP, this BO, and the forthcoming permit conditions. The uses provided under these zoning districts are found in Escambia County Code of Ordinances, Part III, Article 4 Subdivisions and Site Plans, Article 6 Zoning Districts, Sections 6.05.15, 6.05.15.01 and 6.05.15.03 as may be amended or supplemented by County action.

In the 1997 Settlement Agreement with the Department of Community Affairs (DCA) (now the Department of Economic Opportunity), a dwelling cap was issued for Perdido Key. The terms were that the maximum allowed units on the Key were 7,150 dwelling units and 1,000 lodging units. As of September 14, 2009, Development Orders/Agreements (DOs) for 6,850 dwelling units have been issued or "reserved" (**Table 5**). Only 149 lodging units have been issued or reserved (leaving 651 units) (**Table 5**). The majority of the projects are located on the eastern part of the Key between the bridge and River Road and the west end of Perdido Key Drive near the Alabama border. Relative to the rest of Escambia County from 2003 to 2008, Perdido Key accounts for approximately 10% (138 DO of 1,445 DOs County-wide) of the

Development Orders/Agreements. In northwest Florida, coastal areas even in the down markets have become significant sources of revenue for the counties.

| DEVELOPMENT ON PERDIDO KEY | |
|---|---|
| **DWELLING UNIT DATA SUMMARY** | |
| **TOTAL DWELLING UNITS AVAILABLE** | **7150** |
| MINUS EXISTING ON THE GROUND | 3835 |
| MINUS DWELLING UNITS WITH DEVELOPMENT RIGHTS | 443 |
| MINUS UNITS WITH DEVELOPMENT AGREEMENTS OR DEVELOPMENT ORDERS | 687 |
| MINUS WCI AVAILABILITY | 1691 |
| **TOTAL DWELLING UNITS LEFT-AVAILABLE** | **494** |

| LODGING UNITS (LU) | |
|---|---|
| TOTAL LODGING UNITS AVAILABLE | 1000 |
| MINUS LODGING UNITS- EXISTING AND APPROVED | 104 |
| MINUS LODGING UNITS WITH DEVELOPMENT AGREEMENTS | 0 |
| **TOTAL LODGING UNITS REMAINING** | **896** |

**Table 5. Residential, commercial and lodging dwelling unit on Perdido Key as of January 2014.**
**http://myescambia.com/business/ds/development-monitoring**

Based on current development projections on Perdido Key, we expect up to 10 Development Orders and 30 Building Permits could be issued by Escambia County under this ITP the first year providing the phased take isn't exceeded. While development was increasing in 2005 through 2008, then considerably slowed until recent activity in real estate on Perdido Key experienced renewed interest. There are a few projects that would be redevelopments and construction could take place within the existing footprint (providing meets current conservation standards) without Service permits providing habitat has not reverted back. Several more parcels fall into redevelopment projects that no longer require emergency action as it relates to hurricane destruction and significant habitat has reverted back, these could incorporate the existing footprint, but should expect to incorporate the conservation measures of this ITP. All other parcels are likely undeveloped land and will require use of this ITP. Thus, depending on the development scenario, the current market trend, and the phased release of "take" acreage, revenue to the local, county and State economies would be generated by the construction, occupancy and maintenance of small and large projects on varying timeframes. The existing two-lane SR 292 has sufficient capacity to accommodate growth within the existing development cap.

*Hurricanes and Tropical Storm Events*
Hurricanes are known to affect beach mouse population densities in various habitats. Mechanisms for effects include direct mortality of individuals, relocation/dispersal, and subsequent effects of habitat alterations (that impact such factors as forage abundance/production and substrate elevation). Habitat impacts can be widespread and encompass the range of the entire subspecies as indicative of past storms in the Escambia County area.

Hurricanes can severely affect beach mice and their habitat in the following ways:

1) Tidal surge and wave action overwashed habitat leaving a flat sand surface denuded of vegetation.
2) Sand deposition completely or partially covered vegetation.
3) Blowouts occurred between the Gulf and bay/lagoon leaving a patchy landscape of bare sand, dune, and scrub habitat.
4) The frontal portion of the primary dune habitat was sheared but landward areas were relatively unaffected;
5) Vegetation was killed by salt spray and/or prolonged inundation;, and
6) Islands were breached entirely and channels from the Gulf to bay/lagoon were created.

Future active storm seasons will likely affect Perdido Key and PKBM in the same manner if a direct or near landfall event occurs.

Until frontal dune topography and vegetation can redevelop or be restored, scrub habitat maintains beach mice populations and provides the majority of food resources and potential burrow sites (Lynn 2000; Sneckenberger 2001). Pries et al. 2009 found that frontal dune habitat occupancy by the Santa Rosa beach mouse went from 100% prior to Hurricane Ivan in 2004 to 60% after the storm. Occupancy of scrub habitat remained relatively constant at around 75%. Approximately 68% of the frontal dune area occupied by beach mice was lost, compared to a loss of only 15% of the scrub dunes. Scrub area may provide more stable habitat for beach mice than frontal dunes. Scrub dunes can serve as refugia if mice can move from the frontal dunes to scrub dunes during hurricanes (Swilling et al. 1998), and are a source for recolonization of frontal dunes following hurricanes.

While storms temporarily reduce population densities (often severely), this disturbance regime maintains open habitat and retards plant succession, yielding a habitat more suitable for beach mice than one lacking disturbance. The low-nutrient soil of the coastal dune ecosystem often receives a pulse of nutrients from the deposition of vegetative debris along the coastline (Lomascolo and Aide 2001). Therefore, as the primary and secondary dunes recover, beach mice recolonize this habitat readily as food plants develop to take advantage of the newly available nutrients. Recovery times vary depending upon factors such as hurricane characteristics (*e.g.* severity, amount of associated rain, directional movement of the storm eye, storm speed), successional stage

of habitat prior to hurricane, elevation, and restorative actions post hurricane. Depending on these factors, recovery of habitat may take from one year to over 40 years.

The impact of hurricanes on plant communities temporarily affects food availability, and hence can limit population densities in impacted habitats soon after storms. Observations indicate that Hurricane Opal (a Category 3 storm in November 1995) caused a decrease in one population of ABM by 30% (Swilling et al. 1998). However, population densities in scrub habitat typically increased following hurricanes (Swilling 2000; Sneckenberger 2001). Five months post-storm, "densities (individuals/km) were up to 7.5 times greater in scrub areas than in frontal dune grids" (Sneckenberger 2001). Impacts of the storm may have been apparent as long as 17 months after the storm when scrub densities remained triple those of frontal dunes (Sneckenberger 2001). Similar results were found for CBM at Grayton Beach State Park. When frontal and primary dunes sustained extensive damage during Hurricane Opal in 1995, beach mice were captured behind what remained of primary dune habitat (Moyers et al. 1999). By 1998, however, primary dunes and the immediate habitat inland appeared to support higher numbers of beach mice.

In addition to the overall change in post Hurricane Opal distribution of ABM, the average percent of newly marked beach mice individuals increased from 14% for the three trapping periods before the storm to an average of 26.7% for the same interval post hurricane (Swilling et al. 1998). The average for the three trapping periods immediately following was even higher, at 42.7% of the individuals captured. This increased presence of new individuals reflected increased reproduction (Swilling et al. 1998). A statistical analysis of the data indicated that the number of females exhibiting signs of reproduction was higher than normal (18.9 % higher). Similar results were also found at Topsail Hill Preserve State Park. Four to five months following Hurricane Opal, all female CBM captured were pregnant or lactating (Moyers et al. 1999). Trapping six months after the hurricane, 52% of captured CBM were new unmarked beach mice.

Although hurricanes can significantly alter PKBM habitat and population densities in certain habitats, some physical effects may benefit the subspecies. Hurricanes may function to break up population subgroups and force population mixing (Holler et al. 1999). The resultant breeding between members of formerly isolated subgroups increases genetic heterogeneity and could decrease the probability of genetic drift and bottlenecks.

Habitat Loss and Degradation

Perdido Key is a barrier island and part of a complex and dynamic coastal system that is continually responding to inlets, tides, waves, erosion and deposition, longshore sediment transport, and depletion, and fluctuations in sea level. The location and shape of barrier island beaches perpetually adjusts to these physical forces. Winds move sediment across the dry beach forming dunes and the island interior landscape. The natural communities contain plants and animals that are subject to shoreline erosion and deposition, salt spray, wind, drought conditions, and sandy soils. Vegetative communities include foredunes,

primary and secondary dunes, interdunal swales, scrub dunes, and maritime forests. During storm events, overwash is common and may breach the island at dune gaps or other weak spots, depositing sediments on the interior and backsides of islands, increasing island elevation and accreting the sound shoreline. Breaches may result in new inlets through the island.

The quality of the dune habitat (primary, secondary, and scrub) is an important factor in maintaining and facilitating beach mouse recovery. Habitat manipulation is an old and widely used tool in wildlife management. It is especially useful in improving habitat suitability to increase local populations of a species. For beach mice, improving habitat can enhance the abundance and diversity of food resources, increase the chances of meeting a mate, and reduce competition for food and burrow sites.

Long-term trapping data has shown that beach mouse densities are cyclic and fluctuate by magnitudes on a seasonal and annual basis. These fluctuations can be a result of reproduction rates, food availability, habitat quality and quantity, catastrophic events, disease, and predation (Blair 1951; Bowen 1968; Smith 1971; Hill 1989; Rave and Holler 1992; Swilling et al. 1998; Swilling 2000; Sneckenberger 2001). Without suitable habitat sufficient in size to support the natural cyclic nature of beach mouse populations, subspecies are at risk from local extirpation and extinction, and may not attain the densities necessary to persist through storm events and seasonal fluctuations of resources.

Habitat loss and fragmentation associated with residential and commercial real estate development is the primary threat contributing to the endangered status of beach mice (Holler 1992; Humphrey 1992). Coastal development has fragmented all the subspecies into disjunct populations. Furthermore, isolation of small populations of beach mice reduces or precludes gene flow between populations and can result in the loss of genetic diversity. Demographic factors such as predation (especially by domestic cats), diseases, and the potential competition with house mice, are intensified in small, isolated populations which may be rapidly extirpated by these pressures. Especially when coupled with events such as storms, reduced food availability, and/or reduced reproductive success, isolated populations may experience severe declines or extirpation (Caughley and Gunn 1996). The influence these factors have on populations or individuals is largely dependent on the degree of isolation.

The conservation of multiple large, contiguous tracts of habitat is essential to the persistence of beach mice. At present, there are few remaining large tracts of private lands remaining for potential conservation. Development interests have also identified these parcels for future projects. The three public lands are the largest and will always be the largest tracts of contiguous coastal dune habitat on Perdido Key. Protection, management, and recovery of beach mice on public areas have been complicated by increased recreational use as public lands are rapidly becoming the only natural areas left on the coast. Public lands and their staff are now under pressure to manage for both the recovery of endangered species and recreational use. Where protection of large contiguous tracts of beach mouse habitat along the coast is not possible, establishing multiple populations is the best defense against local and complete extinctions due to

storms and other stochastic events (Danielson 2005). Protecting multiple populations, increases the chance that at least one population within the range of a subspecies will survive episodic storm events and persist while vegetation and dune structure recover.

Habitat connectivity also becomes essential where mice occupy fragmented areas lacking one or more habitat types. If scrub habitat is lacking from a particular tract, adjacent or connected tracts with scrub habitat are necessary for food and burrow sites when resources are scarce in the frontal dunes, and are essential to beach mouse populations during and immediately after hurricanes. Trapping data suggests that beach mice occupying the scrub following hurricanes recolonize the frontal dunes once vegetation and some dune structure have recovered (Swilling et al. 1998; Sneckenberger 2001). Similarly, when frontal dune habitat is lacking from a tract and a functional pathway to frontal dune habitat does not exist, beach mice may not be able to attain the resources necessary to expand the population and reach the densities necessary to persist through the harsh summer season or the next storm. Functional pathways may allow for natural behavior such as dispersal and exploratory movements, as well as gene flow to maintain genetic variability of the population within fragmented or isolated areas. To that end, contiguous tracts or functionally connected patches of suitable habitat are essential to the long-term conservation of beach mice.

The presence of vegetative cover reduces perceived predation risk of foraging beach mice, and allows for normal movements, activity, and foraging patterns. Foraging in sites with vegetative cover is greater and more efficient than in sites without cover (Bird 2002). Beach mice have also been found to select habitat for increased percent cover of vegetation, and decreased distance between vegetated patches (Smith 2003). Wilkinson et al. (2010) noted that the Santa Rosa beach mouse (SRBM) preferred to cross narrow open sand gaps (less than 8.38 m (27.49 ft.) wide) to relatively large patches of vegetation ($\geq$11.75 $m^2$) (126.43 $ft^2$) during new moon phases when the predation risk is presumed to be low. A preliminary test of predictive models for the SRBM found that barrier island occupancy may be constrained more by predation risk, hurricane damage, and human impacts than by strict dependence on a particular preferred habitat (Wilkinson et al. 2009).

Beach mice use burrows to avoid predators, protect young, store food, and serve as refugia between foraging bouts and during periods of rest. Beach mice have been shown to select burrow sites based on a suite of abiotic and biotic factors. A limitation in one or more factors may result in a shortage of suitable sites and the availability of potential burrow sites in each habitat may vary seasonally. Beach mice tend to construct burrows in areas with greater plant cover, less soil compaction, steep slopes, and higher elevations above sea level (Lynn 2000; Sneckenberger 2001). These factors are likely important in minimizing energy costs of burrow construction and maintenance while maximizing the benefits of burrow use by making a safe and physiologically efficient refuge. Similar to food resources, this fluctuation in availability of burrow sites suggests that a combination of primary, secondary and scrub dune habitat is essential to beach mice at the individual level.

Genetic viability

Selander et al. (1971) conducted an electrophoretic study on 30 populations of *P. polionotus*, including populations of beach mouse subspecies. Based on 30 allozyme loci, they estimated that the level of allozyme variation found in beach mouse populations was at least 40% lower than the level of variation in nearby inland populations. This work indicates that beach mouse populations already have lower genetic variability before inbreeding, bottleneck events, or founder effects that may occur in a reintroduced population. Lower levels of heterozygosity has been linked to less efficient feeding, fewer demonstrations of social dominance and exploratory behavior, and smaller body size (Smith et al. 1975; Garten 1976, Teska et al. 1990). Research focused on inbreeding depression in old-field mice (including one beach mouse subspecies), determined that the effects of inbreeding negatively influenced factors such as litter size, number of litters, and juvenile survivorship (Lacy et al. 1995).

In 1995, the Service contracted with Auburn University to conduct genetic analysis of post-re-establishment gene structure in PKBM (Wooten and Holler 1999). Results of the work for PKBM determined the following: (1) founder effect (from Gulf State Park to GINS) did impact the GINS population and loss of rare alleles and allele frequency shifts were noted; (2) a low to moderate level of overall genetic divergence was observed; (3) data suggest that some effects of genetic drift were mediated by continued transfer of individuals; (4) levels of heterozygosity were unexpectedly high given recent history; (5) average level of relatedness among individuals is high which may portend future inbreeding related problems and no substantial evidence of existing close inbreeding was observed in the data; and 6) the overall level of microsatellite variation retained in the GINS population was higher than anticipated.

A more recent genetic investigation with the University of Florida and FWC has looked at the genetic structure across the entire range of PKBM. This has advanced our understanding of existing variability, the impact of captive breeding on genetic variation, and has provided important insight into the dispersal capabilities of PKBM island-wide. The work conducted by Austin (2012) and Austin et al in review was focused on the level of genetic drift associated with the reintroduction of captive bred PKBM at GSP in 2010. The growth and connectivity of the PKBM population over a two year period was documented at each of the three public lands. In 2010, the three park populations were significantly genetically different than 2012. This level of differentiation can be easily explained by the known history of bottlenecks, reintroductions from an inbred captive colony, and natural re-colonization of PKSP by a few GINS founders in 2009. Genetic levels were highest in GINS, which is consistent with the relatively long history of PKBM occupation of that park.

Recommendations to manage the genetic variability within PKBM include: (1) preserving the natural population to the maximum extent possible since the loss of the GSP population resulted in the permanent loss of alleles; (2) using whichever population of PKBM (GSP, PKSP, or GINS) has the most amount of genetic variation at the current time as donors for re-establishment of other populations when needed; (3) transfers

between donor and re-established populations in re-establishment plans (Wooten and Holler 1999); and (4) maintain genetic similarities between the wild populations and captive population to the maximum extent possible. In addition, future translocations and re-introductions should be accomplished in pairs.

Beachfront Lighting

Artificial lighting increases the risk of predation and influences beach mouse foraging patterns and natural movements as it increases their perceived risk of predation. Foraging activities and other natural behaviors of beach mice are influenced by many factors. Artificial lighting alters behavior patterns causing beach mice to avoid otherwise suitable habitat and decreases the amount of time they are active (Bird et al. 2004). The effects from lighting should be reduced by avoiding lighting in all PKBM habitat.

The PCFO supports the practices associated with the International Dark-Sky Association (www.darksky.org) which stresses limiting outdoor lighting to those areas truly needed. Therefore, dark skies are recommended for projects proposed on Perdido Key. However, if lighting is deemed essential, wildlife-friendly lighting (FWC and Service approved) should be utilized. These are light sources that emit long wavelength light, highly directed light or that do not emit significant light in the spectral range of 550 to 620nm. These long-wavelength light sources include low pressure sodium vapor lamps 8000 lumens or less, bug lamps 480 lumens or less, amber and red LEDs (light emitting diodes), true red neon, and some color-filtered compact fluorescent lamps that are housed in a full cut off or fully shielded fixture. Fixtures should be mounted as low in elevation (height) for the needed purpose. The Service continues to work with public and private land owners concerning light pollution on Perdido Key. While wildlife-friendly lighting is considered to meet nocturnal wildlife specifications, beach mice have been shown to avoid illuminated habitat. Therefore, as our understanding of artificial lighting on PKBM continues, so should the parameters for wildlife friendly lighting within the coastal dune habitat.

Predation

Beach mice have a number of natural predators including coachwhip (*Masticophis flagellum*) and corn snakes (*Elaphe guttata guttata*), pygmy rattlesnake (*Sistrurus miliarius*), and Eastern diamondback rattlesnake (*Crotalus adamanteus*), short-eared (*Asio flammeus*) and great-horned owls (*Bubo virginianus*), great blue heron (*Ardea herodias*), northern harrier (*Circus cyaneus*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*) skunk (*Mephitis mephitis*), weasel (*Mustela frenata*), and raccoon (*Procyon lotor*) (Blair 1951; Bowen 1968; Holler 1992; Novak 1997; Moyers et al. 1999; Van Zant and Wooten 2003). Predation in beach mouse populations that have sufficient recruitment and habitat availability is natural and less of a concern. However, predation pressure from natural and non-native predators on populations already stressed from a variety of threats may result in the extirpation of small, local populations of beach mice.

Free-roaming and feral cats are believed to have a devastating effect on beach mouse persistence (Bowen 1968; Linzey 1978) and are considered to be the main cause of the loss of at least one population of beach mice (Holliman 1983). Cat tracks have been observed in areas of low trapping success for beach mice (Moyers et al. 1999). The PHVA for the ABM indicated that if each population had as few as one cat which ate one mouse a day, rapid extinction occurred in over 99% of all iterations (Traylor-Holzer 2005).

In response to increasing depredation of sea turtle nests by coyote, fox, and raccoon, a multi-agency cooperative effort was initiated in northwest Florida in 1996. Ten Federal and State agencies have provided funding and/or in-kind services to implement a control program on coastal public lands across northwest Florida. The program is ongoing, and a permanent USDA position was established in northwest Florida to conduct the control work (Northwest Florida Partnership 2000; Daniel et al. 2002). USDA continues to capture feral cats in beach mouse habitat on Perdido Key. In 2013, the FWC was awarded a grant from the National Fish and Wildlife Foundation to increase predator control efforts in northwest Florida to conserve beach-nesting birds. Beach mice and sea turtles benefit from this increase effort as well. There are now three dedicated USDA positions in the area.

*Climate Change*

The varying and dynamic elements of climate science are inherently long term, complex and interrelated. At present, the science is not exact enough to precisely predict when and where climate impacts will occur. Although we may anticipate the direction of change it may not be possible to predict its precise timing or magnitude. These impacts may take place gradually or episodically in major leaps.

According to the Intergovernmental Panel on Climate Change Report (IPCC 2007), warming of the earth's climate is "unequivocal," as is now evident from observations of increases in average global air and ocean temperatures, widespread melting of snow and ice, and rising sea level. The IPCC Report (2007) describes changes in natural ecosystems with potential wide-spread effects on many organisms, including marine mammals and migratory birds. Scientific evidence indicates a rapid and abrupt climate change, rather than the gradual changes that have been currently forecasted (IPCC Report 2007), posing a significant challenge for fish, wildlife, and plant conservation. Species' abundance and distribution are dynamic, relative to a variety of factors, including climate. As climate changes, the abundance and distribution of fish and wildlife will also change. Highly specialized or endemic species are likely to be most susceptible to the stresses of changing climate. Based on these findings and other similar studies, the Fish and Wildlife Service will incorporate potential climate change effects as part of their long-range planning activities (Service 2009 a, b).

Climate change at the global level drives changes in weather at the regional level, although weather is also strongly affected by season and by local effects (e.g., elevation, topography, latitude, proximity to the ocean). Temperatures are predicted to rise from

$2^{o}$C to $5^{o}$C for North America by the end of this century (IPCC 2007). Other processes to be affected by this projected warming include rainfall (amount, seasonal timing, and distribution), storms (frequency and intensity), and sea level. The 2007 IPCC report found a 90% probability of 7 to 23 inches of sea level rise by 2100. The exact magnitude, direction, and distribution of these changes at the regional level are not well understood or easy to predict. Seasonal change and local geography make prediction of the effects of climate change at any location variable. Current models project a wide range of regional changes.

Florida is one of the areas most vulnerable to the consequences of climate change. Climatic changes in Florida could amplify current land management challenges involving habitat fragmentation, urbanization, invasive species, disease, parasites, and water management (Pearlstine 2008). Global warming will be a particular challenge for endangered, threatened, and other "at risk" species. It is difficult to estimate, with any degree of precision, which species will be affected by climate change or exactly how they will be affected. The Service will use Strategic Habitat Conservation planning, an adaptive science-driven process that begins with explicit trust resource population objectives, as the framework for adjusting our management strategies in response to climate change (Service 2006b).

Increased sea levels, resulting from global warming, have accelerated shore line erosion rates in the Gulf of Mexico (Twilley et al. 2001). According to the Third National Climate Assessment, release May 2014, sea level rise and increasing storm surge events are occurring and are impacting coastal species and ecosystems (Melillo et al. 2014 and Wolf 2014). As the coastal shore line of Perdido Key erodes gradually or rapidly during storm events, the frontal dune habitat of PKBM can be significantly degraded and reduced. A diminished frontal dune enables a hurricane storm surge to inundate secondary dunes and swales, killing vegetation and any burrowed mice. Perdido Key has relatively few high elevation dunes to provide refugia for PKBM during (and in the aftermath of) storms. The ability of PKBM to re-populate Perdido Key after a destructive hurricane is predicated on the successful re-establishment of dune vegetation. If late-succession dune species that occupy the higher elevation scrub dunes and provide refuge for beach mice during hurricanes (Pries *et al*. 2009) are damaged during an intense hurricane, it is unlikely they will have time to re-establish themselves between narrowing hurricane cycles (Feagin et al. 2005).

**Analysis of the species/critical habitat likely to be affected**

In summary, the Action Area includes areas within the geographic range occupied by the subspecies, provides essential connectivity between public lands, and provides habitat for natural movements, behaviors, and long-term persistence of PKBM. The Action Area includes all five critical habitat units for the PKBM: PKBM-1, PKBM-2, PKBM-3, PKBM-4, and PKBM-5 (Figure 3). PKBM-2 consists of 114 acres in Florida and 33 acres in Alabama. It consists of private lands and contains essential features of beach mouse habitat between PKBM-1 and PKBM-3. It consists of primary, secondary, and scrub dune habitat (PCEs 2 and 3). It is essential to the conservation of the species

because it provides: necessary connectivity between PKBM-1 and PKBM-3; and habitat for expansion, natural movements, and recolonization (PCE 4). Though considered unoccupied at the time of listing in 1985, PKBM presence was confirmed in 2005 through observations of tracks and burrow (Sneckenberger 2005) and it is currently considered occupied.

The 238-acre PKBM-3 is owned and managed by the Florida Park Service. It contains one of the three core populations of PKBM needed for recovery. It provides essential features of beach mouse habitat including primary, secondary, and scrub dune habitat (PCEs 2 and 3), some areas of connectivity (PCE 4), and a natural light regime (PCE 5). PKBM were known to inhabit this unit in 1979, though numbers plummeted following Hurricane Frederic in 1979 and by the time of listing PKSP was considered unoccupied. PKBM were reintroduced to PKSP in 2000 and currently support a healthy population.

PKBM-4 consists of 162 acres and included features essential to the conservation of beach mouse habitat between GINS and PKSP. It consists of private lands with primary, secondary, and scrub dune habitat (PCEs 2 and 3). It includes the largest contiguous acreage of high elevation scrub habitat on Perdido Key, an important refuge during storm events as well as an important source population if storms extirpate or greatly reduce local populations. It is essential to the conservation of the species because it provides essential connectivity between two core populations (GINS and PKSP) (PCE 4). While considered unoccupied at the time of listing, the presence of beach mice was confirmed in 2004 as a result of live-trapping efforts in conjunction with permitting (Service 2004). PKBM sign (tracks and burrows) has recently been seen in several locations throughout this unit.

Since the listing of PKBM in 1985, the relative importance of the frontal dune and scrub dune habitat has been reconsidered. While the frontal dunes were thought to represent optimal habitat, the scrub dunes are now considered to serve an equally important role in the persistence of beach mice. The role of the scrub dunes becomes particularly important during and after storm events when inland habitat is the only refugia from storm surge.

Habitat loss and degradation, loss of genetic variation, predation, artificial lighting, and hurricanes are threats to beach mouse populations. Enhancing and maintaining habitat connectivity and protecting multiple populations work to moderate the effects of these threats and these measures are essential to the long-term persistence of PKBM. Incorporation of a natural light regime within the three public lands and private developments throughout the Action Area would limit effects from artificial lighting and address the requirements for PCE 5. PKBM populations have been on the decline since before listing and have struggled for several years to recover from the tropical storms and hurricanes of 2004 and 2005. Currently, it is thought the population is doing well based on the track tube monitoring data from each of the three public parks.

Habitat loss and fragmentation within PKBM-2 and PKBM-4 are mainly due to development. Other specific threats within PKBM-2 and PKBM-4 are similar to those of

PKBM-3 including: artificial lighting, feral cats, predation, foot traffic, soil compaction, and damage to dunes and dune vegetation.

## ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including known habitat and designated critical habitat), and the ecosystem within the Action Area. The environmental baseline is a "snapshot" of a species' health at a specified point in time. It does not include the effects of the action under review in the consultation.

### Status of the species within the Action Area

The Action Area for this project is the entire range of the PKBM (and the entire island of Perdido Key) and is approximately 15 miles long and encompasses approximately 3,050 acres. The approximate total of PKBM habitat within the Action Area is 1,711 acres. This includes approximately 274 acres of PKBM habitat (including primary, secondary, and coastal scrub) and designated critical habitat that is privately owned and could be developed under Escambia Counties' permit authority, plus an additional 60 acres of habitat not designated critical habitat. The total PKBM habitat that could be developed under this HCP by Escambia County within the Action Area is 334 acres. These impacts will be tracked by separate ledger to account for current available habitat.

The Action Area for the Perdido Key HCP is the entire range of the PKBM, therefore, refer to the Status of the Species/Critical Habitat section above. The Action Area includes the core populations of PKBM at each of the three public parks (GSP, PKSP, and GINS), and the areas that provide essential connectivity between these populations. . The Action Area also provides essential connectivity between frontal and scrub dune habitat and provides habitat for natural movements, refuge from storm surge, recolonization following storms, and population persistence. The Action Area is essential to the conservation of the species. Actions that prevent or temporarily impede these movements also prohibit these natural behaviors and can impact the likelihood of PKBM persistence. The Action Area is particularly susceptible to habitat fragmentation and other threats from development as it includes the FDOT roadway and property in private ownership.

### Factors affecting species environment within the Action Area

<u>Coastal development</u>

The greatest factor threatening the status of PKBM is coastal development and other human-induced actions that result in habitat loss and fragmentation, excessive ambient artificial light, landscaping with non-native vegetation, free-roaming cats, and high numbers of natural predators. Habitat loss and fragmentation is one of the chief reasons for the precipitous decline of many endangered species is (Wilcox and Murphy 1985). In the case of the PKBM, fragmentation began with the first active human use of the island

when Fort McRee was constructed in 1831 and greatly increased as Perdido Key emerged as a beach resort development in the 1970's and 1980's (Work et al. 1991). This fragmentation of habitat increases the obstacles faced by the PKBM when natural events such as hurricanes and predation occur, and likely contributed to the severe decline of the PKSP population following Hurricanes Ivan, Dennis, and Katrina. One of the most rapid and obvious effects of fragmentation is elimination of the species that occurred only in the portions of the landscape destroyed by development (Noss and Csuti 1977). Many species, like the PKBM, are especially susceptible to extinction from habitat loss because of their limited distributions. The prime example of the loss of a similar species is the extinction of the pallid beach mouse in Florida (Humphrey 1992).

Some mobile species can integrate a number of habitat patches (Noss and Csuti 1997). An example is the white-footed mouse (*P. leucopus*) which is able to maintain populations in fragmented landscapes only when dispersal between woodlots, aided by hedgerows, is great enough to balance out local extinctions (Fahrig and Merriam 1985). Studies on the ABM indicate that beach mouse species can and do move between undeveloped habitat and remnant parcels of suitable habitat within developed areas. While we are uncertain what habitat parameters define a corridor for PKBM (*e.g.*, minimum width, amount of cover), we have evidence that PKBM use undeveloped habitat surrounding single-family residences and blocks of habitat preserved within multi-family developments with HCPs. However, if a species is incapable of surviving in developed areas or in a fragmented landscape, then it is destined for eventual extinction (Noss and Csuti 1977). When coupled with events such as storms, reduced food availability, and/or reduced reproductive success, isolated populations may experience severe declines or extirpation (Caughley and Gunn 1996).

Isolation of habitats by imposing barriers to species movement is an effect of fragmentation that accomplishes the same loss as reduction in habitat size (Noss and Csuti 1977). A barrier to PKBM movement depends upon a number of factors, such as location and size, and can include roads, parking lots, high-density residential developments, highly lit areas, and holding ponds. Fragmentation from SR 292 may have been a factor in the lack of detection of beach mice in frontal dunes during early trapping efforts at PKSP (*e.g.* separation of frontal dunes from scrub dunes (Meyers 1983). However, trapping/tracking surveys indicate that the existing two-lane SR 292 does not pose an impermeable barrier to the PKBM, although movement across the road is likely inhibited. In 2010, PKBM were able to build up densities south of SR 292 and eventually cross the road and repopulate scrub dune habitat north of the road (Figure 8**).** The viability of populations may depend on enough movement of individuals among and between habitat patches to balance extirpation from other habitat patches (*e.g.*, if the GSP population had been able to move to another patch of habitat to the east, or if other populations in local habitat patches had been able to migrate to GSP [as a source population], then the GSP population would not have been extirpated after Hurricane Frederick). If essential habitat requisites are eliminated or habitat connectivity is severed, PKBM populations may be at increased risk. Therefore, PKBM requires habitat connectivity that allows the species to move between habitat patches containing vital resources (*e.g.* food, cover, burrowing habitat, and higher elevation refugia).

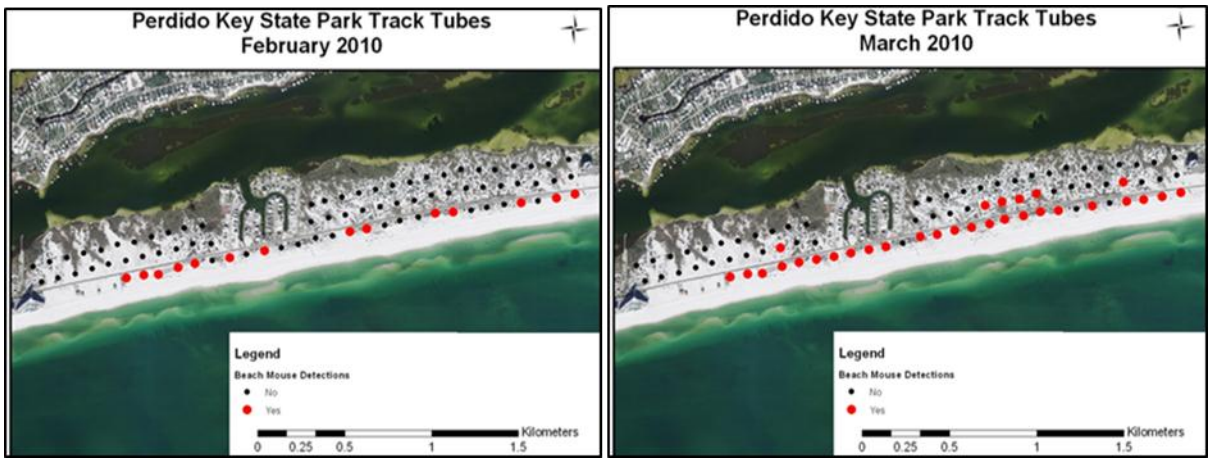


**Figure 8. Track tube evidence of PKBM crossing the existing two-lane SR 292 (FWC 2010a).**

Habitat connectivity is especially important where mice occupy fragmented areas lacking one or more habitat types. For instance, when food or burrow sites are scarce in the frontal dunes (*e.g.*, seasonally or after hurricanes), beach mouse access to connected tracts (*e.g.*, scrub or other frontal dune habitats) with these resources is important in maintaining local beach mouse populations and distributions. Trapping data suggest that beach mice occupying the higher elevation scrub dunes and open interior scrub following hurricanes recolonize the frontal dunes once vegetation and some dune structure have recovered (Swilling et al. 1998; Sneckenberger 2001). Similarly, when frontal dune habitat is lacking from a tract or a functional pathway to frontal dune habitat does not exist, beach mice may not be able to obtain the resources necessary to expand the local population and reach the densities necessary to persist through the harsh summer season or the next storm. Functional pathways may allow for natural behavior, such as dispersal and exploratory movements, as well as gene flow, to maintain genetic variability of the population within fragmented or isolated areas (Service 2009c).

The effects of barriers or loss of habitat connectivity on PKBM are dependent on their location, duration and magnitude. These effects are both relative and cumulative. Meyers (1983) contended that high density developments which eliminate large sections of contiguous habitat can be expected to be more of a barrier to beach mouse movement than a fully developed single-family subdivision, which in turn would impede beach mouse movement more than single-family homes on large lots. The cumulative effects of barriers are what finally extinguish populations in most cases (Noss and Csuti 1997).

How such development activities will affect the PKBM over the long term is not known and will likely depend on interactions between future developments and stochastic events (*e.g.*, hurricanes). The importance of the fragmentation process in the habitat requirements of the PKBM is not totally understood. However, fragmentation can affect the biological integrity of the PKBM through isolation and possible local extirpation. It is believed that fragmentation contributed to the loss of PKBM at Florida Point (GSP) and the pallid beach mouse (Humphrey 1992; Lynn 2000).

Development of Perdido Key with residential homes, large condominiums, and commercial retail has undoubtedly reduced the amount of historic natural habitat available to the PKBM and this trend will likely continue. Development pressures also include indirect effects, such as attraction of potential competitors (house mice) through inadequate refuse management, artificial lighting that disrupts normal nocturnal PKBM behavior, and attraction of non-native predators such as the domestic/feral cat.

Although the negative effects of artificial lighting are well documented for sea turtles (Witherington and Martin 2003), its potential effects within beach mouse habitat have not been extensively studied. Natural illumination of the dune systems due to moon phases is known to have a direct effect on beach mouse activity (Blair 1951; Wolfe and Summerlin 1989; Wilkinson et al. 2010). Bird et al. (2004) found that beach mouse foraging behavior was altered as a result of artificial light by reducing use of foraging patches and/or reducing seed harvest. They also suggested that artificial lights may cause habitat fragmentation due to altered movement patterns of mice. This alteration in behavioral patterns causes beach mice to avoid otherwise suitable habitat and decreases the amount of time they are active (Bird et al. 2004). Efforts are being planned to address beachfront lighting within the range of the subspecies. Escambia County has drafted a wildlife lighting ordinance that may help reduce artificial lighting impacts on beach mouse habitat in the Action Area. The finalization of the ordinance will be a component of this permit.

Following documentation of PKBM on private lands in 2004 an interagency working group formed to address the new and re- development occurring on Perdido Key. The Service, FWC, and Escambia County worked together to create other options to offset impacts to PKBM and their habitats from the development. A Conservation Strategy for the PKBM outlined the measures needed to conserve the subspecies (FWC et al. 2005) (see Status and Distribution, Coastal development above for more detail). A Business Plan (RCF 2005) determined the funding needed to implement the Conservation Strategy (Conservation Fund). Finally, an intergovernmental agreement between the three levels of government was signed in December 2005. The agreement establishes the Conservation Fund for implementing PKBM conservation activities and outlines the coordination and processes by which the Conservation Fund will be managed. As part of the Intergovernmental Agreement, Escambia County adopted an ordinance that prohibits building or placing structures seaward of the 1975 Coastal Construction Control Line. This is estimated to permanently protect an additional 5 acres of PKBM habitat.

Provided coastal development projects address the objectives and strategies identified in the Conservation Strategy, incidental take of PKBM can be minimized with the ability to compensate for unavoidable losses. Escambia County has the responsibility of managing the PKBM Conservation Fund and conducting compliance evaluation. While land acquisition is a component of the Conservation Strategy, funding for land acquisition within the Conservation Fund is minimal, keeping the cost of the initial and annual contributions low. Consequently, avoidance and minimization on each project site to the maximum extent practicable must be accomplished before using the Fund to offset impacts.

Following each of the hurricanes in 2004 and 2005, the Service informed Federal agencies, State agencies, local governments, and landowners that repair or rebuilding of structures damaged by the storms within their original footprint would not likely adversely affect PKBM. No additional coordination was required. Most initial response and recovery actions were handled in this manner. The Services' current hurricane guidance states that if rebuilds were not reconstructed in the original footprint within five years of the federally declared disaster; then current ESA regulations will be enforced. Five years is the approximate amount of time it takes for the coastal dune habitat to show significant progress in rebuilding itself.

Service-issued take for section 7 and 10 actions provided under the ESA were summarized from 2004-2014. For that time period, 105.3 acres were covered for incidental take in connection with private development on Perdido Key in Florida (Table 6). This is including the acreage associated with this permit, even though the 66 acres are not included in the environmental baseline. The habitat remaining onsite following all these associated actions is 257.37 acres.

| Project | Year | ESA Action | Total BM habitat onsite (acres) | BM Habitat Impacts permitted (acres) | Habitat to remain onsite |
|---|---|---|---|---|---|
| Florencia | 2005 | Informal consultation | 3.5 | 3.0 | 0.5 |
| PKSP Re-build (not included in total) | 2005 | Emergency consultation | | 1.99 | |
| FEMA Berm Emergency consultation (not included in total) | 2005 | | | | |
| Magnolia West* | 2006 | Section 7 BO | 11.00 | 5.20 | 5.80 |
| Palazzo* | 2006 | section 10 ITP | 1.72 | 0.58 | 1.14 |
| Retreat* | 2006 | section 10 ITP | 0.88 | 0.21 | 0.67 |
| Searinity* | 2006 | section 10 ITP | 0.87 | 0.32 | 0.55 |
| Bond Residence | 2006 | section 10 ITP | 1.03 | 0.17 | 0.86 |
| Paradise Isle* | 2007 | section 7 BO | 2.07 | 0.91 | 1.16 |
| SR 292 turn lane at River Road (not included in total) | 2007 | Section 7 BO | | 0.58 | |
| Escambia County (Perdido Key)beach nourishment (not included in total) | 2008 | | | 6.5 miles frontal dune | |
| Island Club* | 2008 | section 10 ITP | 0.67 | 0.31 | 0.36 |
| Marquesas* | 2008 | section 10 ITP | 1.39 | 0.50 | 0.89 |
| Lorelei* | 2008 | section 10 ITP | 0.57 | 0.14 | 0.43 |
| Seabreeze* | 2009 | Section 10 ITP | 0.91 | .37 | 0.54 |
| Calabria* | | section 7 BO | 0.77 | 0.33 | 0.34 |
| Spanish Key | 2010 | Section 10 ITP | 0.48 | 0.21 | 0.27 |
| PK Fire Station | 2010 | Section 7 BO | 0.87 | 0.43 | 0.44 |
| Evans Residence* | 2012 | Section 10 ITP | 1.29 | 0.21 | 1.08 |
| Stern Residence | 2012 | Section 10 ITP | 0.13 | 0.07 | 0.06 |
| Whalen Residence* | 2012 | Section 10 ITP | 1.08 | 0.18 | 0.90 |
| Carbone Residence | 2012 | Section 10 ITP | 0.157 | 0.074 | 0.083 |
| Lost Key* | 2012 | section 7 BO | 59.4 | 26.1 | 33.3 |
| Escambia County HCP (Perdido Key-wide)[1] | 2014 | Section 10 ITP | 274 | 66 acres over 30 years | 208 |
| **Total** | | | **362.78** | **105.3** | **257.37** |

***not constructed*** [1]Not included in existing baseline

**Table 6. ESA section 7 and 10 actions completed by the Service from 2004-2014 and acres of PKBM habitat affected.**

Public Lands

*Gulf State Park at Florida Point.* GSP is located on Perdido Key in Alabama. It contains 115 acres of designated PKBM critical habitat and is managed by Alabama Department of Conservation and Natural Resources (ADCNR). The north and south portions of the park are bisected by Highway 182, a four lane road. This is the western most range for the PKBM and supports one of three core populations. GSP does not contain scrub dune habitat that would provide for recolonization following catastrophic storms. This likely contributed to the extirpation of PKBM in the past.

*Perdido Key State Park*. This 247-acre state park is centrally located on Perdido Key and includes approximately 238 acres of designated critical habitat for the PKBM (PKBM-3). It is managed by the Florida Park Service, Florida Department of Environmental Protection. SR 292 divides the frontal dunes from the scrub dunes within PKSP. The park boundaries exclude the SR 292 ROW. One of three core populations of PKBM occurs within PKSP. This population was severely depleted in size and range following Hurricanes Ivan, Dennis, and Katrina; the population has gradually rebounded as coastal habitat recovered.

*Gulf Islands National Seashore-Johnson Beach.* GINS is a 638 acre park managed by the National Park Service and located on Perdido Key in the eastern-most range of the PKBM. It contains the largest, most contiguous portion of PKBM habitat, mostly primary and secondary dunes. One of the three core populations can be found here and according to recent genetic data by Austin 2012, these mice are the most genetically diverse. As with each of the other core populations in the public parks, this population has been extirpated in the past and recolonized.

Tropical Storms, Hurricanes, and Hurricane Recovery Actions

Post-Hurricanes Ivan/Dennis/Katrina (Category 3 storms) habitat assessments combined with subsequent trapping and tracking tube efforts at PKSP and GINS indicated that PKBM distribution and numbers were severely reduced as a result of the storms. An estimated 80% of PKBM habitat was impacted by storm surge, high winds, sand erosion, and salt spray. In 2005, the anticipated rate of PKBM recovery after these storms was unknown and believed to be largely dependent on the response of storm-impacted habitats and their connectivity to remaining habitat patches, pre-storm PKBM distribution, post-storm development or reconstruction efforts, post-storm dune restoration actions, and the frequency, extent and/or intensity of future storm events. No major storms have impacted the area since 2005. By 2010, tracking tube data suggested that PKBM distribution was recovering, likely the result of the improving condition of storm-impacted habitat and connectivity facilitated by a Gulf-side vegetated berm constructed between GINS and PKSP.

Large tropical storms and hurricanes will continue to impact PKBM habitat throughout its range in the future. To anticipate the habitat effects of future hurricanes, the Service

conducted a modeling exercise using Federal Emergency Management Agency (FEMA) 100-year flood hazard data and 2009 LIDAR (Light Detection and Ranging) elevation data to predict inundated/uninundated habitat resulting from hurricane storm surge. Using this model, the Service estimates that PKBM may be restricted to 272 acres of uninundated habitat within the HCP Area during catastrophic storms (Figure 9). This is approximately 76.4% of the 356 acres of uninundated habitat available throughout the PKBM's range. Some minimum amount of dune habitat that is suitable for PKBM is necessary to allow beach mice to find refugia during these events and to persist over the long-term (Pergams et al. 2000).

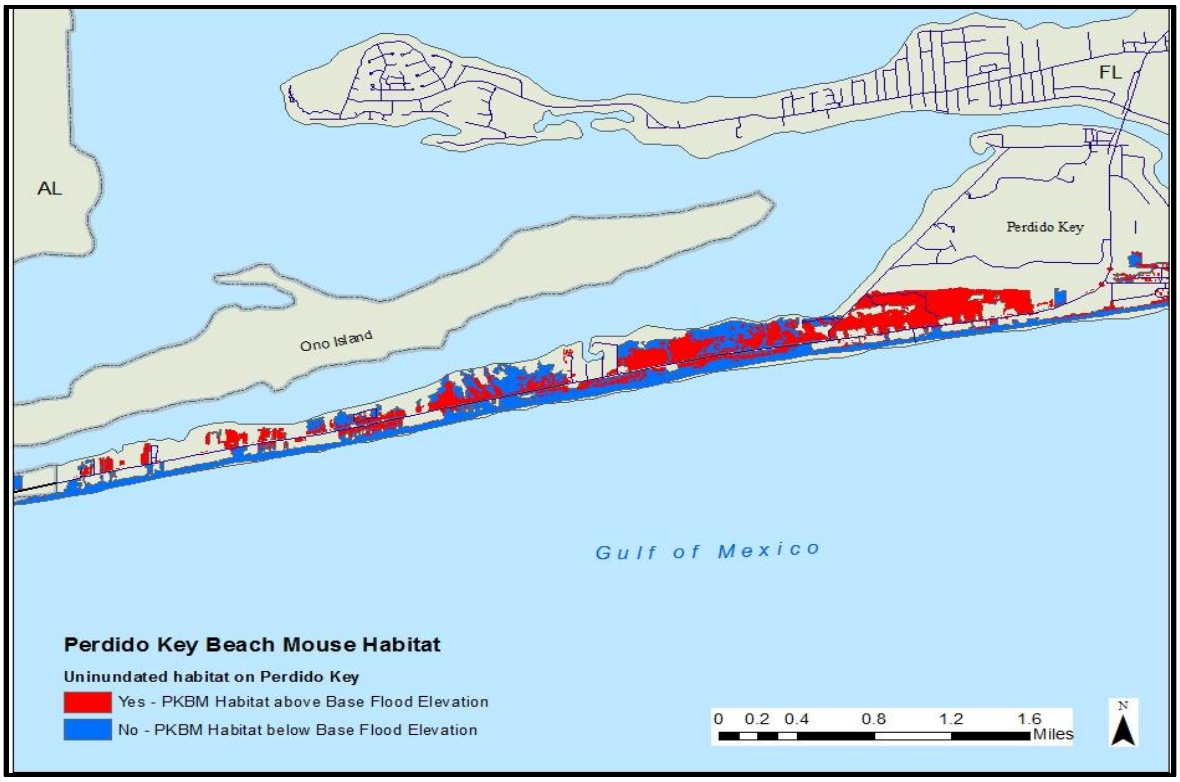


Figure 9. **Effects of 100-year storm surge on PKBM habitat. Areas above base flood elevation are uninundated storm refugia.**

Hurricane restoration efforts conducted by local, State, and Federal agencies are still underway in the Action Area. Some efforts may affect the PKBM and/or may adversely modify areas of critical habitat while other efforts are intended to restore habitats for PKBM.

The FEMA funded Escambia County to construct an emergency berm to provide storm protection along the Gulf of Mexico beachfront. The berm was completed in 2005 and was planted in 2006. This effort has expedited natural dune restoration which enhances beach mouse habitat within the Action Area. This vegetated berm likely provided essential connectivity between GINS and PKSP, enhancing the repopulation of PKSP.

Storm-surge overtopped SR 292 during Hurricane Ivan and caused extensive pavement destruction and scour from weir-like flow traveling down the road's north side and

undercutting the road (Douglass et al. 2004) (Figure 10). Chunks of asphalt and the old clay road base were widely distributed throughout PKBM habitat in PKBM-2, PKBM-3, and PKBM-4. Repairs were made in 2004-2005 and most debris was removed from PKBM habitat using FHWA funding. An emergency consultation was completed in 2005. PKSP biologist Anne Harvey (pers. comm. 2012) indicated that impacts to PKBM habitat persist to this day, including an approximately 48,000 cubic-foot pile of asphalt and sand left by the contractor, and areas with underlying clay and asphalt chunks (overwash plains north of PKSP's West Use Area and on the east end of the park near the Florencia development). Restoration plantings in these areas have been less successful than at other locations in the park.

**Figure 10.** Hurricane damage to SR 292 and nearby habitat for the PKBM in 2004.

Escambia County is currently in the final permitting stages of a beach nourishment project for Perdido Key. The project would cover approximately 4 miles of beachfront along county and private lands, not including state and Federal lands. The Service completed an endangered species consultation for the project in 2008. The beach nourishment project is likely to enhance PKBM habitat by providing additional dune habitat (creation) seaward of the existing primary dune habitat. This will provide a buffer to the coastal dune habitat and development structures from future storm events.

The Pensacola Naval Air Station (NAS) has proposed to dredge their navigation channel resulting in the need to place 8 million cubic yards of dredged material that is beach compatible. Because of cost, Perdido Key is the closest area to receive the material. Receiving areas include the Perdido Key Gulf beachfront (in lieu of the County implementing their project described above), PKSP, and GINS. The project could result in the placement of dredged material on 16 miles of beachfront including private, County, State, and Federal lands. The Navy has received their permits to complete the project. The Service completed an endangered species consultation for the project in 2007.

Non-Native Species

Any activities that modify coastal dune habitats (*e.g.*, road building, land grading and development) can create avenues for non-native species, such as cogon grass (*Imperata cylindrica*) and fire ants (*Solenopsis invicta*) to invade PKBM habitat and impact local

PKBM populations. Following Hurricane Ivan, FDOT brought in Bahama rock for shoulder stabilization in the West Use Area of PKSP that was contaminated with cogon grass. The PKSP is treating it annually to reduce its coverage but expect eradication will take several years (Harvey 2012 pers. comm.). Cogon grass can replace native plants which are important in maintaining the structure and continuity of PKBM habitat, and provide food resources. Fire ants have been known to attack beach mice in live traps and may have impacts on nesting females and their pups (Service 2009c). Other non-native species, such as the house mouse, domestic cat, red fox and coyote, also may place additional predation or competition pressures on PKBM populations (see Threats to Perdido Key beach mice, Predation). During 2010, within the Action Area, during the release of captive-bred PKBM in GSP, red foxes denning under Highway 182 were associated with the loss of 35 mice within a span of a few days. There is potential for similar incidents throughout the Action Area.

Deepwater Horizon Oil Spill

The Deepwater Horizon Oil Spill (Oil Spill) that resulted from the April 20, 2010 explosion on the Deepwater Horizon oil platform off the coast of Louisiana had the potential to significantly impact the coastal ecosystem of the Gulf Coast. It will be a number of years until the damage has been fully assessed. However, at this time, it appears that the dune environment was not significantly harmed. There has been minor damage to PKBM habitat that resulted from response efforts in the form of dune destruction and trampling. These impacts were minimized through consultation with the Service, land managers, and Escambia County. There has also been some oil deposited in the dunes of Perdido Key during periodic summer storms, most notably tropical storm Alex. The low tropical activity during the hurricane season of 2010 enabled the damaged well to be capped, and cleanup efforts have been able to proceed almost unabated. Response efforts continue as needed. Impacts to PKBM were minimized through a continuing emergency consultation with the U.S. Coast Guard and now fall under non-emergency (standard) consultation.

Other Factors

Increases in sea level, temperature, precipitation and storms are expected with global climate change, as described above (see Threats to Perdido Key beach mice, Climate Change). Although the implications for changes to the Florida Gulf coast are far from clear, the possible effects of global warming/sea level rise may have significant impacts on PKBM habitat and populations. It is reasonable to assume that beach mouse habitat, particularly the frontal dunes, could be adversely impacted by shoreline inundation and erosion, as well as the effects of flooding and salt spray on interior dune vegetation, associated with predicted increases in sea level and/or storm activity along the Gulf coast.

## EFFECTS OF THE ACTION

This section is an analysis of the effects of the project on the species and critical habitat. This section addresses the future direct and indirect effects of the project, including the effects of any interrelated and interdependent activities. Our determination of total effects to the species and critical habitat in the "Conclusion" section is the sum of the effects evident in the baseline plus effects of the action and cumulative effects. The proposed action is likely to result in adverse effects to the PKBM and its habitat. In addition to effects realized by these species at the project site, we also evaluated effects to designated critical habitat.

### Factors to be considered

The PKBM is found throughout its historic range in areas of suitable habitat and where other threats have at times been managed, controlled or ameliorated. Our recent estimates indicate that 1,711 acres of PKBM habitat exists in Florida (1,518 acres) and Alabama (192 acres). While various population estimates have been attempted for beach mouse populations and in select areas, differing sample methods and data gaps have rendered a total population estimate difficult. Similarly, because of fluctuations in PKBM populations, loss of a specific habitat area will represent different numbers of PKBM depending on season of the year, recent storm events, food supply, and other factors. Since impacts cannot be assessed accurately in fluctuating populations on the sole basis of number of PKBM affected, a corresponding measure is the amount of PKBM habitat lost due to a project, and subsequently the PKBM that depend on that habitat. Because of this population fluctuation, the exact number of PKBM will not be precisely determined during the project analysis. However, since the impact to PKBM will be determined by loss of habitat, the direct impact to habitat will be provided.

The proposed work would result in site preparation and construction of residential structures, roadways, bridges, walkways, parking, and other associated development facilities and amenities. To the extent that PKBM exist within the Action Area, direct impacts may consist of crushing individual beach mice, excavating or burying a beach mouse burrow, and permanent and temporary loss of PKBM habitat.

Although a phased construction schedule is planned to minimize the amount of habitat impacted at any given point, habitat impacts will be driven by market conditions and a worst case scenario would mean that 66 acres of beach mouse habitat would be permanently removed over a 30 year period.

During site specific planning specific consideration will be given toward high quality habitat preservation, restoration, corridor maintenance, and habitat refugia above 9 feet mean sea level. These preserved and/or restored areas will provide substantial acreages of

permanently protected beach mouse habitat managed to maintain habitat connectivity in north-south and east-west corridors throughout the known range. These corridors will influence the overall movement of PKBM, including immigration and emigration pathways, thus affecting PCE 4 (functional, unobstructed pathways) throughout the Action Area. Indirect impacts with each development range from alterations to the behavior of beach mice on the properties (due to presence of humans, lighting, and barriers to movement) to failure to sustain a source population for post-storm repatriation of habitat. Conservation measures will be implemented as part of the project to minimize these indirect effects by improving the value of the habitat on site for PKBM through predator removal, current restoration, provision of easements, post-storm restoration, use of wildlife lighting, allowance of monitoring, and exclusion of barriers that might prohibit wildlife movement. Proposed conservation measures will improve the value of the remaining habitat throughout the Action Area.

It is important to note that funds contributed to offset the impacts from development could not purchase PKBM habitat similar in size and function; as these costs exceed the available funds. Development-related habitat loss continues on the approximately 578 acres of remaining habitat on private lands that connect the habitat on public lands. Additional contributing threats include greatly fluctuating population numbers, habitat loss from other causes (including hurricanes), predation (fox, coyotes, and cats), and competition by animals associated with human development (house mice).

Proximity of the action: The development activities will occur in habitat potentially occupied or used by PKBM and designated as critical habitat. This includes PKBM-2 and PKBM-4, as these are the two critical habitat units that contains private and county owned lands. Beach mice spend their entire life cycle within the coastal dune system with peak reproduction periods occurring during late winter and early spring.

Distribution: The development activities are expected to occur within 66 acres of primary, secondary, and scrub dune habitat within the Action Area on Perdido Key, Escambia County, Florida.

Timing: The overall plan calls for a thirty year process, which is broken down to five year incremental impacts. If designated impact levels are achieved prior to each five year level, this permit mechanism may not be used. Beach mice reproduce year round with a peak in the late winter and early spring. Activities impacting habitat during peak breeding season could have a greater immediate impact on the mice than other times of year, but the long-term effect on beach mice populations would be the same; carrying capacity and habitat connectivity would be diminished on a permanent basis to an undetermined extent taking into account those impacts not offset by the restoration and habitat enhancement designed to improve the suitability of the remaining habitat.

Nature of the effect: Implementation of the project will result in the permanent loss of 66 acres of PKBM habitat and designated critical habitat, representing 3.9% of the total habitat within the Action Area. This loss has the potential to affect: (1) reducing the total carrying capacity of PKBM habitat within the Action Area, (2) decreasing the

connectivity between PKBM-1, PKBM-3, and PKBM-5 that support the core populations of PKBM, and (3) reducing the total amount of refugia within the Action Area for nearby PKBM during major storm events. Conservation measures are included as part of the project design to minimize temporary and permanent effects including protection, restoration, and a coordinated approach to the management of approximately 208 acres of PKBM habitat, funding to support beneficial conservation actions in other parts of the PKBM's range, provision of corridors within restored habitats to allow for continued PKBM north-south movement between the primary dunes and the high scrub refugia and east-west movements within the Action Area to maintain the connection between adjacent PKBM-1, PKBM-3, and PKBM-5. Maintaining the connection between the three core populations is a priority essential element and function of the long term maintenance and management of the population. This overall coordinated approach provides protection and management of essential habitat for PKBM expansion, natural movements, and recolonization. Project conservation actions should also protect, improve, and maintain remaining storm refugia habitat and habitat to maintain a PKBM source population.

Duration: Initial impacts to PKBM would occur during site demolition, preparation, and construction. Permanent impacts of the action would occur from a loss of 66 acres of habitat over a thirty year period. Depending on the intensity of the impacts, the degree of fragmentation, and the success of the habitat restoration, the effect of the project on these areas during construction will be minimized through implementation of the conservation measures that will be provided by the Applicant. Approximately 208 acres of PKBM habitat acres are expected at full build out as a result of the implementation of the HCP. Specific interest will be afforded to preserve and/or restore existing habitat located above 9 feet mean sea level as refugia for PKBM during and following extreme storm events. These areas would remain onsite and be placed in a conservation easement and managed to provide the needed PCEs.

Disturbance frequency: Impacts are highly dependent upon market conditions, and the overall five year incremental impact protocol will manage the rate and timeframes for impacts. In addition to the incremental "release" of acreage for impacts, specific conditions as related to population densities and beach mouse presence has to be met. Therefore, the proposed action would result in a disturbance to the PKBM within the Action Area from the long term construction action, plus time required for temporarily impacted habitat to be restored.

Disturbance intensity and severity: The proposed action would permanently alter 66 acres out of 274 total acres of beach mouse habitat within the Action Area consisting of private lands covered under Escambia Counties' permitting authority. This equates to 26% of the habitat available in the covered area. Additionally, an unknown amount of habitat may be temporarily impacted during phased construction. However, at a minimum 208 acres will be restored and preserved. An additional 60 acres of habitat that was missed or has reverted back has been identified within the Action Area as well. Disturbance and preservation to these acres shall be accounted for as well.

**Analyses for effects of the action**

The potential direct loss of individual beach mice may be detrimental to the genetic diversity of the remaining population because population numbers remain low from the recent hurricanes. From a genetic perspective, beach mice are able to recover from population size reductions if sufficient habitat is available (Wooten 1994). When population numbers are low, beach mice are more vulnerable to stochastic events, such as hurricanes. Site design and proper management of habitat to protect connectivity necessary for movement and expansion is beneficial to PKBM and is an essential function of PKBM habitat within the Action Area. In addition, enough habitat must be available to support PKBM by providing food, burrow sites, and vegetative cover necessary for the conservation of the species. The placement of a minimum of 208 acres of PKBM habitat within the Action Area in a conservation easement and management of habitat in perpetuity will assist in reducing future threats to PKBM within the Action Area. The monetary contribution to the PKBM Conservation Fund would allow for additional conservation activities pursuant to the Conservation Strategy. As would the identification and preservation of a portion of the additional 60 acres that has reverted back to habitat.

Coastal habitat in the Action Area consist of the Gulf beachfront including the wet and dry unvegetated beach, developing foredunes, interdunal swales, and primary, secondary, and scrub dunes. Of these habitats, the primary, secondary, and scrub dunes, would be inhabited by PKBM and the other habitats may be used by PKBM on a daily or seasonal basis for foraging and movements. Primary dunes and scrub dunes are considered to be habitats of high importance to the beach mouse (Sneckenberger 2001; Service 2006a). Higher elevation habitats provide necessary refugia for PKBM to survive flood events. Maintaining connectivity to these areas is likewise essential to the long-term survival and recovery of beach mice. Figure 9 in the Tropical Storms, Hurricanes, and Hurricane Recovery Actions section above shows the location of elevated habitats (uninundated) relative to the project as determined using LIDAR data and 100-year flood elevation maps to predict storm surge.

Approximately 208 acres remaining within the Action Area will be protected, restored, and managed to ensure that habitat connectivity and refugia are retained within all the critical habitat units. Plus portions of the 60 acres of additional habitat that has reverted back since the 2004-2005 hurricane season will be preserved and managed under the same guidance. Additionally, the proposed conservation measures should be sufficient to maintain the PCEs in each of the critical habitat units. Available data have shown that the inland scrub habitat serves as a refuge during storms and is often the only habitat available years after storm events. Connectivity to each of the critical habitat units and to the higher scrub habitat should be maintained to provide utilization of all needed areas.

All PKBM habitat within the Action Area that would be covered under Escambia Counties' permitting authority (274 acres) and the proposed levels of expected development would result in the permanent loss of 66 acres, and a temporary loss of an unknown amount of acres of PKBM habitat. The primary constituent elements for PKBM

critical habitat were described in the STATUS OF THE SPECIES/CRITICAL HABITAT section. Analyses of activities associated with a development that may destroy or adversely modify critical habitat include (but are not limited to), is provided below:

(1) Actions that would significantly alter dune structure, soil compaction levels, and substrate characteristics. Such activities could include, but are not limited to, excessive foot traffic, the use of construction, utility, or off-road vehicles in beach mouse habitat, and sand contamination from gravel, clay, or construction debris. These activities, even if temporary, could alter burrow construction, reduce the availability of potential burrow sites, and degrade or destroy beach mouse habitat. *Analysis: The overall Perdido Key project impacts will permanently destroy 66 acres of critical, and suitable habitat. Each project applicant will restore temporary impacts as associated with land clearing, and construction activities. Reducing the area of permanent and temporary impacts would lessen the effects of this action. Escambia County maintains, and enforces a sand ordinance which prohibits the use of clays or other soils that may have a negative effect on the natural light sands found on Perdido Key. The result of the proposed Action is that 76% of PKBM habitat will remain. In addition there will be unknown temporary impacts and these areas will not be available to beach mice until restored. However, restoration of all temporary impacts will be restored with native vegetation under a restoration plan that was developed by the Applicant with input and approval by the Service.*

(2) Actions that would significantly alter the natural vegetation of the coastal dune community. Such activities could include, but are not limited to, allowing non-native species to establish in the area, landscaping with plants that do not reflect habitat type prior to disturbance, landscaping that yields excessive leaf litter. These activities could alter beach mouse foraging activities and degrade or destroy beach mouse habitat. *Analysis: The proposed project will destroy 66 acres over a thirty year period. Proposed conservation measures include identification of restoration areas and planting of temporary impacts with only native Escambia County dune plants.*

(3) Actions that would significantly alter the natural predator/prey balance of the coastal dune community. Such activities could include, but are not limited to, allowing unmanaged refuse in the area that attracts beach mouse predators and competitors, and allowing or encouraging feral cat communities. These activities could alter PKBM foraging activities, the availability of foraging resources, and directly alter beach mouse survival. *Analysis: The proposed action is expected to have a limited effect on this constituent element because the proposed conservation measures include prohibiting cats on the premises, confining other pets to the interior areas of the development, and the use of animal-proof refuse containers. Effects of this action could be further ameliorated by eliminating waste receptacles from all outdoor common areas, and funding for animal control.*

(4) Actions that would significantly alter natural lighting. Such activities could include, but are not limited to installing or allowing artificial lighting that does not comply with wildlife lighting specifications. These activities could alter beach mouse movement and foraging activities, increase predation upon beach mice, and reduce the use of otherwise

suitable beach mouse habitat. *Analysis: The proposed action is not expected to affect this constituent element because the proposed action includes a conservation measure that wildlife lighting would be used for the parking areas, common areas, and exteriors of the structures (when deemed necessary) The applicant will strive to meet the International Dark-Sky Associations' initiative supported by the Service. Wildlife lighting is considered to meet nocturnal wildlife specifications. Luminaires, lamps/bulbs, and other light sources and light fixtures that are certified as Wildlife Lighting in accordance with the joint Florida Fish and Wildlife Conservation Commission and the U.S. Fish and Wildlife Service Wildlife Lighting Certification Program (LCP).*

(5) Actions that would directly result in a significant loss of habitat and/or elimination or degradation of functional pathways within and among critical habitat units. Such activities could include, but are not limited to residential or commercial development, road widening, or land clearing. These activities eliminate beach mouse habitat, reduce connectivity necessary for gene flow, reduce all necessary resources such as food, mates, burrow sites, refugia from storms; and decrease space available to conduct natural behaviors, thereby limiting their ability to persist. *Analysis: The proposed action would permanently destroy 66 acres of beach mouse habitat over a thirty year period, this represents a total habitat loss of 3.9% of PKBM habitat within the Action Area and 24% within the HCP Area. Proposed conservation measures to maintain habitat connectivity are expected to allow and enhance for movement through the habitat network north of SR 292, but connectivity south of SR 292 would be more limited as a result of the limited property available relative to the respective setbacks required. However, in conjunction with neighboring set back, the available corridors are expected to provide the requisite connectivity to provide for the persistence of beach mice on the project site, within the Action Area.*

The Applicant will implement their HCP to minimize impacts to PKBM habitat. Proposed minimization efforts include providing corridors for beach mouse habitat connectivity, and restoring habitat where applicable. Developing a scientifically based monitoring program to track success of this HCP/ITP is essential. The monitoring program will be developed and conducted by the County, in conjunction with the Service, and will be conducted by personnel that are properly permitted by State and Federal authorities and either have prior experience or are trained specifically to carry out the field responsibilities described in the HCP and this BO. The Service will evaluate the PKBM monitoring program annually to ensure the data collected in support of the HCP are consistent, reliable, and convey an accurate assessment of the effectiveness of the associated conservation measures. Additional minimization of impacts include, controlling free roaming pets, posting of protected habitat to allow for animal movement, installing native landscaping, and payment of the fee associated with the PKBM Conservation Fund.

Direct and Indirect Impacts

*Effects to the species*

Project activities including demolition, site preparation and construction activities have the potential to adversely affect beach mice of any life stage including those able to leave their burrows and search for food as well as those still in the burrow and dependent on a lactating female. Beach mice disturbed and able to leave the immediate area are subject to increased pressures from predation while they search out a new territory or move from one burrow to another. Pregnant and lactating females that are disturbed may abort their current litter or leave young in burrows. Loss of PKBM individuals is anticipated from the proposed 66 acres of long term habitat alterations.

In addition to direct impacts to individual mice, the permanent loss of PKBM habitat from the development reduces the amount of habitat available to support the subspecies on each particular project site, particularly higher elevation habitat. Within the northern project area higher elevation PKBM habitat is present. Specific project emphasis toward the maintenance and preservation of the high elevation refugia will occur within the Action Area. In addition to providing habitat during times of higher population numbers and providing areas for dispersal, the scrub dunes affected by these proposed actions are of fundamental importance to sustaining beach mice during storm events. Interior and higher elevation dune habitat provides a refuge for beach mice during and after storm events, and this scrub habitat is frequently the only beach mouse habitat available after hurricanes. This higher elevation scrub dune habitat is found throughout the Action Area, but primarily in the widest portion of Perdido Key in PKBM-4. The loss of 66 acres of habitat including some loss of high elevation scrub dune will reduce the carrying capacity of the Action Area. Temporary impacts will additionally negatively influence the carrying capacity of the Action Area.

The quality and connectivity of PKBM habitat are important factors in maintaining and facilitating beach mouse survival and recovery. Conservation planning needs to incorporate the landscape pattern and the response of organisms to changes in the pattern. This is particularly true for species under the stresses of habitat loss and fragmentation (Fahrig and Merriam 1994). Functional pathways may allow for natural behavior such as dispersal and exploratory movements, as well as gene flow to maintain variability of the population within fragmented or isolated areas. To that end, contiguous tracts and functionally connected patches of suitable habitat are essential to the conservation of PKBM.

Research has shown that beach mice travel great distances (up to 1 mile) within one night within a natural landscape (Swilling et al. 1998; Lynn 2000; Moyers and Shea 2002). Beach mice have also been observed crossing two-lane roadways (Gore and Schaefer 1993; Service 2004). However; travel distances, minimum width of corridor use, and use of linear areas of habitat within commercial or residential development is still largely unknown.

Maintaining beach mice on the site and preserving the connectivity between the populations centered at GSP, GINS, and PKSP are vital to persistence of the PKBM. Actions that prevent or temporarily prevent the dune connectivity hinder the movement of PKBM and consequently impede PKBM dispersal, population expansion, and access to refuge during and after storm events. Recovery actions needed to ensure the functional connectivity include working with Escambia County, FDOT, and private property owners to restore and maintain native habitat between each of the core populations.

In addition to the direct effects of the Perdido Key 30 year HCP, indirect affects to beach mice may occur due to the increased human population and presence. Increased human use of beach mouse habitat is expected to occur as the residential units are occupied and recreational opportunities are sought by the occupants. Foot traffic across sand dunes destroys vegetation essential for dune development and maintenance. The project conservation measures include provisions which control access and foot traffic in PKBM habitat through covenants, restrictions, signage, and boardwalks.

Additionally, an increase in recreational use of the developed areas and the beach may occur from the human occupation of the project site which may result in additional disturbance or behavior modification of individual mice. The severity of impacts will be minimized by implementing conservation measures included in the project description and the Applicant's HCP.

Injury or death to individual beach mice may occur incidental to the site demolition, preparation, and construction work. Effects to beach mice are expected to be a result of the following: (1) direct loss or injury of adult and sub-adult beach mice from physical injury caused by use of heavy equipment and placement of building materials during demolition, site prep, and construction activities; (2) adult female beach mice aborting litters caused by physical injury or stress due to disturbance from heavy equipment use and placement of building materials during construction activities; (3) loss of newly born or juvenile beach mice left alone in the burrow resulting from the loss of a lactating adult female; and (4) loss of adult, juvenile, and newborn beach mice resulting from the temporary and/or permanent destruction or damage to coastal habitat used by the PKBM for foraging, nesting, and refugia. In addition, beach mouse habitat may be affected by foot traffic from workers present on-site and from building occupants.

*Effects to critical habitat*

The overall incorporation of the Perdido Key HCP will allow for a proactive sustainable planning approach by allowing development to occur while providing conservation measures that allow for the continued existence and possible recovery of the PKBM. The permanent loss of PKBM critical habitat amounts to approximately 66 acres or 26% of the Action Area. Proposed conservation measures include; dune walkovers, prohibition of cats, enhance animal control enforcement, increase fines for free roaming pets, use of appropriate native vegetation, appropriate siting of development and structures, proper habitat buffers and corridor widths, condensed parking incentives, development clustering and variance for setbacks where appropriate, minimizing impervious surfaces,

contributions to the PKBM conservation fund, zoning density limitations, and a phased impact release schedule to extend availability of the use of habitat.

The Service believes once the remaining PKBM critical habitat within the Action Area has been preserved, restored and enhanced, it will continue to provide the ecological function within and between each of the critical habitat units to the extent that the PCEs would be satisfied. This is further enhanced by the conservation measures associated with this HCP/ITP. The ability of the HCP project area to connect PKBM habitat within the Action Area for gene flow, population expansion, and refuge from storm events would be maintained.

The incorporation of planning on a landscape scale will allow consideration of protection of high value critical habitat; such as high elevation dunes, which are expected to be the area least likely to be overwashed during tropical storm events. These areas are important features for beach mice to take refuge during storm events and can be an important source for repopulation if storms extirpate or greatly reduce local populations. Also, consideration of the development pattern on a landscape level will allow the protection of essential habitat connectivity, and corridors between the three core populations. This overall planning and implementation tool will help provide essential habitat for expansion, natural movements, and recolonization (PCE 4). Overall, critical habitat should continue to provide functional, unobstructed pathways with adjacent properties and other critical habitat units. The implementation of this Programmatic HCP will augment and improve remaining habitat , provide contingencies for post storm habitat rebuilding, and allow the overall planning for habitat connectivity and enhancement.

Subject to disturbance allowed by the terms of the ITP, permanent impacts to each site shall be limited to the specific impacts indicated in the ITP and corresponding County issued permits. All temporary impacts associated with the ITP and the associated HCP shall be restored after completion of construction and placed into a conservation easement.

**Species Response to a Proposed Action**

PKBM densities are cyclical and can fluctuate greatly on both a seasonal and annual basis. These fluctuations result from multiple factors such as changing reproductive rates, food availability, habitat quality and quantity, catastrophic events, and predation. Each subpopulation has experienced periods of local extirpation following hurricanes, likely due to a combination of the effects of habitat damage, reduced food resources, and non-native predators. In order for the PKBM to persist and recover, sufficient suitable habitat must be available to support beach mice in the densities necessary to survive these stochastic events and the continually changing condition of resources in a dynamic coastal environment. Habitat connectivity is essential for PKBM source populations to repopulate locally extirpated areas following storms. These source populations are generally associated with the scrub dune storm refugia that provide sufficient elevation for beach mice to escape the effects of storm surge. Only 272 acres of uninundated storm refugia habitat are available in the Action Area. Connectivity also provides an avenue for

genetic exchange for small habitat patches on Perdido Key. Without connectivity, evidence suggests that beach mice will eventually disappear from these small areas. Habitat connectivity also provides beach mice access to a diversity of habitat types (frontal dunes, secondary dunes, scrub dunes, and storm refugia) necessary to support all phases of their life history (breeding, feeding, burrowing, exploratory behaviors, and dispersal).

The project would result in the permanent loss of 66 acres of PKBM critical habitat and an additional 60 acres suitable habitat not previously identified. Site specific pre-impact assessments will reveal areas of critical habitat and suitable habitat within each development site. To offset the permanent loss of 66 acres, the project design will provide conservation measures that minimize the effect of habitat loss and ensure that the ecological functions of the PCEs associated with critical habitat and suitable habitat are not significantly impaired. The same methodology will be applied to the additional 60 acres of suitable habitat not previously considered. These habitat impacts and restoration acres will be tracked and monitored for PKBM use. It is expected that approximately 208 acres of PKBM habitat will be placed under conservation easement providing protection in perpetuity as associated with a complete build out scenario. This preserved habitat, which includes primary, secondary, and coastal scrub dunes, will be restored with native vegetation (where appropriate), properly signed to prohibit future human related impacts, and permanently managed for PKBM conservation. This action will provide improved habitat for PKBM breeding, feeding, and sheltering outside of the lost 66 acres. Other measures such as exclusion of barriers that impede or prevent natural PKBM movements, use of dark skies or wildlife friendly lighting, and predator control will provide both short- and long-term benefits for the conservation of the PKBM.

It is anticipated that the implementation of the habitat protection guidelines within the HCP are expected to provide for the long-term persistence of the PKBM on Perdido Key. Upon build-out and through the years of implementation of the HCP, the remaining protected and restored habitat will continue to provide the resources identified as PCEs needed for the survival and recovery of PKBM.

**CUMULATIVE EFFECTS**

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur within the Action Area considered in this BO. Future Federal actions that are unrelated to the proposed project are not considered in this opinion because they require separate consultation pursuant to section 7 of the ESA. Except areas set aside for wildlife and natural resources within the public areas, existing land uses on Perdido Key are primarily related to coastal development for human recreation and habitation.

It is reasonably certain to expect that human occupancy and recreational use of Perdido Key will increase in the future. As identified in the Environmental Baseline, there has been an increase in the number of multi-family developments on the Key since 1995, typically being developed at the maximum density allowed. Development and re-

development activities have continued. Single-family residences and small multi-family complexes have been sold for construction of high-rise/high density complexes (Perdido Key Neighborhood Plan 1997 as referenced in Escambia County 2003). Projects that are within endangered or threatened species habitat will require section 7 or 10 permitting from the Service. Those projects outside of the coastal dune habitat will ultimately add to the infrastructural and recreational pressures on the beaches and dunes of Perdido Key. We expect that the conservation activities to be conducted through the PKBM Conservation Fund will reduce some detrimental effects of the increasing infrastructural and recreational pressures.

While we are not aware of any additional future actions that are reasonably certain to occur within the Action Area that will not require separate section 7 or 10 permitting in the future, we nonetheless mention several of the more significant actions below to demonstrate the coordination efforts and large scale conservation efforts that are likely to result from these actions.

Prior to and immediately following the hurricane season of 2004, coastal development and redevelopment of Perdido Key began to substantially increase. Land values rose considerably. The traditional method of land acquisition for offsetting impacts to listed species was hindered due to the high cost of land. Further, recovery efforts for the PKBM were needed Key-wide and would be best managed from a centralized entity rather than on an individual property basis. Because of the current and anticipated requests for permits, the Service, FWC, and County realized that consistency and streamlining of the process were needed. Formalizing the process and objectives was recognized by the three entities through participation in an intergovernmental agreement. The Intergovernmental Agreement, signed in December 2005, established a Conservation Fund for PKBM that is based on a Conservation Strategy and Business Plan completed for the PKBM. The Conservation Fund donations, obtained through state and federal sections 7 and 10 permitting actions, will be used to fund conservation actions intended to perpetuate a viable population of PKBM in native habitat on Perdido Key.

Based on the projection of County issued Development Orders and Building Permits for projects on Perdido Key, we estimate a maximum of 40 Section 10 ITP applications or requests for section 7 consultations for commercial, multi-family, and single-family projects. Without the programmatic HCP, each of these actions will undergo a separate section 10 permit process or section 7 consultation and will be required to minimize and offset their impacts to the maximum extent practicable. The separate or individual processing of the potential applications is a time consuming process, and will not allow the landscape level approach as suggested above. When appropriate, the applicants/permittees may choose to use the compensation option of contributing to the PKBM Conservation Fund. If the majority of the applicants/permittees choose the PKBM Conservation Fund option, we anticipate that the Fund will receive significant contributions in the next several years. Anticipated contributions for the first year of implementation are estimated at a minimum of $628,000 (estimated based on expected permit issuance time lines) while the Business Plan predicted $738,700 (PKBM Business Plan 2005) in the first year of implementation.

After Hurricane Ivan, FEMA provided funds for Escambia County to construct an emergency berm for storm protection along the Gulf of Mexico beachfront. While the berm project may potentially have adversely affected the PKBM during construction, the project helped restore dune habitat and connectivity to over 4 miles of beachfront. The berm has protected primary dune habitat landward of the berm that has been naturally restoring after the 2004 and 2005 hurricane seasons. An emergency consultation was completed for this work. The Service provided the following recommended guidance for minimizing and avoiding project impacts to listed species which was followed by a BO after the emergency work was complete and the final report was submitted. Measures pertinent to the PKBM include: (1) berm material needed to be placed as far landward as possible except where dunes remain to maximize the extent of dune growth and provide habitat connectivity; (2) berm material needed to be placed in a low, wide configuration to encourage dune vegetation growth and natural acceleration of the dune restoration process; (3) material for the berm needed to be compatible with existing beach sand as determined by the FDEP, and should not contain more than 10 % fines, and be free of cobbles, gravel, or debris; (4) the berm needed to be planted with native dune plants to accelerate the berm stabilization process; (5) equipment staging and storage needed to be located outside of the vegetated dune habitat and public lands; (6) vehicle and equipment beach access sites needed to be minimal in number, designated and marked, and be in areas devoid of vegetation; and (7) all areas impacted by the work needed to be restored upon completion of the berm construction.

Escambia County is currently planning a beach nourishment project for Perdido Key. The County received funds from the State of Florida to conduct a feasibility study for the nourishment project. The study was completed in 2006. A large portion of the feasibility study was to locate suitable offshore borrow areas that contain an adequate quantity and quality (beach compatible) nourishment material. The study was completed in 2006. Permits were obtained from the FDEP and USACE in 2009 for the planned nourishment project. The Service wrote a BO covering PKBM, sea turtles, and beach mice in 2008. The county is currently seeking easements from the beachfront property owners. Funding sources are under consideration. While the nourishment project may potentially adversely affect PKBM during construction, the project has a proposed dune restoration or vegetated berm that can contribute to habitat and connectivity for PKBM.

A second beach nourishment project on Perdido Key was consulted on for the Pensacola Naval Air Station (Navy). They proposed to dredge their navigation channel resulting in the need to place 8 million cubic yards of beach compatible dredged material. Because of the cost to pump the dredged material, Perdido Key is the closest and most logical area to receive the material. An interagency working group met to determine the best use of the material. Receiving areas include the Perdido Key offshore borrow site, the Pensacola offshore borrow site, a nearshore site at the eastern end of Perdido Key, and the beachfront of GINS at Johnson Beach and Fort Pickens. Because Perdido Key has suffered past erosion from the 2004 and 2005 storm seasons, a portion of the 8.0 million cubic yards could help in restoring the sand source Key wide. The Service has worked with our partners and will continue to do so to assure the dredged material placement is

conducted to enhance the natural dune restoration process and minimize negative affects to the PKBM as well as other coastal species. While the Navy project may potentially adversely affect the PKBM during construction, it could help restore a sand source to facilitate beach and dune habitat formation. The project is ongoing in planning and funding discussions.

The Florida – Alabama Transportation Planning Organization (FATPO) amended the 2020 Cost Feasible Long Range Transportation Plan to include four-laning Perdido Key Drive (SR 292) from the Alabama Line to Innerarity Road. The roadway runs adjacent to designated critical habitat for the PKBM along the length of Perdido Key. Much of the right-of-way likely used for the expansion is designated as critical habitat. Federal funds are expected to be used for this project; the Service is currently providing technical assistance and assisting with research to gather more information on PKBM and the existing roads.

The Army Corps of Engineers (Corps) initiated formal consultation with the Service on November 2, 2011, on issuance of a section 404 permit to fill wetlands associated with the Lost Key Golf and Beach Club (Lost Key) multi-use development. Lost Key will result in an estimated 26 acres of permanent impacts to PKBM habitat within PKBM-4. The Service issued a BO on August 10, 2012 and the Corps issued their permit on June 17, 2013. It is the intent that these acres will be subtracted from the 66 acres available under the Escambia County HCP through a phased approach. The 26 acres of impact will be deducted from the allowable 66 acres in the same 5 year increments. This will equate to 4.3 acres per 5 years for the 30 year life of the permit. This format will allow the smaller developments the ability to use the HCP/ITP mechanism while accounting for the larger impact to be factored into the overall 66 acres of allowable impacts. Currently, the Corps has temporarily rescinded their permit while they complete a thorough review following the January 14, 2014 lawsuit filing by Defenders of Wildlife.

## CONCLUSION

After reviewing the current status of the PKBM, the environmental baseline, the phased impact approach, the effects of the activities, the proposed protective, avoidance, and minimization measures, as well as the expected cumulative effects, it is the Service's biological opinion that the Perdido Key HCP project will not jeopardize the continued existence of the PKBM, and will not destroy or adversely modify their critical habitat. This biological opinion does not rely on the regulatory definition of destruction or adverse modification of critical habitat at 50 Code of Federal Regulations [C.F.R.] 402.02. Instead, we have relied upon the statutory provisions of the Act to complete our analysis with respect to critical habitat.

Suitable and critical habitat for the PKBM occurs throughout the Action Area. Currently, PKBM occupy each of the three core populations (GSP, PKSP, and GINS) as well as private lands throughout the Action Area. Habitat throughout the Action Area provides essential connectivity between these three core populations and between frontal and scrub dune habitat. The Action Area also provides habitat for natural movements, refuge from

storm surge, and population persistence. Actions that prevent or temporarily impede these movements within the Action Area also prohibit these natural behaviors and reduce the likelihood of PKBM persistence.

The project would directly and indirectly affect approximately 66 acres, over a 30 year period, of PKBM critical habitat and portions of an additional 60 acres not previously identified as suitable habitat. Additionally, an undetermined amount of acreage may be affected temporarily and would be restored with native vegetation and permanently protected and managed under a conservation easement. Approximately 76% and 96% of PKBM habitat will remain within the HCP Area and Action Area, respectively. This remaining acreage (208 acres) will be permanently protected through a conservation easement.

As discussed in the Effects of the Action section of this BO, we would not expect the carrying capacity of the Action Area to be appreciably reduced. While permanent impacts of the actions would occur from a loss of 66 acres of habitat, this loss is mitigated by permanent protection of important habitat connections and the removal of threats to beach mouse habitat in these areas. The PKBM habitat remaining will continue to provide for the biological needs of the species as demonstrated below:

1. The habitat on each project site will continue to provide a contiguous mosaic of habitat onsite, with adjacent properties, and within the Action Area.

2. The higher secondary and scrub dune habitat on each project site will remain connected to the primary dune habitat. All dune habitat remaining on the project site will be maintained and restored following storm events.

3. Unobstructed habitat corridors will be provided along each boundary of each project site.

4. Each project is required to minimize required lighting and install wildlife friendly lighting only where needed (per Service and FWC guidelines). Furthermore, the Service supports the adoption of criteria developed by The International Dark-Sky Association to reduce the impacts of development lighting on the night sky.

5. Prohibit cats and free roaming dogs from each project site and be responsible for contacting County animal control to handle predator issues. Allow County animal control, the Service, FWC, or USDA-Wildlife Services to access all covered properties to capture all animals posing a risk to covered species.

6. Upon completion, the entire HCP project will permanently protect 208 acres of habitat through conservation easements and removing future threats to these critical and suitable habitat areas.

7. Temporary impacts are expected to be limited to the clearing and initial construction phase of each project, typically only three to four months. As a female mouse can reproduce every 30 days, the temporary impacts of the proposed action may affect three to four generations of PKBM. Colonization or recolonization of the restored and protected habitat remaining onsite would be expected within several months if neighboring populations are healthy.

8. Installation of dune walkovers or elevated boardwalks to prevent degradation to the primary dune habitat along the Gulf beaches by additional human and recreational use.

Based on the project design parameters and conservation measures, we do not anticipate that the loss of the critical habitat would preclude the remaining critical habitat from meeting the PCEs for the Action Area or appreciably diminish the habitats' capability to provide the intended conservation role for PKBM.

## INCIDENTAL TAKE STATEMENT

Section 9 of the Endangered Species Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Endangered Species Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The proposed Perdido Key HCP and the associated documents clearly identify expected impacts to affected species likely to result from the proposed taking and the measures that are necessary and proper to minimize those impacts. All conservation measures described in the proposed HCP (including amendments or modifications) and any section 10(a)(1)(B) permit issued with respect to the proposed HCP are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement under 50 CFR §402.14(I). Such terms and conditions are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the Act to apply. If the Permittee fails to adhere to these terms and conditions, the protective coverage of the section 10(a) (1) (B) permit and section 7(o) (2)

may lapse. The amount or extent of incidental take expected under the Applicant's proposed HCP, associated reporting requirements, and provisions for disposition of dead or injured animals are as described in the HCP and its accompanying section 10(a)(1)(B) permit.

## AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service has reviewed the biological information and other information relevant to this action. Based on this review, incidental take is anticipated for: (1) harm of PKBM within the 66 acre construction footprint; (2) harm of PKBM within the temporary impact that will be restored; and (3) harassment through behavior modification of all PKBM on the remaining development area due to the changes onsite from the site preparation and construction resulting in altered interactions with other beach mice, foraging or dispersal activities, and potential population expansion, and increased natural predation.

Incidental take is anticipated from the project including site preparation and construction over the phased construction implementation of the project and for the occupation and use of the project for the life of the development. The Service anticipates incidental take of beach mice would be difficult to detect for the following reasons: (1) the inability to predict the timing of the project activities to occur during the peak beach mouse reproduction and dispersal seasons, (2) beach mice are nocturnal and are outside of their burrows only at night and consequently, mice affected by the project may not be found as a result of predation or death within a burrow, and (3) an unknown number of beach mice may have reduced life spans and/or may not be able to disperse for population expansion and genetic exchange.

## EFFECT OF THE TAKE

In this BO, the Service determined that this level of anticipated take is not likely to result in jeopardy to PKBM, and would not result in destruction or adverse modification of PKBM critical habitat. Incidental take of PKBM is anticipated to occur. However, measures to reduce potential impacts to PKBM have been incorporated into the activities and project plans for each development as well as the overall HCP project.

## REASONABLE AND PRUDENT MEASURES

The Service believes the following Reasonable and Prudent Measure is necessary and appropriate to minimize impacts of the incidental take to the PKBM:

The County permit review process shall include or incorporate a special condition to ensure full implementation of the HCP and Project Conservation Measures that address PKBM prior to site plan approval.

## TERMS AND CONDITIONS

All conservation measures described in the Project Plan Conservation Measures section in this BO are hereby incorporated by reference as terms and conditions within this document pursuant to 50 CFR § 402.14(I) with the addition of the following terms and conditions. In order to be exempt from the prohibition of section 9 of the Act, the Applicant must comply with the following terms and conditions, which implement the reasonable and prudent measures. These terms and conditions are mandatory.

### Species Monitoring

1. Access to the preserved and restored areas will be granted to the Service, FWC, and their representatives to conduct PKBM monitoring and predator control. Activities covered for access are described in the PKBM Conservation Strategy and include, but are not necessarily limited to, status surveys and translocations to the preserved areas. These activities will be funded through the PKBM Conservation Strategy's Conservation and Management Fund (Conservation Fund).

2. As a measure of PKBM and PKBM habitat function, the County will monitor the restored and preserved areas to assess restoration success, functionality of habitat, and to inform further restoration needs. Habitat monitoring will be performed annually on each covered project site per the approved monitoring plan. If conditions do not meet habitat expectations and success criteria, the County will contact the Service to discuss future management plans. The exception will be following destructive storm events, at which time, restoration needs will be evaluated by the County within 3 months of the storm to evaluate needs and implement management action to restore damaged habitat. This post-storm monitoring may occur at any time or frequency during the five-year period as necessitated by storm occurrence.

    a. A Service approved monitoring plan shall be implemented within the first year of permit issuance following the hiring of pertinent staff to implement the HCP and ITP program.

3. These ongoing monitoring efforts, and the consistency and quality of the resulting data, are essential to monitoring the progress of the Perdido Key HCP. These data shall be compiled and maintained by the County and submitted to the Service on an annual or as needed basis.

**Project Design and Construction**

4. The Permittee will implement the following exterior lighting restrictions throughout the HCP Area to minimize the effects of artificial lighting on PKBM habitat.
    a. The Permittee will limit exterior lighting on each project to those areas deemed essential for human health, safety, and welfare. Where essential, install shielded wildlife-friendly lighting in conjunction with current Service standards at the time.
    b. The Permittee will direct all lighting downward and beachfront lighting shall be directed downward and away from beaches and Gulf waters.
    c. All windows and glass doors would have the appropriate glass or window tint that only allows 45% light transmittance from inside to outside.
    d. The Permittee will be responsible for review and approval of each project's lighting plan. These should be provided on construction phase drawings and maintained for Service review if needed. Each projects' lighting plan shall be consistent with the Counties' forthcoming Service approved lighting ordinance. The Service will provide the lighting plan review while the ordinance is being finalized. In such cases, the Service will review requested lighting plans no later than 60 days prior to the commencement of construction. The Service will review for consistency with current lighting requirement within 14 business days from receipt.

5. The County will finalize and pass a Service approved lighting ordinance for Perdido Key within 180 days after issuance of the ITP. A draft has been provided to the Service.

6. The County will preserve and/or restore appropriate on-site habitat for PKBM use post construction.
    a. Each applicant will be required to delineate preserved/restored areas during pre-development consultation with the County HCP staff or qualified designee. Prior to land disturbance activities, silt fencing will be placed 25 feet beyond each vertical construction footprint to prevent encroachment and restrict construction activities and workers within the disturbed construction footprints. Silt fencing shall be placed 4 inches off the ground to allow for PKBM to pass through these areas.
    b. Each applicant will provide a minimum 10-foot natural vegetated corridor/buffer along all sides of each parcel. These corridors shall be maximized on parcels north of SR 292 where a contiguous primary dune is not available for connectivity. The corridors shall be the entire length of the parcel.
    c. Permanent fencing may be required for some specific project sites to restrict access through habitat. Post and rope or split rail fencing are options for preventing human access to areas.
    d. Each applicant will select plants from the list of native plants (Appendix B) required for landscaping within the coastal dune ecosystem of

Escambia County. The restoration of temporary impact areas shall be completed prior to receiving Certificate of Occupancy.

e. For Gulf front lots, each applicant will construct elevated dune walkovers (consistent with existing Service guidelines) within each project site (as appropriate) to manage and discourage human traffic from entering and impacting natural and restored habitat.
f. Prior to commencement of construction, each applicant shall develop a final site plan for each specific project overlaid on a current aerial showing all conservation areas. The County shall send the plan to Service to monitor ongoing development efforts that are using the HCP/ITP. Each project will be accounted for during end of the year reporting provided to the Service. Additionally, a database or map will be maintained that shows where each project is within the Action Area to depict areas allowed to access for monitoring, etc. This will allow for compliance and enforcement of the terms and conditions of the 30 year ITP.
g. Each applicant will record a conservation easement over the preserved and/or restored areas within each site per requirements of Section 704.06, Florida Code. The conservation easements will be recorded with Escambia County within sixty (60) days after receiving a Certificate of Occupancy. A copy of the recorded conservation easement shall be provided to the Service no later than thirty (30) after the easement is recorded in the public records of Escambia County, Florida.
h. Each applicant will develop and record restrictions and covenants for each site to provide for the long-term management and maintenance of the preserved and restored areas and to obligate the homeowner or homeowners' association (or similar organization) to implement and fund the long-term management and maintenance of these areas. These documents must be provided to the Service within ninety (90) days after receiving Certificate of Occupancy.
i. In the event of a future major storm event, all preserved and/or restored areas must be replanted by the Permittee according to the plant list in Appendix B.
j. All areas temporarily impacted during construction will be restored to ambient or design grade and planted with native dune vegetation (Appendix B). Restoration of temporary impacted habitat shall be completed prior to receiving Certificate of Occupancy.

7. Final landscape design/plan for each project will be reviewed and approved by the Permittee to confirm the plants proposed are consistent with the list of native coastal dune plants in Appendix B and contain a variety of species. The landscape design/plan shall be meet all the requirements of this BO to allow for connectivity, food, shelter, etc. for PKBM. A copy of these landscape design/plans shall be maintained by the Permittee to provide to the Service to fulfill the reporting requirements of this BO.

8. A summary of the permit requirements shall be provided to the general contractor and shall be included in the construction contract between the owner and general contractor. The construction contract shall also obligate the general contractor to provide the permit requirements to all sub-contractors and obtain affirmation for compliance. No later than 30 days prior to commencement of construction of a specific project, each applicant will conduct a pre-construction meeting with the County and general contractor to review permit and BO conditions.

9. Educational signs informing of the habitat importance shall be designed in coordination with the Service. The signage plan will be used for each project during the entire length of construction. The County shall develop a standard signage plan to be used for each covered project. The Service will review and approve this signage plan within 60 days prior to the first project utilizing this permit.

10. The use of mulch and landscape fabric is prohibited in the dune habitat and native landscaped areas.

11. Irrigation of planted dune vegetation within the restoration areas shall be by hose or backpack, no surface or subsurface irrigation pipes will be permitted.

**Operation and Maintenance**

12. Permanent signs and/or approved fencing must be used to prevent pedestrian traffic in PKBM habitat. Educational signs shall be permanently installed to increase awareness of coastal conservation, endangered species endemic to the area, and to encourage sustainable use by people. These educational signs can be the same as the construction phase, but will be permanent and maintained throughout the life of the permit. The signs shall be provided to the Service for review and approval sixty (60) prior to receiving a Certificate of Occupancy. A standard sign can be developed for similar habitats and submitted for review and approval once. The signage location shall be placed on the final landscape plan to be submitted to the Service during the end of year report.

13. Prior to receiving the Certificate of Occupancy, the Permittee shall submit the pertinent portions of the draft restrictions and covenants to the Service for review and approval. Within 30 days, the Service will review with comments or approve the restrictions and covenants. These documents shall be recorded with Escambia County.

14. Each applicant will pay the $100,000-per-acre mitigation payment for each acre of permanent impact within PKBM habitat, as provided in the Unified Mitigation Option specified in the Business Plan for the PKBM Conservation Management Fund (CMF) (July 1, 2005) and the Intergovernmental

Agreement (USFWS Agreement No. 401816K002) executed in December 2005 by the Service, FWC, and Escambia County (Intergovernmental Agreement). Each applicant will pay the per-acre mitigation payment applicable to each phase of development 30 days prior to commencing each phase of development. The final acreage of permanent impact will be depicted on the Escambia County building permit. Each applicant will submit the mitigation payments to Escambia County for deposit in the CMF as provided in the Intergovernmental Agreement.

15. The Project's recorded restrictions and covenants will provide notice that dwelling units within the areas designated by the Section 7.13.01(E) LDC as PKBM habitat will be required to pay the annual $201 per unit special assessment payments to Escambia County, Florida in accordance with Section 7.13.01(E) LDC. Hotels would be assessed $201 per room annually. Commercial developments will be assessed $201 per designated parking space annually.

16. The Permittee will incorporate into the each project's recorded restrictions and covenants the following:
    a. The recorded restrictions and covenants will prohibit domestic cats (*Felis catus*) as pets or the possession or maintenance of domestic cats at any time.
    b. The recorded restrictions and covenants will provide that no pets may free-range within any project site and require all dogs to be maintained on a leash and under direct control of their owner while outdoors.
    c. The recorded restrictions and covenants will provide that all household trash and other waste materials be maintained and deposited for disposal in animal-proof containers.
    d. The recorded restrictions and covenants will prohibit the use or disposal of herbicides or pesticides that are harmful to native plants or rodents within the project site.
    e. The recorded restrictions and covenants will provide that prior written approval of the Service is required for modification of any provisions associated with any of these conditions.
    f. The recorded restrictions and covenants will provide that educational fliers on the ecology and history of Perdido Key, the biology and status of beach mice, and the importance of natural areas to wildlife and human quality of life will be made available to all project residents and guests.

**Reporting**

17. Prior to conveyance of title to any real property within any development, the Permittee shall record a separate legally binding covenants and restrictions or other appropriate legal instruments for that development incorporating and requiring full and timely compliance with the pertinent terms and conditions of this BO. Such documents shall include a brief description of the project

and the requirements associated with protecting PKBM. The conservation measures associated with the HCP, BO and ITP shall be incorporated in these documents as well as a statement that no changes would be made that would cause noncompliance with these requirements without prior written approval from the Service. In the event of a condominium type development using this HCP (in accordance with State of Florida condominium Association requirements), the specific ITP requirements will be transferred to the property owners association at the appropriate time when a majority of the units are no longer owned by the developer/applicant. Within ninety (90) days after the initiation of construction for each development, the Permittee shall provide certification of the compliance with this requirement, along with a copy of the said documents, to the Service.

18. Annual reporting will be accomplished at the end of each calendar year. The County HCP Coordinator will be responsible for compiling and analyzing PKBM data collected under this ITP. These data will be summarized in a manner that allows for an assessment of natural and human related impacts to PKBM on Perdido Key. Direct, indirect, and cumulative impacts to PKBM related to private development activities and County infrastructure improvements will be identified. The phased take acreages and additional take acreages associated with the ITP will be reported to ensure compliance. Data from the Counties' predator control program will be analyzed to ensure that targeted goals are being met. Any deficiencies within the HCP program will be identified and potential remedial actions proposed.

19. Upon locating a dead, injured, or sick individual of an endangered or threatened species, initial notification shall be made to the U.S. Fish and Wildlife Service Law Enforcement Office, Groveland, Florida at (352) 429-1037 and to the U.S. Fish and Wildlife Service Panama City Field Office at (850) 769-0552 within 24 hours. Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury.

Compliance and enforcement of the terms and conditions of the ITP will be accomplished by Federal and State agencies that have the ability to enforce provisions of the Act as they relate to the taking of an endangered species with respect to each specific occurrence. If general terms and conditions required under the HCP and the ITP are not carried out in a timely manner, the Service may suspend the ITP until all parties agree to a solution.

## CONSERVATION RECOMMENDATIONS

Section 7 (a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency

activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help carry out recovery plans, or to develop information.

The Recovery Plan for the Gulf coast subspecies of beach mice (including the PKBM), published in 1987, identified recovery objectives for the Gulf coast beach mouse species: stabilize populations by preventing further habitat deterioration, re-establish populations in areas from which they have been extirpated, and education of the general public. Efforts to achieve these objectives have been only moderately successful depending on the location, effects of weather events, land management and regulations, and funding. The Service will be revising the Recovery Plan in the future. However, in the interim the 2014 PKBM 5-year review and the PKBM Conservation Strategy Plan will supplement the Recovery Plan in providing guidance for implementing recovery actions. The following conservation recommendations will serve as the Service's long-term conservation strategy for the PKBM.

1. Complete revision of the 1987 Recovery Plan for the PKBM.

2. Implement the PKBM Conservation Strategy Plan and update the Plan as necessary.

   Conservation objectives for the Perdido Key beach mouse are:

   a. To create, enhance, and maintain PKBM and habitats in PKSP, GINS, and GSP.

   b. To restore, enhance, and maintain beach mice and contiguous PKBM habitat in the primary, interdunal, secondary and scrub dune systems within and between GINS, PKSP, and GSP.

3. Continue to participate in the Northwest Florida Interagency Partnership to protect endangered and threatened species on public lands.

4. In coordination with FWC complete valuation of current management practices and their appropriateness for conservation and recovery of PKBM.

5. Continue to fund and participate in the FDEP Greenhouse project to provide beach mouse food source plants for dune restoration and maintenance.

## REINITIATION NOTICE

This concludes formal consultation on the Service's issuance of an ITP for the Norton Bond single family residence. As written in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Service involvement or control over the actions has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take authorized by this biological opinion is exceeded; (2) new information reveals effects of the Service's action that may affect listed species or designated critical habitat in a manner or to an extent not considered in this biological opinion; (3) the

Service's action is subsequently modified in a manner that causes an effect to the listed species or designated critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the actions. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease until reinitiation of consultation is completed.

cc:
FWS, Atlanta, Georgia (HC/TE)
FWS, Daphne, Alabama
FWC, Panama City, FL (Non-game)

LITERATURE CITED

Bigler, W.J. and J.H. Jenkins. 1975. Population characteristics of *Peromyscus gossypinus* and *Sigmodon hispidus* in tropical hammocks of South Florida. Journal of Mammalogy 56:633-644.

Bird, B. L, L.C. Branch, and D.L. Miller. 2004. Effects of coastal lighting on foraging behavior of beach mice. Conservation Biology 18: 1435-1439.

Bird, B. L. 2002. Effects of predatory risk, vegetation structure, and artificial lighting on the foraging behavior of beach mice. Masters thesis. University of Florida, Gainesville.

Blair, W. F. 1951. Population structure, social behavior, and environmental relations in a natural population of the beach mouse (*Peromyscus polionotus leucocephalus*). Contributions from the Laboratories of Vertebrate Biology 48:1-47.

Bowen, W. W. 1968. Variation and evolution of Gulf Coast populations of beach mice, *Peromyscus polionotus*. Bulletin of Florida State Museum of Natural History 12:1-91.

Browder, A.E. and R.G. Dean. 1999. Pensacola Pass, FL inlet management study. Prepared for the Florida Department of Environmental Protection, Bureau of Beaches and coastal Systems. Univ. of FL, Coastal & oceanographic Engineering Depart., Gainesville, FL.

Burkey, T.V. 1995. Extinction rates in archipelagoes: implications for fragmented populations in fragmented habitats. Conservation Biology 9: 527-541.

Caughley, G. and A. Gunn. 1996. Conservation biology in theory and practice. Blackwell Science, Oxford.

Conroy, M.J. and J.P. Runge, 2006. Interim report: review of trapping protocols, demographic estimation, and viability analysis for the Alabama beach mice (*Peromyscus polionotus ammobates*) II. Critique of population viability analyses for Alabama beach mouse. Georgia Cooperative Fish and Wildlife Research Unit, University of Georgia, Athens, GA. April 4. Report to U.S. Fish and Wildlife Service, Daphne, AL. 17 pp.

Daniel, M., B. Constantin, and L. Patrick. 2002. U.S. Department of Agriculture, Wildlife Services aids coalition of agencies across the Florida panhandle with control of nonnative predators to protect sea turtle nests. Poster paper presented at the 22nd Annual Symposium on Sea Turtle Biology and Conservation, Miami, FL U.S.A. April 4-7, 2002.

Danielson, B. J. 2005. Importance of multiple independent populations of Alabama beach mice. Issue paper and presentation to Alabama beach mouse recovery team. May 16, 2005. Iowa State University, Ames.

Dawson, W. 1983. Unpublished comments to U.S. Fish and Wildlife Service regarding beach mouse taxonomy. University of South Carolina, Columbia.

Dodd, C.K., W.J. Barichivich, and L.L. Smith. 2004. Effectiveness of a barrier wall and culverts in reducing wildlife mortality on a heavily traveled highway in Florida. Biological Conservation 118: 619-631.

Ehrlich, P. R. 1988. The loss of diversity: causes and consequences. Pages 21-27 in E.O. Wilson, editor. Biodiversity. National Academy Press, Washington, D.C. Escambia County. 2003. Perdido Key neighborhood plan. 2002 update. April 16, 2003. 141 pp.

Extine, D.D. 1980. Population ecology of the beach mouse, *Peromyscus polionotus niveiventris*. Unpublished M.S. thesis, Department of Natural Sciences, University of Central Florida; Orlando, Florida.

Fahrig, L., and G. Merriam. 1994. Conservation of fragmented populations. Conservation Biology 8:50-59.

Feagin, R.A., D.J Sherman, and W.E. Grant. 2005. Coastal erosion, global sea-level rise, and the loss of sand dune plant habitats. Frontiers in Ecology and the Environment 3(7): 359- 364.

Florida Fish and Wildlife Conservation Commission. 2004. Post hurricane Ivan tracking and trapping informal report. October. Panama City, FL.

Florida Fish and Wildlife Conservation Commission. 2005. Post hurricane Ivan tracking informal report. May and October. Lake City and Panama City, FL.

Florida Fish and Wildlife Conservation Commission, U.S. Fish and Wildlife Service, and Escambia County. 2005a. Perdido Key beach mouse conservation strategy. May. Tallahassee, FL. 9 pp.

Florida Fish and Wildlife Conservation Commission. 2006. Post hurricane season 2005 tracking and trapping informal report. Panama City, FL.

Florida Fish and Wildlife Conservation Commission. 2007. Personnel communication from Ron Loggins to Sandra Sneckenberger concerning tracking and trapping surveys of Perdido Key beach mice. Florida Fish and Wildlife Conservation Commission. Panama City, FL to U.S. Fish and Wildlife Service, Panama City, FL.

Florida Fish and Wildlife Conservation Commission. 2010. Perdido Key State Park Beach Mouse Track Tube Results May 2005 to August 2010. Panama City, Florida.

Florida Fish and Wildlife Conservation Commission. 2012a. Beach Mouse Track Tube Monitoring in Northwest Florida 2011 - 2012. Panama City, Florida.

Florida Fish and Wildlife Conservation Commission. 2012b. Beach Mouse Track Tube Monitoring in Northwest Florida April - July 2012. Panama City, Florida.

Florida Fish and Wildlife Conservation Commission. 2012c. Beach Mouse Track Tube Monitoring in Northwest Florida August – October 2012. Panama City, Florida.

Florida Fish and Wildlife Conservation Commission. 2013a. Beach Mouse Track Tube Monitoring in Northwest Florida January - June 2013. Panama City, Florida.

Florida Fish and Wildlife Conservation Commission. 2013b. Beach Mouse Track Tube Monitoring in Northwest Florida July - December 2013. Panama City, Florida.

Florida Fish and Wildlife Conservation Commission. 2014. Unpublished Beach Mouse Track Tube Monitoring Data for Northwest Florida 2009 - 2011. Panama City, Florida.

Florida Fish and Wildlife Conservation Commission, U.S. Fish and Wildlife Service, and Escambia County. 2005a. Intergovernmental Agreement for the Conservation of the Perdido Key Beach Mouse Conservation Strategy. December.

Florida Fish and Wildlife Conservation Commission, U.S. Fish and Wildlife Service, and Escambia County. 2005b. Perdido Key beach mouse conservation strategy. May. Tallahassee, FL. 9 pp.

Foltz, D. W. 1981. Genetic evidence for the long-term monogamy in a small rodent, Peromyscus polionotus. American Naturalist 117:665-675.

Galindo-Leal. C. and C. J. Krebs. 1998. Effects of food abundance on individuals and populations of the rock mouse (*Peromyscus difficilis*). Journal of Mammalogy 79(4): 1131-1142.

Garten, C. T., Jr. 1976. Relationships between aggressive behavior and genetic heterozygosity in the oldfield mouse, *Peromyscus polionotus*. Evolution 30: 59-72.

Griswold, K.E. Undated. A review of the taxonomic status and population dynamics of *Peromyscus polionotus* from western Florida and eastern Alabama.

Groom, M.J. and M. A. Pascual. 1997. The analysis of population persistence: an outlook on the practice of viability analysis. Pp 1-27 in: P.L. Fiedler and P.M. Karieva. eds. Conservation biology for the coming decade. Chapman and Hall, New York.

Gulf Islands National Seashore. 2004. Informal beach mouse tracking surveys conducted by GINS staff, post Hurricane Ivan. Summary 11/30/04 to 12/6/04. National Park Service, Gulf Breeze, Florida.

Gulf Islands National Seashore. 2005. Informal beach mouse tracking surveys conducted by GINS staff, post Hurricane Ivan. National Park Service, Gulf Breeze, Florida.

Gore, J. A. and T. Schaefer. 1993. Santa Rosa beach mouse survey. Florida Fish and Wildlife Fish Commission. Final performance report. July 1, 1991 – June 30, 1992.

Hall, E. Raymond. 1981. The Mammals of North America, 2nd edition, 2 vols., John Wiley and Sons.

Hess, G.R. and R. A Fischer. 2001. Communicating clearly about conservation corridors. Landscape and urban planning 55: 195-208.

Hill, E. A. 1989. Population dynamics, habitat, and distribution of the Alabama beach mouse. Masters thesis. Auburn University, Alabama.

Himes, J. 2008. Biologist, Florida Fish and Wildlife Conservation Commission. Personal communication on 2008 trapping results in Perdido Key State Park to Ben Frater, biologist, U.S. Fish and Wildlife Service, Panama City, Florida.

Hilty, J.A., W.Z. Lidicker, A.M. Merenlender. 2006. Corridor ecology: The science and practice of linking landscapes for biodiversity conservation. Island Press, Washington, D.C.

Holler, N. R. 1992. Perdido Key beach mouse. Pages 102-109 in S.R. Humphrey, editor. Rare and Endangered Biota of Florida, Volume 1. Mammals. University Presses of Florida, Tallahassee.

Holler, N.R. 1995. Personal communication about beach mouse captive breeding program from Unit Leader, Alabama Fish and Wildlife Cooperative Research Unit, Auburn University, to Lorna Patrick, U.S. Fish and Wildlife Service, Panama City, Florida.

Holler, N.R., D.W. Mason, R.M. Dawson, T. Simons, M.C. Wooten. 1989. Reestablishment of the Perdido Key beach mouse (*Peromyscus polionotus trissyllepsis*) on Gulf Islands National Seashore. Conservation Biology 3: 397-403.

Holler, N.R., M.C. Wooten, and C.L. Hawcroft. 1997. Population biology of endangered Gulf coast beach mice (*Peromyscus polionotus*): conservation implications. Technical Report. Alabama Cooperative Fish and Wildlife Research Unit.

Holler, N.R., M.C. Wooten, and M. Oli. 1999. Viability analysis of endangered Gulf coast beach mice (*Peromyscus polionotus*) populations. Project report for agreement 1448-0004-94- 9174, mod. 2, Obj. 2 for the U.S. Fish and Wildlife Service, Panama City, Florida. 16 pp. With graphs and tables.

Holliman, D. C. 1983. Status and habitat of Alabama gulf coast beach mice *Peromyscus polionotus ammobates* and *P. p. trissyllepsis*. Northeast Gulf Science 6: 121-129.

Howell, A. H. 1909. Notes on the distribution of certain mammals in the southeastern United States. Proceedings of the Biological Society of Washington 22: 55-68.

Howell, A. H. 1921. A biological survey of Alabama. North American Fauna 49:1-88.

Humphrey, S.R. 1992. Rare and endangered biota of Florida, Volume 1. Mammals. University Presses of Florida, Tallahassee.

Humphrey, S. R. and D. B. Barbour. 1981. Status and habitat of three subspecies of *Peromyscus polionotus* in Florida. Journal of Mammalogy 62: 840-844.

International Union for Conservation of Nature and Natural Resources. 2001. The IUCN Red List of threatened species™. 2001 categories and criteria (v.3.1).

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds. Cambridge University Press, Cambridge, UK, 976 pp

Ivey, R. D. 1949. Life history notes on three mice from the Florida east coast. Journal of Mammalogy 30: 157-162.

James, F. C. 1992. St. Andrews beach mouse. Pages 87-93 in S.R. Humphrey, editor. Rare and Endangered Biota of Florida, Volume 1. Mammals. University Presses of Florida, Tallahassee.

Johnson, A. F. 1997. Rates of vegetative succession on a coastal dune system in northwest Florida. Journal of Coastal Research 13: 373-384.

Kaufman, D.W. and G. A. Kaufman. 1987. Reproduction by Peromyscus polionotus: Number , size, and survival of offspring. Journal of Mammalogy 68: 275-280.

Kautz, R. S. and J. A. Cox. 2001. Strategic Habitats for Biodiversity Conservation in Florida. Conservation Biology 15: 55-77.

Lacy, R. C. 1993. Impact of Inbreeding in Natural and Captive Populations of Vertebrates: Implications for Conservation. The University of Chicago.

Lacy, R. C., G. Alaks, A. Walsh. 1995. Hierarchical analysis of inbreeding depression in *Peromyscus polionotus*. Evolution 50: 2187-2200.

Laurance, S.G.W., W.F. Laurance, and T. E. Lovejoy. 2003. Faunal corridors and their role in wildlife conservation in the Americas. Pages 313 to 325 in G.A. Bradshaw and P.A. Marquet, eds. How landscapes change: Human disturbance and ecosystem fragmentation in the Americas. Springer, Berlin.

Linzey, D.W. 1978. Perdido Bay beach mouse. Pages 19-20 in J.N. Layne, editor. Rare and Endangered Biota of Florida, Volume 1. Mammals. University Presses of Florida, Gainesville.

Lomascolo, T. and T.M. Aide. 2001. Seed and seedling bank dynamics in secondary forests following hurricane Georges in Puerto Rico. Caribbean Journal of Science 37: 259-270.

Lynn, W. J. 2000. Social organization and burrow-site selection of the Alabama Beach Mouse *Peromyscus polionotus ammobates*). Masters Thesis. Auburn University. Auburn, Alabama.

Lynn, W. J. 2004. E-mail communication to Lorna Patrick about the capture of a Perdido Key beach mouse on the Pat Siegler property in January 2004. U.S. Fish and Wildlife Service, Panama City, FL.

Lynn, B. and L. Kovatch. 2004. Perdido Key beach mouse final translocation report. U.S. Fish and Wildlife Service. Panama City, FL. 14 pp. plus figures and maps. FWC 2010a and 2010b

Meyers, J. M. 1983. Status, microhabitat, and management recommendations for *Peromyscus polionotus* on Gulf coast beaches. Report to U.S. Fish and Wildlife Service, Atlanta, Georgia, USA.

Melillo, J.M., T.C. Richmond, and G.W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi: 10.7930/J0Z31WJ2. Available at http://nca2014.globalchange.gov/

Moyers, J.E. 1996. Food habits of Gulf Coast subspecies of beach mice (*Peromyscus polionotus* ssp.). Masters thesis. Auburn University, Alabama.

Moyers, J.E., N.R. Holler, and M.C. Wooten. 1999. Species status report, current distribution and status of the Perdido Key, Choctawhatchee and St. Andrew Beach Mouse. U.S. Fish and Wildlife Service. Grant Agreement no. 1448-0004-94-9174. July. 43 pp.

Moyers, J.E and S. Shea. 2002. Annual trapping report. Choctawhatchee and St. Andrew beach mice at St. Joe development sites, Walton, Bay, and Gulf counties, Florida. St. Joe Timberland Co., Panama City, Florida.

Noss, R.F., and B. Csuti. 1997. Habitat fragmentation. Pages 269–304 in G.K. Meffe and R.C. Carroll, editors. Principles of conservation biology, Second edition. Sinauer Associates, Sunderland, Massachusetts.

Novak, J.A. 1997. Home range and habitat use of Choctawhatchee beach mice. M.S. Thesis, Auburn University, Alabama. 113 pp.

Oli, M., N.R. Holler, and M.C. Wooten. 2001. Viability analysis of endangered Gulf Coast beach mice (*Peromyscus polionotus*) populations. Alabama Cooperative Fish and Wildlife Research Unit and Department of Zoology and Wildlife Science.

Otis, D.L., K.P. Burnham, G.C. White, and D.R. Anderson. 1978. Statistical inference from capture data on closed animal populations. Wildlife Monograph. 62:1-135.

Oxley, D.J., M.B. Fenton, G.R. Carmody. 1974. The effects of roads on populations of small mammals. Journal of Applied Ecology 11:51-59.

Pearlstine, L.G. 2008. Ecological consequences of climate change for the Florida Everglades: An initial summary. Technical memorandum, South Florida Natural Resources Center, Everglades National Park. Homestead, Florida.

Pollock, K.H., J.D. Nichols, C. Brownie, and J.E. Hines. 1990. Statistical inference for capture-recapture experiments. Wildlife Monograph. 107: 1-97.

Pournelle, G.H., and B.A. Barrington. 1953. Notes on mammals on Anastasia Island, St. Johns County, Florida. Journal of Mammalogy 34:133-135.

Pries, A., L. Branch, and D. Miller. 2009. Impact of Hurricanes on Habitat Occupancy and Spatial Distribution of Beach Mice. Journal of Mammalogy, 90(4): 841-850.

Rave, E.H. and N.R. Holler. 1992. Population dynamics of beach mice (*Peromyscus polionotus ammobates*) in southern Alabama. Journal of Mammalogy 73:347-355.
RCF Economic and Financial Consulting, Inc. 2005. Business Plan for the Perdido Key Beach Mouse Conservation Fund. July 1. 50 pp.

Selander, R.K., M.H. Smith, S.Y. Yang, W.E. Johnson, and J.B. Gentry. 1971. Biochemical polymorphism and systematics in the genus *Peromyscus*. I. Variation in the old-field mouse (*Peromyscus polionotus*). University of Texas Studies in Genetics 6: 49-90.

Shaffer, M. L. 1981. Minimum population sizes for species conservation. Bioscience 31:131- 134.

Smith, K.E.L. 2003. Movements and habitat use of the Santa Rosa beach mouse (*Peromyscus polionotus leucocephalus*) in a successional dune mosaic. Master's thesis. University of Florida, Gainesville.

Smith, M. H. 1966. The evolutionary significance of certain behavioral, physiological, and morphological adaptations of the old-field mouse, Peromyscus polionotus. Ph.D. dissertation, University of Florida, Gainesville, 187 pp.

Smith, M.H. 1971. Food as a limiting factor in the population ecology of Peromyscus polionotus group from Florida and Alabama. Journal of Mammalogy 7:149-184.

Smith, M.H., C.T. Garten, Jr., and P.R. Ramsey. 1975. Genic heterozygosity and population dynamics in small mammals. pp. 85-102. In C.L. Markert (ed.), Isozymes IV. Genetics and Evolution. Academic Press, N.Y.

Sneckenberger, S.I. 2001. Factors influencing habitat use by the Alabama beach mouse (*Peromyscus polionotus ammobates*). Master's thesis. Auburn University, Auburn, Alabama.

Sneckenberger, S.I. 2005. Biologist, U.S. Fish and Wildlife Service, Panama City, FL. Observations of beach mouse burrows on private lands on Perdido Key.

Sneckenberger, S.I. 2008. Biologist, U.S. Fish and Wildlife Service, Vero Beach, FL. Personal communication about 2008 PKBM trapping results to Ben Frater, biologist, U.S. Fish and Wildlife Service, Panama City, Florida.

Soulé, M. E. and D. Simberloff. 1986. What do genetics and ecology tell us about the design of nature reserves? Biological Conservation 35: 19-40.

Soulé, M. E. and B.A. Wilcox. 1980. Conservation biology: an evolutionary-ecological perspective. Sinauer Associates, Inc. Sunderland, Massachusetts.

Stout, I.J. 1992. Southeastern beach mouse. Pages 242-249 in: S.R. Humphrey, Ed., Rare and Endangered Biota of Florida, Volume 1. Mammals. University Press of Florida, Tallahassee. 392 pp.

Swilling, W.R. 2000. Ecological dynamics of the endangered Alabama beach mouse (*Peromyscus polionotus ammobates*). Masters thesis. Auburn University, Alabama.

Swilling, W.R. Jr., M.C. Wooten, N. R. Holler, and W. J. Lynn. 1998. Population dynamics of Alabama beach mice (*Peromyscus polionotus ammobates*) following Hurricane Opal. American Midland Naturalist 140: 287-298.

Teska, W. R., M. H. Smith, and J. M. Novak. 1990. Food quality, heterozygosity, and fitness correlated in *Peromyscus polionotus*. Evolution 44: 1318-1325.

Traylor-Holzer, K. 2004. Draft Population Viability Analysis for the Alabama Beach Mouse: Report to the U.S. Fish and Wildlife Service, IUCN/SSC Conservation Breeding Specialist Group, Apple Valley, NM.

Traylor-Holzer, K. 2005. Revised Population Viability Analysis for the Alabama Beach Mouse: Report to the U.S. Fish and Wildlife Service, IUCN/SSC Conservation Breeding Specialist Group, Apple Valley, NM.

Traylor-Holzer, K. 2006. Revised Population Viability Analysis III for the Alabama Beach Mouse: Report to the U.S. Fish and Wildlife Service, IUCN/SSC Conservation Breeding Specialist Group, Apple Valley, NM.

Twilley RR, Barron EJ, Gholz HL, et al. 2001. Confronting climate change in the Gulf Coast region: prospects for sustaining our ecological heritage. Cambridge, MA, and Washington, DC: Union of Concerned Scientists and Ecological Society of America.

U.S. Army Corps of Engineers. 1976. Final environmental impact statement. Perdido Pass channel (maintenance dredging) Baldwin County, Alabama. Mobile District, AL.

U.S. Fish and Wildlife Service. 1987. Recovery plan for the Alabama beach mouse (*Peromyscus polionotus ammobates*), Perdido Key beach mouse (*P. p. trisyllepsis*), and Choctawhatchee beach mouse (*P. p. allophrys*). U.S. Fish and Wildlife Service, Atlanta, Georgia.

U.S. Fish and Wildlife Service. 1999. South Florida multi-species recovery plan. Atlanta, Georgia.

U.S. Fish and Wildlife Service. 2003. Choctawhatchee beach mouse East Pass, Shell Island trapping report. U.S. Fish and Wildlife Service. Panama City Field Office, Florida.

U.S. Fish and Wildlife Service. 2004. Perdido Key beach mouse final translocation report. 21 pp. July 27, 2004. U.S. Fish and Wildlife Service. Panama City Field Office, Florida.

U.S. Fish and Wildlife Service. 2006a. Designation of critical habitat for the Choctawhatchee beach mouse, Perdido Key beach mouse, and St. Andrew beach mouse: Final Rule. U.S. Fish and Wildlife Service. Washington, DC.

U.S. Fish and Wildlife Service. 2006b. Biological opinion for Magnolia West on Perdido Key, Florida. Panama City, Florida.

U.S. Fish and Wildlife Service. 2007. Biological opinion for Island Club, Marquesas, Lorelei, and Coquina Caye Condominiums on Perdido Key, Florida. Panama City, Florida.

U.S. Fish and Wildlife Service. 2009a. Rising to the challenge. Strategic plan for responding to accelerating climate change. Draft document. (http://www.fws.gov/home/climatechange/).

U.S. Fish and Wildlife Service. 2009b. Appendix: 5-year action plan for implementing the climate change strategic plan. Draft document. (http://www.fws.gov/home/climatechange/).

Van Zant, J.L. and M.C. Wooten. 2003. Translocation of Choctawhatchee beach mice (*Peromyscus polionotus allophrys*): hard lessons learned. Biological Conservation, 112(3): 405-413

Van Zant, J.L. and M.C. Wooten. 2006. Personal communication about beach mouse genetic research ongoing at Auburn University to Sandra Sneckenberger, U.S. Fish and Wildlife Service, Panama City, FL.

Weston, J. 2007. Captive breeding of beach mice. Peromyscus Genetic Stock Center, University of South Carolina, Columbia, South Carolina.

Wiens, J.A. 1996. Wildlife in patchy environments: metapopulations, mosaics, and management. Pages 53-84 in D.R. McCullough, editor. Metapopulations and wildlife conservation. Island Press. Washington D.C.

With, K.A., and T.O. Crist. 1995. Critical thresholds in species responses to landscape structure Ecology 76:2446-2459.

Wolf, S. 2014. Letter to the Service on behalf of Center for Biological Diversity (CBD). June 13,2014. San Francisco, California.

Wooten, M. C. 1994. Estimation of genetic variation and systematic status of populations of the beach mouse, Peromyscus polionotus. Final Report, Florida Game and Freshwater Fish Commission. Tallahassee, Florida.

Wooten, M. C. and N. R. Holler. 1999. Genetic analyses within and among natural populations of beach mice. Final report to U.S. Fish and Wildlife Service. Atlanta, Georgia.

## APPENDIX A

## CONSERVATION MEASURES FOR NESTING SEA TURTLES, NON-BREEDING PIPING PLOVER, AND OTHER SHOREBIRDS

The conservation measures are from the Applicants' HCP and will be incorporated in all future projects covered by this HCP/ITP when applicable. By incorporation of these conservation measures, the Service supports a "may affect, but not likely to adversely affect" determination for nesting sea turtles and piping plover.

1. Beach Vendors must obtain a permit from Escambia County to drive on the beach. Established Best Management Practices (BMPs), County permit conditions, and applicable State permit condition shall be followed. These conditions include deployment and retrieval of beach furniture outside of sea turtle nesting season (May 1 – Oct 1).
2. Public safety, beach maintenance (trash pickup), wildlife surveyors, and law enforcement shall receive training to educated individuals on proper beach driving techniques.
3. Prohibition of beach driving by the general public per Section 94-4 of the Escambia County Code of Ordinances. Beach driving on vegetated areas of the beach is prohibited by all.
4. Adopt a Service approved Perdido Key wildlife lighting ordinance within 180 days of issuance of the ITP for the Perdido Key HCP.
5. Establish County ordinance to address special event requests to ensure consistent with the Endangered Species Act and other applicable wildlife laws. Also inform potential requestors of required State permitting.
6. Sand fencing shall be used in limited areas only when needed. Applicants must obtain and adhere to State permits for use and placement of sand fencing.
7. The County will be responsible for and/ or coordinate with the primary sea turtle permit holder to ensure that all permit conditions will be followed by activities covered under this ITP.
8. Maintain animal-proof trash receptacles at all County owned facilities.
9. All construction on nesting beaches (toe of dune waterward) shall be conducted outside of sea turtle nesting season.
10. Sea turtle nest and non-breeding piping plover monitoring programs shall be established for projects that have the potential to interact with these species (i.e special event permits, etc.).
11. Prior to any construction activity during shorebird nesting season (February 15 through September 1 on the Gulf of Mexico coast and the Panhandle), a Permittee shall follow the guidelines below:
    a. The Permittee should arrange for daily nesting surveys prior to project commencement throughout the construction period or through August.
    b. Surveys for detecting nesting activity should be completed prior to movement of equipment, operation of vehicles, or other activities that could potentially disrupt nesting behavior or cause harm to the birds or their eggs or young.
    c. The FFWCC Regional Biologist should be notified within 24 hours if a scrape or eggs are observed (phone: 850-233-5110).

d. A protective buffer zone, up to 300-feet wide if possible, should be created around any nests or colonial nesting areas. Any and all construction activities, including movement of vehicles, should be prohibited in the buffer zone.
e. The width of the buffer zone shall be increased if birds appear agitated or disturbed by construction or other activities in adjacent areas.
f. FFWCC staff may assist the Permittee with posting buffer zones with clearly marked signs around the perimeter.

12. Observations of nesting shorebirds within the project area shall be submitted to the County and the Florida Beach-Nesting Bird Website at www.wildflorida.org/shorebirds/ for each individual project.
13. All tilling and escarpment removal should be done outside the shorebird nesting season. It is the responsibility of the contractors to avoid tilling or scarp removal in areas where nesting birds are present.
    a. A relatively even surface, with no deep ruts or furrows, shall be created during tilling. To do this, chain-linked fencing or other material shall be dragged over those areas as necessary after tilling.
    b. The slope between the mean high water line and the mean low water line must be maintained in such a manner as to approximate natural slopes.
14. To preserve piping plover feeding and roosting habitat, the mechanical removal of natural organic material (wrack) shall be prohibited year-round.
15. The County shall post at all beach access points the provisions of the County Animal Control Ordinance (Code 1985, § 1-4-1, Chap. 10) informing beach users of the prohibition of animals on the beach.
16. The County will conduct and/or coordinate a survey of the HCP Area beaches to identify nesting sites of shorebirds. The County will work with the FWC to cordon off nesting areas each season as appropriate. If construction is proposed near a shorebird nest, a 300 ft. buffer will be established and marked.

The following BMPs are incorporated in the HCP and shall be followed in regards to public infrastructure improvements which involve roadways. These BMPs are from the USFWS guidance document titled Guidance for Road Construction and Maintenance In Areas with Federally Protected Beach Mice, U.S. Fish and Wildlife Service, August 2, 2005. The County shall incorporate the most current BMPs for roadway construction/maintenance or emergency projects covered under this 30 year permit.

Construction Activities

1. There will be no clay materials used in construction.
2. Fill material must be certified as clean of noxious weeds. Hay bales must also be certified by the Florida Department of Agriculture and Consumer Services Division of Plant Industry as free from noxious weeds. No hay bales will be used in dunes. No fertilizer or lime will be applied within the "limits of construction" zone.
3. All construction will occur within the existing maintained right-of-way (ROW) zone with the exception of areas with additional ROW requirements.

4. There will be no vegetation removal/destruction beyond the existing maintained ROW.
5. Staging/storing areas will be identified and approved by the County during the design phase of the project. These areas will be used as turning points, parking areas, and stockpiling areas to prevent vehicles or construction equipment from violating the construction zone limits. These identified, surveyed, and approved areas will be depicted as hatched areas on the construction plan sheets. Station number will identify the locations of these areas in project documentation. These staging/storage areas will be located only in the non-native, disturbed/maintained ROW areas to avoid impacts to native vegetation and wildlife habitat and reduce erosion control problems.
6. Native grasses such as seashore paspalum (Paspalum vaginatum), beach grass (Panicum amarum), and sea oats (Uniola paniculata) may be incorporated into the design as commercially available, as well as other native vegetation for aesthetic and erosion-control function, drought hardiness, and low maintenance value. These plants will be especially considered in areas where sod will not grow and to replace the use of rock aggregate. (See FWS Plant List for Coastal Franklin, Gulf, and Bay Counties, Florida).
7. Use of sod in the ROW is not allowed due to its tendency to spread into adjacent beach mouse habitat.
8. In locations where aggregate material is needed for shoulder stabilization along the pavement edge, White Bahama Rock has been considered an acceptable material for use in the coastal zone. However, it isn't natural to the coastal dune habitat and is becoming dispersed within PKBM habitat. Other materials are being considered as better options.
9. Sands outside of the ROW shall be sifted post-construction to remove construction debris and restore the habitat to pristine fine sand.

# APPENDIX B

## Escambia County Approved Plant List for Dune Restoration

| Scientific Name | Common Name | Height | Container | Primary & Secondary Dune | Inter-dunal | Scrub dune |
|---|---|---|---|---|---|---|
| **Trees** | | | | | | |
| Magnolia grandiflora | Southern Magnolia | 60'-90'* | 1gTP,3gTP,D | | | X |
| Osmanthus americanus | Wild Olive | 70'* | 1gTP,3gTP,D | | | X |
| Pinus clausa | Sand Pine | 20'* | 1gTP,3gTP,D | | | X |
| Pinus elliottii | Slash Pine | 80'-100'* | 1gTP,3gTP,D | | | X |
| Quercus geminata | Sand Live Oak | 30'* | 1gTP,3gTP,D | | | X |
| Quercus myrtifolia | Myrtle Oak | 40'* | 1gTP,3gTP,D | | | X |
| Quercus virginiana maritima | Sand Live Oak | 40'-50'* | 1gTP,3gTP,D | | | X |
| **Medium to Large Shrubs & Small Trees** | | | | | | |
| Callicarpa americana | Beautyberry | 5' | 1gTP,TB,D | | | X |
| Ilex vomitoria | Yaupon Holly | 20' | 1gTP,TB,D | | | X |
| Iva frutescens | Marsh-Elder | 11' | 1gTP,TB,D | | X | |
| Rhus copallina | Winged Sumac | 10' (30') | 1gTP,TB,D | | X | X |
| Serenoa repens | Saw Palmetto | 10' (30') | 1gTP,TB,D | | | X |
| **Small Shrubs & Ground Covers** | | | | | | |
| Schizachyrium (formerly maritimum) | Bluestem | | LT,TB | X | | X |
| Asclepias humistrata | Sandhill Milkweed | | LT,TB | | | X |
| Bignonia capreolata | Cross Vine | | LT,TB | | | X |
| Cakile constricta | Sea Rocket | | LT,TB | X | | |
| Ceratiola ericoides | Seaside Rosemary | | LT,TB | | | X |
| Chryosoma pauciflosculosa | Seaside Goldenrod | | LT,TB | X | | X |
| **(T)** Chrysopsis gossypina cruiseana | Cruise's Golden Aster | | LT,TB | X | | X |
| Conradina canescens | Beach Heather | | LT,TB | X | | X |
| Cyperus sp. | Sedge | | LT,TB | | X | |
| Heterotheca subaxillaris | Aster (Camphor weed) | | LT,TB | X | | X |
| Hydrocotyle bonariensis | Pennywort | | LT,TB | X | X | X |
| Ipomoea pes-caprae | Railroad Vine | | LT,TB | X | | |
| Ipomoea imperati (formerly stolonifera) | Beach Morning Glory | | LT,TB | X | | |
| Licania michauxii | Gopher Apple | | LT,TB | | | X |
| Panicum amarum | Beach Grass | | LT,TB | X | X | |
| **(E)** Polygonella macrophylla | Large-leaved Jointweed | | LT,TB | | | X |
| Tradescantia ohiensis | Spiderwort | | LT,TB | | X | X |
| Uniola paniculata | Sea Oats | | LT,TB | X | | X |

**The use of installed irrigation, mulch, whether artificial or natural material, and landscape fabric is prohibited.**

T & E = State of Florida protected plant. Planting is strongly encouraged to help recover the species. Make sure the nursery you purchase the plant from is in the Association of Florida Native Plants; they follow all State regulations to grow and sell protected species.
*****Trees living in coastal dunes do not reach "normal heights." They tend to be stunted and "pruned" by the wind, sand, and salt spray. Plant small specimens preferably in protected areas such as on the landward side of the dunes.