RCS 99-145, Rev 1, 2009

EGLIN AIR FORCE BASE
Florida

ELECTROMAGNETIC RADIATION

FINAL
RANGE ENVIRONMENTAL ASSESSMENT, REVISION 1

DECEMBER 2009

Report Documentation Page

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FINDING OF NO SIGNIFICANT IMPACT
FOR

ELECTROMAGNETIC RADIATION RANGE ENVIRONMENTAL ASSESSMENT ON EGLIN AIR FORCE BASE, FLORIDA RCS 99-145, Revision 1, 2009

This finding, and the analysis upon which it is based, was prepared pursuant to the President's Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of the National Environmental Policy Act (NEPA) and its implementing regulations as promulgated at 40 Code of Federal Regulations (CFR) Part 1500 (40 CFR 1500–1508) plus:

- U.S. Air Force *Environmental Impact Analysis Process* (EIAP) as promulgated at 32 CFR Part 989.

The Department of the Air Force has conducted a Range Environmental Assessment (REA) of the potential environmental consequences associated with the use of Electromagnetic Radiation (EMR) Emitters on Eglin Air Force Base (AFB), Florida. That December 2009 REA is hereby incorporated by reference into this finding.

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Proposed Action

The **Proposed Action** is for the 46th Test Wing (46 TW) Commander to establish a new authorized level of activity regarding the use of EMR emitters (radar systems, microwave communication systems, and lasers) on Eglin AFB that is based on an anticipated maximum usage, with known or minimal environmental impacts. Demonstrating that the individual and cumulative effects of EMR emitter utilization do not have significant environmental impact is the method for establishing the maximum threshold baseline, which is being identified as the *Range EIAP Baseline*. The environmental analysis is accomplished by evaluating the effect that the military mission activities and expendables have on Eglin AFB's natural environment (human and biological resources).

The Range analysis performed in this report allows for a cumulative look at the impact on Eglin AFB receptors from EMR emitters in use on the Eglin Range. By implementing an authorized level of activity and a process by which to approve future EMR systems, Range management will be streamlined and cumulative environmental impacts will be more fully considered.

The No Action Alternative and Alternative 1 are not expected to be sufficient to account for the increase in the use of EMR emitters on Eglin AFB. Therefore, Alternative 2 was selected as the Preferred Alternative, as it provides an assessed and authorized reasonable maximum level of activity for the use of EMR emitters as they occur. There were no alternatives eliminated from detailed analysis.

No Action Alternative

This alternative is defined as authorizing the baseline approved in the *2002 EMR Programmatic Environmental Assessment* (PEA) which established the environmental baseline as site-specific EMR locations such as the 46 TW range instrumentation systems and the phased array radar operated by the 20th Space Control Squadron, as well as the total aggregate volume of EMR hazard space on Eglin AFB. The environmental baseline also prescribed guidelines to screen future EMR requests through the Air Force Form 813 process when any future activity involving an EMR emitter would change the baseline parameters and to ensure site-specific Best Management Practices (BMPs) were implemented which would minimize the risk of adverse exposure to hazardous levels of EMR for human and biological resources on Eglin AFB.

Alternative 1: Authorize the Current Environmental Baseline Plus the Removal, Relocation, Addition, or Upgrade of any EMR emitters since the 2002 EMR PEA

Alternative 1 would authorize the 2002 EMR PEA baseline plus include the removal, relocation, addition or upgrade of any EMR emitter systems since the 2002 EMR PEA baseline was designated. Alternative 1 included an overall reduction in range radar systems (from 24 to 19), an increase in range communication transmitter systems (from 29 to 33) and an increase in range laser systems (from 15 to 69).

Alternative 2 (Preferred Alternative): Alternative 1 Plus the Inclusion of Projected Future Systems and the Process to Approve Future EMR Systems on Eglin AFB

Alternative 2 would authorize the environmental baseline as described under Alternative 1, plus include projected future EMR systems on Eglin AFB and designate a process to approve future EMR systems on Eglin AFB. Since specific future actions involving EMR emitters are dependent on future mission requirements, and because future mission requirements are unknown, Alternative 2 attempts to prescribe guidelines and establish a methodology, or BMPs, based on current EMR safety programs. These guidelines would be established to consistently screen EMR requests and facilitate the AF Form 813 process when any future activity involving an EMR emitter would change baseline parameters. This methodology would compliment existing Eglin AFB human safety programs for EMR and would ensure that the relocation, addition, or upgrade of an EMR emitter system would not be detrimental to the natural resources present on Eglin AFB.

Alternative 2 is selected as the Preferred Alternative because it provides an assessed and authorized reasonable maximum level of activity, providing both timely access of the military mission to the Eglin AFB Range and safety for the many natural resources present on the Range.

ENVIRONMENTAL IMPACTS

Analysis was conducted to determine the potential impacts to the human and natural environment resulting from the No Action Alternative, Alternative 1, and Alternative 2. No significant impacts to resources have been identified, provided new EMR emitter systems are screened and analyzed through the AF Form 813 process and appropriate BMPs are applied to

specific EMR testing events. A detailed discussion of issues analyzed and management strategies used to reduce potential impacts is given in Chapter 4 of the REA.

PUBLIC NOTICE

A public notice was published in the *Northwest Florida Daily News* inviting the public to review and comment upon the Draft REA and Draft Finding of No Significant Impact. The public comment period closed on October 19, 2009, and no public comments were received. State agency comments were received and have been addressed in Appendix F, *Public Involvement*, of the Final REA.

FINDING OF NO SIGNIFICANT IMPACT

Based on my review of the facts and the environmental analysis contained in the attached REA, and as summarized above, I find the proposed decision of the Air Force to implement Alternative 2, the current EMR baseline on Eglin AFB plus the inclusion of projected future systems and the process to approve future EMR systems on Eglin AFB, will not have a significant impact on the human or natural environment; therefore, an environmental impact statement is not required. This analysis fulfills the requirements of the NEPA, the President's CEQ, and 32 CFR Part 989.

24 JAN 2010

DAVID H. MAHARREY, JR., Col, USAF
Commander, 96th Civil Engineer Group

Date

ELECTROMAGNETIC RADIATION

FINAL
RANGE ENVIRONMENTAL ASSESSMENT, REVISION 1

Submitted to:

96 CEG/CEVSP
Environmental Analysis Section
Eglin Air Force Base, Florida

RCS 99-145, REV 1, 2009

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

7SFG(A)	7th Special Forces Group (Airborne)
20 SPCS	20th Space Control Squadron
46 RANSS/TSRS	46th Range Support Squadron/Range Systems Flight
46 RANSS/TSRI	46th Range Support Squadron/Range Instrumentation Flight
46 TW	46th Test Wing
46 TW/OSS	46th Test Wing/Operations and Support Squadron
46 TW/XPX	46th Test Wing Plans Office
96 AMDS/SGPB	Bioenvironmental Engineering
96 CEG	96th Civil Engineer Group
96 CEG/CEVSP	96th Civil Engineer Group/Environmental Analysis Section
96 CEG/CEVSN	96th Civil Engineer Group/Natural Resources Section
96 CG/SCXF	96th Communications Group/SCXF
AAC	Air Armament Center
AACI	Air Armament Center Instruction
AAC/SE	Air Armament Center Safety Office
AFB	Air Force Base
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFOSH	Air Force Occupational Safety and Health
AFPAM	Air Force Pamphlet
AFRL	Air Force Research Laboratory
AGL	Above Ground Level
AMIRS	Advanced MMW Imaging Radar System
ANSI	American National Standards Institute
ARDS	Advanced Range Data System
BMP	Best Management Practice
BRAC	Base Realignment and Closure
CATEX	Categorical Exclusion
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DoD	Department of Defense
EA	Environmental Assessment
EBD	Environmental Baseline Document
EED	Electroexplosive Device
EIAP	Environmental Impact Analysis Process
EM	Electromagnetic
EMR	Electromagnetic Radiation
EO	Electro-Optical
ERP	Environmental Restoration Program
ESA	Endangered Species Act
ETTC	Eglin Test and Training Range Complex
eV	Electron Volts
FCC	Federal Communications Commission
FNAI	Florida Natural Areas Inventory
GAFC	Gulf Area Frequency Coordinator
GHz	Gigahertz
GPS	Global Positioning System
HF	High Frequency
IEEE	Institute of Electrical and Electronics Engineers
ILRIS	Imaging Laser Radar Instrumentation System
INRMP	Integrated Natural Resources Management Plan
I-SAR	Inverse Synthetic Aperture Radar
LTRC	Laser Ranging Tracking Cinesextant
MANPADS	Man Portable Air Defense Systems

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS, CONT'D

MHz	Megahertz
MMW	Millimeter Wave
MPE	Maximum Permissible Exposure
MSL	Mean Sea Level
mi^2	Square Miles
MSTTE	Multi-Spectra Test and Training Environment
mW/cm^2	Megawatt per Square Centimeter
NEPA	National Environmental Policy Act
nm	Nanometer
NOHD	Nominal Ocular Hazard Distance
ORM	Operational Risk Management
OSHA	Occupational Safety and Health Administration
PEA	Programmatic Environmental Assessment
PCS	Personal Communications Service
PEL	Permissible Exposure Limit
POL	Petroleum, Oil and Lubricant
REA	Range Environmental Assessment
RF	Radio Frequency
RFI	Radiation Frequency Interference
RMB	Risk Management Board
ROI	Region of Influence
RSO	Radiation Safety Officer
SADS	Simulated Air Defense Systems
SAR	Specific Absorption Rate
SRI	Santa Rosa Island
SSN	Space Surveillance Network
TSPI	Time-Space-Position Information
UHF	Ultra-High Frequency
U.S.	United States
UV	Ultraviolet
VHF	Very High Frequency
USFWS	U.S. Fish and Wildlife Service
W/kg	Watts per Kilogram
WEST	Weapons Effectiveness Simulator Threat
YAG	Yttrium Aluminum Garnet

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1. PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

The Eglin Military Complex, located in the northwest Florida panhandle (Figure 1-1) is one of 19 component installations categorized as a Department of Defense (DoD) Major Range Test Facility Base. Eglin Air Force Base (AFB) is situated within three counties: Santa Rosa, Okaloosa, and Walton. The Eglin Military Complex also includes Cape San Blas, which is located in Gulf County. Eglin AFB's primary function is to support research, development, test, and evaluation of conventional weapons and electronic systems. It also provides support for individual and joint training of operational units. The Eglin Military Complex currently comprises four components (U.S. Air Force, 2001), which do not include the cantonment or main base areas:

1) Test Areas/Sites
2) Interstitial Areas (areas beyond and between the test areas)
3) The Eglin Gulf Test Range
4) Airspace (overland and water)

The United States (U.S.) Air Force Air Armament Center (AAC) has responsibility for the Eglin Military Complex and for all its users, which include DoD, other government agencies, foreign countries, and private companies. For range operations, the 96th Civil Engineer Group (96 CEG) provides AAC with environmental analyses and necessary National Environmental Policy Act (NEPA) documentation to ensure compliance with Air Force policy and applicable federal, state, and local environmental laws and regulations.

AAC includes two wings and four directorates that collectively operate, manage, and support all activities on the Eglin Military Complex. AAC accomplishes its Range operations through the 46th Test Wing (46 TW) with support from the 96th Air Base Wing. The 46 TW Commander is responsible for day-to-day scheduling, executing, and maintaining of this national asset. The continued DoD utilization of the Eglin Military Complex requires flexible and unencumbered access to land ranges and airspace, which support all of Eglin AFB's operations.

Eglin AFB encompasses 724 square miles (463,000 acres) of land area, of which approximately 50,000 acres are land test areas (where weapons testing occurs) (Figure 1-2); approximately 990 acres are at Cape San Blas, located approximately eight miles south of Port St. Joe in Gulf County on the southwestern terminal portion of the St. Joseph Peninsula, and about 17 miles consist of Santa Rosa Island along the Gulf of Mexico. Eglin also controls 142,000 square miles (mi^2) of airspace overlying land and water ranges.

This Range Environmental Assessment (REA) addresses the potential impacts to human and biological resources from *electromagnetic radiation (EMR) emissions*, defined as the emission of nonionizing electromagnetic radiation within the radio frequency (RF) and infra-red/ visual/ultraviolet spectrum used by man-made emitters (specifically radar, laser, and microwave communication systems) on Eglin AFB. The types of emitters of concern which are present on

Eglin AFB are described in Chapter 2 of this document. Impacts to resources from any actions other than the emission of EMR (i.e., construction of new facilities, clearing of sight lines) are separate issues and not covered in this document. The construction of new facilities and the clearing of vegetation for sight lines would be dealt with on a case-by-case basis through the Air Force (AF) Form 813 process.

1.2 PROPOSED ACTION

The **Proposed Action** is for the 46 TW Commander to establish a new authorized level of activity regarding the use of EMR emitters (radar systems, microwave communication systems, and lasers) on Eglin AFB that is based on an anticipated maximum usage, with known or minimal environmental impacts. Demonstrating that the individual and cumulative effects of EMR emitter utilization do not have significant environmental impact is the method for establishing the maximum threshold baseline, which is being identified as the *Range Environmental Impact Analysis Process (EIAP) Baseline*.

The environmental analysis is accomplished by evaluating the effect that the EMR emitters have on Eglin AFB's natural and physical environment. The military mission has been broadly identified as the effector of environmental impacts and Eglin AFB's environment has been identified as the receptor. Evaluation and quantification of this effector/receptor relationship is the scientific basis for the environmental analysis performed in this report.

The **purpose and need of the Proposed Action** is twofold as described in the following.

1. Purpose: to quickly and efficiently process new programs requesting the use of EMR emitters during routine and crisis situations.

   Need: to provide military users a quick response to priority needs during war or other significant military involvement, as well as maintain the current approval process for routine uses; and,

2. Purpose: to update the NEPA analysis by re-evaluating EMR emissions on Eglin AFB and by performing a cumulative environmental analysis of all EMR emissions.

   Need: the need associated with this item is multifaceted and is described below.

Eglin AFB previously performed environmental analysis on EMR emitters in the *2002 Electromagnetic Radiation (EMR) Programmatic Environmental Assessment* (PEA) (U.S. Air Force, 2002a) [copies of referenced documents can be obtained through Eglin AFB's Public Affairs Office]. Furthermore, the *2003 Electromagnetic Radiation Environmental Baseline Document* (EBD) (U.S. Air Force, 2003a) established an environmental baseline for EMR emitters as the 46 TW range instrumentation systems and the phased array radar operated by the 20th Space Control Squadron at Site C-6 (identified in Section 1.3.2). Since it was difficult to quantify the use of EMR emitters on Eglin AFB (i.e., how often they are used, the amount of time emitters are in use) due to the wide variety of mission activities involving the use of EMR emitters, analysis in those documents focused on establishing hazard areas for recorded emitters on the range and, subsequently, estimating the potential for exposure to proximal organisms entering those areas.

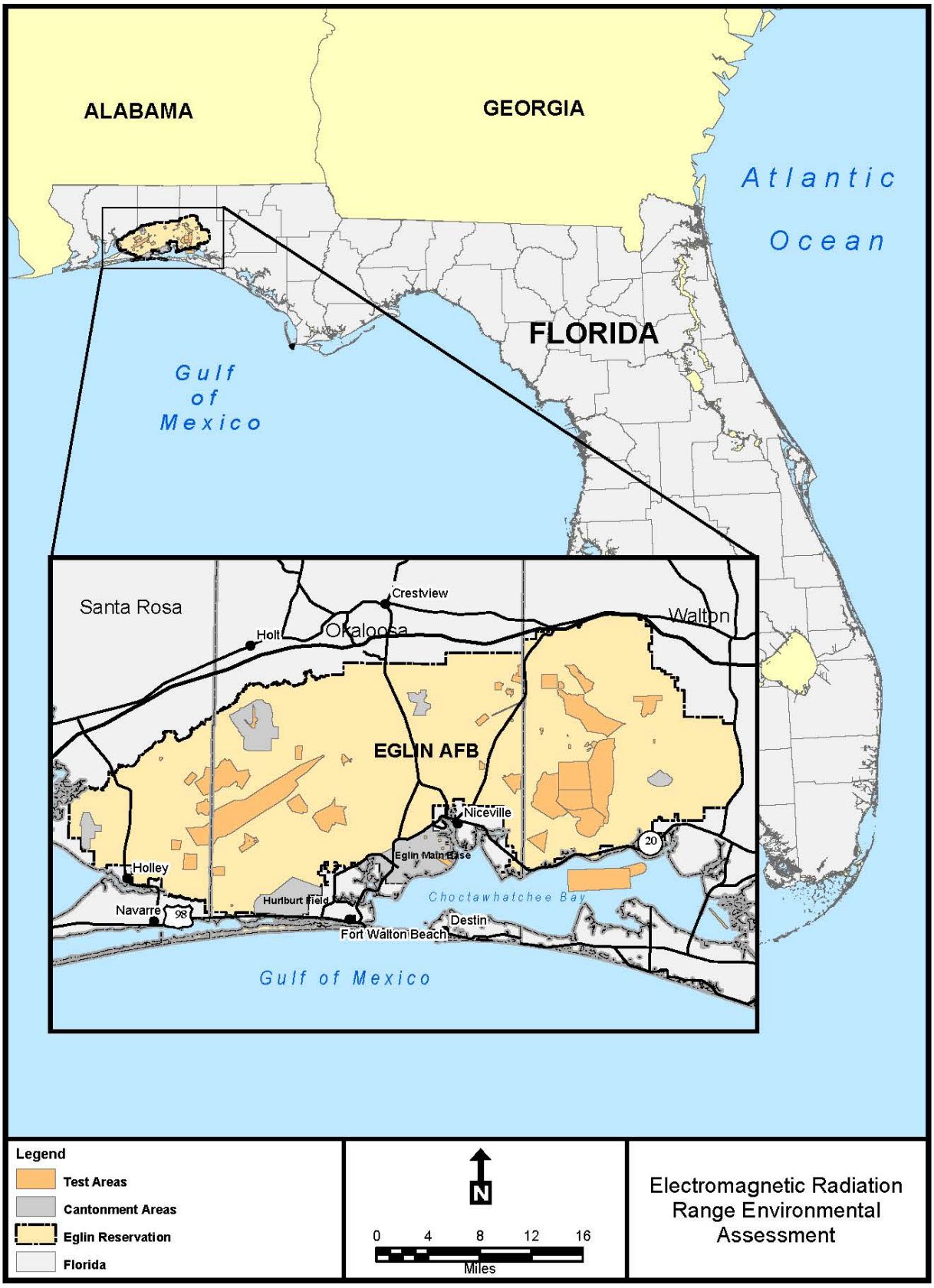

Figure 1-1. The Eglin Military Complex

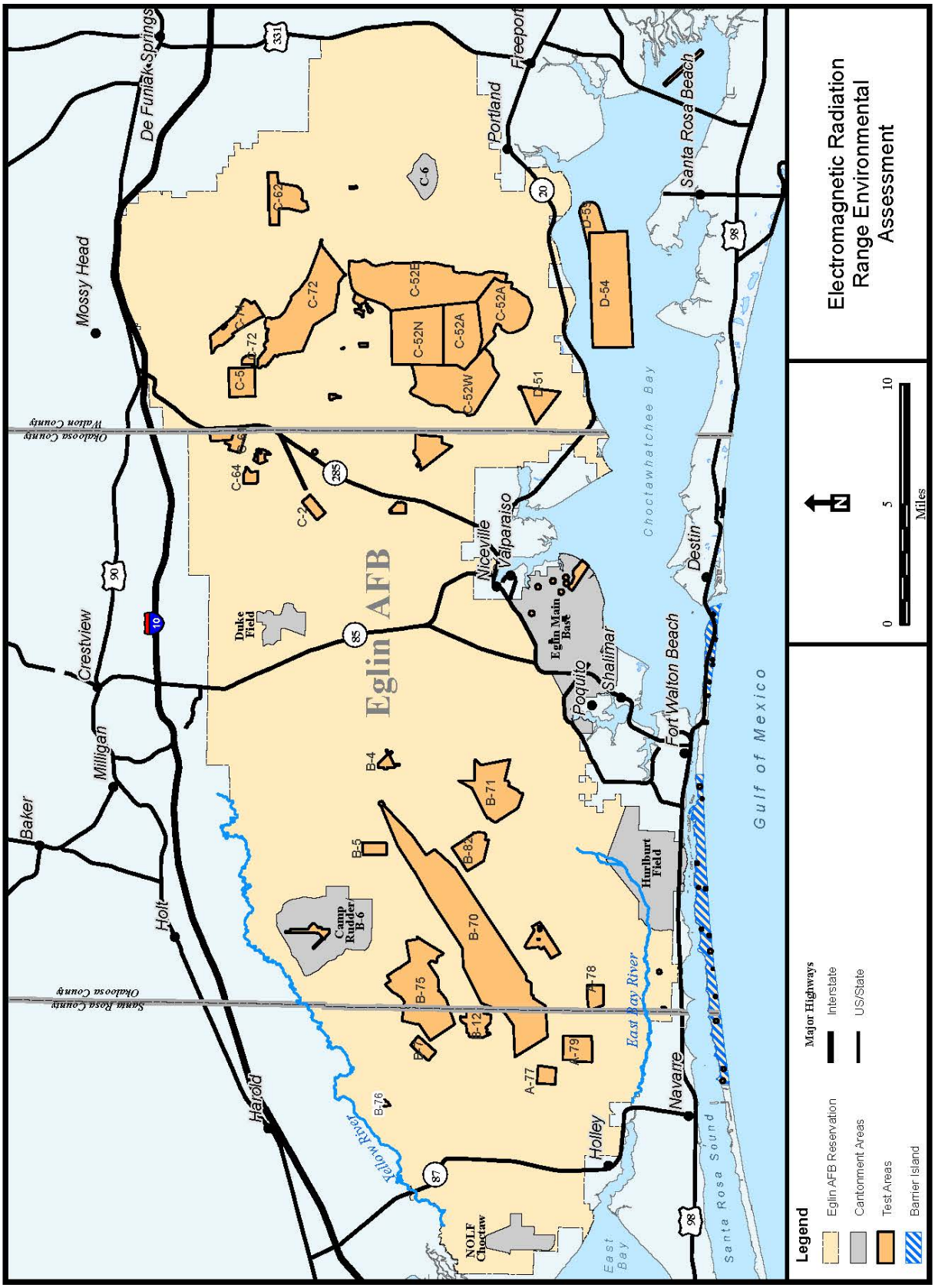

Figure 1-2. Land Test Areas and Interstitial Test Areas Comprising the Eglin Military Complex

Since the completion of the original environmental analysis, there have been removals, additions, relocations, and/or upgrades of emitters resulting in a change of site-specific baseline hazard area locations and/or volumes identified in the 2002 EMR PEA and the 2003 EMR EBD. These changes require new environmental analysis. Currently, when approval for a new mission is requested, it may be categorically excluded from additional environmental analysis if it is similar in action to a mission that has been previously assessed and the assessment resulted in a finding of no significant environmental impact. The categorical exclusion (CATEX) designation is in accordance with NEPA and Air Force regulations (Council on Environmental Quality [CEQ] 32 Code of Federal Regulations [CFR] 989.13 and Air Force Instruction [AFI] 32-7061).

Since the time that some of these ongoing mission activities were originally assessed, and also since some of the mission activities that are used for CATEX purposes were assessed, changes have occurred at Eglin AFB that could affect environmental analysis. These changes, outlined below, create a need to re-evaluate the NEPA analysis individually and cumulatively.

- Additional species have been given federal and state protected status.
- Species that were not previously known to exist at Eglin AFB have been discovered.
- Additional cultural resources have been discovered and documented.
- The population of communities along Eglin AFB's borders has increased.
- Air Force regulations have changed.
- Military missions and weapons systems have evolved.

The analysis performed in this report allows for a cumulative look at the impact on Eglin AFB receptors from EMR emissions. By implementing an authorized level of activity, range management will be streamlined and cumulative environmental impacts will be more fully considered.

1.3 SCOPE OF THE PROPOSED ACTION

This document addresses the potential impacts to human and biological resources from EMR emitters associated with activities on the Eglin Mainland Reservation, Santa Rosa Island and surrounding areas. Activities associated with Cape San Blas are described and analyzed in the *Cape San Blas Programmatic Environmental Assessment* (U.S. Air Force, 1999). Accordingly, when it is determined that an update to the Cape San Blas PEA is warranted, any new information pertaining to EMR emitters at Cape San Blas would be included and potential effects would be analyzed.

The Region of Influence (ROI) for EMR emitters consists of all Eglin's range support facilities that are known to operate EMR sources during testing and training activities. Since some EMR sources are portable and not fixed on a test range (i.e., portable lasers, portable radars), it is difficult to determine the exact location where a test event could occur. Therefore, the ROI will also include any portions of Eglin AFB that could be utilized for EMR testing. EMR sources at Eglin AFB are categorized into three groups (1) radar, (2) range communication transmitters, and (3) lasers, and are depicted in Figure 1-3, Figure 1-4, and Figure 1-5, respectively.

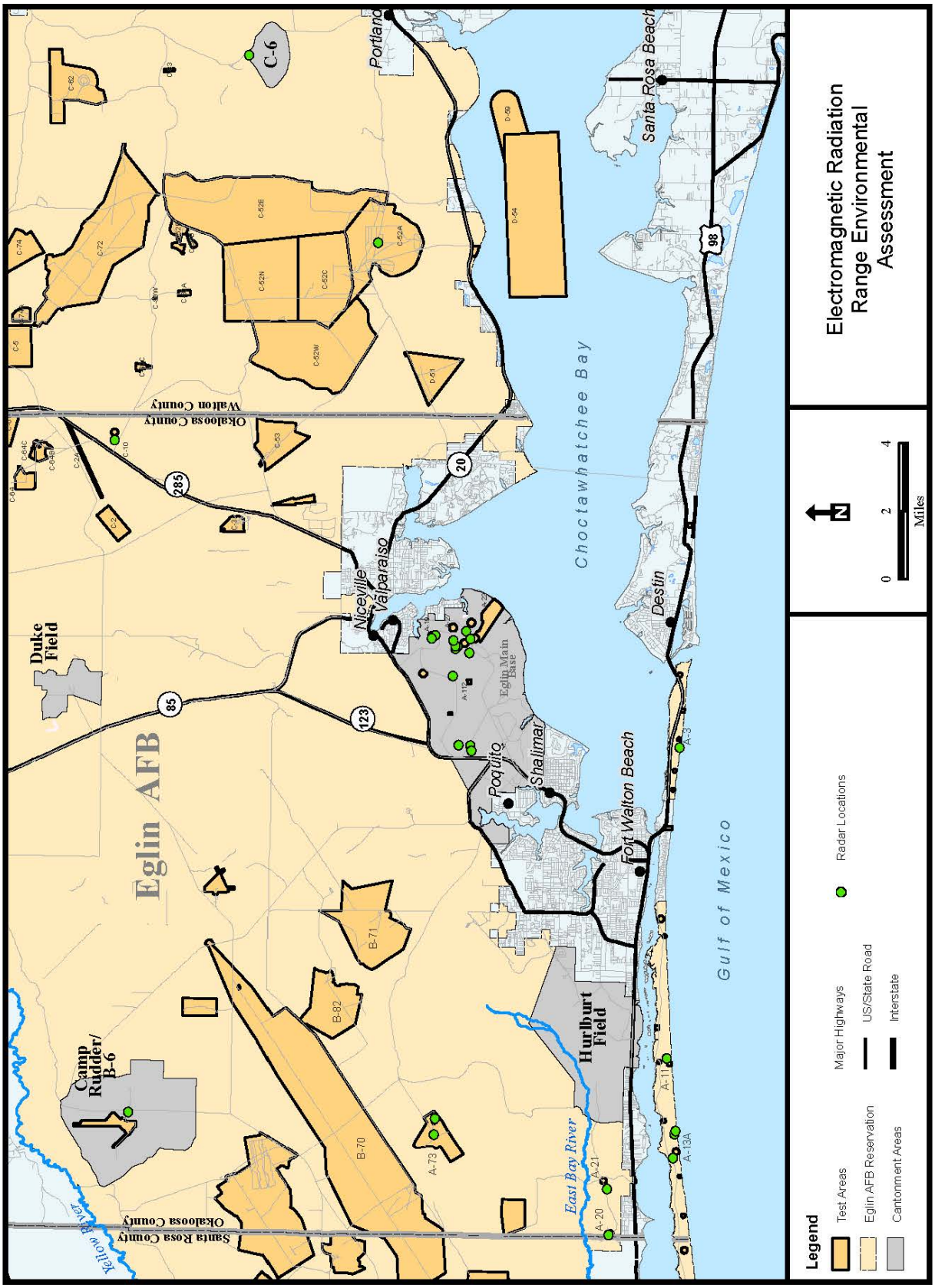

Figure 1-3. Location of Radar Systems on Eglin AFB, FL

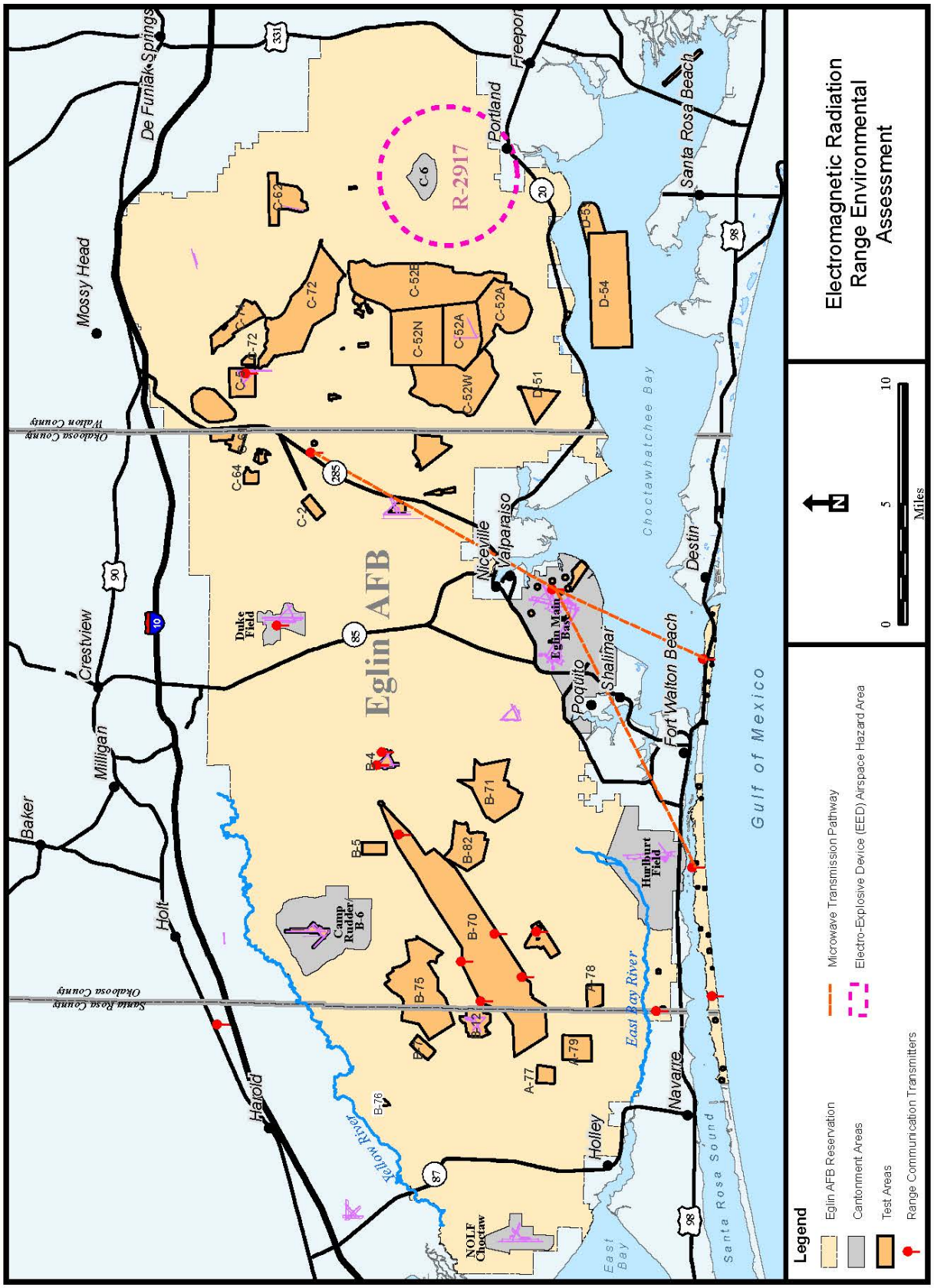

Figure 1-4. Location of Range Communication Transmitters on Eglin AFB, FL

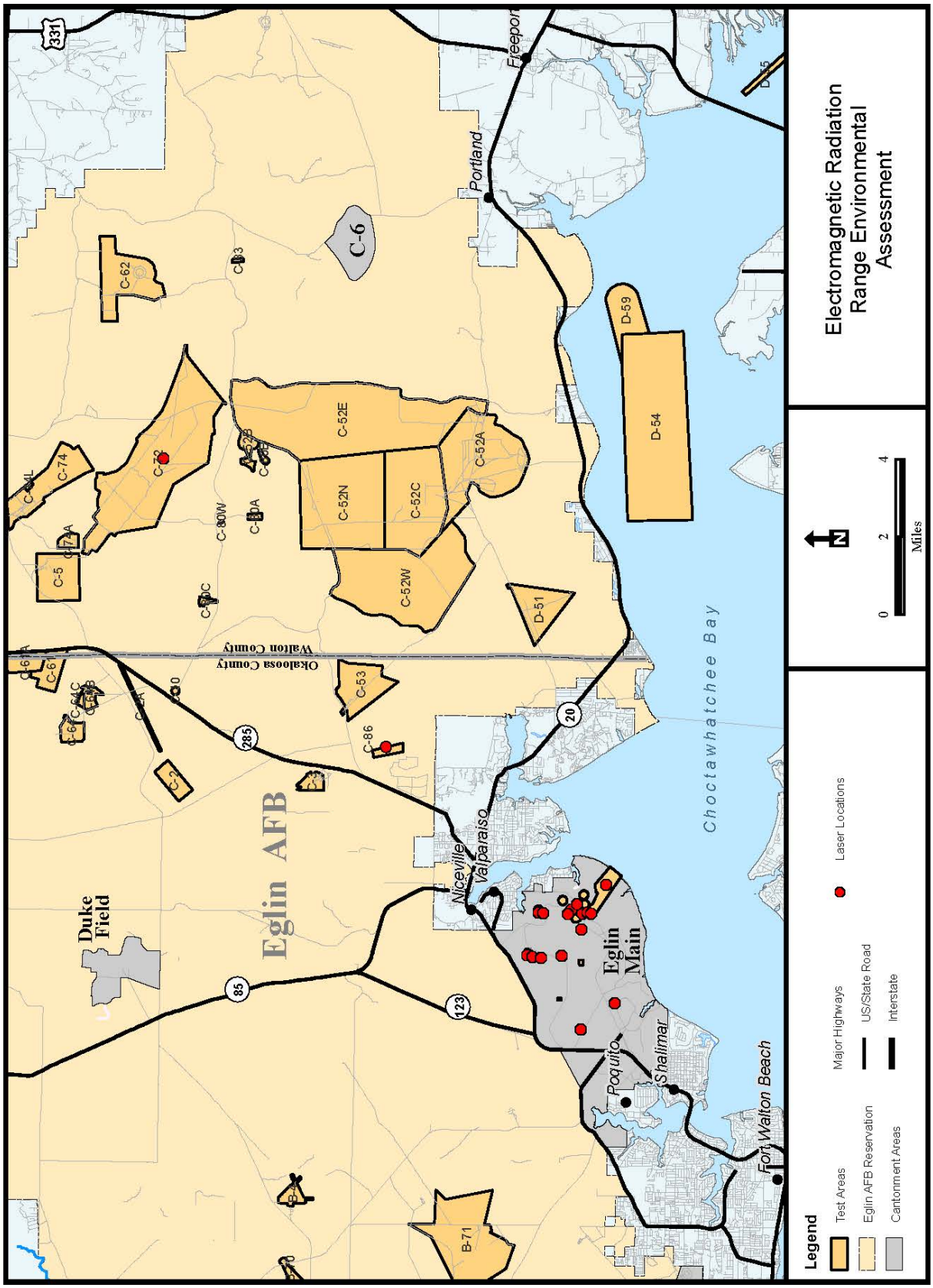

Figure 1-5. Location of Laser Systems on Eglin AFB, FL

The Eglin Range supports a variety of weapons system testing and range support facilities with a wide range of capabilities. The test areas are equipped with precision instrumentation for time-space-position-information (TSPI) data collection, microwave systems for data transfer, radio communication systems, and a large complex of threat simulators which supports the electronic countermeasures system testing in the Multi-Spectra Test and Training Environment (MSTTE). In addition, there are numerous range supports tenant units that may operate EMR sources.

Testing operations involving radar systems, microwave transmission systems and lasers are designed to test, verify, validate, demonstrate, or prove that the new or improved hardware, system, software, or tactics will work safely and accomplish the desired effect. Training missions are designed to teach, maintain, or increase the operator's proficiency to perform mission operations. The three previously mentioned testing and training EMR categories are described as follows:

- **Radar System Utilization** - These activities include the use of both stationary and mobile radar systems. These systems are used for collection of TSPI via reference radar systems, use of threat simulation radar systems to measure the effectiveness of electronic warfare items, and the use of imaging, EMR instrumentation, jamming, and radar simulation systems in support of flight testing and evaluation of sensor/seeker systems.

- **Communications Support and Data Relays** - These activities involve the use of both stationary and mobile microwave communication and data relay systems, all of which are used range wide. Mobile microwave transmitters extend control and data links to instrumentation sites in the absence of wire circuits or to satisfy other requirements. Stationary microwave systems connect separate range and site control centers to various control, data, and communications centers on Eglin Main.
- **Laser Use** - These activities involve the operation of various and numerous lasers for test and measurement programs in labs and on the Eglin ranges. The lasers are used for ground and aircraft-based fire control laser systems (rangefinders and target designators), target scoring, direct energy weapons, and alignment. Of the four classes of lasers, only two classes of lasers (Class 3 and Class 4) are analyzed within this REA as they have the potential to affect humans and biological resources. Lasers and laser systems are assigned one of four broad Classes (1 to 4) depending on the potential for causing biological damage (Purdue University, 2008). More detailed information pertaining to laser class designation and potential effects from usage is provided in Appendix B.

EMR sources are utilized by a wide variety of user groups on Eglin AFB. Radar systems are under the purview of the 96th Communications Group (CG)/SCXF and the Gulf Area Frequency Coordinator (GAFC) is responsible for coordinating field utilization of radio frequencies by all authorized users (i.e., military, government, and nongovernment). Lasers are monitored by Bioenvironmental Engineering (96 AMDS/SGPB), and the range certification is held by the 46th Range Support Squadron, Range Systems Flight (46 RANSS/TSRS). Communications support and data relay systems are managed by the 46 RANSS/TSRI (Range Instrumentation Flight).

A list of radar systems, communications transmitters, and lasers currently in use on Eglin AFB are depicted in Table 1-1, Table 1-2, and Table 1-3, respectively.

Table 1-1. Eglin Range Radar Systems

System	Site Location	Quantity	Height (feet)*	Human Hazard Distance (uncontrolled environment) (feet)
HPISS	A-11	1	86.487	413
MPQ-46 (I HAWK)	A-13	1	39.129	366
SADS III	A13A	1	N/A	117
AN/FPS-16 (SN #20)	A-20	1	93.198	2,336
AN/FPS-16 (SN #31)		1	91.368	
AN/FPS-16 (SN #32)		1	77.400	
AN/FPS-16 (SN #42)		1		
AN/FPS-16 (SN #39)	C-10	1	295.258	
AN/FPQ-13 (SN #17)	A-20	1	93.213	
SADS X	A-21A	1	124.110	1,171
WEST XIC	A-30	1	124.898	102
ROLAND		1	128.272	53
SADS VIIIR		1	125.174	191
WEST XR		1	127.486	112
SADS VIR		1	123.780	413
WEST IA		1	129.443	340
SADS IIR	A-31	1	136.860	254
WEIBEL	MOBILE	1	N/A	TBD
AN/FPS-85	C-6	1	138.400	- 4,000 above ground (when operated in the manual mode at 45 to 60 degrees below bore sight) - 100-150 at ground level when operated in manual mode - on face of antenna when operated in computer mode
Total Radar Systems		**19**		

Source: Higdon, 2009a
N/A = data not available; TBD = to be determined
* Height of antenna above mean sea level

Table 1-2. Eglin Range Communication Transmitters

Description	Range/Site Location	Height (feet[1])	Quantity
CTS-100 (Radar)	A-3 (Omni antennas)	64	2
	A-3 (Directional antennas)	35	1
ACATEL MDR-8000	A-10	150	2
	A-15A	100	2
	C-62	N/A	1
	C-1	195.600	1
	BLDG 44 Tower 49	180	4
	BLDG 44 Tower 79	140	4
	A-3	150	4
	A-20	185.750	2

Table 1-2. Eglin Range Communication Transmitters, Cont'd

Description	Range/Site Location	Height (feet[1])	Quantity
Motorola radio to Floridale	B-1 (north side of B-70)	304.520	1
Microwave Tower[2]	B-4B	331.880	1
	Field 1 (Near C-5)	377.970	1
	B-120A (South side of B-70)	302.720	1
Microwave Tower[2]	B-135 (South side of B-70)	303.666	1
	B-140 (North side of B-70)	282.270	1
	B-141 (North side of B-70)	348.460	1
	Duke Field (Field 3)	338.940	1
Microwave Tower	C-7 (near C-10)	346.110	1
90 ft. Microwave Tower	C-64	N/A	1
		Total Transmitters	**33**

Source: Scharmen, 2009
N/A = information not available
1. Transmitter height above mean sea level.
2. These towers do not have fixed EMR transmitters. However, they are fitted with mobile transmitters as needed for a specific testing event.

Table 1-3. Eglin Range Laser Systems[1]

Model Number	Range/Site Location	Type/Power	Quantity	NOHD (km)	Laser Classification
Lasers Used on the Eglin Range					
1110-Ider	C-86	-	1	N/A	3b
1110-Signal			1	N/A	4
APL-1			1	N/A	3a
B10-106Q			2	N/A	4
CFR 400			1	N/A	4
CFR 400 OPO			1	N/A	4
Compact Raman Shifted Laser			1	N/A	3b
Consultec			1	N/A	3a
FC/Q			1	N/A	4
HAC-HEAD			1	N/A	4a
HLS-3			1	N/A	4
Roadmaster			1	N/A	4
Seeker			1	N/A	4
TFR Pump			1	N/A	4
YVO4 Laser			1	N/A	4
Typical Fielded Military Lasers Certified for Use on Eglin Range					
Tank Mounted Systems					
AN/VVG-1	-	-	-	9.00	-
AN/VVS-1				9.00	-
AN/VVG-2				0.30	-
AN/VVG-3				0.00	-

Table 1-3. Eglin Range Laser Systems, Cont'd

Model Number	Range/Site Location	Type/Power	Quantity	NOHD (km)	Laser Classification
Man-Portable Systems					
AN/GVS-5	-	-	-	2.70	-
AN/TVQ-2				25.00	-
AN/PAQ-3				20.00	-
AN/PEQ-1	C-1	ND-YAG		10.00	-
Portable Lasers Currently in Use on the Eglin Range					
N/A	Portable	N/A	12	N/A	N/A
Helium-Neon (He-Ne)	Portable	N/A	3	N/A	N/A
1307 He-Ne	Portable	N/A	1	N/A	N/A
He-Ne 5mW	Portable	N/A	2	N/A	N/A
Nedynlum-YAG	Portable	N/A	2	N/A	N/A
57-2-208W	Portable	N/A	1	N/A	N/A
AN/TWQ-2	Portable	N/A	4	N/A	N/A
1107 He-Ne .8mW	Portable	N/A	3	N/A	N/A
1307P He-Ne .8mW	Portable	N/A	1	N/A	N/A
709, 1.064 Microns	Portable	N/A	1	N/A	N/A
76-5, .532 Microns	Portable	N/A	1	N/A	N/A
2340-C	Portable	N/A	1	N/A	N/A
IR, .845	Portable	N/A	1	N/A	N/A
5005	Portable	N/A	2	N/A	N/A
3305 DR	Portable	N/A	2	N/A	N/A
1603 SM	Portable	N/A	1	N/A	N/A
1603 SMX	Portable	N/A	1	N/A	N/A
Infrared Thermometer	Portable	N/A	3	N/A	N/A
Sonet Link Transport System	Portable	N/A	2	N/A	N/A
MP 1570A	Portable	N/A	1	N/A	N/A
GN Net Test	Portable	N/A	4	N/A	N/A
AN/TVQ-2	Portable	N/A	4	N/A	N/A
Total Laser Systems			**69**		

Source: Moyer, 2009

He-Ne = helium-neon; km = kilometers; mW = megawatt; N/A = information was not available; NOHD = nominal ocular hazard distance

1. Table lists only those lasers that are used on the range for which information was available. There are also many lasers used within the confines of laboratories that are not of concern in this document as well as many Class 1 and Class 2 lasers that are not analyzed within the REA.

The Final PEA for EMR (U.S. Air Force, 2002a) and the 2003 EMR EBD (U.S. Air Force, 2003a) identified two primary EMR sources that are part of the instrumentation systems that support the Eglin land test range and those systems operated by tenant units. These EMR sources are still in use at Eglin and are as follows:

- 46 TW – Land Range Instrumentation Systems
- 20th Space Control Squadron (20 SPCS) – Phased Array Radar

1.3.1 46th Test Wing – Land Range Instrumentation Systems

Eleven range instrumentation systems are identified as being presently used to support land range testing. This section provides a summary of those range instrumentation systems. EMR emitters employed as part of the particular instrumentation package are identified, where appropriate. The range systems are as follows:

- TSPI Systems
- Reference Radars
- Optical Systems
- Advanced Range Data System (ARDS) Global Positioning System (GPS) TSPI
- Data Handling Systems
- Threat Radar Systems
- Telemetry Systems
- Electro-Optical/Millimeter Wave Instrumentation
- Communications Support
- Remote Vehicle Control
- Threat Missile Plume Simulators (Mallina)

Time-Space-Position-Information Systems

The Eglin Range supports a wide and varied array of weapons systems testing. In support of this testing, the land ranges are equipped with specific instrumentation to collect TSPI information data from radar, RF (part of the EMR frequency spectrum) multilateration, and optical/laser systems.

Reference radars and GPS based land, sea, and air instrumentation systems provide real time TSPI. Nonreal time TSPI is provided by optical trackers (cinetheodolites) and the laser ranging tracking cinesextant (LTRC). Multilateration tracking is accomplished using multiple airborne and/or ground-based stations to monitor test system RF communication (timing information) transmissions and the GPS to provide direct position/velocity data. EMR sources contained within these instrument packages are the reference radars, LTRC, and data link transceivers used in the ARDS TSPI system.

Reference Radar Systems

Reference radars are located at three sites as shown in Table 1-2. These units provide coverage of the western part to the southern-most part of the Eglin Test Range and allow airborne objects to be tracked throughout the entire range. Radars provide range, azimuth, and elevation data.

The AN/FPS-16 radar is designed specifically to provide space position data to evaluate airborne object performance. It has the capability of acquiring and tracking missiles, rockets, aircraft, nose cones, boosters, tankage assemblies, instrumentation packages, and debris. It also has the

capability of providing test object trajectory data for real-time use or future performance evaluation. There are seven of these units in the inventory.

The AN/FPQ-13 radar is a modified AN/FPS-16. This system provides increased tracking range, higher transmitter peak power output, and real-time high accuracy data capability. There is one AF/FPQ-13 located at Test Area A-20.

In addition, Site A-13A maintains a Simulated Air Defense System (SADS) III radar system.

Optical Systems

Optical systems provide a wide variety of data products to include:

- Precision TSPI
- Engineering sequential photography
- Photogrammetric configurations
- Base-line data for calibration of other TSPI systems
- Operational aids

The optical systems consist of a wide range of data collection instrumentation packages that can be operated in local or remote configurations throughout the Eglin Range. The one optical system that is capable of EMR emission is the LRTC. This system consists of a cinesextant modified to carry a laser ranger and tracker. The system is mobile across land and is air deployable. It is capable of measuring the TSPI of a cooperative airborne target (aircraft, bomb, missile, rocket, etc.).

Advanced Range Data System GPS TSPI

The ARDS and ARSD Lite provide the capability to simultaneously track multiple aircraft or any participant carrying an instrumentation package as well as multiple land target vehicles over the entire Eglin land range and part of the water range. The EMR sources are the data link transponders installed on target airborne, ground, and water vehicles and the data link transmission system (antenna tower) for collecting and relaying data to/from participating vehicles.

Data Handling Systems

Data handling systems are used with all range reference radars to provide a means of collecting electronic tracking data within the instrumentation complex and delivering it in a convenient and useful format. Data is recorded on appropriate media at the sites and/or transmitted immediately via microwave to a central control facility. EMR sources associated with the various data handling systems are the microwave transmission units.

Threat Radar Systems

The AAC maintains and operates the MSTTE which provides an open-air, threat air defense system environment for test and evaluation of electronic warfare systems, components, and

techniques. It also provides a threat environment for training of air crews. The MSTTE consists of the following two types of threat system.

- **Simulated Air Defense System (SADS)** – Short, medium, and long range air defense missile systems.
- **Weapons Effectiveness Simulator Threat (WEST) Systems** – Short range air defense gun control systems.

All of the threat radar systems are considered to be EMR emitters.

Telemetry Systems

The Range Telemetry Complex operates from several strategically located fixed locations and mobile vans. Most of the telemetry equipment is housed in special buildings at Sites B-4A, B-4B, and D-3. Each fixed site is equipped with three 16-foot high gain parabolic receiving antennas. Telemetry sites have the capability of transmitting data by way of microwave data links. The microwave transmitters are considered the only EMR sources associated with the telemetry systems.

Electro-Optical/Millimeter Wave Instrumentation

The Electro-Optical/Millimeter Wave (EO/MMW) Instrumentation Division provides the capability to design, fabricate, assemble, calibrate, and operate unique EO and MMW instrumentation packages to support range test activities. Instrumentation is available to measure target and background radiation/reflectivity in the ultraviolet, visible, infrared, laser wavelengths, and MMW frequencies. The primary requirement is to support terminally guided-weapons testing and counter-countermeasure tests associated with the terminally guided weapons. The following instrument systems used by the EO/MMW Instrumentation Division utilize EMR transmitters.

Seeker Test Van. This system is a self-propelled, self-contained, air transportable ground-based data collection platform designed for development and exploitation of ground-to-air and air-to-air seekers, assessment of countermeasure effectiveness, and development of countermeasure techniques and tactics. The van is configured with range-only radar that produces real-time slant range to the target. This radar is considered to be an EMR source.

Advanced MMW Imaging Radar System (AMIRS). This system is designed for Radar Cross Section measurements of full-scale vehicles in a field environment. Frequencies supported are: 7 gigahertz (GHz), 10 GHz, 17 GHz, 35 GHz, and 95 GHz. The AMIRS radar system is considered a source of EMR.

Millimeter Wave Radar Obscurant Characterization System. This instrument package consists of two high power and two low power radar systems designed for attenuation and backscatter measurements of aerosols, obscurants, and chaff. These radars are considered sources of EMR.

Lynx Synthetic Aperture Radar System. This is an airborne Synthetic Aperture Radar system that generates imagery of ground targets using 17 GHz AN/APY-8 radar. Raw radar data can also be collected and recorded. The Lynx Synthetic Aperture Radar system is considered a source of EMR.

Dynamic AMIRS. This MMW radar system is mounted on a 100 foot tall mobile platform. It is a coherent 35 GHz imaging radar that can be used to collect background clutter data, as well as Inverse Synthetic Aperture Radar (I-SAR) imagery data. Dynamic AMIRS is considered a source of EMR.

MMW Jamming Systems and Radar Simulators. These systems are designed to support captive flight testing of sensor/seeker systems. Both the jamming systems and the radars are considered sources of EMR.

Laser Sources. The EO/MMW Instrumentation Division and other tenant/visiting organizations operate numerous lasers for test and measurement programs in the lab and on the Eglin ranges such as Test Area C-86, a major laser test site possessing both indoor and outdoor laser test capabilities. Test Area C-86 performs laser characterization tests for optical systems and millimeter wave testing. The lasers are used for alignment, holography, and in tactical operations as ground-based target designators. An Imaging Laser Radar Instrumentation System (ILRIS) is also used to collect XYZ position data on ground targets. The ILRIS laser is eye-safe and is used predominantly at the Seeker Test and Evaluation Facility on range C-52A. These lasers are EMR emitters.

Communications Support

The communication systems on the ranges are made up of both permanent and portable wire, radio, and microwave equipment which allow any part of the Eglin Range (land or water) to be used as a separate facility or to be tied together as one large test and development complex. A typical communication configuration has a control center with voice control and instrumentation circuits connected to remote instrumentation sites. Portable microwave transmitters extend control and data links to instrumentation sites in the absence of wire circuits or to satisfy other requirements. Fixed microwave connects separate range and site control centers to various control, data, and communications centers on Eglin Main.

Radio Communications. An assortment of radios is used throughout the Eglin Test Range to support test missions. Radio types include:

- Ultra-High Frequency (UHF) air-to-ground
- Very High Frequency (VHF) point-to-point, air-to-ground, remote control of various types of equipment, and data collection
- High Frequency (HF) point-to-point and air-to-ground

Transmitting radios are considered to be sources of EMR.

Microwave Systems. Microwave systems provide the primary data links between the various ranges/sites. Microwave transmitters are considered sources of EMR.

Transportable Communication Systems. Transportable systems are used to provide communications at remote sites not located near a fixed microwave or landline system. Included in this category are the closed circuit television systems. These communication systems are considered to be sources of EMR.

Remote Vehicle Control

UHF Remote Vehicle Control Systems are designed for installation in remotely controlled vehicles and aircraft drones on land and sea test ranges. Command control of remotely piloted vehicles is accomplished by transmitting command code utilizing a UHF radio transmitter. The UHF transmitter associated with this system is considered a source of EMR.

Command-Control Systems. The command and control function is provided by a UHF command-guidance system that provides the command link for remotely controlling unmanned airborne drones and missiles from ground stations. The primary systems are located at Sites A-3 and D-3. These systems are primarily used to provide a destruct system for drones and missiles. These UHF communication systems are considered to be sources of EMR.

Threat Missile Plume Simulators

The Threat Missile Plume Simulator (Mallina) is a ground-based ultraviolet (UV) system which emits the UV energy required to induce threat declaration by an aircraft-installed UV Missile Warning Sensor by reproducing the appropriate UV missile plume signature phases (i.e., eject, ignition, boost, sustain, postburn) of various Man Portable Air Defense Systems (MANPADS) and other surface-to-air missiles. The Mallina is an EMR emitter.

1.3.2 20th Space Control Squadron (21st Space Wing of the Air Force Space Command)

Also known as Site C-6, the 20 SPCS is located approximately 35 miles east of Eglin Main. The 20 SPCS executes a space control mission by performing all-weather, day-night location and tracking of man-made objects, and supports the commander, Air Force Space Command, and theater warfighters' requirements through continuous surveillance of orbiting satellites. The 20 SPCS operates and maintains the AN/FPS-85 Phased Array Radar, the only phased array radar dedicated to tracking more than 16,000 near-earth and deep-space objects (U.S. Air Force, 2008a). The AN/FPS-85 Phased Array Space Surveillance Radar provides space situational awareness for U.S. Strategic Command's space control mission area. It is one of 29 sensors that comprise the global Space Surveillance Network (SSN) and is the only phased array radar dedicated to space surveillance. It collects more than 16 million observations of satellites per year, accounting for 30 percent of the SSN's total workload (U.S. Air Force, 2008a). The AN/FPS-85 Phased Array Radar covers 120 degrees in azimuth and in excess of 22,000 nautical miles in range and is considered an EMR emission source.

1.4 DECISION DESCRIPTION

The 46 TW wishes to authorize a new level of activity, updating the current EMR environmental baseline and established hazard zones (where applicable) by including current or new EMR systems on Eglin AFB that have been added, removed, upgraded, or relocated since the 2002 EMR PEA, as well as to address projected future EMR systems and the process to approve future systems. A decision is to be made on the *level* of EMR activity to be authorized and the process by which to authorize future EMR systems. By authorizing a new level of activity and analyzing the effects of this new level of activity, future similar actions may be categorically excluded from further environmental analysis. This will save both time and money in the review of proposed actions and will enable users to access the range more quickly and efficiently.

1.5 ISSUES

Specifically, an issue may be the result of a mission activity or land use activity that may directly or indirectly impact physical and biological environment resources. A *direct* impact is a distinguishable, evident link between an action and the potential impact, whereas an *indirect* impact may occur later in time and/or may result from a direct impact.

Potential environmental impacts of alternative actions on Eglin AFB resources from EMR emissions were identified through preliminary investigation. Resource areas eliminated from further analysis are discussed in Section 1.5.1. Resource areas identified for detailed analysis are described in Section 1.5.2, with narratives providing a summary of the preliminary screening for potential impacts.

1.5.1 Resource Areas Eliminated from Detailed Analysis

Land Use

Land use generally refers to human management and use of land. Specific uses of land typically include residential, commercial, industrial, agricultural, military, and recreational. Land use also includes areas set aside for preservation or protection of natural resources, wildlife habitat, vegetation, or unique features. No change to current land uses from EMR emissions is expected; therefore, land use is not analyzed further in this REA.

Soils

Soils are primarily affected by land disturbing activities such as the construction of new facilities or the clearing of sight lines; however, these types of activities are outside the scope of this document. There would be no digging or excavation associated with EMR activities discussed in this document and EMR emissions are not expected to impact Eglin AFB soils; therefore, soils are not further analyzed.

Environmental Justice/Special Risks to Children

Potential impacts include those that would expose low-income and minority populations to disproportionate negative impacts or pose special risks to children (under 18 years old)

associated with exposure to EMR emitters. The socioeconomic receptors also include nearby communities and property that could potentially be impacted by EMR exposure. Since the EMR hazard areas do not extend off Eglin AFB, it is expected that there would be no impacts to low-income/minority populations or special risks to children; therefore, they are not further analyzed in this REA.

Water Resources

Although present throughout the ROI, water resources (wetlands, floodplains, and surface waters) would not be impacted by EMR emissions; therefore, they are not further analyzed in this REA.

Cultural Resources

Potential effects to cultural resources would include disturbance or destruction of sites or artifacts. All EMR activities would avoid areas of known cultural resources. Further, EMR emissions would not be expected to have an impact on any cultural resources; therefore, they are not further analyzed in this REA.

Air Quality

Emissions of EMR would not introduce any particulates into the air; therefore, no impacts to air quality are anticipated and air quality is not further analyzed.

Noise

Noise is defined as the unwanted sound produced by mission activities. Noise may directly inconvenience and/or stress humans and some wildlife species and may cause hearing loss or damage. Noise from EMR emissions would not be expected to have an impact on physical or biological resources on Eglin AFB; therefore, impacts from noise are not further analyzed in this REA.

Chemical Materials/Debris

The use of EMR would not cause the introduction of any chemical materials or debris into the environment; therefore, chemical materials/debris is not further analyzed in this REA.

Environmental Restoration Program Sites

The Air Force Environmental Restoration Program (ERP) is designed to identify, investigate, and cleanup contamination associated with past Air Force activities at active Air Force installations. ERP sites are located across Eglin AFB. All EMR activities would avoid ERP site locations; therefore, they are not further analyzed within this REA.

1.5.2 Resource Areas Identified for Detailed Analysis

Safety/Restricted Access and Human Exposure

Safety involves hazards to military personnel and the public resulting from mission activities. Restricted access is typically the result of safety considerations. Restricted access applies to the restriction of public access, described in terms of the availability of Eglin AFB resources (such

as test areas, interstitial/recreational areas, or public roads) to the general public. Receptors potentially impacted include military personnel and the public desiring to use these areas. Due to the potential for hazardous human exposure from EMR activities, potential safety issues are analyzed within this REA and measures to reduce the potential for impacts are identified, where appropriate.

Human exposure is defined as exposure to hazardous levels of EMR that would result in adverse biological effects. Hazardous human exposure may result in a number of unique biological effects that are dependent upon the emission source (i.e., radar beam exposure versus laser exposure) and the intensity and duration of the EMR exposure. The effects of EMR on certain biological systems are well documented, with various studies having been conducted on laboratory animals in order to determine hazard safety levels for humans. These hazard safety levels, referred to as Permissible Exposure Limits (PELs), are used to develop safety standards for the operation and maintenance of EMR emitters. As a result of these PELs, numerous regulations (Occupational Safety and Health Administration [OSHA], DoD, Federal Communications Commission [FCC]) and operational safety measures have been enacted in order to prevent hazardous EMR exposure to humans. Refer to Appendix B for a more detailed discussion of PELs.

In addition, this document evaluates possible impacts from EMR emitted by cell phones and associated base stations, high voltage power transmission lines, and EMR effects on electroexplosive devices (EEDs) and fuel stations.

Electroexplosive Device and Flammable Liquid Hazards

EEDs are small pyrotechnic or explosive devices that are ignited electrically by the passage of an electric current through them, igniting an explosive charge. Many of these devices are initiated by low levels of electrical energy and are susceptible to unintentional ignition by many forms of direct or induced stray electrical energy, including RF radiation. Flammable liquids, more specifically the vapors from flammable liquids, also pose a potential hazard if exposed to RF radiation. Petroleum, oil, and lubricant (POL) products are commonly used on Eglin AFB. An electrical arc produced by RF radiation under the right conditions has the potential to ignite flammable vapors from these POLs. The circumstances contributing to EED and flammable liquid ignition from RF radiation, as well as preventative safety measures utilized by Eglin AFB, are analyzed in order to assess the potential occurrence of such hazards.

An airspace EED hazard area exists on Eglin AFB at Site C-6 (refer to Figure 1-4). According to the Eglin AFB Range Safety Office, this EED hazard area exists from 0 to 23,000 feet above mean sea level (MSL) and is located within designated military airspace R-2917 (Chesser, 2009). The Eglin AFB Range Safety Office regularly communicates with pilots to ensure they do not fly directly over the radar located within the hazard area.

The airspace EED hazard area does not pose a threat to personnel or humans on the ground. This conclusion is based on a study conducted at Site C-6 during the 1990s by Keesler AFB personnel (Chesser, 2009). Extensive radiation measurements were taken at various points both on and off of Eglin AFB at 6 feet above ground level (AGL) to determine the presence of hazardous levels of EMR exposure. Of all the locations studied, there was only one location that registered EMR,

and it was directly in front of the radar antenna at Site C-6 (Chesser, 2009). As the radar system at Site C-6 regularly undergoes maintenance, radiation measurements are routinely taken at the site. Therefore, the Eglin AFB Range Safety Office would be made aware of any potential hazards on the ground to humans or personnel from EED at Site C-6.

Biological Resources

Any mission activities involving the use of EMR emitters create the potential for direct physical impact to biological resources on Eglin AFB via exposure to hazardous levels of EMR. The operational parameters of the various EMR emitters utilized on Eglin AFB are analyzed in order to determine what, if any, potential direct physical impacts exist to wildlife, including threatened/endangered species and critical habitats as designated by the Endangered Species Act (ESA).

Based on the operational parameters of EMR emitters, it is unlikely that vegetation would be affected by EMR activities. The transmission of RF waves occurs in a specific path/direction from one microwave telemetry system to another. In order for this to occur properly, and without interruption, the path must be completely free of obstructions. For this reason, any transmission of microwaves must occur either above the tree line or along a cleared path and therefore, vegetation would not be exposed to EMR (U.S. Air Force, 2002a). For radar testing events, a clear line-of-sight must be present in order for the system to work properly, without interruption. The line-of-sight must also be clear of obstructions, including trees. Additionally, laser testing requires the projection of a system-to-target beam, which travels along a selected path, or line-of-sight. Obstructions such as trees would interrupt the beam's trajectory, thereby affecting testing (U.S. Air Force, 2002a). Due to these factors, exposure to vegetation from the three sources of EMR is highly unlikely and impacts to vegetation (i.e., rare plants, trees) are not further addressed within this REA.

1.5.3 Other Areas Not Further Analyzed in the Range Environmental Assessment

Electromagnetic Radiation Emissions from Aircraft

Exposure to hazardous levels of EMR can occur from ground-based radar/laser systems and aircraft radar and laser systems. However, it is unlikely that emissions from aircraft pose any threat to humans (or other biological organisms). Use of potentially dangerous lasers (Class 3B and Class 4) is tightly controlled and under the strict guidance of the Eglin AFB Risk Management Board (RMB) to ensure the safety of both civilians and Air Force personnel. The chance of hazardous EMR exposure from aircraft radar use is extremely small due to the nature of the circumstances needed for the occurrence of hazardous exposure from a radar beam. Aircraft are usually flying much too fast to allow for anything other than the target being tracked to be exposed for more than a few seconds. Additionally, with hazard distances of a few hundred feet, an aircraft would need to be in very close proximity to a biological organism for it to be put within the hazard distance of the radar beam. Due to these factors, it is logical to conclude that hazardous exposure to humans or wildlife from aircraft EMR does not pose any significant threat, and is therefore determined to be a nonissue and is not further analyzed in this REA.

Communications Interference

Communications interference is a concern when dealing with EMR and RF sources. However, according to the GAFC, interference between civilian and military communications equipment is not a frequent occurrence. Local radio stations are sometimes affected, and small Part 15 unlicensed communications devices pose a small problem. The 46th Test Wing/Operations and Support Squadron (46 TW/OSS) at the AAC schedules the frequency resources on the Eglin Test and Training Range Complex (ETTC) which comprises approximately 136,000 mi^2 of air space and 724 mi^2 of land range areas. The 46 TW/OSS also coordinates radio, radar, telemetry, electronic countermeasures, and other radiating devices with using agencies in order to preclude spectral conflicts for all operational test and training missions. The GAFC consistently monitors for interference, and frequency management is tightly controlled in the GAFC's 313,000 mi^2 Area of Responsibility which includes 24 military installations including the ETTC. Radiation Frequency Interference (RFI) to military operations from the civil sector is investigated by the GAFC in conjunction with the FCC (Higdon, 2009b). Reported cases of RFI to military operations caused by military operations are investigated by the GAFC and the 46 OSS. Detected interference, both from outside (civil sector) sources or from within the ETTC, is mitigated promptly and the issue is resolved in a timely manner. For this reason, interference is not an issue warranting further investigation in this document.

1.6 FEDERAL PERMITS, LICENSES, AND ENTITLEMENTS

Because of the nature of this REA, it is unknown what specific actions (relocation, addition, or upgrade of EMR generators) may take place in the future. However, any future EMR actions such as those involving construction or land disturbance would comply with all pertinent federal, state, and local permitting requirements (air, storm water, drinking water, etc.). The installation of any new microwave, radar system, or any other RF emitter on Eglin AFB requires the system to be certified in accordance with the National Telecommunications and Information Administration spectrum allocation/certification process as described in AFI 33-118 and Air Force Manual (AFMAN) 33-120. Upon completion of the certification process and receipt of a J/F-12, a frequency assignment will be requested from the Air Force Frequency Management Agency. Following receipt of the assignment, a Radio Frequency Authorization will be issued from the 96 CG/SCXF for operation on Eglin AFB.

Some components of the Proposed Action would take place within or otherwise may affect the jurisdictional concerns of the Florida Department of Environmental Protection and therefore, will require a consistency determination (Appendix E) with respect to Florida's Coastal Zone Management Plan under the Federal Coastal Zone Management Act.

Any potential impacts to biological resources, specifically threatened and endangered species and their critical habitats, as defined by the ESA, would be evaluated on a case-by-case basis through the AF Form 813 process and a determination would be made if an ESA Section 7 consultation with the U.S. Fish and Wildlife Service (USFWS) would be required.

2. ALTERNATIVES

2.1 INTRODUCTION

This section introduces the alternatives that are evaluated for potential environmental impacts in this REA for activities involving EMR emitters on Eglin AFB. The proposed alternatives analyzed in this document are:

- **No Action Alternative:** This is the baseline level of activity as defined by the Preferred Alternative (Alternative 3) in the 2002 EMR PEA (U.S. Air Force, 2002a).
- **Alternative 1:** This alternative is defined as the baseline defined in the 2002 EMR PEA (U.S. Air Force, 2002a) plus the removal, relocation, addition or upgrade of any EMR emitter systems since the 2002 EMR PEA (U.S. Air Force, 2002a).
- **Alternative 2 (Preferred Alternative):** This alternative is defined as Alternative 1 plus the inclusion of projected future systems and the process to approve future EMR systems on Eglin AFB.

A brief description of each alternative, including the alternative-specific activities, is provided in the following section.

2.2 ALTERNATIVES CONSIDERED

The alternatives considered for analysis were determined during an interdisciplinary meeting at Eglin AFB, which included, but was not limited to, representatives from the 46 TW/Plans Office (46 TW/XPX), the 96 CEG/Environmental Analysis Section (CEVSP) and the 96 CEG/Natural Resources Section (CEVSN). The alternatives chosen were a result of discussions on how foreseeable future activities will expand Eglin AFB's testing support requirements in the upcoming years.

The No Action Alternative and Alternative 1 are at risk of being insufficient to account for the expected growth of testing activities at Eglin AFB over the next 10 years. Therefore, in order to adequately cover the environmental analysis needed to support future testing requirements as they occur and to establish a process to screen future EMR requests through the AF Form 813 process, Alternative 2 was selected as the Preferred Alternative. There were no alternatives eliminated from detailed analysis.

2.2.1 No Action Alternative

The No Action Alternative is defined as authorizing the baseline approved in the 2002 EMR PEA (U.S. Air Force, 2002a), which established the environmental baseline as site-specific EMR locations such as the 46 TW range instrumentation systems and the phased array radar operated by the 20 SPCS, as well as, the total aggregate volume of EMR hazard space on Eglin AFB. The environmental baseline also prescribed guidelines to screen future EMR requests through the AF Form 813 process when any future activity involving an EMR emitter would change the baseline parameters and to ensure site-specific best management practices (BMPs) were implemented that

would minimize the risk of adverse exposure to hazardous levels of EMR for anthropogenic and biological resources on Eglin AFB. Table 2-1 shows the environmental baseline under the No Action Alternative.

Table 2-1. No Action Alternative – Eglin AFB Electromagnetic Radiation Emitters: Previously Approved Environmental Baseline

Electromagnetic Radiation (EMR) System	Site Location	Quantity	Human Hazard Distance (uncontrolled environment) (feet)
Eglin Range Radar Systems			
AN/MPS-19	A-3	1	255
HPISS	A-11	1	413
NIKE TRR/CROATALE	A-13	2	288
NIKE TTRV	A-13	1	229
MPQ-46 (I HAWK)	A-13	1	366
SADS II	A-13	1	117
AN/FPS-16 (SN#20)	A-20	1	2,336
AN/FPS-16 (SN#31)	A-20	1	2,336
AN/FPS-16 (SN#32)	A-20	1	2,336
AN/FPS-16 (SN#42)	A-20	1	2,336
AN/FPS-16 (SN#39)	C-10	1	2,336
AN/FPS-16 (SN#23)	D-3	1	2,336
AN/FPS-16 (SN#27)	D-3	1	2,336
AN/FPQ-13 (SN#17)	A-20	1	2,336
SADS X	A-21A	1	1,171
WEST XIC	A-30	1	102
ROLAND	A-30	1	53
SADS VIIIR	A-30	1	191
WEST XR	A-30	1	112
SADS VIR	A-30	1	413
WEST IA	A-30	1	340
SADS IIR	A-31	1	254
FPS-85	C-6	1	-4,000 above ground (when operated in the manual mode at 45 to 60 degrees below bore sight) -100 to 150 at ground level when operated in manual mode -on face of antenna when operated in computer mode
Total Radar Systems No Action Alternative		**24[a]**	
Eglin Range Communication Transmitters			
EMR System	**Site Location**	**Quantity**	
CTS-100	A-3, D-3	1 each site	
FCA Station EMVI	A-6	1	
FCA Station (Mobile)	A-6	1	
DF-1 Antenna	A-6	1	

Table 2-1. No Action Alternative – Eglin AFB Electromagnetic Radiation Emitters: Previously Approved Environmental Baseline, Cont'd

Electromagnetic Radiation (EMR) System	Site Location	Quantity	Human Hazard Distance (uncontrolled environment) (feet)
Microwave Collins MDR8-5N	A-10, B-4B, D-3	1 each site	
Microwave Collins MDR-8	A-20	1	
Microwave Collins MVR-8GW	B-1, B-4B, C-1, Field 1, D-3	1 each site	
Telemetry Station	D-3, B-4A, B-4A (Mobile), B-4B	1	
CCTV Tracker	B-4B	1	
FCA Station	D-3	1	
Microwave Tower	B-120A, B-135, B-140, B-141, Duke Field (Field 3), A-15A	1 each site	
TM Tower	C-7	1	
90 foot Microwave Tower	A-15	1	
90 foot Microwave Tower	C-64	1	
RF Mulitlateration Systems	A-73, B-70, B-71, B-75, B-82, C-5, C-52, C-62, C-72	Numerous	
Total Range Communication Transmitters No Action Alternative		**29[a]**	
Eglin Range Laser Systems[1]			
Model Number	**Site Location**	**Quantity**	**Laser Classification**
1110-Ider	C-3	1	3b
1110-Signal	C-3	1	4
APL-1	C-3	1	3a
B10-106Q	C-3	2	4
CFR 400	C-3	1	4
CFR 400 OPO	C-3	1	4
Compact Raman Shifted Laser	C-3	1	3b
Consultec	C-3	1	3a
FC/Q	C-3	1	4
HAC-HEAD	C-3	not available	4a
HLS-3	C-3	1	4
Roadmaster	C-3	1	4
Seeker	C-3	1	4
TFR Pump	C-3	1	4
YVO4 Laser	C-3	1	4
Total Eglin Laser Systems No Action Alternative		**15[a]**	

a. Estimated total based on data in the 2002 EMR PEA.

1. Table lists only those lasers that are used on the range for which information was available in the 2002 EMR PEA. There are also many lasers used within the confines of the laboratories that were not of concern for analysis in the 2002 EMR PEA, and many portable lasers used on the range for which information was not available.

2.2.2 Alternative 1: Authorize the Current Environmental Baseline Including the Removal, Relocation, Addition, or Upgrade of Any EMR Emitters Since the 2002 EMR PEA

Alternative 1 would authorize the current environmental baseline, including the removal, relocation, addition, or upgrade of any EMR emitter systems on Eglin AFB since the 2002 EMR PEA was completed. The following changes pertaining to EMR emitters on Eglin AFB have occurred since the 2002 EMR environmental baseline was designated:

Range Radar Systems:

- The AN/MPS-19, previously located at Site A-3, is no longer in operation.
- The HPISS radar at Site A-11 was moved from 27.485 feet above MSL to 86.487 feet above MSL.
- The NIKE TRR/CROTALE, previously located at Site A-13, is no longer in operation.
- The NIKE-TTRV, previously located at Site A-13, is no longer in operation.
- The SADS II located at Site A-13 is now correctly identified as a SADS III and is in operation at Site A-13A.
- The WEIBEL, a mobile radar system, is now in operation at Eglin AFB.
- Two AN/FPS-16 radar systems located at Site D-3 and previously included in the 2002 EMR environmental baseline have been omitted from inclusion in this REA since they are located at Cape San Blas. These radar systems will be addressed separately in a future update to the Cape San Blas REA.

Range Communication Transmitters:

- Multilateration systems that were identified in the 2002 EMR PEA are no longer in use at Eglin AFB.
- FCA Stations identified at Site A-6 and Site D-3 in the 2002 EMR PEA were determined not to be sources of EMR as they function solely as receivers and subsequently, do not emit EMR. Therefore, they have been removed as part of the EMR baseline.
- Two additional CTS-100 antennas have been identified and are located at Site A-3.
- The CCTV Tracker identified at Site B-4B in the 2002 EMR PEA was determined not to be a source of EMR as it functions solely as a receiver and subsequently, does not emit EMR. Therefore, the CCTV Tracker has been removed as part of the EMR baseline.
- Telemetry systems, identified at Sites D-3, B-4A and B-4B in the 2002 EMR PEA, were determined not to be sources of EMR as they function solely as receivers and subsequently, do not emit EMR. Therefore, all telemetry systems have been removed as part of the EMR baseline.

- The DF-1 Antenna identified at Site A-6 in the 2002 EMR PEA was determined to not be a source of EMR as it functions solely as a receiver and subsequently, does not emit EMR. Therefore, the DF-1 antenna has been removed as part of the EMR baseline.

Range Laser Systems:

- Table 2-1 identifies a group of lasers that were located at Site C-3 during the 2002 EMR PEA environmental baseline. These lasers are operated by the Air Force Research Laboratory (AFRL) and have moved to Site C-86.
- Since the 2002 EMR PEA environmental baseline, new information has become available pertaining to portable lasers on Eglin AFB. These portable lasers are identified in Table 2-1.
- Laser systems previously designated at Test Area C-64 are categorized as Class 1 and Class 2 lasers. Therefore, they are not of concern for analysis in this document as they pose no human hazard potential or potential to impact biological resources.

Table 2-2 shows the locations of EMR emitter sources on Eglin AFB under Alternative 1.

Table 2-2. Alternative 1 – Eglin AFB Electromagnetic Radiation Emitters: Current Environmental Baseline

Electromagnetic Radiation (EMR) System	Site Location	Quantity	Human Hazard Distance (uncontrolled environment) (feet)
Eglin Range Radar Systems			
HPISS	A-11	1	413
MPQ-46 (I HAWK)	A-13	1	366
SADS III	A-13A	1	117
AN/FPS-16 (SN#20)	A-20	1	2,336
AN/FPS-16 (SN#31)	A-20	1	2,336
AN/FPS-16 (SN#32)	A-20	1	2,336
AN/FPS-16 (SN#42)	A-20	1	2,336
AN/FPS-16 (SN#39)	C-10	1	2,336
AN/FPQ-13 (SN#17)	A-20	1	2,336
SADS X	A-21A	1	1,171
WEST XIC	A-30	1	102
ROLAND	A-30	1	53
SADS VIIIR	A-30	1	191
WEST XR	A-30	1	112
SADS VIR	A-30	1	413
WEST IA	A-30	1	340
SADS IIR	A-31	1	254

Table 2-2. Alternative 1 – Eglin AFB Electromagnetic Radiation Emitters: Current Environmental Baseline, Cont'd

Electromagnetic Radiation (EMR) System	Site Location	Quantity	Human Hazard Distance (uncontrolled environment) (feet)
AN/FPS-85	C-6	1	-4,000 above ground (when operated in the manual mode at 45 to 60 degrees below bore sight) -100 to 150 at ground level when operated in manual mode -on face of antenna when operated in computer mode
WIEBEL	MOBILE	1	TBD
Total Radar Systems Alternative 1		**19**	
Eglin Range Communication Transmitters			
EMR System	**Site Location**	**Quantity**	
CTS-100	A-3 (Omni antennas)	2	
CTS-100	A-3 (Directional antennas)	1	
ACATEL MDR-8000	A-10	2	
ACATEL MDR-8000	A-15A	2	
ACATEL MDR-8000	C-62	1	
ACATEL MDR-8000	C-1	1	
ACATEL MDR-8000	BLDG. 44 Tower 49	4	
ACATEL MDR-8000	BLDG. 44 Tower 79	4	
ACATEL MDR-8000	A-3	4	
ACATEL MDR-8000	A-20	2	
Motorola radio to Floridale	B-1 (north side of B-70)	1	
Microwave Tower	B-4B	1	
Microwave Tower	Field 1 (Near C-5)	1	
Microwave Tower	B-120A	1	
Microwave Tower	B-135	1	
Microwave Tower	B-140	1	
Microwave Tower	B-141	1	
Microwave Tower	Duke Field (Field 3)	1	
Microwave Tower	C-7 (near C-10)	1	
90 foot Microwave Tower	C-64	1	
Total Range Communication Transmitters Alternative 1		**33**	
Eglin Range Laser Systems			
Model Number	**Site Location**	**Quantity**	**Laser Classification**
1110-Ider	C-86	1	3b
1110-Signal	C-86	1	4
APL-1	C-86	1	3a
B10-106Q	C-86	2	4
CFR 400	C-86	1	4

Table 2-2. Alternative 1 – Eglin AFB Electromagnetic Radiation Emitters: Current Environmental Baseline, Cont'd

Electromagnetic Radiation (EMR) System	Site Location	Quantity	Human Hazard Distance (uncontrolled environment) (feet)
CFR 400 OPO	C-86	1	4
Compact Raman Shifted Laser	C-86	1	3b
Consultec	C-86	1	3a
FC/Q	C-86	1	4
HAC-HEAD	C-86	1	4a
HLS-3	C-86	1	4
Roadmaster	C-86	1	4
Seeker	C-86	1	4
TFR Pump	C-86	1	4
YVO4 Laser	C-86	1	4
N/A	Portable	12	N/A
Helium-Neon (He-Ne)	Portable	3	N/A
1307 He-Ne	Portable	1	N/A
He-Ne 5mW	Portable	2	N/A
Nedynlum-YAG	Portable	2	N/A
57-2-208W	Portable	1	N/A
AN/TWQ-2	Portable	4	N/A
1107 He-Ne .8mW	Portable	3	N/A
1307P He-Ne .8mW	Portable	1	N/A
709, 1.064 Microns	Portable	1	N/A
76-5, .532 Microns	Portable	1	N/A
2340-C	Portable	1	N/A
IR, .845	Portable	1	N/A
5005	Portable	2	N/A
3305 DR	Portable	2	N/A
1603 SM	Portable	1	N/A
1603 SMX	Portable	1	N/A
Infrared Thermometer	Portable	3	N/A
Sonet Link Transport System	Portable	2	N/A
MP 1570A	Portable	1	N/A
GN Net Test	Portable	4	N/A
AN/TVQ-2	Portable	4	N/A
Total Eglin Laser Systems Alternative 1		**69**	

He-Ne = helium-neon; mW = megawatt; N/A = information not available; TBD = to be determined

2.2.3 Alternative 2 (Preferred Alternative): Alternative 1 Plus the Inclusion of Projected Future Systems and the Process to Approve Future EMR Systems on Eglin AFB

Alternative 2 would authorize the environmental baseline as described under Alternative 1, plus include projected future EMR systems on Eglin AFB and designate a process to approve future EMR systems on Eglin AFB. Therefore, there is no summary table for EMR emitter sources and aggregate hazard space for Alternative 2, as future EMR systems on Eglin AFB are unknown.

Since specific future actions involving EMR emitters are dependent on future mission requirements and because future mission requirements are unknown, Alternative 2 attempts to prescribe guidelines and establish a methodology, or BMPs, based on current EMR safety programs. These guidelines would be established to consistently screen EMR requests and facilitate the AF Form 813 process when any future activity involving an EMR emitter would change baseline parameters. This methodology would complement existing Eglin AFB human safety programs for EMR and would ensure that the relocation, addition, or upgrade of an EMR emitter system would not be detrimental to the natural resources present on Eglin AFB.

Again, there is no *anticipated increase in future use* of EMR emitters, only the possibility that future mission requirements may call for the relocation, addition, and/or upgrade of EMR emitters at any time. The movement, upgrade, or addition of EMR emitters at Eglin AFB has the potential to affect the electromagnetic environment of the range. Therefore, the relocation, upgrade, or addition of a new EMR emitter to Eglin AFB should take into account where and how the system is to be used. The methodology under Alternative 2 would first verify that all human safety concerns associated with EMR emitters have been properly addressed according to all applicable Air Force regulations and guidelines. It would then be determined whether or not the addition, relocation, or upgrade of the EMR emitter met permitting requirements (i.e., construction, storm water, drinking water, and/or Title V air permits), as each individual action would require compliance with these permitting requirements as needed. Finally, a determination would be made as to whether the emitter posed a proximal threat to sensitive species. All determinations would be made through the AF Form 813 process.

If it is determined that the addition, relocation, or upgrade of an emitter would put sensitive species within the human hazard area a closer examination of the situation would be warranted. This may involve an ESA Section 7 consultation with the USFWS to identify the type(s) of species potentially affected, potential for exposure, and what *site-specific* BMPs could be applied to minimize the risk of adverse exposure to hazardous levels of EMR for biological resources on Eglin AFB.

2.3 COMPARISION OF ALTERNATIVES

The No Action Alternative maintains the current level of EMR emitters on Eglin AFB, as defined in the baseline period described in the 2002 EMR PEA (U.S. Air Force, 2002a) (which would also maintain the current aggregate space occupied by hazard areas on Eglin AFB). The current, total aggregate space occupied by hazard areas (areas in which hazardous exposure may occur) for EMR emitters under the No Action Alternative is presented in Table 2-3.

Table 2-3. Total Aggregate Space Occupied by Electromagnetic Radiation Hazard Areas on Eglin AFB[1] with the No Action Alternative

Aggregate Metric Measurement of Hazard Areas on Eglin AFB[2]	Radars	Range Communication Transmitters	Lasers[3]
Number of systems[4]	24	29	15
Hazard area (ft^2)	88,301,710	N/A	223,097
Hazard area acreage	1,539.64	N/A	5
Volume of space occupied by hazard areas (ft^3)	36,528,960,000	65,021	N/A

ft^2 = square feet; ft^3 = cubic feet; N/A = information not available

1. These figures represent the total sum of EMR hazard areas associated with individual emitters on Eglin AFB.
2. For those systems where specific parametric data was unavailable, the maximum hazard area calculated for similar systems was applied as representative of the unknown hazard area.
3. Laser hazard areas calculated using the associative nominal ocular hazard distance (of those lasers for which data was supplied) using a 3,280.84 foot (1 km) wide base
4. Estimated based on data provided in the 2002 EMR PEA.

Alternative 1 includes the baseline identified in the No Action Alternative and presented in Table 2-1, plus the removal, relocation, addition or upgrade of any EMR emitter systems on Eglin AFB since the 2002 EMR PEA (U.S. Air Force, 2002a). Table 2-4 shows the total aggregate space occupied by hazard areas for EMR emitters under Alternative 1, for which information was available. Since the types of lasers used on Eglin AFB changes frequently, and new systems are often being utilized, it is difficult to calculate an aggregate laser hazard area for the entire range for Alternative 1. Laser hazard areas are specific to the type of laser being utilized and are based upon the nominal ocular hazard distance (NOHD) for each laser type. Laser hazard areas are calculated during the AF Form 813 review process and an associated safety profile is designated for the specific test event (Chesser, 2009). For a more detailed discussion of laser NOHDs, refer to Appendix B.

Table 2-4. Total Aggregate Space Occupied by Electromagnetic Radiation Hazard Areas on Eglin AFB with Alternative 1

Aggregate Metric Measurement of Hazard Areas on Eglin AFB	Radars	Range Communication Transmitters	Lasers
Number of systems	19	33	69
Hazard area (ft^2)	124,842,960	N/A	N/A
Hazard area acreage	2,866	N/A	N/A
Volume of space occupied by hazard areas (ft^3)[a]	42,008,395,132	N/A	N/A

ft^2 = square feet; ft^3 = cubic feet; N/A = information not available

a. Calculated based upon 20 radar systems (excluding the unknown hazard area for WIEBEL) and using the formula: Volume = $1/3\pi\ r^2\ h$, where π is the *pi* symbol (3.14).

Both the No Action Alternative and Alternative 1 have the same environmental consequences. These consequences result in the possibility of exposure of biological resources (i.e., wildlife) to EMR. EMR on Eglin AFB comes from a variety of sources, all of which are described in Chapter 1. Possibility of exposure to EMR from these sources is dependent on a number of factors, all of which are based on the operational parameters of the emitter. These parameters include the type of emitter (radar, laser, microwave, etc.), the system power density, the location of the system, utilization, proximity to organisms, and other parameters. Currently there are no

recorded incidences of hazardous exposure occurring to animals on the range; however, the remote possibility of this occurring does exist and will be analyzed in this REA.

Alternative 2 may affect the natural resources on Eglin AFB by increasing the chances for hazardous exposure to organisms from Eglin's EMR emitters by allowing the introduction of new hazard areas to the range. This could occur from introduction of a new system, the upgrade of a current system, or the relocation of a current system.

The increase in the possibility of exposure may be alleviated, however, by the implementation of the methodology outlined under Alternative 2. Alternative 2 could also result in the removal of a hazard area from a test site through the relocation process. This would result in the elimination of the chance for hazardous exposure to EMR for species in the immediate vicinity of the removal. Because the chance of exposure hinges on the operational parameters of the emitter and the type of organism in question (human, bird, bear, etc.), the variables involved here are unquantifiable, especially with no clear knowledge of how these systems may be utilized in the future. In short, the only mitigations available are preventative measures that reduce the chance for exposure, as the possibility of a natural resource being exposed to hazardous levels of EMR cannot be entirely eliminated.

2.4 PREFERRED ALTERNATIVE

Alternative 2 was selected as the Preferred Alternative because it provides an assessed and authorized reasonable maximum level of activity, providing both timely access of the military mission to the Eglin AFB Range and safety for the many natural resources present on the range.

3. AFFECTED ENVIRONMENT

3.1 INTRODUCTION

The Affected Environment section of this report describes the resources within the Eglin Reservation that have the potential to be impacted by the emission of EMR. This chapter is organized into Safety/Restricted Access (Section 3.2) and Biological Resources (Section 3.3). An EMR background discussion is provided in Appendix B and provides a more in-depth review of EMR characteristics, including safety standards, so that a better understanding of the potential for impacts to both human and biological resources can be gained. Human Exposure is addressed within the Safety/Restricted Access section, which discusses activities unrelated to mission activities (e.g., recreation). Additionally, the Safety/Restricted Access section discusses the potential for EMR exposure to personnel involved in mission activities. The Biological Resources section describes the sensitive species and habitats located on Eglin AFB that could have the potential for hazardous exposure to EMR.

3.2 SAFETY/RESTRICTED ACCESS

The existing safety environment encompasses risk to public health and, with respect to testing and training activities, risk to the health of military personnel, as well as those measures designed to minimize that risk. For actions occurring on military property with inherent safety risks, procedures are in place that minimize or eliminate altogether risks to the public. Such measures include the designation of areas as "restricted" or "closed" to the public, either permanently or temporarily. Such closures are driven by the dimensions of the "safety footprint" of a particular action that may have potentially harmful noise, blast, or other effects, or by the existence of unexploded ordnance from historical missions.

This section presents information concerning the existing range safety conditions at Eglin AFB. It includes a discussion of safety regulations and process, safety organizations and responsibilities, other safety procedures, and human exposure potential.

Safety, as it pertains specifically to EMR, encompasses human exposure to Eglin AFB personnel, EEDs, and flammable liquid hazards.

3.2.1 Regulatory and Management Overview

This section discusses the regulations, policies, and management protocols in place at Eglin AFB range safety that impact EMR use. AAC Instruction (AACI) 91-203, *Safety Program*, and 91-201, *Test Safety Review Process*, established the AAC Safety Program and the Test Safety Review Process, respectively. In part, AACI 91-203 ensures that all tests covered by a 46 TW test directive are reviewed at a Risk Management Board chaired by AAC Safety Office (AAC/SE) personnel and meet Range Safety approval. Range Safety approval is based on the analysis of several factors, including electromagnetic radiation hazard areas and laser test procedures, controls, shielding standards, nominal ocular hazard distance, protective eyewear verification, radiation footprint determination, and flight profile approvals.

The Test Safety Review Process described in AACI 91-201 implements the Operational Risk Management (ORM) process, as specified in AFI 90-901, *Operational Risk Management*, for all AAC test programs, and reflects the practical application of ORM as outlined in Air Force Pamphlet (AFPAM) 90-902, *ORM Guidelines and Tools*. The steps in the ORM process, as they relate to the Test Safety Review Process are (U.S. Air Force, 2000):

1. **Identify the hazards.** Personnel involved with the test or activity act as a team to identify all potential hazards.
2. **Assess the potential risk.** Assess the probability and severity of loss from exposure to the identified hazard.
3. **Analyze risk control measures.** Investigate specific strategies and tools that reduce, mitigate, or eliminate the risk.
4. **Make control decisions.** Approve the best risk control or combination of controls based on the analysis of overall costs and benefits.
5. **Implement risk controls.** Once procedures to minimize identified hazards have been determined and approved at the appropriate level, those procedures are implemented during the test.
6. **Supervise and review.** Continue the ORM process throughout the accomplishment of every test program.

This instruction affects all test operations that are conducted under a 46 TW Test Directive. It includes ground-training activities involving personnel, aircraft, equipment, or airspace. It applies to system program managers, program engineers, test engineers, range safety engineers, and aircrews that are responsible for incorporating safety planning and review into the conduct of test and training programs. Safety procedures associated with routine training operations are implemented through the individual organization, based on its specific training protocols/guidance.

The Radiation Safety Officer (RSO) is a supporting member of the RMB and will be present when the test involves potential health hazards associated with radiation exposure to include:

- Radio frequency radiation
- Microwave radiation
- Laser radiation

A number of standard safety procedures exist to ensure limited public access to affected training areas during test implementation. These procedures require every practical effort to keep the designated training areas clear of all nonparticipating persons and vehicles.

Large portions of Eglin AFB are closed to public use, which facilitates range clearance operations. Depending on the type of training being conducted, contingency personnel may stand by in case of emergencies (U.S. Air Force, 2003b).

3.2.2 AAC Nonionizing Radiation Programs

Generally, there is little human hazard on the Eglin range complex from the operation of EMR sources such as radars, microwave transmitters, and lasers because of the DoD, Air Force, AAC, FCC, OSHA, and other government regulations/programs that implement RF radiation and laser safety programs applicable to range activities. EMR programs dealing with radar and microwave emitters involve the recognition and evaluation of the potential risk to human health. The underlying concept of laser range safety is to prevent exposure of unprotected personnel to laser radiation by determining where the laser radiation is expected to be and restricting access.

AACI 48-102, *Nonionizing Radiation Control Program*, establishes the Nonionizing Radiation Control Program on Eglin with the intended purpose of minimizing hazards created by the use of nonionizing systems and equipment without unduly restricting their use, and to implement required regulatory controls. This instruction also implements Air Force Occupational Safety and Health (AFOSH) Standard 48-9, *Radio Frequency Radiation Safety Program* and American National Standards Institute (ANSI) Z136.1-1993, *American National Standard for Safe Use of Lasers*. Under AACI 48-102, a RSO is appointed to perform inspections, surveys, and review programs utilizing nonionizing radiation.

The RSO for Eglin AFB is a member of 96 AMDS/SGPB. RSO duties under this program include:

- Responsibility for the AAC Nonionizing Radiation Program
- Carrying out the AAC Nonionizing Radiation Program to include:
    - Enforcement of AACI 48-102 in addition to area monitoring if applicable
    - Emergency procedures
    - Review of plans for proposed radiation use
    - Preliminary hazard evaluations
    - Training and instruction
    - Consultant services
- Conducting investigations of exposures in excess of PEL for RF exposure or Maximum Permissible Exposure (MPE) (refer to Appendix B) for laser exposures
- Requiring users of nonionizing radiation equipment to submit to inspections when unsafe conditions are indicated or suspected and to terminate immediately any undertaking in which the conditions are deemed unnecessarily detrimental to health and safety
- Conducting periodic hazard reviews and recommending or directing supervisors, as appropriate, to adopt necessary protective measures to ensure radiation doses are maintained below established levels
- Ensuring that using personnel are briefed annually on relevant hazards of radiation, radiation protection programs, and care and use of radiation protection equipment

In addition to AAC instructions discussed above that implement nonionizing radiation programs and range safety review programs, numerous other instructions and guidelines provide information for safe operation of EMR and laser sources on the Eglin Range. Following is a list of documents that address the safe use of EMR and laser devices:

- DoD Instruction 6055.11: *Protection of DoD Personnel from Exposure to Radiofrequency Radiation and Military Exempt Lasers* (DoD, 1996)
- AFI 13-212, *Range Planning and Operations* (U.S. Air Force, 2007a)
- Range Commanders Council, Range Safety Group: *Laser Range Safety* (RCC, 1998)
- Mil-HDBK-828A: *Department of Defense Handbook, Laser Safety on Ranges and in other Outdoors Areas* (DoD, 1996a)
- Joint Pub 3-09.1: Joint Laser Designation Procedures (JLASER) (DoD, 1991)
- MIL-STD-1425A: Safety Design Requirements for Military Lasers and Associated Support Equipment (DoD, 1991a)
- UASFOEHL Report 87-091RC0111GLA: Laser Range Evaluation Guide for Bioenvironmental Engineers (U.S. Air Force, 1987)

An additional safeguard used by Eglin AFB to ensure range missions/projects pose a minimal risk of environmental impact is the AF Form 813 process. To comply with NEPA, Eglin is required to assess the environmental impact of all proposed actions and projects. This assessment includes all proposed missions/projects conducted on the Eglin Range. The NEPA compliance process is called the EIAP and is directed by 32 CFR 989.

Eglin has developed procedures to help the proponent of a project complete required NEPA documents and EIAP forms. The Air Force form used for EIAP is AF Form 813, *Request for Environmental Impact Analysis*. AF Form 813 is the primary form used for EIAP and prompts the proponent for required information about the proposed project. AF Form 813 documents the environmental analysis as required under 32 CFR 989.

Once the proponent completes the AF Form 813, it is forwarded to the Environmental Analysis Section (96 CEG/CEVSP), which coordinates a review of the proposal by the EIAP Working Group. Members of the Working Group pertinent to EMR are Bioenvironmental Engineering, Range Safety, and Ground Safety. Once the Working Group has reached a decision and the Environmental Analysis Section has finalized its review, the form is returned to the proponent. This decision could be either a CATEX from further review if the project is deemed to have insignificant environmental impacts or an environmental assessment or environmental impact statement must be completed for the project.

3.2.3 Restricted Access

Restricted access pertains to the temporary or permanent closure of areas on Eglin AFB from mission activities. The purpose of restricting access to the public during these times is to ensure their safety while maintaining mission integrity. Entrance to these areas requires proper military identification and is granted only to those military personnel or contractors involved in mission

activities. Receptors potentially impacted would include the military and the public desiring to use recreational areas. Guidance for restricted access is utilized to coordinate public and military use of land within the Eglin Range. Range areas in use are closed to all forms of public recreation. Areas permanently closed to the public are shown in Figure 3-1. Some military missions may require certain areas to be closed to the public for various periods of time. Recreational access information is available on a daily basis by calling the Base Information Line, (850) 882-0007 (U.S. Air Force, 2008c).

3.2.4 Human Exposure

Human exposure refers to exposure to hazardous levels of EMR that would result in adverse biological effects. These effects have been studied extensively by various organizations, and regulations, policies, and procedures have been implemented to ensure that personnel are not exposed to hazardous levels of EMR. These policies are those discussed in Section 3.2.1.

There are three primary area classifications on Eglin AFB at risk of exposure to EMR: cantonment areas, closed areas (conditionally or permanently), and recreational areas. Safety policies and procedures already in place act to minimize the chances of human exposure to personnel as well as members of the public.

Cantonment Areas

Cantonment areas consist of those areas on the Eglin Reservation that are populated by military and/or civilian personnel for 24 hours a day. There are six areas on the Eglin Reservation designated as cantonment areas:

- Eglin Main
- Hurlburt Field
- Duke Field
- Choctaw Field
- Camp Rudder
- Site C-6
- 7th Special Forces Group (Airborne) [7SFG(A)] Cantonment

Eglin Main is home to the 96th Air Base Wing, which provides medical, civil engineering, personnel, logistics, communications, computer security and other host services to AAC units (U.S. Air Force, 1996). Eglin Main supports over 15,000 active duty and civilian personnel.

Hurlburt Field, the 16th Special Operations Wing, organizes, trains, and equips Air Force special operations forces (U.S. Air Force, 1996). Hurlburt Field supports approximately 8,000 civilian and active duty personnel.

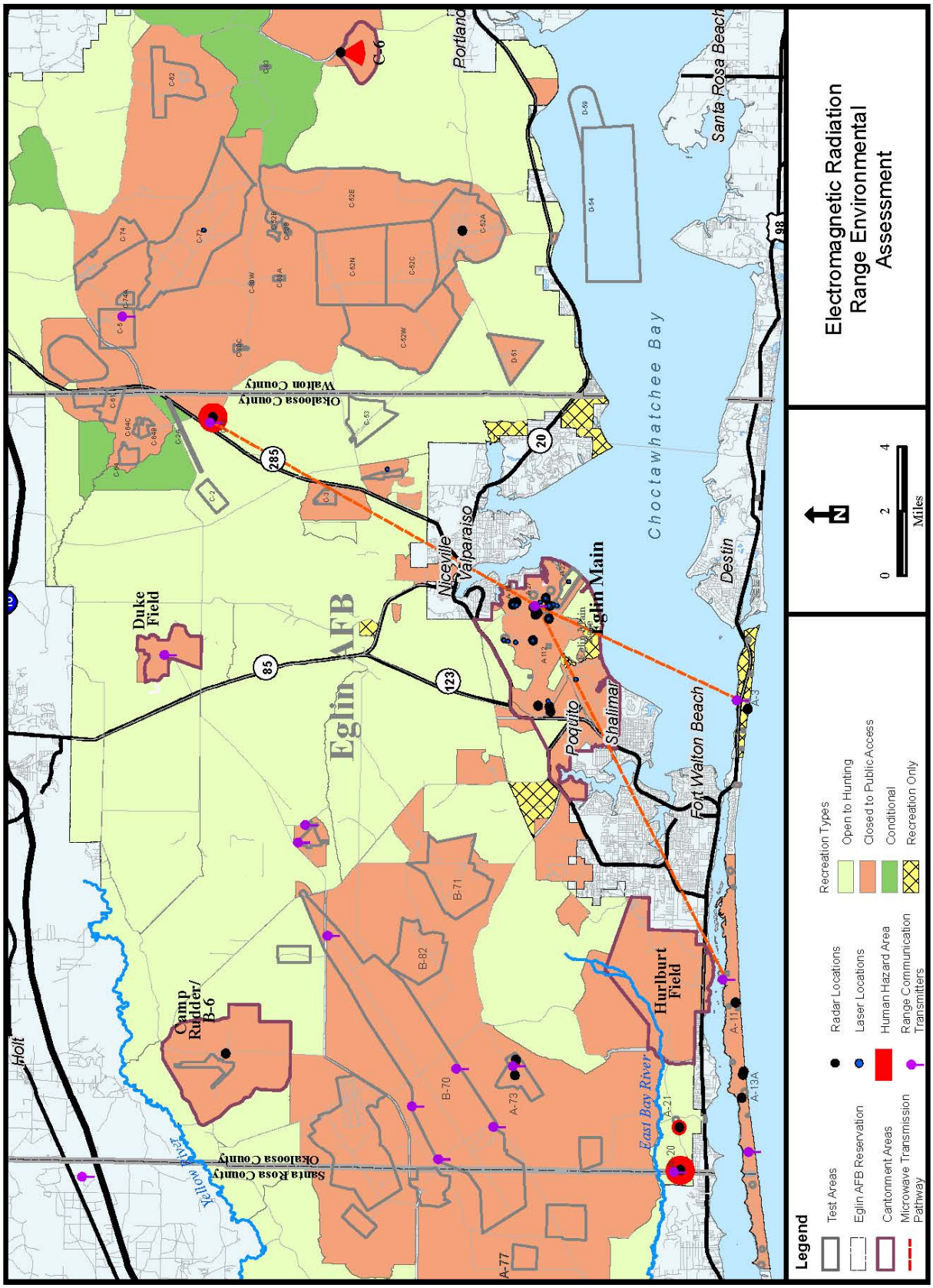

Figure 3-1. Recreational Areas on Eglin AFB, FL

Duke Field is the training facility for the 919th Special Operations Wing, an Air Force Reserve Wing (U.S. Air Force, 1996). This cantonment area supports 1,251 active duty, civilian, and reservist personnel.

Choctaw Field is operated by Training Air Wing 6, which is based at Naval Air Station Whiting Field. This area provides primary flight training to all branched services, foreign services, and other fixed-wing flight students (U.S. Air Force, 1996). Choctaw Field supports, on average, about six Navy personnel during flight operations.

Camp Rudder provides jungle phase training via the 6th Ranger Training Battalion. Training includes ground maneuvers throughout the Eglin Reservation, with personnel moving unrestricted throughout the fringe areas when access is not restricted due to other Range activities or safety considerations (U.S. Air Force, 1996). No information on the number of personnel supported by this cantonment area was available.

Site C-6 is the location of the 20th Space Surveillance Squadron, which operates and maintains a space tracking radar (U.S. Air Force, 1996). C-6 supports a total of 126 personnel.

The 7SFG(A) cantonment area is currently under construction as part of the Base Realignment and Closure (BRAC) decisions from 2005 and is scheduled for completion in 2011. The cantonment will eventually support some 2,200 military personnel (U.S. Air Force, 2008b).

Closed Areas

Closed areas are composed of active test areas and interstitial areas where access is restricted (Figure 3-1). Entrance to these areas requires proper military identification and is granted only to those military personnel or contractors involved in mission activities.

Recreational Areas

In accordance with the Sikes Act, the Air Force has provided many public recreation areas in order to support various recreational activities on the Eglin AFB reservation (Figure 3-1). With the exception of approved campsites after sunset, public recreation on Eglin is permitted during daylight hours only. There are 280,000 acres of land open for outdoor recreation. Activities include hunting, fishing, hiking, and camping, with the most popular being hunting and fishing. All persons that engage in outdoor recreational activities are required to adhere to applicable Eglin AFB, federal, and state laws, rules, and regulations. Unless the AAC Commander has granted special permission, entry into both "closed" areas and "seasonally closed" areas is prohibited. Areas such as the east end of Okaloosa Island, designated as "open," are available for all types of outdoor recreation with the exception of hunting. All rules, regulations, and safety warnings for recreational activities can be obtained from the 96 CEG/CEVSN (the Natural Resources Section) at Eglin AFB (U.S. Air Force, 2008c) and are provided to all permit holders.

3.2.4.1 Cellular and Personal Communications Service

Radio frequencies, as discussed in Appendix B, constitute part of the electromagnetic (EM) spectrum. Cellular communications systems use frequencies in the 800–900 megahertz (MHz)

portion of the spectrum and transmitters used for Personal Communications Service (PCS) use frequencies in the range of 1850–1990 MHz. Primary antennas for cellular and PCS transmitters are usually located on towers or other elevated structures and are referred to as cellular or PCS base stations or "cell sites." Typical antenna heights range from 50 to 200 feet. A typical cellular base station normally uses several omnidirection antennae that look like poles or whips of 10 to 15 feet long. A PCS base station may use a number of antennae that look like rectangular panels, typically 1 foot by 4 feet.

The signal from a base station is directed toward the horizon in a relative narrow beam and, as with all forms of EM energy, the power density from a transmitter decreases rapidly as the distance from the transmitting antenna increases (according to the inverse square law). Consequently, the ground-level exposure is much less than the exposure encountered near the antenna or directly in the transmitting beam. Measurements made near cellular and PCS base stations indicate that ground-level power level densities are well below recommended RF safety standards (FCC, 1998).

In the case of cellular base station transmitters, the FCC recommends an MPE level to the general public of about 0.580 megawatt per square centimeter (mW/cm^2) because the environment is uncontrolled. The MPE is the level of radiation to which a person may be exposed without experiencing hazardous effects or adverse biological changes in the eye or skin and is further discussed in Appendix B, EMR Background Information. The FCC standards are identical to those recommended by the National Council on Radiation Protection and Measurements and similar to the 1992 guidelines recommended by the ANSI and the Institute of Electrical and Electronics Engineers (IEEE) (ANSI/IEEE C95.1-1992). Measurements have shown that worst-case ground-level power densities near typical cellular towers are on the order of 0.001 mW/cm^2. Calculations indicate that in order to be exposed to levels near the FCC's limits for cellular frequencies, a person would have to be in the main transmitting beam and within a few feet of the antenna (be at the height of the antennae). For PCS base stations, using the same type analysis, except for PCS frequencies, the FCC's exposure limit for the general public is 1.0 mW/cm^2 (Air Force standard would be approximately 6.0 mW/cm^2 because of exposure controls and specific awareness of exposure hazards). In this case, there would be a greater margin of safety for the general public (FCC, 1998; FCC, 1999). The *Cellular Phone Tower Plan Final Environmental Assessment* determined that implementation of its proposed action, which included construction of eight cellular tower farms consisting of up to 20 towers each, would not have a significant impact on the natural or human environment and that RF radiation would not exceed known FCC and U.S. Environmental Protection Agency standards for human health (U.S. Air Force, 2002c).

Vehicle-mounted antennae used for cellular communications are normally mounted on the roof, on the trunk, or on the rear window of a car or truck. These antennae normally operate at a power level of three watts or less. Studies have shown that in order to be exposed to RF levels that approach FCC guidelines, it would be necessary to remain very close to the antenna for extended periods of time. Results of studies indicate that properly installed, vehicle mounted, personal wireless transceivers using up to three watts of power would result in maximum exposure levels near the vehicle well below FCC guidelines (FCC, 1998; FCC, 1999).

With regard to hand-held cellular telephones and PCS devices, FCC exposure guidelines specify exposure limits based on the Specific Absorption Rate (SAR) (refer to Appendix B). For exposure of the general public (user of the cellular or PCS phone), the SAR limit is an absorption threshold of 1.6 watts per kilogram (W/kg) as measured over 1 gram of tissue. Measurements of SAR in models of the human head, and other studies using handheld phones, indicate that the 1.6 W/kg limit is unlikely to be exceeded. In addition, before FCC grants approval for marketing a cellular or PCS phone, the manufacturer must show compliance with the 1.6 W/kg limit (FCC, 1999; FCC, 1998).

The Air Force considers handheld radios (which emit less than 7 watts) and cellular phones as nonhazardous emitters, and they are excluded from PEL requirements as long as the radiating structure is not maintained within 2.5 centimeters of the body (U.S. Air Force, 2002b).

3.2.4.2 Electroexplosive Devices

EEDs are small pyrotechnic or explosive devices that are ignited electrically by the passage of an electric current through them, which detonates an explosive charge. EEDs include such items as primers, bomb detonators, blasting caps, squibs, and igniters for ejection seat and missile/rocket launchers. Many of these devices are initiated by low levels of electrical energy and are susceptible to unintentional ignition by many forms of direct or induced stray electrical energy, such as lightning discharges, static electricity, friction-generated effects, and RF radiation. The response of an EED to an RF field and the possibility of detonation depend on many factors, such as the average power output and frequency of radiation from the transmitter; the ability of the lead, circuit, or installation to capture RF energy; the type and characteristics of the RF energy, antenna, physical separation distance between transmitter and firing circuit lead wires; and shielding of the EED. Typically, an EED becomes less sensitive to RF energy as the RF frequency increases.

Handheld (1–5 watts) and mobile (5–50 watts) transceivers offer a unique hazard situation where an EED hazard may exist even though the RF energy levels are within safe limits. The antennae of these devices can create a hazardous situation when they are allowed to touch equipment that contains EEDs. To avoid creating possible hazard situations, transceivers should not be operated within 10 feet of equipment that contains EEDs. AFMAN 91-201 should be consulted to determine the safe separation distance between EEDs and the transmitting antenna of all RF equipment.

3.2.4.3 Flammable Liquids

An electrical arc produced by RF radiation under the right conditions could ignite flammable vapors from POL products commonly used on Air Force bases; therefore, any fuel handling operation near a RF source is of concern. The existence of a fuel hazard is determined by comparing the actual RF energy level to established safety criteria. In order for fuel vapor to be ignited by a spark, the following conditions must be present:

- The presence of a fuel vapor-air mixture that is between the upper and lower flammability limits
- A spark of sufficient energy

RF radiation can induce electrical energy into any metal object. The amount of current and thus the strength of the spark across a gap between two conductors are dependent on both the strength of the RF energy and how well the conductors act as a receiving antenna. Many parts of aircraft, refueling vehicles, and static grounding conductors can act as receiving antennas. The induced current depends of the length of conductor in relation to the wavelength of the RF energy and the orientation of the conductor in the radiated field. Since it is not possible to predict these relationships, it is assumed that an ideal receiving antenna can be inadvertently created.

The safe power density standard for exposure of POL to EMR is 5 watts/cm^2, based on peak power of the emitter (U.S. Air Force, 1997). Areas that exceed the safe power density level are considered hazardous areas for refueling operations regardless of the source of RF energy. Explosive hazards to fuel vapors could result from the following actions:

- Installation of higher-powered equipment at facilities that were previously considered safe
- Siting mobile radar units near refueling facilities
- Use of radar sets equipped with antennae to provide lower beam angles (not normally found with tower mounted units)

The location of fuel storage and handling facilities with respect to nearby communications-electronic equipment and the associated radiated RF field must be given extensive study during the mission-planning and siting phase. Planned utilization of natural terrain features often eliminates the need for large tracts of land that would be required to obtain satisfactory separation of facilities. In other words, the minimum separation distances can be less when the terrain features block the facilities from direct illumination by the radar beam or the facilities lie below the beam.

Safety control measures should be observed when operating radars capable of producing an explosive fuel vapor hazard to an adjacent fuel handling area. Each RF facility should perform an evaluation to develop operating procedures to be used and safety devices that could be installed to permit fuel handling in complete safety. Below are typical situations and the associated safety precautions that are generally followed (U.S. Air Force, 1981):

- Where sufficient separation exists to allow normal operation of the transmitter, some precautions may still be required.
- Transmitter power should not be increased without considering the increased hazard distance.

- Transmitter should not be operated below normal elevation angle without considering the change in the hazard area.
- Refueling of lawn mowers or vehicles should not be permitted within the hazard area.
- Where restrictions on transmitter operation (blanking angles, elevation angles, power restrictions) are required, information should be put in the facility operating instruction.
- Where a transmitter is not allowed to operate during refueling operations, there should be a checklist procedure and close coordination between all concerned.

Handheld (1–5 watts) and mobile (5–50 watts) transceivers offer a unique hazard situation when they are allowed to touch equipment that contains fuels. To avoid creating possible hazard situations, transceivers should not be operated within 10 feet of equipment containing fuel.

3.3 BIOLOGICAL RESOURCES

Biological resources, for purposes of this REA, include the native and introduced terrestrial and aquatic animals found on Eglin AFB. The habitats of Eglin AFB are home to an unusually diverse biological community including several sensitive species and habitats, many of which are present within the EMR ROI. For purposes of biological resources addressed within this REA, the EMR ROI consists of any designated test area known to contain EMR emitters (including the associated EMR hazard areas), as well as any portion of the Eglin Range that could be utilized for EMR activities. Since numerous portable EMR sources exist on Eglin AFB, all of Eglin's range support facilities that may operate EMR sources during testing and training activities are considered to be part of the EMR ROI, including specific test areas located on Santa Rosa Island.

Based on the operational parameters of EMR sources and their proximity to sensitive species and habitats, some sensitive species found on Eglin AFB are not addressed within this REA as they would not be affected by EMR. This includes all rare plant species and aquatic species. Appendix D, Biological Resources, provides a more detailed explanation of the basis for eliminating certain species from inclusion within this REA.

3.3.1 Ecological Associations

Four broad matrix ecosystems exist on Eglin AFB: Sandhills, Flatwoods, Wetlands/Riparian, and Barrier Island. The ecosystems are defined by floral, faunal, and geophysical similarities. Artificially maintained open grasslands/shrublands and urban/landscaped areas also exist on Eglin, primarily on test areas or Eglin Main. Although grasslands/shrublands and urban/landscaped areas are not true ecological associations, they are included in this section as land uses as they are present within the study area.

Typical animal species found within each ecological association are shown in Table 3-1 and ecological associations are depicted in Figure 3-2.

Table 3-1. Animal Species of Eglin AFB by Ecological Association

Common Name	Scientific Name
Sandhills Ecological Association	
Red-cockaded woodpecker	*Picoides borealis*
Bobwhite quail	*Colinus virginianus*
Great horned owl	*Bubo virginianus*
Gopher tortoise	*Gopherus polyphemus*
Six-lined racerunner	*Cnemidophorus sexlineatus*
Diamondback rattlesnake	*Crotalus adamanteus*
Raccoon	*Procyon lotor*
Florida black bear	*Ursus americanus floridanus*
Fox squirrel	*Sciurus niger*
Least shrew	*Cryptotis parva*
Cottontail rabbit	*Sylvilagus floridanus*
Pocket gopher	*Geomys pinetus*
White-tailed deer	*Castor canadensis*
Red-cockaded woodpecker	*Picoides borealis*
Bobwhite quail	*Colinus virginianus*
Wetland and Riparian Ecological Association (Freshwater)	
Florida black bear	*Ursus americanus floridanus*
American alligator	*Alligator mississippiensis*
Pine barrens tree frog	*Hyla andersonii*
Five-lined skink	*Eumeces fasciatus*
Green anole	*Anolis carolinensis*
Garter snake	*Thamnophis sirtalis*
Raccoon	*Procyon lotor*
American beaver	*Castor canadensis*
Little blue heron	*Egretta caerulea*
Flatwoods Ecological Association	
Wood duck	*Aix sponsa*
Red-winged blackbird	*Agelaius phoenicius*
Cottonmouth	*Agkistridon piscivorus*
Florida black bear	*Ursus americanus floridanus*
River otter	*Lutra canadensis*
Beaver	*Castor canadensis*
Gray fox	*Urocyon cinereoargenteus*
Open Grasslands/Shrubland Ecological Association	
Red-shouldered hawk	*Buteo lineatus*
Southeastern American kestrel	*Falco sparverius paulus*
Florida burrowing owl	*Athene cunicularia*
Flycatchers	*Tyrannidae spp.*
Cotton mouse	*Peromyscus gossypinus*
Slender glass lizard	*Ophisaurus attenuatus*
Gopher tortoise	*Gopherus polyphemus*

Source: U.S. Air Force, 2008d

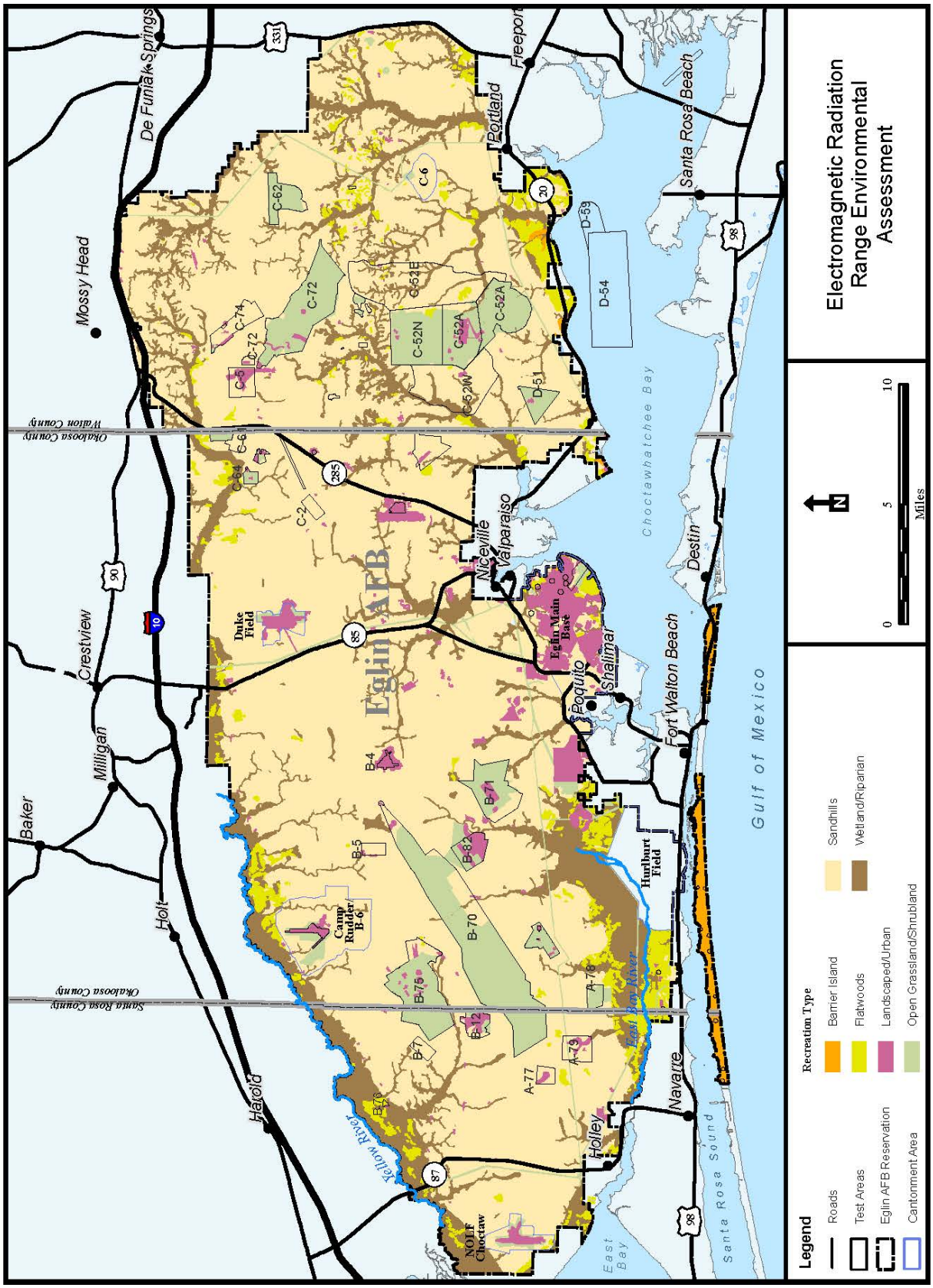

Figure 3-2. Ecological Associations Found on Eglin AFB, FL

Detailed information on the different ecological associations is available in Appendix D, Biological Resources. Animal species generally found within the barrier island ecological association and on Santa Rosa Island are outlined later in this chapter and discussed in further detail in Appendix D. Typical plant species found within each ecological association are not identified as they are not expected to be impacted by EMR activities.

3.3.2 Sensitive Habitats

Specific areas exist within Eglin AFB that are ecologically unique due to their high quality examples of natural communities or presence of rare species. These areas were identified by the Florida Natural Areas Inventory (FNAI) through a project funded by the DoD Legacy Resource Management Program. Termed "High Quality Natural Communities," these areas are distinguished by the uniqueness of the community, ecological condition, species diversity, and presence of rare species. These high quality areas total 75,266 acres and cover approximately 16 percent of the installation.

FNAI also identified special habitats that support rare plants on Eglin called Significant Botanical Sites, as well as larger-scale landscapes containing complexes of rare species, which they named Outstanding Natural Areas (FNAI, 1995; FNAI, 1997). Large portions of these two areas overlap. Combined, these "Outstanding Natural Areas" and "Significant Botanical Sites" total 43,210 acres, or approximately 9 percent of the installation. These landscapes contain the highest quality examples of the natural communities on the installation.

As previously mentioned, EMR exposure would not have an effect on rare plant species found within the sensitive habitats on Eglin AFB. Further, aquatic species are not expected to be exposed to EMR under any testing conditions. Therefore, sensitive habitats such as Outstanding Natural Areas, Significant Botanical Sites, High Quality Natural Communities, Outstanding Florida Waters and Aquatic Preserves are not further addressed within this REA.

3.3.3 Sensitive Species

Air Force projects that may affect federally listed species, species proposed for federal listing, and critical habitat for protected species are subject to Section 7 of the ESA. Through the *Integrated Natural Resources Management Plan* (U.S. Air Force, 2007b), Eglin has developed an overall goal to continue to protect and maintain populations of native threatened and endangered plant and animal species within the guidelines of ecosystem management. Eglin's Natural Resources Section (96 CEG/CEVSN) protects state-listed species through habitat management, specifically through the management of habitats identified as conservation targets by The Nature Conservancy. By addressing the needs of conservation targets, which are sensitive, essential habitats as well as cornerstone species, Eglin's 96 CEG/CEVSN indirectly supports the management of other species and habitat, including state-listed species.

Sensitive species are those species protected under federal or state law, to include migratory birds (protected under the Migratory Bird Treaty Act [16 United States Code 703–712; 1997-Supp]) and threatened and endangered species (protected under the ESA). An endangered species is one that is in danger of extinction throughout all or a significant portion of its range. A threatened species is any species that is likely to become endangered in the future throughout all or a significant portion of its range due to loss of habitat, anthropogenic effects, or other causes. Federal candidate species and all state-listed species are those that should be given consideration during planning of projects, but have no protection under the ESA.

Table 3-2 and Table 3-3 detail the status of sensitive species that can be found on the Eglin AFB main reservation and Santa Rosa Island, respectively, and that have the potential to be impacted by EMR activities. Aquatic species are not included as they are not expected to be affected by EMR. Figure 3-3 and Figure 3-4 show the location of these sensitive species.

Further information on sensitive species can be found in Appendix D, Biological Resources.

Table 3-2. Sensitive Species Found on Eglin AFB, FL

Common Name	Scientific Name	State Status	Federal Status	Ecological Association
Animals				
Alligator Snapping Turtle	*Macroclemys temmincki*	SSC	--	SW, FW
American Alligator	*Alligator mississippiensis*	SSC	FT (S/A)	SW, FW
Bald Eagle	*Haliaeetus leucocephalus*	ST	MBTA	SH, SW, FW, SP, GS
Gopher Frog	*Rana capito*	SSC	--	SH, SP, GS
Eastern Indigo Snake	*Drymarchon corais couperi*	ST	FT	SH, SW, FW, GS
Reticulated Flatwoods Salamander*	*Ambystoma bishopi*	SSC	FE	SW
Florida Black Bear	*Ursus americanus floridanus*	ST	--	SH, SW, FW
Florida Bog Frog	*Rana okaloosae*	SSC	--	SW, FW
Florida Burrowing Owl	*Athene cunicularia floridana*	SSC	MBTA	GS
Florida Pine Snake	*Pituophis melanoleucus mugitus*	SSC	--	SH, SP
Gopher Tortoise	*Gopherus polyphemus*	ST	--	SH, SP, GS
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	SSC	FT	SW
Pine Barrens Tree Frog	*Hlya andersonii*	SSC	--	SW, FW
Red-Cockaded Woodpecker	*Picoides borealis*	ST	FE, MBTA	SH
Southeastern American Kestrel	*Falco sparverius paulus*	ST	MBTA	SP, GS
Bachman's sparrow	*Aimophila aestivalis*	--	FC, MBTA	

Source: USFWS et al., 2003

-- = Not Listed; FC = federal candidate; FE = federally endangered; FT = federally threatened; FT(S/A) = federally threatened due to similarity of appearance; FW = Flatwoods Ecological Association; GS = Open/Grasslands Ecological Association; MBTA = Protected Under the Migratory Bird Treaty Act; SE = state endangered; SH = Sandhills Ecological Association; SP = Sandpine Ecological Association; SSC = state species of special concern; ST = state threatened; SW = Swamp Ecological Association

* The reticulated flatwoods salamander (*Ambystoma bishopi*) has been recently designated by the USFWS as the species known to occur on Eglin AFB. It was designated as federally endangered by the USFWS in February 2009. The frosted flatwoods salamander (*Ambystoma cingulatum*), was the species previously thought to inhabit Eglin AFB and is federally threatened.

Table 3-3. Sensitive Species Found on Santa Rosa Island, Eglin AFB, FL

Scientific Name	Common Name	Status
REPTILES		
Caretta caretta	Loggerhead Sea Turtle	FT, ST
Chelonia mydas	Green Sea Turtle	FE, SE
Dermochelys coriacea	Leatherback Sea Turtle	FE, SE
Lepidochelys kempii	Kemp's Ridley Sea Turtle	FE, SE
BIRDS		
Charadrius alexandrinus	Snowy Plover	ST, FC, MBTA
Charadrius melodus	Piping Plover	FT, ST, MBTA
Haliaeetus leucocephalus	Bald Eagle	ST, MBTA
Egretta caerulea	Little Blue Heron	SSC, MBTA
Egretta thula	Snowy Egret	SSC, MBTA
Egretta tricolor	Tricolor Heron	SSC, MBTA
Eudocimus albus	White Ibis	SSC, MBTA
Rynchops niger	Black Skimmer	SSC, MBTA
Sterna antillarum	Least Tern	ST, MBTA
Haematopus palliates	American oystercatcher	MBTA
Rhynchopsniger	Black skimmer	MBTA
Ardea alba	Great egret	MBTA
Charadrius wilsonia	Wilson's plover	MBTA
Sterna caspia	Caspian tern	MBTA
Sterna maxima	Royal tern	MBTA
Sterna sandvicensis	Sandwich tern	MBTA
Pelecanus occidentalis	Brown pelican	MBTA
MAMMALS		
Peromyscus polionotus leucocephalus	Santa Rosa Beach Mouse	CT
Trichechus manatus	West Indian Manatee	FE, SE

CT = Eglin/FNAI Conservation Target; FC = Federal Candidate; FE = Federally Endangered; FT = Federally Threatened; MBTA = Protected under the Migratory Bird Treaty Act; MMPA = Marine Mammal Protection Act; SE = State Endangered; SSC = State Species of Special Concern; ST = State Threatened

3.3.4 Invasive Nonnative Species

Invasive nonnative species include plants, animals, insects, diseases and other organisms that are not native to an ecosystem and that threaten the natural biodiversity and functioning of an ecosystem. The introduction and spread of nonnative invasive species may also create significant negative issues for military training or for other anthropogenic land uses. Once established, these species reduce biological diversity and disrupt the natural integrity and function of native ecosystems by altering habitat, depredating native species, or out-competing native species. Construction and land-clearing activities are the primary manner in which invasive species are spread from one location to another. Since this REA only addresses the potential for impacts from EMR exposure and not associated construction activities, invasive species are not anticipated to be of concern for this document. Therefore, they are not further addressed within this REA.

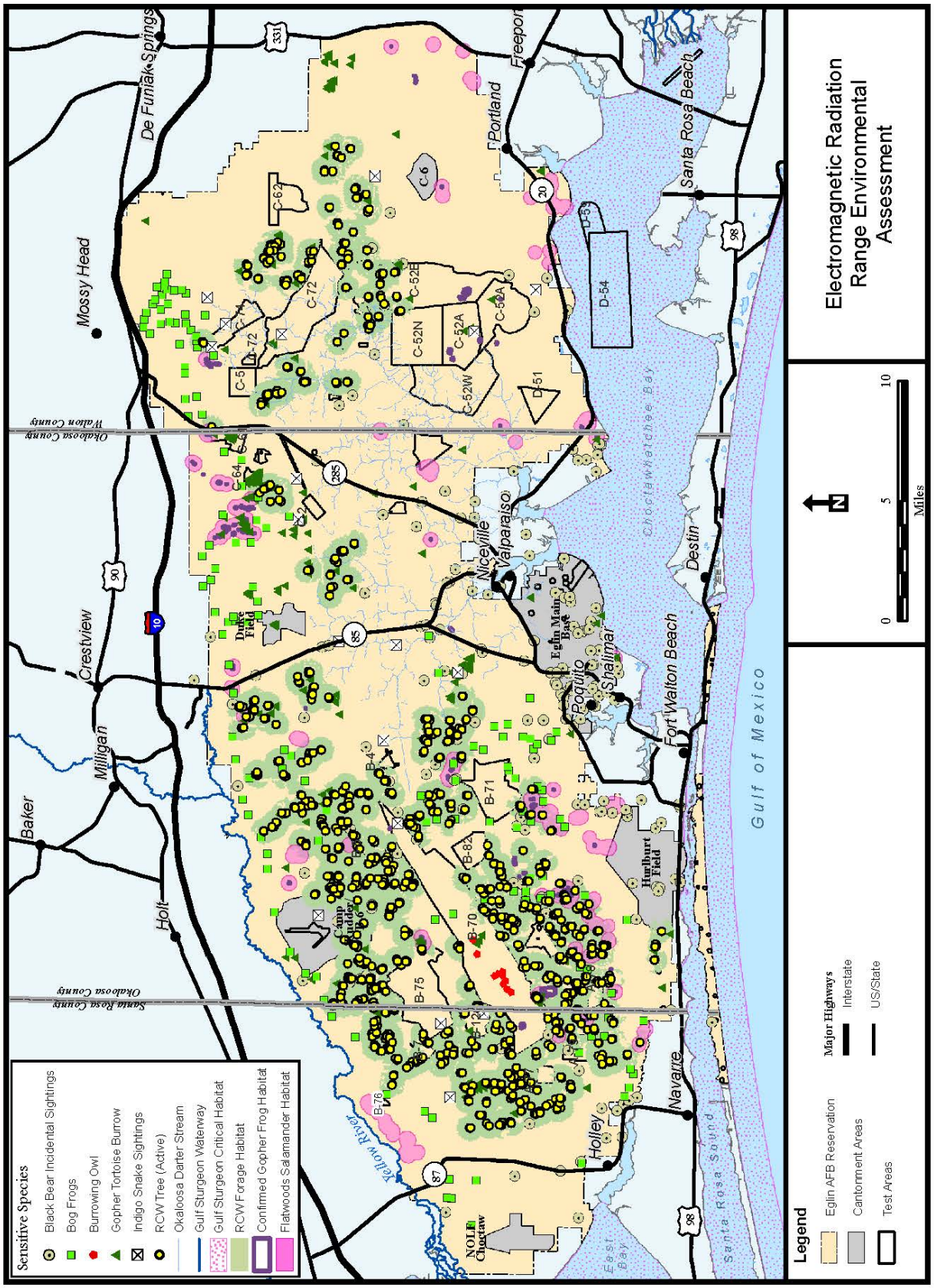

Figure 3-3. Sensitive Species Found on Eglin AFB, FL

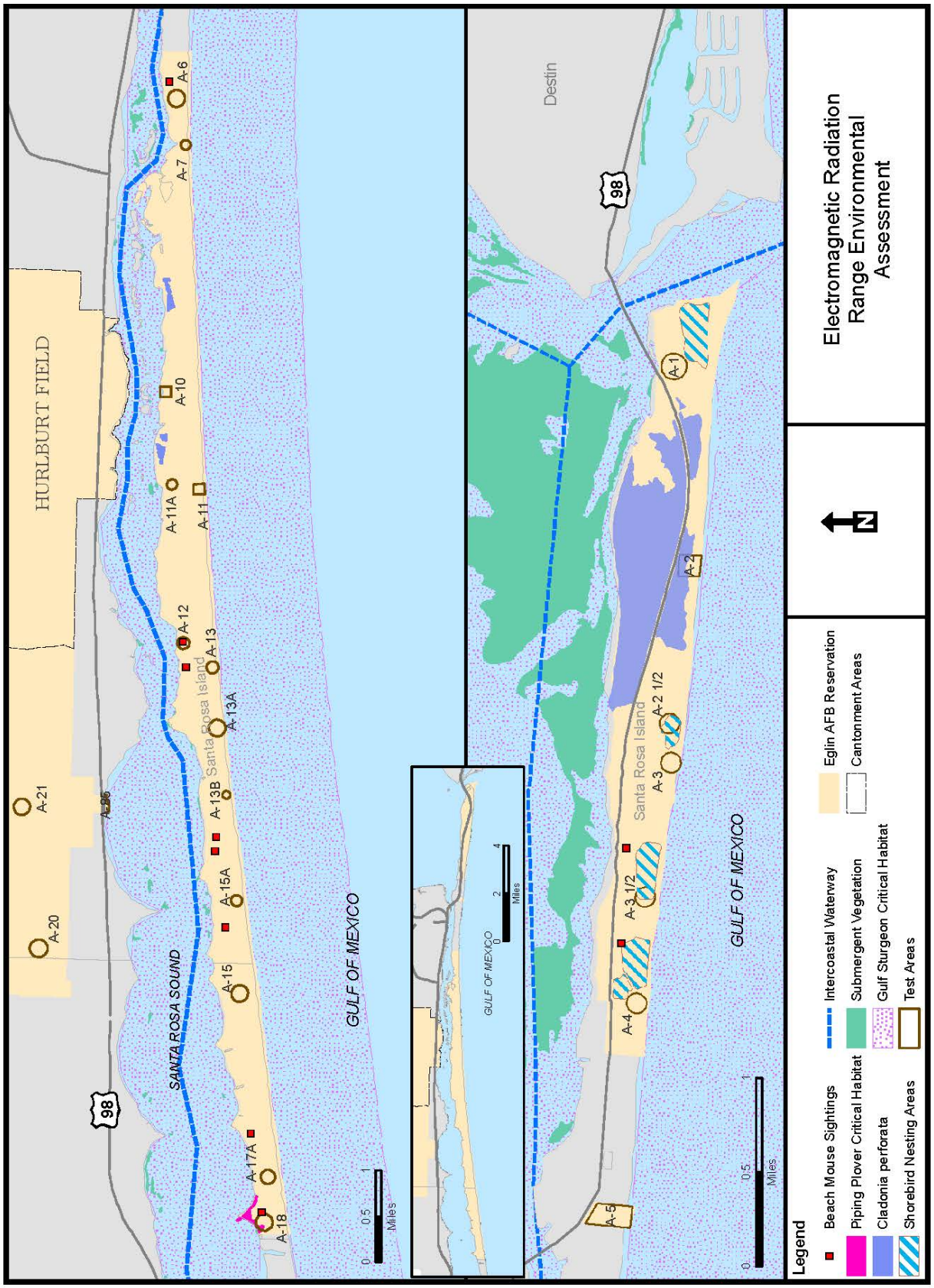

Figure 3-4. Sensitive Species Found on Santa Rosa Island, Eglin AFB, FL

4. ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

It would be extremely difficult to quantify the use of EMR emitters (how often they are used, the amount of time emitters are in use, etc.), for both current and future conditions on Eglin AFB due to the wide variety of mission activities involving the use of EMR emitters. Therefore, analysis presented in this section focuses on establishing hazard areas for recorded emitters on the range and, subsequently, estimating the potential for exposure to proximal organisms entering these areas.

This chapter analyzes the potential impact of EMR emissions generated by the use of emitters during mission activities conducted throughout the Eglin range complex on affected environment resources. The locations of identified radars, communication transmitters, and lasers are shown in Figure 1-3 through Figure 1-5, respectively. This chapter identifies environmental issues related to the emission of EMR from these sources under baseline conditions to determine what, if any, cause-and-effect associations exist between EMR emitters and their potential receptors. Environmental impacts or effects that are identified are quantified, where possible, by using units of measurements or metrics. Impacts to resources from any actions other than the emission of EMR (construction of new facilities, clearing of sight lines, etc.) are separate issues and are not covered in this document.

4.2 SAFETY/RESTRICTED ACCESS

Military lands are open to recreational use as long as public use and safety does not interfere with the military mission. The use of Eglin Reservation lands for mission activities takes a higher priority over other uses. The Sikes Act authorizes and encourages Air Force bases to open areas for outdoor recreation and requires the Air Force to manage the natural resources of reservations to provide for sustained multipurpose use. The Air Base Wing Commander has inherent administrative authority to revoke outdoor recreation privileges (U.S. Air Force, 2003b).

4.2.1 No Action Alternative

4.2.1.1 Restricted Access

The majority of EMR emitting sources are located in areas that are permanently closed to the public. All communication transmitters and permanent laser systems are located within restricted access areas. Therefore, there would be no effects to restricted access with the No Action Alternative, Alternative 1, or Alternative 2.

4.2.1.2 Human Exposure

As discussed in Chapter 3, the Air Force, through specific regulations, guidelines, and programs, controls EMR exposure in Air Force workplaces and environments. These regulations/programs

establish personnel exposure standards and criteria for both military employees and the general public. The Air Force requires military and civilian personnel conducting activities within EMR safety hazard areas to have proper training and personal protective equipment in order to prevent hazardous exposure to EMR. In addition, all proposed range activities involving one or more EMR emitters must be reviewed and approved by the base radiation safety officer. Therefore, because of the strict AAC review and control of activities employing the use of EMR emitters on the Eglin reservation, there is little, if any, EMR exposure to military personnel engaged in test range activities or to fuel vapor situations/EEDs that might cause injury to personnel if ignited or detonated by exposure to sufficient EMR field strengths.

Human hazard areas are based on exposure levels, and are regulated, maintained, and controlled by Bioenvironmental Engineering (96 AMDS/SGPB), as detailed in Section 3.2.4 of this document, to ensure that the general public and military personnel are not exposed to hazardous levels of EMR. Because of the nature of radar systems and the fact that they are elevated and pointed up to the sky, the hazard to people *on the ground* is nonexistent. A group for Keesler AFB that has performed extensive radiation measurements at ground level (6 feet) all around radar system sites was unable to detect measurable levels of EMR using sensitive detection equipment (Chesser, 2009).

Test Areas A-20 and A-21, located in the southwest portion of the reservation north of Wynnhaven Beach, have human hazard areas occurring above recreational use Management Unit 3, which is open for public recreational use year-round. Likewise, the Test Area C-10 hazard area slightly overlaps portions of recreational Management Units 7 and 13.

Those and other human hazard areas associated with radar use are shown in Figure 4-3 through Figure 4-12, later in this document. The elevation of these radar systems is given in each figure to indicate how high above ground the radar hazard area exists. Most radar systems are mounted upon the rooftops of buildings or on pads several stories high and are equipped with elevation interlocks that shut the system down if the radiating beam drops below horizontal, minimizing the chance of exposure to terrestrial organisms. The lowest recorded radar antenna height occurring on Eglin AFB is 39.13 feet and is located on Santa Rosa Island. There are no areas open to public access within human-related EMR ground safety zones and off-base populations are well out of range of EMR exposure (either because of the remoteness of the emitter, the inaccessibility of the radiating beam, the height of the emitter above ground level, or the Air Force restrictions on civilian use of areas when tests are in progress). As a result, the general public is not at risk for hazardous exposure to EMR.

Electroexplosive Devices. The hazard at ground level for the inadvertent detonation of EEDs by exposure to EMR is virtually non-existent, as evidenced by numerous base personnel who work and drive vehicles equipped with airbag EEDs in close proximity to EMR devices daily. EED hazard areas are considered to be *airspace* hazards. Pilots are informed by the Range Safety office not to fly through the hazard areas from 0 to 23,000 feet above MSL (Chesser, 2009). Also, as discussed in Section 3.2, the procedures outlined in AFMAN for analysis and designation of EED hazard areas AFMAN 91-201 would be consulted to determine the safe

separation distance between EEDs and the transmitting antenna of all RF equipment. Therefore, there is no danger to personnel or the public from EED detonation by EMR systems in use on Eglin AFB.

Flammable Liquids. Again, the risks to military personnel and civilians are limited by the policies and general safety practices already in place. When relocating or siting a new EMR, the proximity to POL distribution facilities must be considered. There are no areas where the EMR hazard extends to the ground in recreational areas such that civilians could be subject to danger while refueling a vehicle or otherwise handling flammable liquids.

4.2.2 Alternative 1

4.2.2.1 Restricted Access

Refer to the discussion under the No Action Alternative (Section 4.2.1), which concludes that there would be no effects to restricted access as a result of any of the Alternatives.

4.2.2.2 Human Exposure

Under Alternative 1, the environmental baseline levels authorized in the 2002 EMR PEA plus any changes that have been made since then would be authorized. Under this scenario the total radar systems in operation have decreased from 24 to 19. Total communication transmitters and laser systems have increased from 29 to 33 and 15 to 69, respectively (Table 1-2 and Table 1-3). However, each of these individual actions (taking a system out of operation, relocating a system, or putting a new system into operation) has undergone the AF Form 813 approval process as discussed in Section 3.2.1.

Similarly, Eglin Range Safety and/or Bioenvironmental (96 AMDS/SGPB) analyze the source of the EMR hazard using applicable standards (IEEE standard C95.1 in the case of RF personnel hazards), make worst-case calculations of the danger area around that source, and mark and enforce the resultant danger areas through AACI 91-201 and other policies and procedures as discussed in Section 3.2 (Chesser, 2009).

EED and Flammable Liquids. As explained in Section 4.2.1 (No Action Alternative), there is no danger to personnel or the public from inadvertent EED detonation by EMR systems in use on Eglin AFB. Also, Eglin's EMR hazard areas do not extend to the ground in recreational areas where civilians could be subject to danger while refueling a vehicle or otherwise handling flammable liquids.

Consequently, no significant human exposure impacts would be associated with Alternative 1.

4.2.3 Alternative 2

4.2.3.1 Restricted Access

As with the No Action Alternative (Section 4.2.1) and Alternative 1, there would be no effects to restricted access as a result of Alternative 2.

4.2.3.2 Human Exposure

Implementation of Alternative 2 would authorize the current EMR environment (Alternative 1) plus any projected future EMR systems including relocation, addition, or upgrade of the existing systems. As discussed in Section 3.2, there are numerous Air Force and other regulations and guidance documents to assist in the safe placement and operation of EMR equipment. Through the AF Form 813 submission and subsequent EIAP process, any changes would be evaluated on a case-by-case basis to ensure that base personnel and civilians in the surrounding communities or utilizing Eglin's recreational areas would not be adversely impacted.

EED and Flammable Liquids. As with the No Action Alternative and Alternative 1, there is no danger to personnel or the public from inadvertent EED detonation by EMR systems in use on Eglin AFB. Also, there are no areas where the EMR hazard extends to the ground in recreational areas where civilians could be subject to danger while refueling a vehicle or otherwise handling flammable liquids.

Therefore, no significant human exposure impacts would be associated with Alternative 2.

4.3 BIOLOGICAL RESOURCES

The analysis presented in this section addresses the potential for impacts to biological resources from EMR emitters that are utilized at various locations across Eglin AFB. Previous environmental analysis of the three categories of EMR emitters identified the following issues with regard to biological resources (U.S. Air Force, 2002a; U.S. Air Force, 2003a):

Use of Radar Systems: The potential exists for impacts to birds in flight and tree-dwelling organisms from the use of radar systems.

Use of Range Communication Transmitters: The potential exists for impacts to birds in flight from the use of microwave telemetry systems.

Use of Lasers: The potential exists for impacts to wildlife, particularly ocular and skin damage, from the use of lasers.

All of the above issues were found to not have significant adverse impacts and no effect to threatened or endangered species at the baseline level of EMR emitters that was analyzed in the 2002 EMR PEA (U.S. Air Force, 2002a) and the 2003 *Electromagnetic Radiation Environmental Baseline Document* (U.S. Air Force, 2003a). Since the writing of those documents, no new types

of biological resource issues from EMR emitters have been identified, though the baseline parameters of EMR emitters have changed, or are presumed to change in the future, and certain sensitive species locations have changed over time.

4.3.1 No Action Alternative

The No Action Alternative identified in this REA is identical to that analyzed and approved for the Preferred Alternative (Alternative 3) in the 2002 EMR PEA (U.S. Air Force, 2002a). This alternative included the EMR baseline, aggregate EMR hazard area on Eglin AFB, as well as a process by which to approve the use of future EMR systems on Eglin AFB. Since it was difficult to quantify the effects of EMR emitters to biological resources on Eglin AFB, the No Action Alternative prescribed specific guidelines to establish a methodology based on existing EMR safety programs in order to consistently screen EMR requests and facilitate the AF Form 813 process when any future activity involving an EMR emitter would change the baseline parameters.

New location information for sensitive biological resources was examined in relation to analysis methods from the 2002 EMR PEA, which still apply. Although the numbers of sensitive species and acres of sensitive habitats have changed, the No Action Alternative would still have no significant impacts on biological resources. It was determined that potential impacts to sensitive species from EMR sources would be evaluated on a case-by-case basis through the AF Form 813 process. If it was determined that there are no sensitive species within the respective hazard area of a specific EMR emitter, then the action may proceed, according to the AF Form 813 process, and be CATEXed. Should it be found that the addition, relocation, or upgrade of an emitter would put sensitive species within an EMR hazard area, closer examination of the situation would be warranted before proceeding with the action. This could involve consultations with the USFWS to identify the type(s) of species present, potential for exposure, and what site-specific BMPs could be applied (e.g., fencing, elevation of the system, relocation of the system or the species of concern). BMPs would be determined on a case-by-case basis, depending on the results of the examination.

This section provides a summary of the previous issues and analyses addressed in the 2002 EMR PEA.

4.3.1.1 Use of Radar Systems

Analysis of the potential for impacts to biological resources from the use of radar systems focused primarily on the effects to tree-dwelling organisms and birds in flight; it was determined that there would be no adverse effects to terrestrial wildlife. Due to the nature of the radar systems at Eglin AFB and the operational parameters (i.e., height of elevation, inaccessibility), it is unlikely that terrestrial and/or ground-based sensitive species would be impacted. The majority of radar systems on Eglin AFB are mounted on the rooftops of buildings or on pads several stories high and are equipped with elevation interlocks that shut the system down if the radiation beam drops below horizontal, thereby minimizing the chance of prolonged exposure to

terrestrial organisms. The lowest recorded radar antenna height occurring on Eglin AFB is 39.13 feet and is located at Site A-13 on Santa Rosa Island (Higdon, 2009c).

Analysis in the 2002 EMR PEA also concluded that there would be no effects to vegetation from the use of radar systems on Eglin AFB. This conclusion was based on the operational parameters of a radar system, which require a clear line-of-sight in order for the system to work properly, without interruption. The line-of-sight must be free of obstruction, including trees. For this reason, any radar transmissions must occur either above the tree line or along a cleared path.

In 1993, the U.S. Army conducted an environmental assessment to determine the potential for impacts to biological resources from the use of a ground-based family of radar systems. Analysis contained within the *Final Ground-Based Radar (GBR) Family of Radars Environmental Assessment* (U.S. Army, 1993) concluded that for wildlife mammals such as dogs, rabbits, and mice, EMR power densities in the range of 20 mW/cm^2 to 42 mW/cm^2 would be detrimental. The biological analysis in the 2002 EMR PEA was based on these values and concluded that since these animals would be found at ground level, and all six-minute time averaged power densities (the exposure time needed for adverse effects to occur) would not exceed 10 mW/cm^2 at ground level, terrestrial wildlife should not be adversely affected by the use of radar systems (U.S. Army, 1993).

The greatest potential for hazardous exposure to EMR from radar systems exists for birds and tree-dwelling organisms. It is possible for birds to be subjected to extremely high power densities under a number of circumstances. A bird could be exposed if it flew into the path of the main beam of a radar system or the beam became fixated on the nest of a bird. In order for a bird to remain in the path of a radar beam for a period of time longer than six minutes, it would have to: (a) be flying in the same direction and the same speed of rotation as the radar beam's horizontal and/or vertical movement; (b) fly directly along the beam trajectory path toward or away from the emitter; or (c) hover within the stationary beam for an excessive amount of time. The occurrence of any of the above scenarios is highly improbable.

By analyzing the possible power densities to which the birds could be exposed, a determination of the SAR associated with that power density can be made. The SAR, relative to the bird's standard metabolic rate measured in the same unit of W/kg body mass, gives an estimation of the possibility for detrimental effects. Indications are that EMR power densities between 38 mW/cm^2 and 61 mW/cm^2 would be detrimental for birds weighing between 25 grams and 3.5 kilograms, those ranging in size from medium-sized songbirds to small ducks and hawks (U.S. Army, 1993). In reference to sensitive bird species found on Eglin AFB, adult RCWs weigh approximately 43 grams, adult piping plovers weigh between 43 and 63 grams, and adult Florida burrowing owls weigh between 125 and 175 grams.

The *Final GBR Family of Radars Environmental Assessment* (U.S. Army, 1993) attempted to derive an estimate of the probability of a bird receiving a hazardous exposure to EMR. This estimate was based on the percentage of volumetric space near the radar that would contain the potentially hazardous power density. This example was also used in the 2002 EMR PEA (U.S. Air Force, 2002a) and was based on a model of the most powerful radar system on Eglin AFB,

the AN/FPS-16 radar system (with the exception of the AN/FPS-85 phased array radar located at Site C-6). The hazard distances calculated for birds weighing 25 grams to 3.5 kilograms is much smaller than those for humans (1,198 feet and 946 feet respectively, as compared to 2,336 feet for humans). Figure 4-1 shows the operational parameters used in the assessment model. As mentioned earlier, the hazardous power densities for birds between 25 grams and 3.5 kilograms are 38 mW/cm^2 and 61 mW/cm^2. It was determined that the percent chance of a 25-gram or 3.5-kilogram bird encountering the beam at any given moment when flying within its associated hazard distance was quite low, only 0.0046 percent (1 in 21,739).

The above model was based on the AN/FPS-16 radar system. Hazard distances with respect to other radar systems are much smaller and therefore less of a hazard to birds with respect to chance encounters with the radar beam. Based on the values derived from the assessment models (refer to Appendix A), combined with the fact that a bird would have to remain within the beam for an average of six minutes, it was concluded in the 2002 EMR PEA (U.S. Air Force, 2002a) that the chances for hazardous exposure to birds from AN/FPS-16 type radar systems and the AN/FPS-85 system are extremely small. Table 4-1 summarizes the chances for a bird strike within a given radar hazard area.

Table 4-1. Probability of a Radar Beam Bird Strike in a Given Hazard Area

Bird Size	Radar System	Hazard Area (feet)	Chance of Beam Contact	Probability of Occurrence
25 grams	AN/FPS-16	1,198	0.0046%	1 in 21,739
	AN/FPS-85	1,451	0.0150%	1 in 6,667
3.5 kilograms	AN/FPS-16	946	0.0046%	1 in 21,739
	AN/FPS-85	1,145	0.0150%	1 in 6,667

Source: U.S. Air Force, 2002a

The AN/FPS-85 radar, located at Site C-6, is different than the AN/FPS-16-type radar systems. The same theories applied to the AN/FPS-16 radar system assessment model apply to the AN/FPS-85 radar, although the nature of the AN/FPS-85 radar system allows for a cone-shaped hazard area pointing only in one direction (due south), rather than a dome-shaped hazard area as with the AN/FPS-16-type radars. Figure 4-2 provides a graphical representation of the operational parameters of the AN/FPS-85. The following values were calculated in the 2002 EMR PEA and were based on the AN/FPS-85 Phased Array Radar System (refer to Appendix A for further details).

- 1,451-foot hazard distance for a 25-gram bird
- 1,145-foot hazard distance for a 3.5-kilogram bird
- 0.015 percent (1 in 6,667) chance of a 25-gram bird to encounter the beam within the hazard area at a given moment
- 0.015 percent (1 in 6,667) chance of a 3.5-kilogram bird to encounter the beam within the hazard area at a given moment

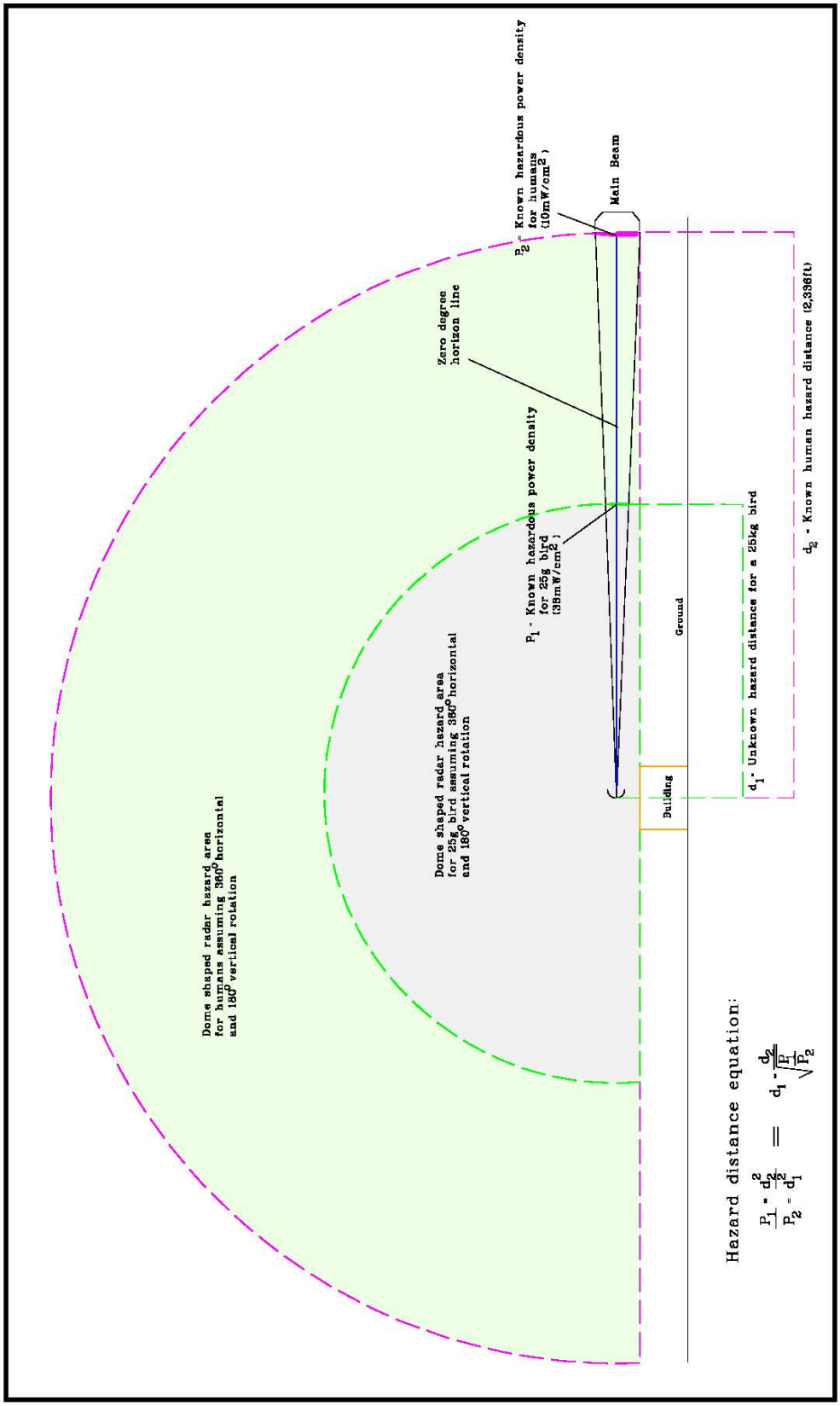

Figure 4-1. Estimation of Radar Hazard Area for a 25-gram Bird for an AN/FPS-16 Radar System

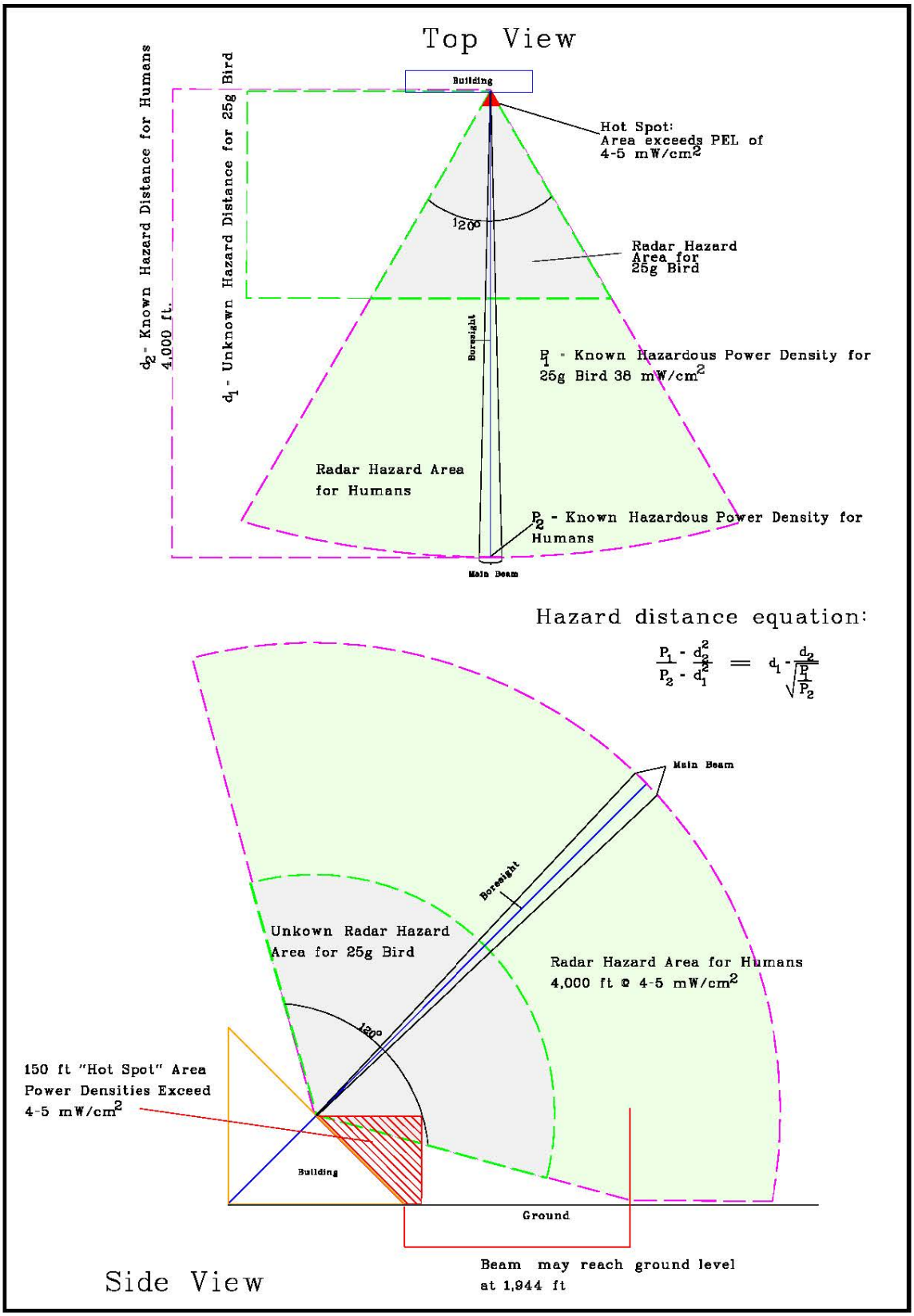

Figure 4-2. Estimation of Radar Hazard Area for a 25-gram Bird for an AN/FPS-85 Radar System

Table 4-2 and Figure 4-3 through Figure 4-12 show the hazard distances for 25-gram and 3.5-kilogram birds associated with identified radar systems on Eglin AFB under the No Action Alternative.

Table 4-2. Radar Hazard Distances for 25-g and 3.5-kg Birds with the No Action Alternative

Radar System	Hazard Distance for 25-g Birds (feet)	Hazard Distance for 3.5-kg Birds (feet)
AN/MPS-19	131	103
HPISS	211	167
Nike TTR/CROTALE	148	117
Nike TTRV	117	93
I-HAWK	188	148
AN/FPS-16	1,197	946
SADS X	601	474
WEST XIC	52	41
ROLAND	27	21
SADS VIIIR	98	77
WEST XR	57	45
SADS VIR	211	167
WEST IA	174	138
SADS IIR	130	102
AN/FPS-85	1,451	1,145
AN/FPQ-13	1,197	946
SADS II	60	47
Doppler Radar	615	168

Source: U.S. Air Force, 2002a

4.3.1.2 Use of Range Communication Systems

Analysis of the potential for impacts to sensitive species from the use of range communication systems, primarily microwave telemetry systems, focused on the effects to birds in flight. Figure 4-13 shows the location of range communication systems on Eglin AFB and their proximity to sensitive bird species under the No Action Alternative. Since the operational parameters of a microwave system require the transmission of RF waves along a cleared path or above a tree line, terrestrial and tree-dwelling organisms as well as vegetation would not be exposed to EMR from microwave transmission systems.

According to analysis within the 2002 EMR PEA, birds in flight are most at risk to hazardous exposure of EMR from microwave transmitter systems. In order to assess the potential for birds in flight to be exposed to hazardous levels of EMR from microwave transmission towers, an assessment model was used (Appendix A). The values given by the model indicated that the hazard area for a 25-gram bird associated with a microwave transmitter with an input power of 7.1 watts and an antenna gain of 43 decibels (a microwave system with these parameters at building 44 on Eglin Main and at Test Site A-20 was used for the analysis) is approximately 18 feet. The percent chance of a 25-gram bird encountering the beam when flying within 18 feet of the transmitter antenna was determined to be approximately 0.0077 percent (1 in 12,987).

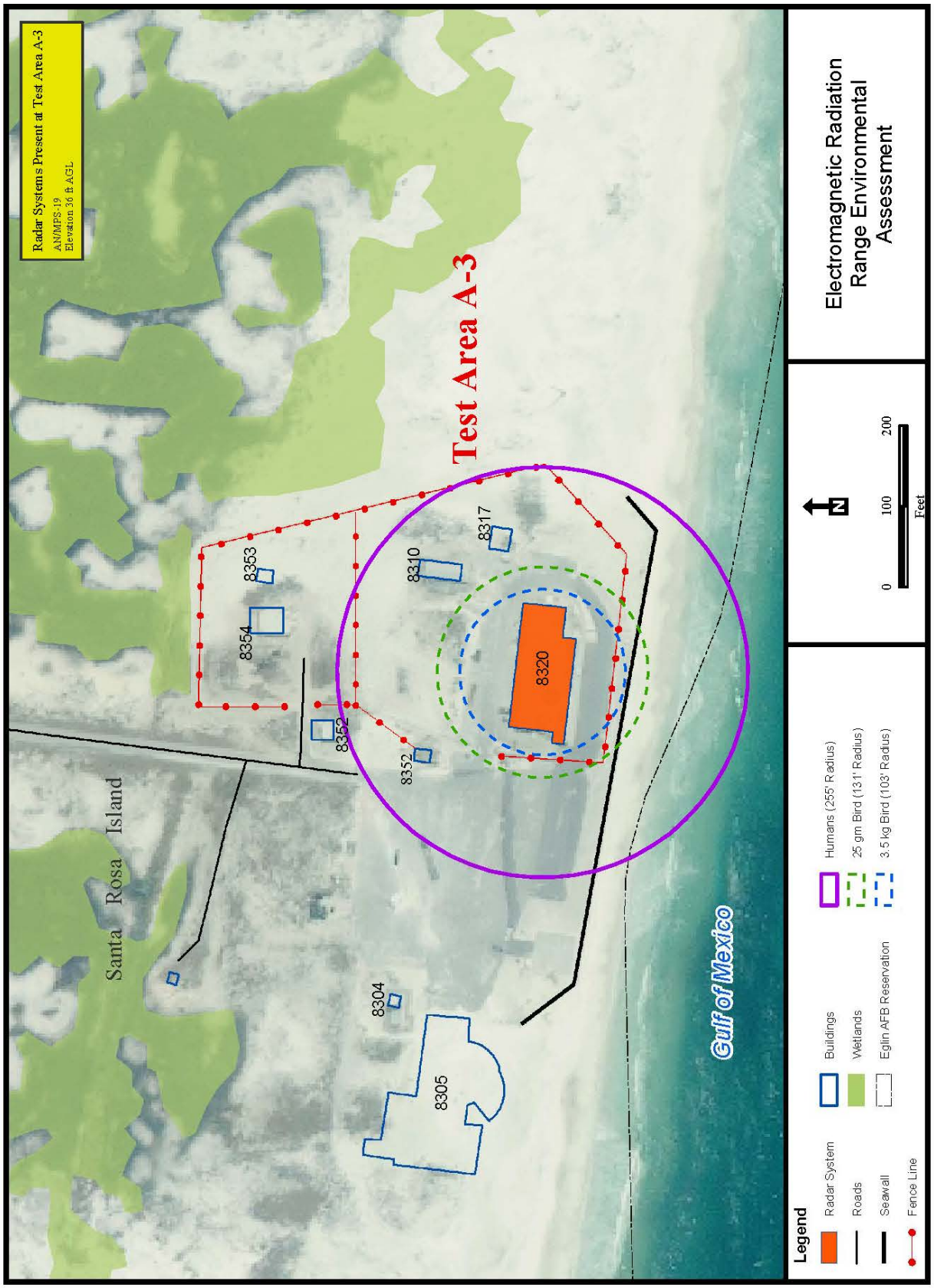

Figure 4-3. Radar Hazard Areas at Test Area A-3 – No Action Alternative

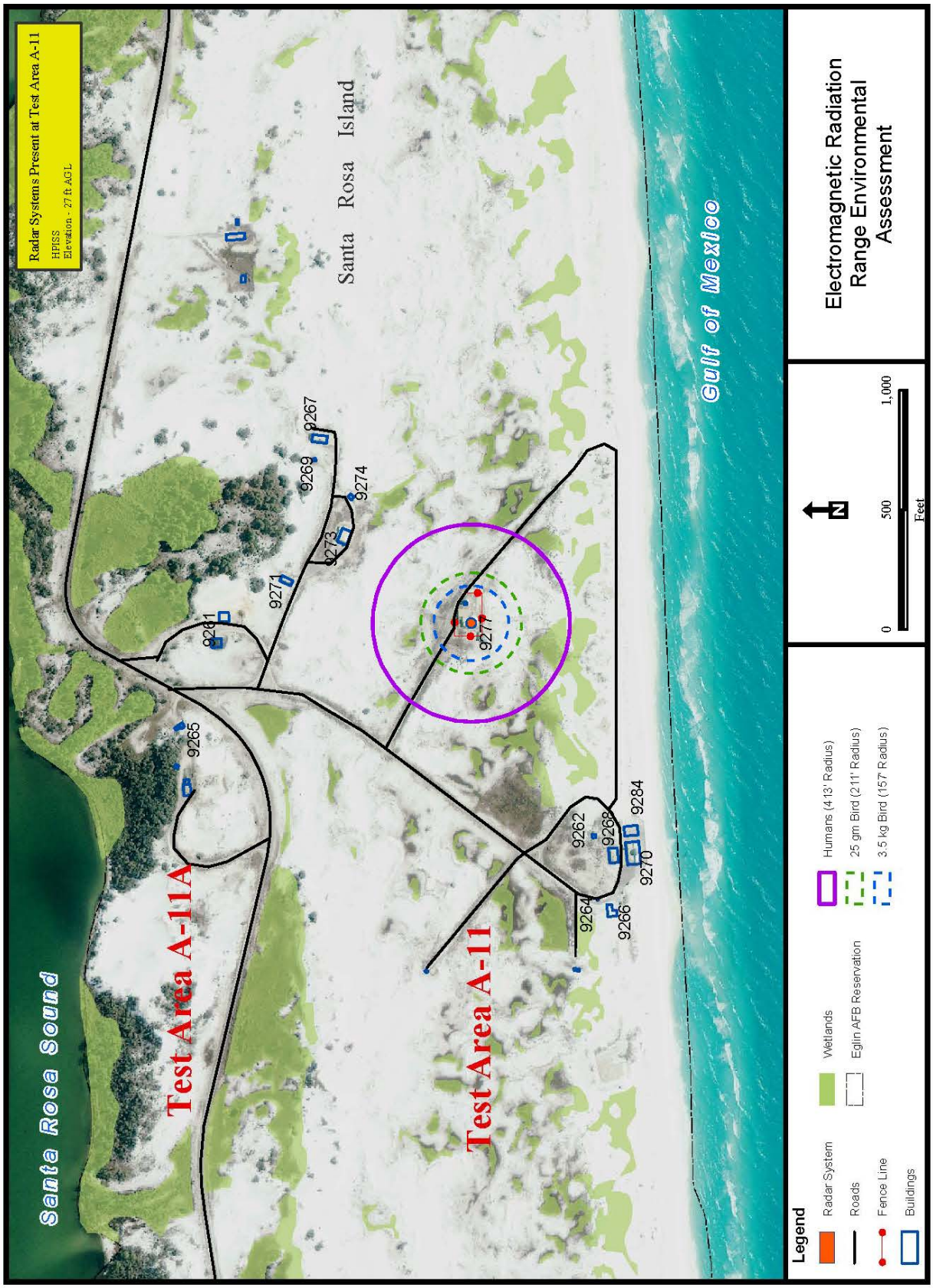

Figure 4-4. Radar Hazard Areas at Test Area A-11 – No Action Alternative

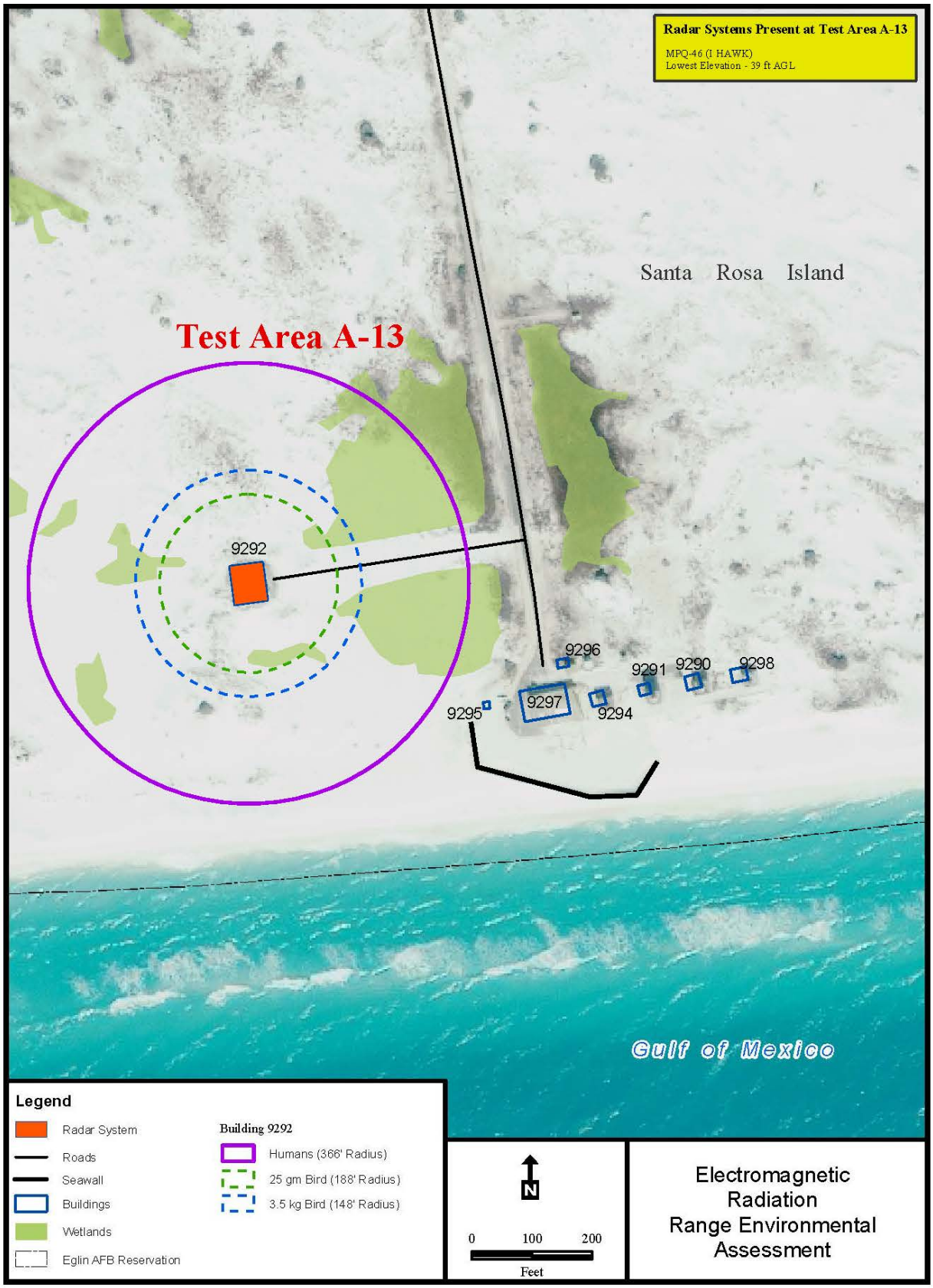

Figure 4-5. Radar Hazard Areas at Test Area A-13 – No Action Alternative

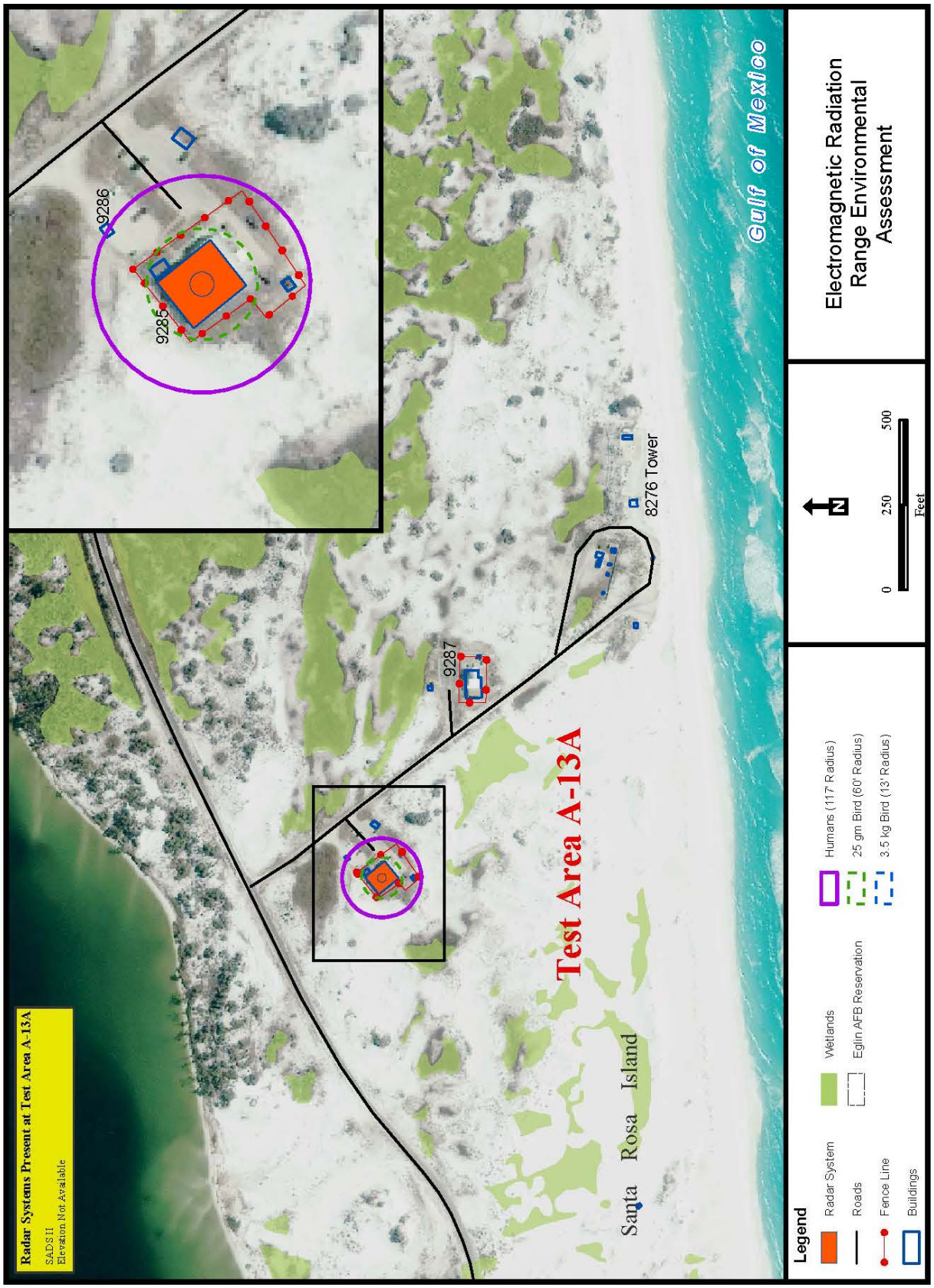

Figure 4-6. Radar Hazard Areas at Test Area A-13A – No Action Alternative

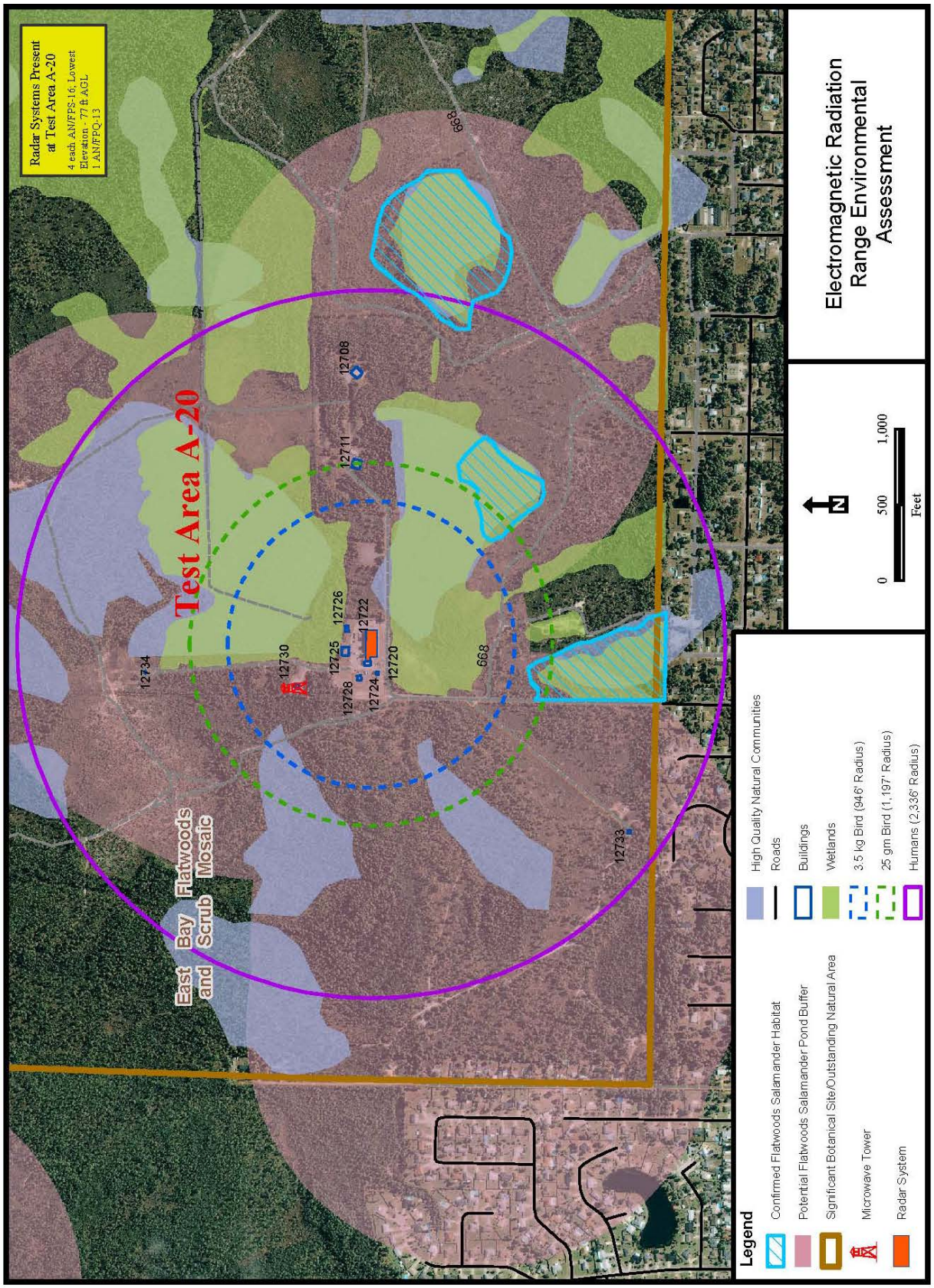

Figure 4-7. Radar Hazard Areas at Test Area A-20 – No Action Alternative

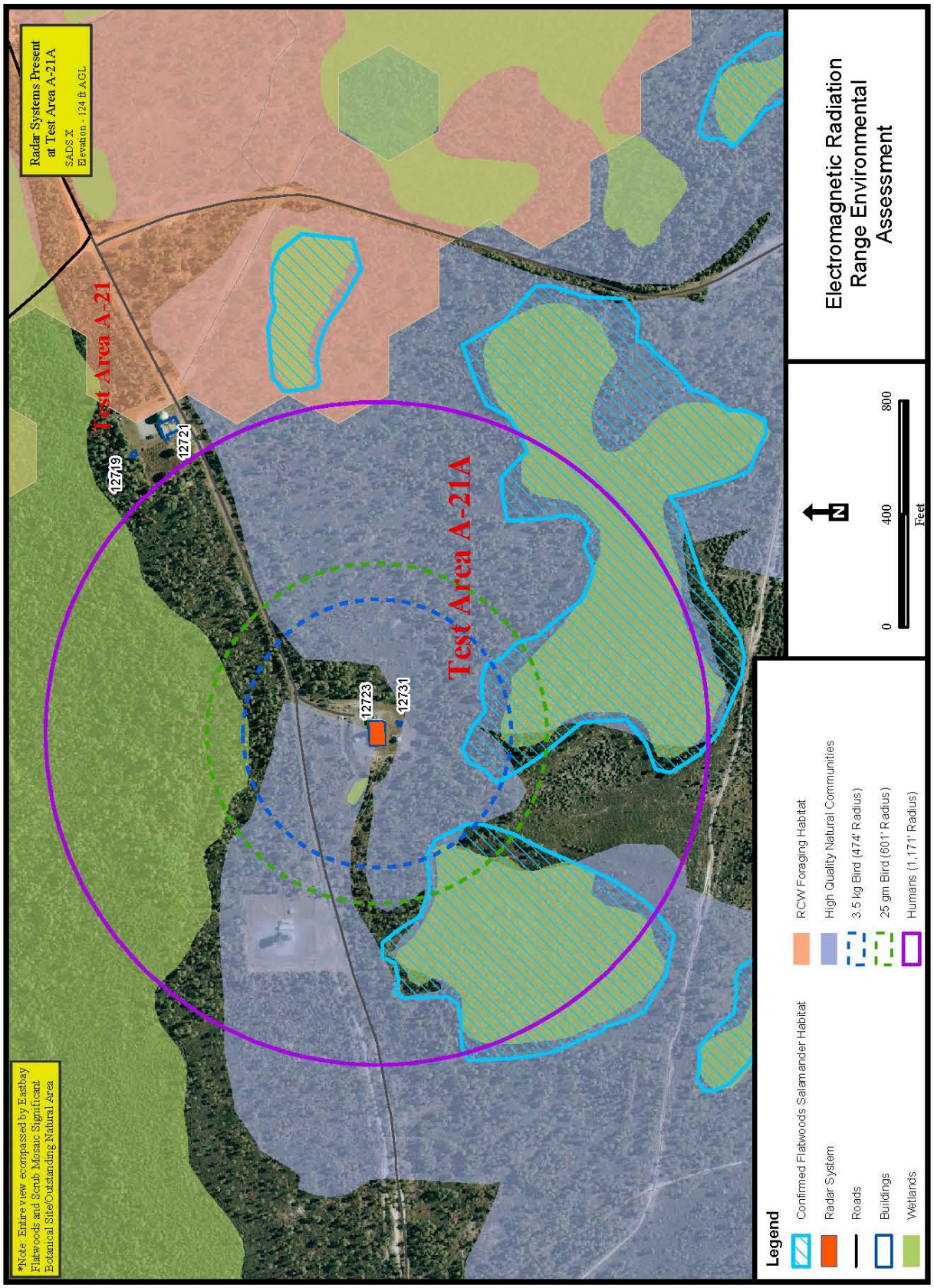

Figure 4-8. Radar Hazard Areas at Test Area A-21 – No Action Alternative

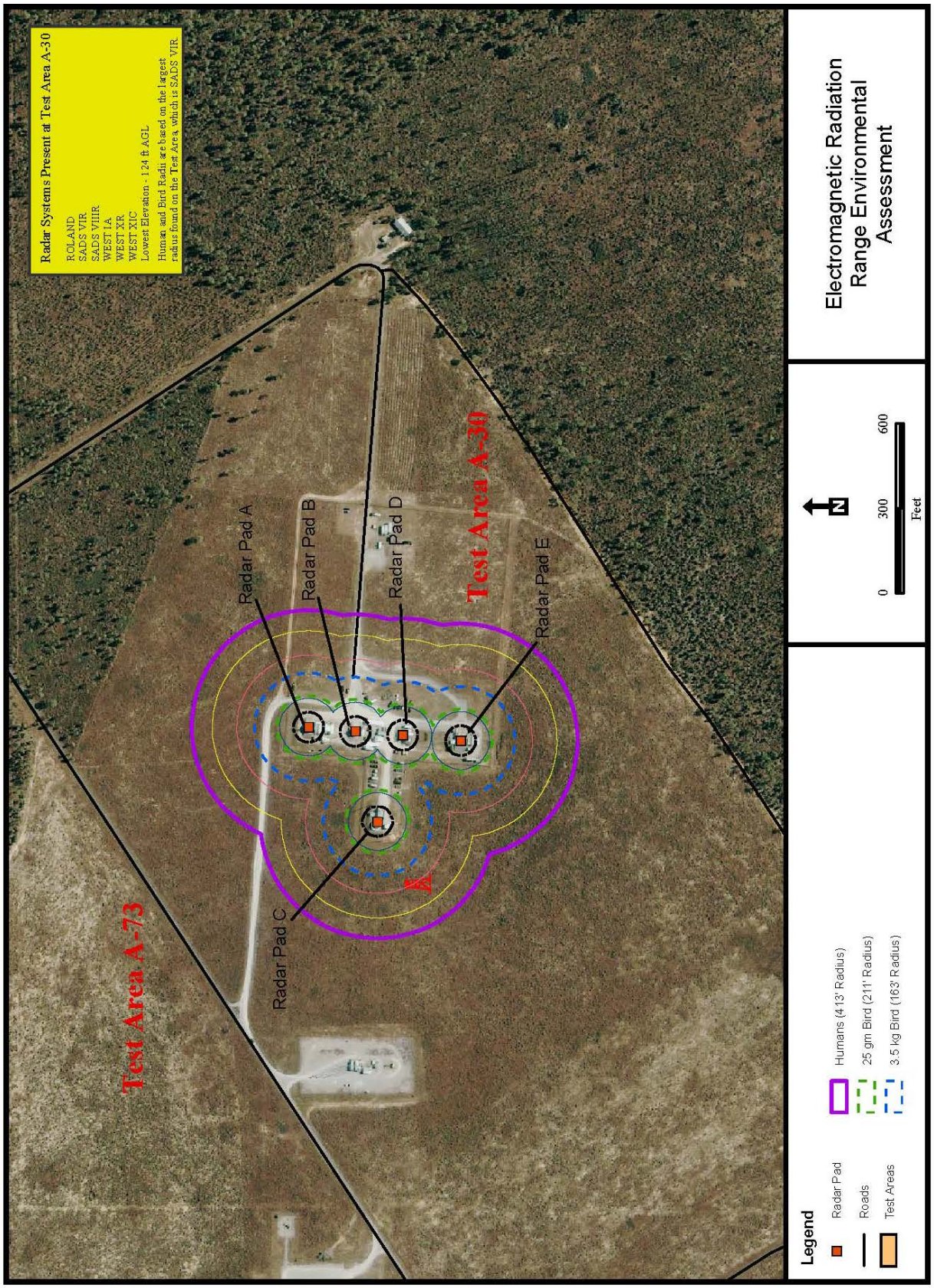

Figure 4-9. Radar Hazard Areas at Test Area A-30 – No Action Alternative

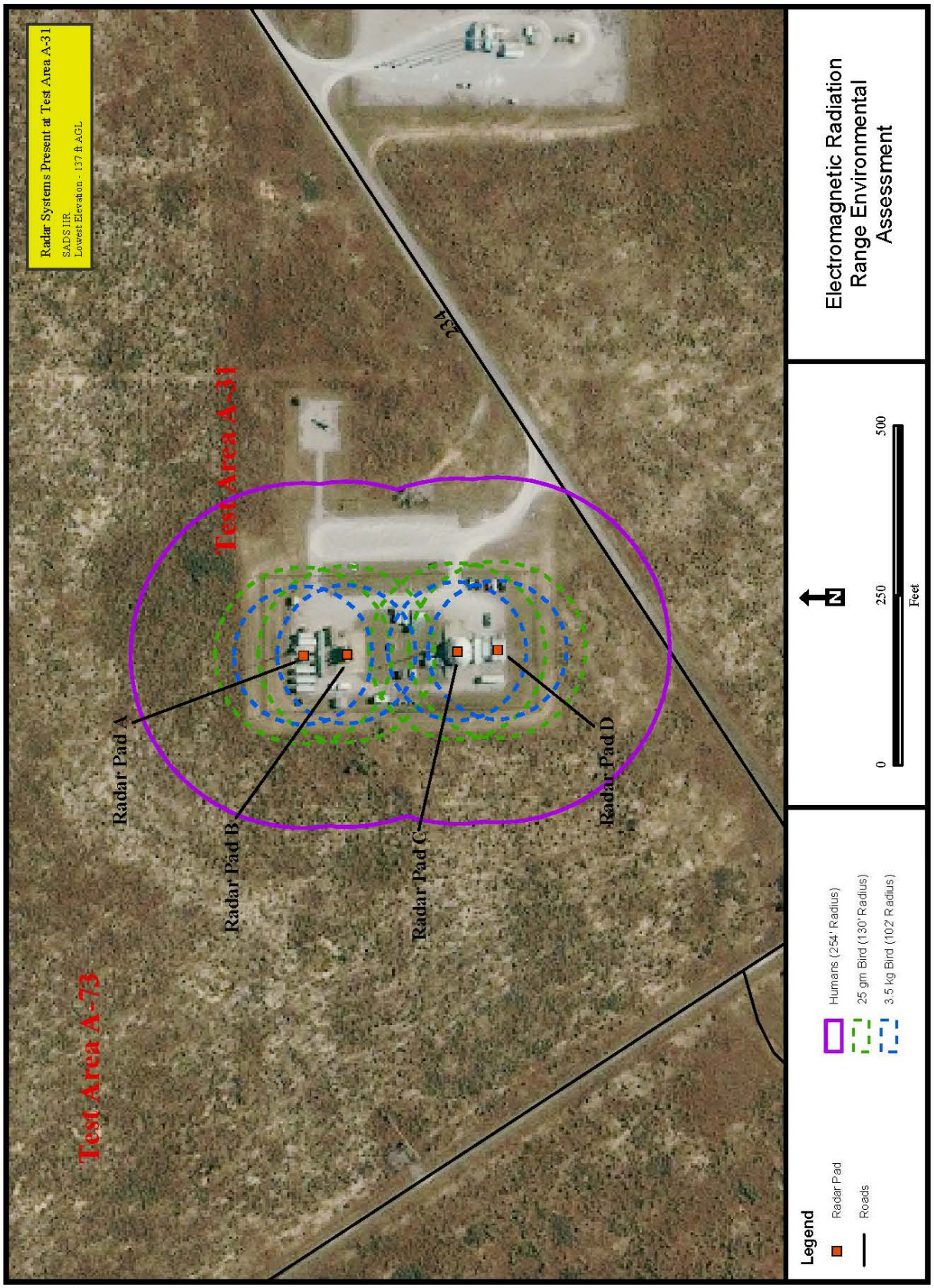

Figure 4-10. Radar Hazard Areas at Test Area A-31 – No Action Alternative

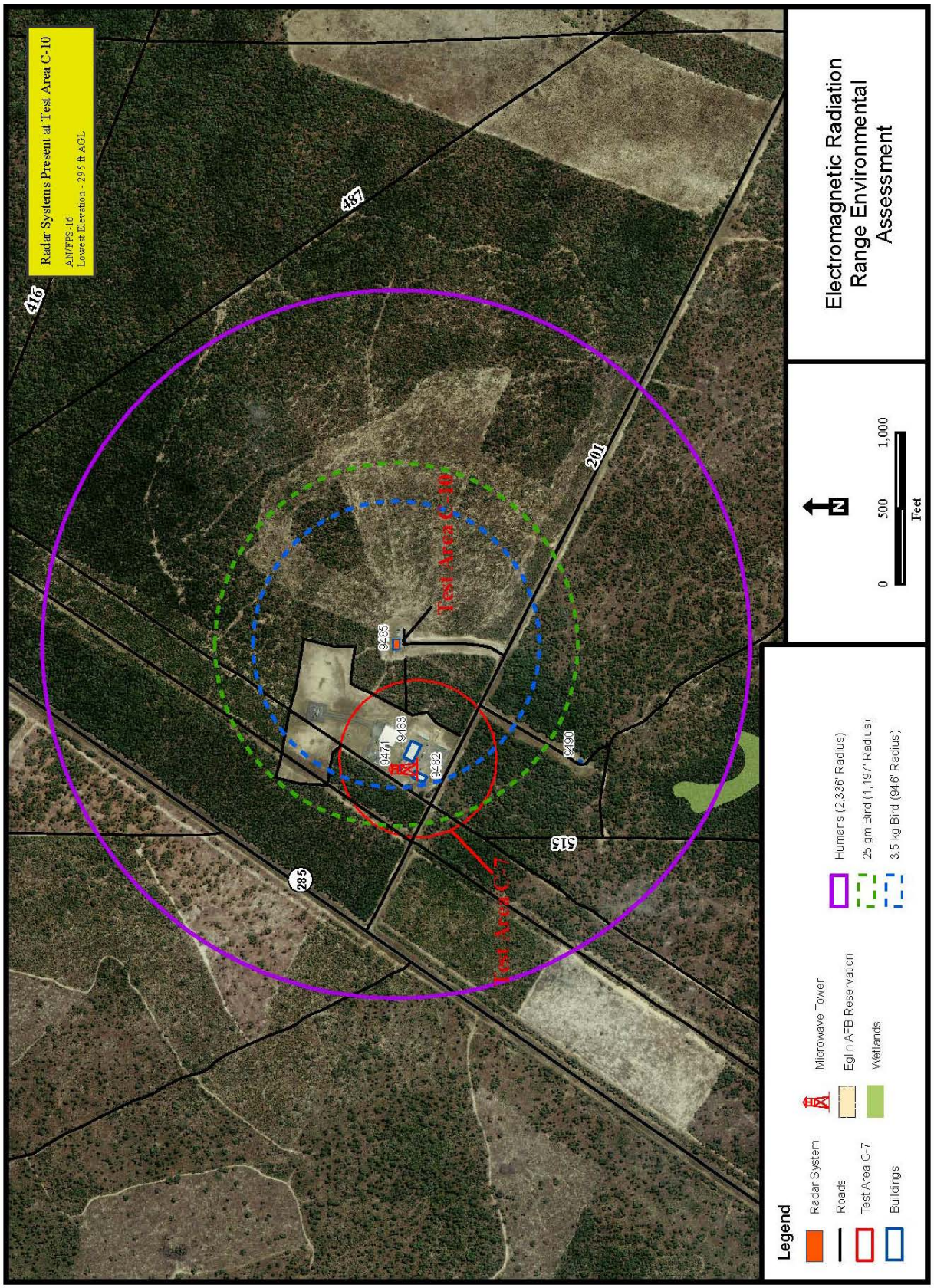

Figure 4-11. Radar Hazard Areas at Test Area C-10 – No Action Alternative

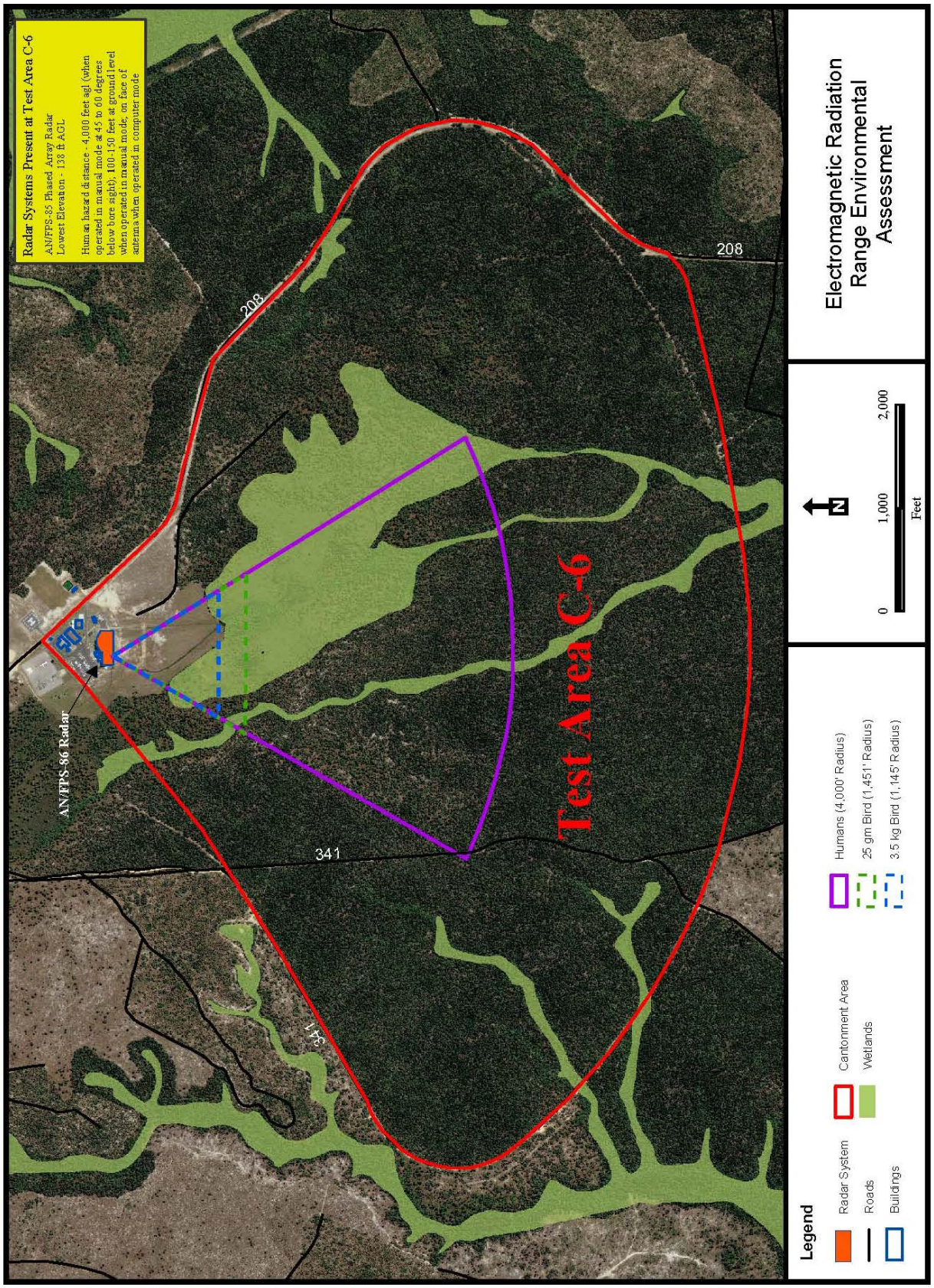

Figure 4-12. Radar Hazard Areas at Test Area C-6 – No Action Alternative

Additionally, since some microwave towers support more than one microwave dish, it was determined that the chance for a bird to encounter a microwave beam increases in proportion to the number of microwave dishes present (i.e., 1 in 6,494 for two dishes on the same tower, 1 in 4,329 for three). Time averaging was determined to be an important aspect in determining whether a bird may be exposed to hazardous levels of EMR. The average maximum time of exposure in relation to hazardous levels of EMR was determined to be six minutes (U.S. Air Force, 2002a). As a result, if a 25-gram bird were to encounter the beam, it would have to either hover within the beam or fly directly along the beam path for a duration of six minutes in order to experience a hazardous exposure to EMR. Since this scenario is highly improbable, it was determined that there would be no effects to birds in flight from the use of range communication systems on Eglin AFB under the No Action Alternative.

4.3.1.3 Use of Lasers

Analysis of the potential for impacts to sensitive species from the use of lasers focused primarily on impacts to wildlife; it was determined that there would be no impacts to vegetation.

Since there are many different types of lasers in use on Eglin AFB and the operational parameters (e.g., exact locations, specific use, laser system specification) was difficult to determine, analysis of the potential for effects to wildlife from the use of lasers under the No Action Alternative was based on the knowledge of general laser capabilities and the potential effects of laser exposure. Figure 4-14 shows the locations of stationary laser systems and their proximity to sensitive species on Eglin AFB under the No Action Alternative.

The main biological hazards associated with exposure to lasers are the potential for ocular and skin damage from direct contact with a laser beam. The potential for effects to biological resources from the use of lasers is the same as that to humans. According to the 2002 EMR PEA, many mission activities involving lasers occur outdoors, with associated eye hazard distances in excess of 1,000 feet, and use occurring throughout the range. Although laser use is performed under a controlled setting and some safety considerations for humans may apply to wildlife (e.g., area monitoring, electromechanical stops), prevention of wildlife from entering the eye hazard area, or in the case of more powerful laser beams crossing the beam path, is extremely difficult, if not impossible. Thus, risk of exposure to lasers was determined to be much greater to wildlife than to humans. Since it was difficult to determine the exact location of laser usage on Eglin AFB and because the types of lasers being utilized at Eglin AFB are constantly changing, it was determined that the potential for effects to sensitive species from the use of lasers would be analyzed through the AF Form 813 process on a case-by-case basis.

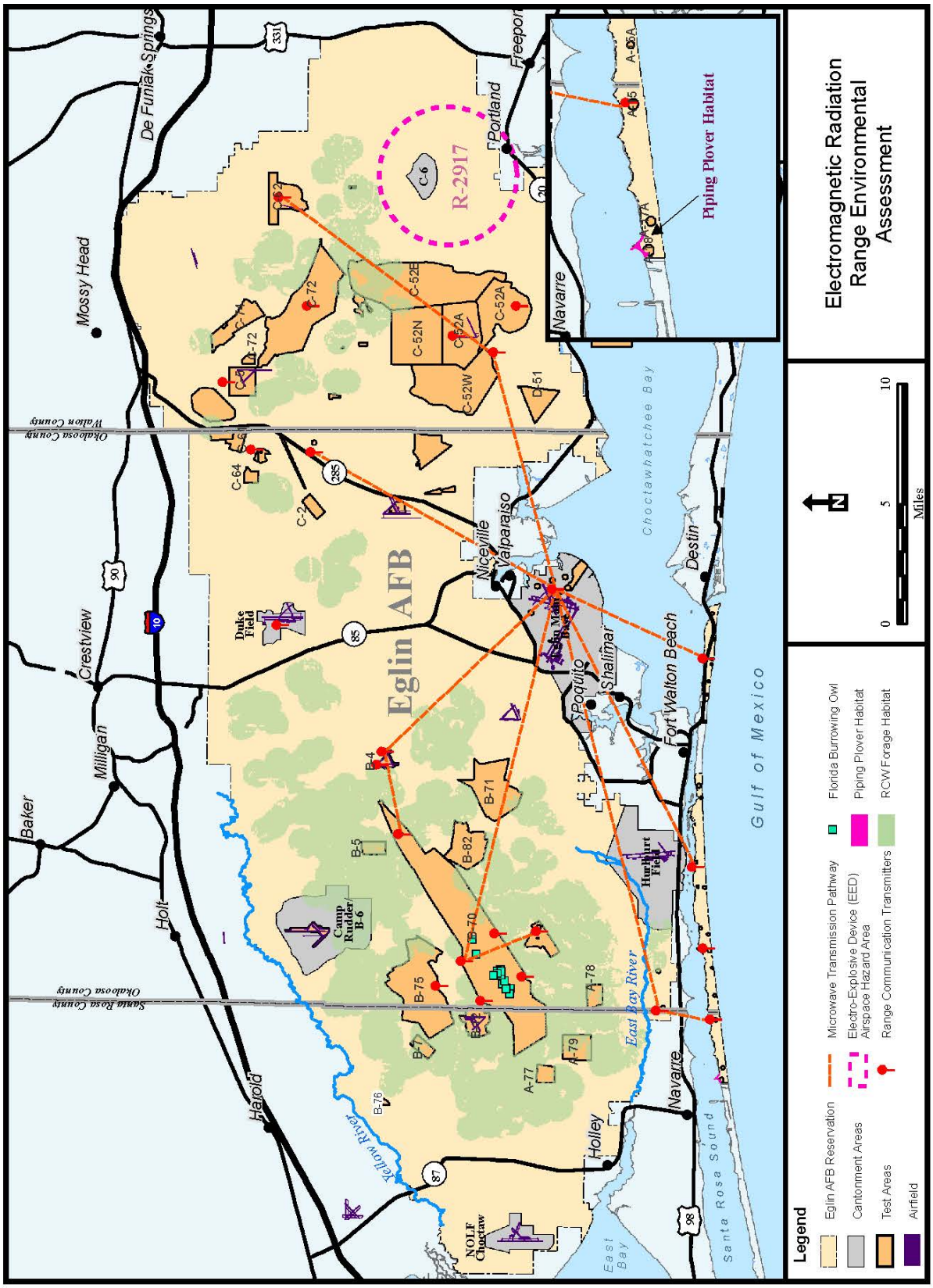

Figure 4-13. Location of Range Communication Systems and Sensitive Bird Species on Eglin AFB with the No Action Alternative

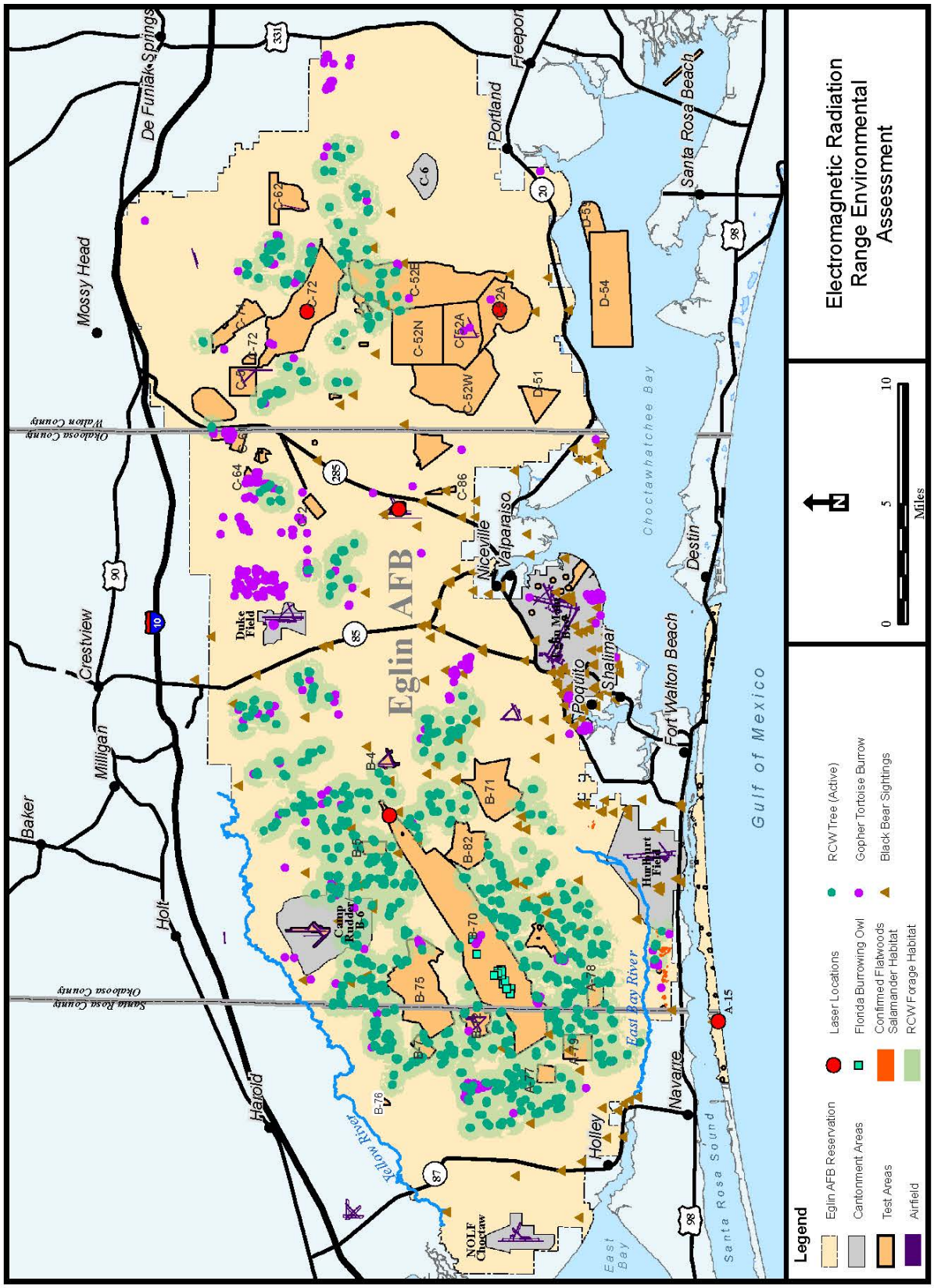

Figure 4-14. Location of Laser Systems and Proximity to Sensitive Species on Eglin AFB with the No Action Alternative

4.3.1.4 Summary of No Action Alternative

Essentially, the environmental consequences of EMR are dependent on the occurrence of exposure to organisms. This, in turn, is dependent on both the operational parameters of the emitter and the proximity of organisms to the emitter. Since these factors are constantly changing, the effects of the No Action Alternative were only qualified, not quantified. The chance of an organism being exposed was analyzed as far as the data allowed, but chances could increase or decrease depending on changes in the factors mentioned above. Case-by-case review of any changes to the EMR baseline on Eglin AFB would continue to be conducted through the AF Form 813 process to determine if the potential exists for impacts to sensitive species and to identify appropriate BMPs to minimize the potential for impacts. Further, based on the analysis provided, the chance of an encounter between EMR and sensitive species is extremely low. Therefore, the current No Action Alternative is not anticipated to have a significant effect on sensitive species.

4.3.2 Alternative 1

Alternative 1 provides the baseline as defined in the 2002 EMR PEA (U.S. Air Force, 2002a) plus the removal, relocation, addition or upgrade of any EMR emitter systems since the 2002 EMR PEA. Table 1-1 through Table 1-3 provide a summary of the current environmental baseline of EMR emitters under Alternative 1. The potential for impacts to sensitive species from the use of EMR emitters under Alternative 1 is the same as that for the No Action Alternative; therefore the analyses are the same. However since the 2002 EMR PEA was prepared, specific test area locations supporting EMR sources have changed as new locations have been added and some EMR systems are no longer in operation. Therefore, analyses provided under Alternative 1 will focus on the changes in the EMR baseline since 2002 and will analyze any new locations/hazard areas that were not included in the 2002 EMR PEA.

4.3.2.1 Use of Radar

Changes to the radar system baseline since the 2002 EMR PEA are identified in Section 2.2.2. Additionally, Table 2-3 and Table 2-4 provide a comparison of the total aggregate space occupied by radar systems under the No Action Alternative and Alternative 1, respectively. Since the data sources used to calculate the aggregate hazard area for the No Action Alternative in the 2002 EMR PEA differ from those used to calculate Alternative 1 in this REA update, it is difficult to provide a direct comparison between the two data sets. Therefore, analysis focuses on changes to the radar system baseline (i.e., total quantity of systems) and the potential effects these changes have on sensitive species.

In total, five radar systems have been removed from the EMR baseline since the 2002 EMR PEA. This has created an overall reduction in the amount of radar hazard area and volume of space occupied by hazard areas across Eglin AFB.

One additional system, the WEIBEL, a mobile radar system, has been added to the EMR baseline. Since the WEIBEL is a mobile radar system and could be used anywhere on Eglin

AFB, it is difficult to assess the potential for impacts to sensitive species from usage. Further, information pertaining to human hazard distances for this system was not available at the time this REA was prepared. Subsequently, since the human hazard distance of a radar system is used to calculate the radar hazard distances for bird species, radar hazard distances for 25-gram and 3.5-kilogram birds are not available for the WEIBEL radar system. Table 4-3 shows the radar hazard distances for all other radar systems under Alternative 1.

Table 4-3. Radar Hazard Distances for 25-g and 3.5-kg Birds with Alternative 1

Radar System	Hazard Distance for 25-g Birds (in feet)	Hazard Distance for 3.5-kg Birds (in feet)
HPISS	211	167
MPQ-46 (I HAWK)	188	148
SADS III	60	47
AN/FPS – 16	1,197	946
AN/FPQ – 13	1,197	946
SADS X	601	474
WEST XIC	52	41
ROLAND	27	21
SADS VIIR	98	77
WEST XR	57	45
SADS VIR	211	167
WEST IA	174	138
SADS IIR	130	102
WEIBEL	N/A	N/A
AN/FPS – 85	1,451	1,145

Source: U.S. Air Force, 2002a; Higdon, 2009a
N/A = the bird hazard distance for the WEIBEL mobile radar cannot be calculated as the human hazard distance is unknown at this time.

As mentioned in Section 2.2.2, two existing radar systems have changed since the 2002 EMR PEA. The HPISS radar site, located at Test Area A-11, was moved from 27.485 feet above MSL to 86.487 feet above MSL. Additionally, the 2002 EMR PEA identified a SADS II radar system in operation at Test Area A-13. Based on communication with the DoD GAFC, this system is a SADS III and is located at Test Area A-13A (Higdon, 2009a). Figure 4-15 and Figure 4-16 depict these changes under Alternative 1. As all other radar systems have remained the same, refer to Figure 4-3 through Figure 4-12 for those bird hazard distances.

4.3.2.2 Use of Range Communication Systems

Changes to the range communication system baseline since the 2002 EMR PEA are identified in Section 2.2.2. Numerous range communication systems that were included as part of the EMR baseline in the 2002 EMR PEA have been removed from usage on Eglin AFB. The majority of these are systems were determined not to be sources of EMR as they function solely as receivers. Removal of these systems from the EMR baseline has created an overall decrease in the amount of aggregate space occupied by EMR emitters on Eglin AFB.

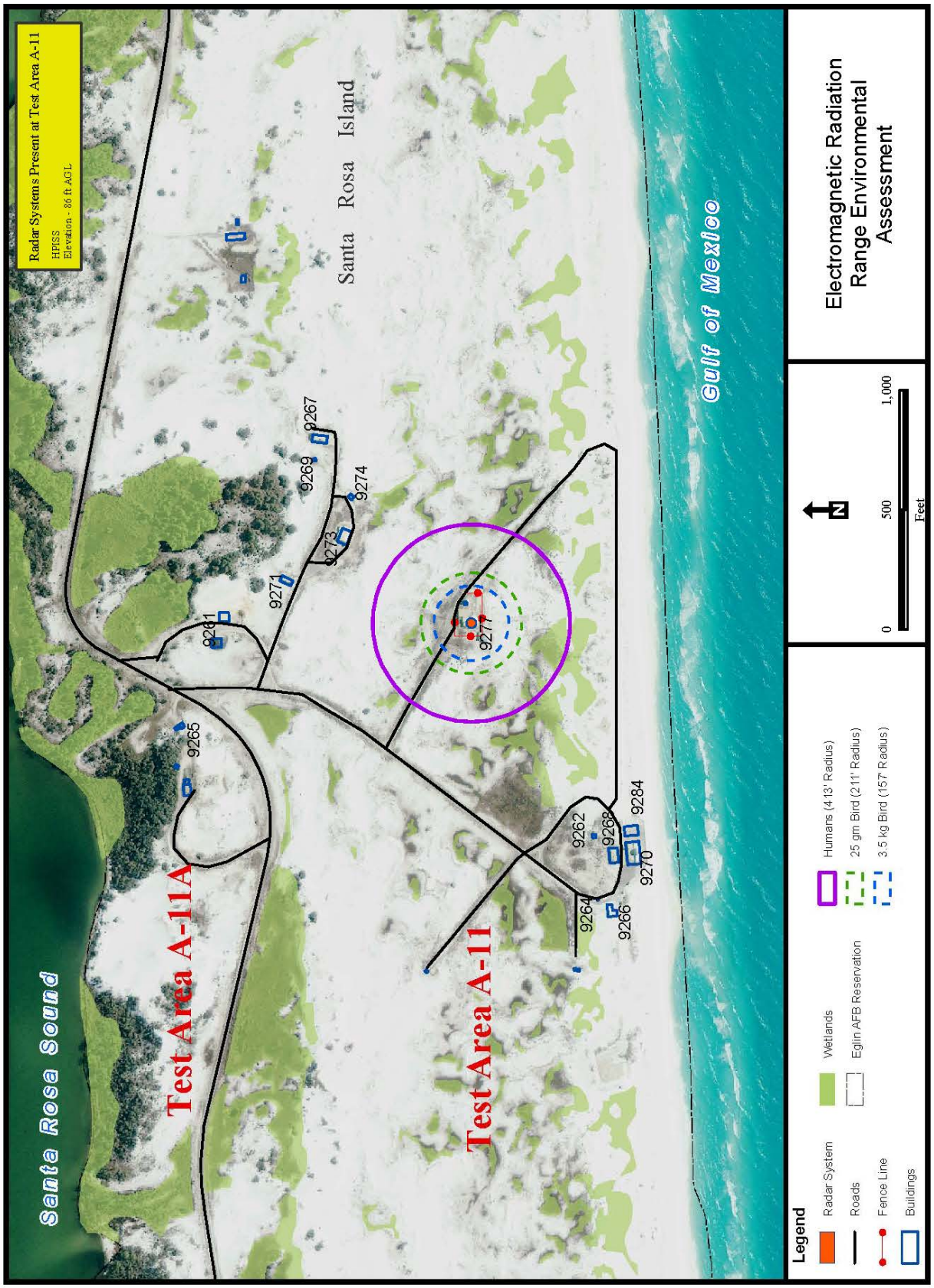

Figure 4-15. Radar Hazard Areas at Test Area A-11 – Alternative 1

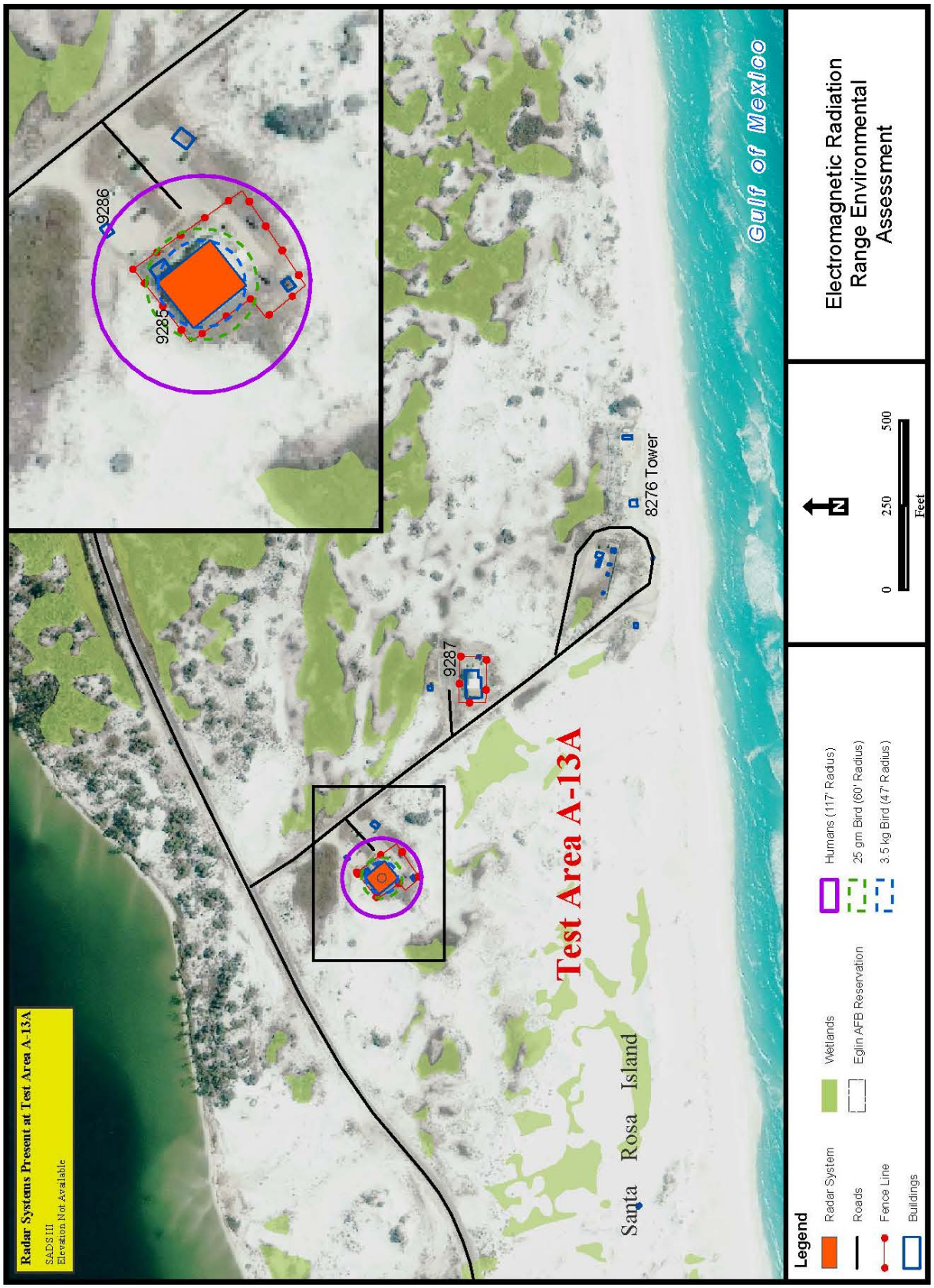

Figure 4-16. Radar Hazard Areas at Test Area A-13A – Alternative 1

In 2002 Eglin AFB prepared an Environmental Assessment (EA) to assess the potential impacts from the construction of eight cellular tower farms, which would support up to 20 separate cell towers each. Each tower required approximately 100 foot by 100 foot area of property, equaling approximately 200,000 square feet or 4.6 acres per tower farm, and was limited to a vertical height of 100 feet without guy wires (U.S. Air Force, 2002c). The cell tower farms were proposed for various locations across the Eglin Reservation and did not include any locations on Santa Rosa Island.

Analysis within the *EA for Cellular Phone Tower Farm Plan* (U.S. Air Force, 2002c) concluded that there would be no effect to sensitive bird species or migratory bird species from the usage of these cellular towers on Eglin AFB. This no effect determination was based on the fact that all towers would be designed and erected in accordance with the USFWS guidelines for preventing potential impacts to migratory birds. These guidelines included tower height restrictions of no more than 199 feet AGL, no guy wires, and for the towers to be unlit if permitted by Federal Aviation Administration regulations. Since bird collisions with towers generally occur with towers that are lit, have guy wires, and are higher than 200 feet AGL, then it was determined implementation of these restrictions would reduce the potential for impacts to bird species (U.S. Air Force, 2002c). Additionally, potential impacts from EMR associated with the cellular towers was determined to be very low, given that the amount of radiation that reaches the ground would not pose a threat to persons or animals on the ground. The maximum expected RF radiation from cell phone towers was not expected to exceed known hazard levels or FCC standards for public exposure (U.S. Air Force, 2002c).

At the time this REA was prepared, the actual number of cellular towers that have been constructed on Eglin AFB was unknown. The Eglin AFB Range Communications Inventory does not include the addition of any new cellular towers on Eglin AFB since the 2002 EMR PEA (U.S. Air Force, 2002a) was completed.

Though new EMR systems have been added, they are primarily radio links and therefore would have no impact on sensitive species. The quantity of microwave telemetry systems on Eglin AFB has remained the same since 2002; no new systems have been added and none have been removed. Figure 4-17 shows the proximity of microwave telemetry systems to sensitive bird species under Alternative 1.

4.3.2.3 Use of Lasers

Changes to the laser system baseline since the 2002 EMR PEA are identified in Section 2.2.2. The greatest change to the EMR laser baseline under Alternative 1 is the relocation of the AFRL from Test Area C-3 to Test Area C-86. AFRL operates both indoor and outdoor lasers at this facility. No sensitive species are located on Test Area C-86, and therefore impacts are not expected from the use of additional lasers within this area.

Additionally, several new portable laser systems have been identified for use on Eglin AFB. Figure **4-18** shows the location of known, stationary laser systems on Eglin AFB and their proximity to sensitive species under Alternative 1. Overall, the total number of laser systems on Eglin AFB has increased since the 2002 EMR PEA was completed. However, since many of these systems are portable and are used in various locations across Eglin AFB, it is difficult to provide site-specific analysis of the potential for impacts to sensitive species. Therefore, potential impacts to sensitive species from the use of lasers are addressed through the AF Form 813 process on a case-by-case basis.

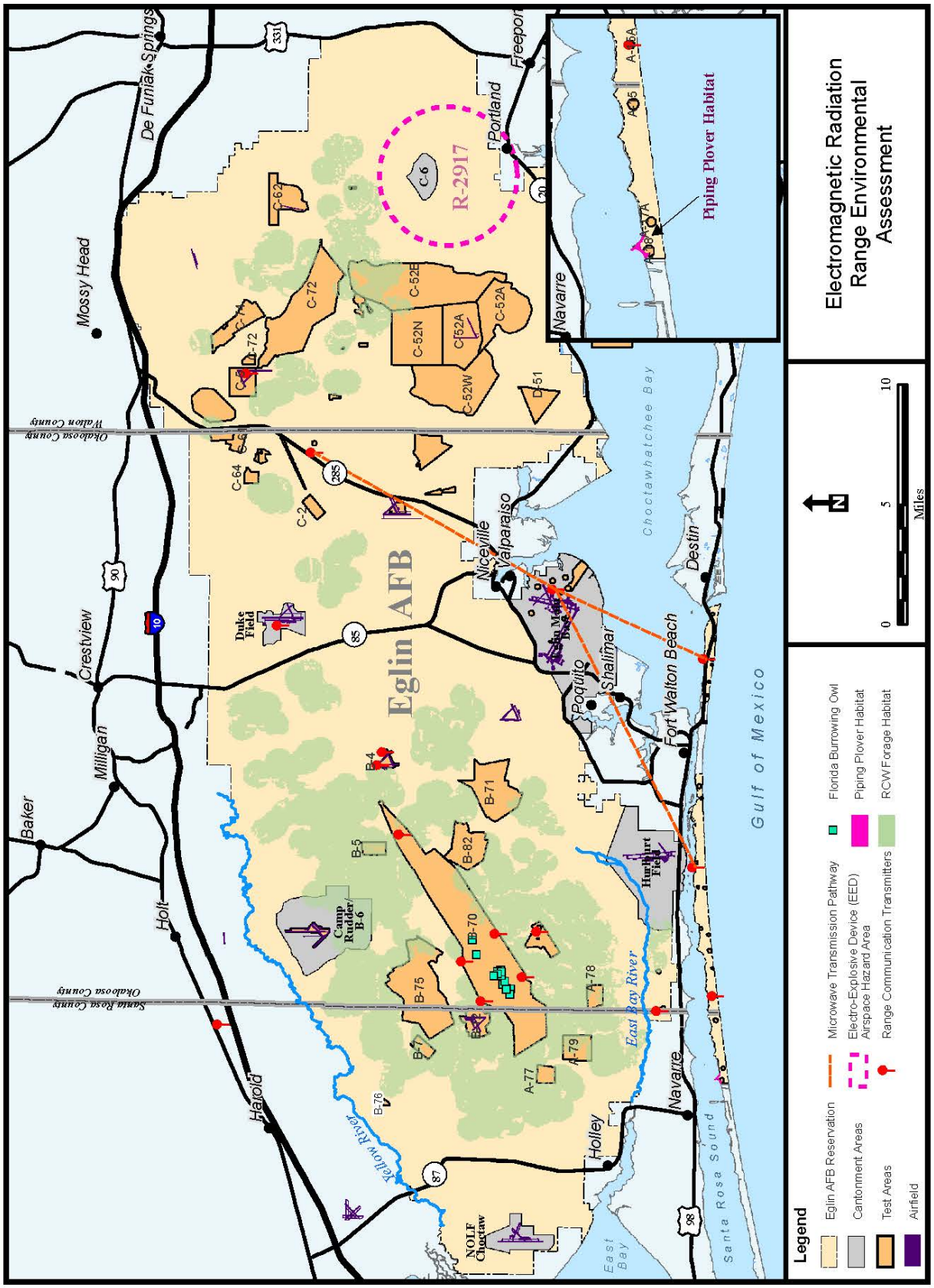

Figure 4-17. Location of Microwave Telemetry Systems on Eglin AFB with Alternative 1

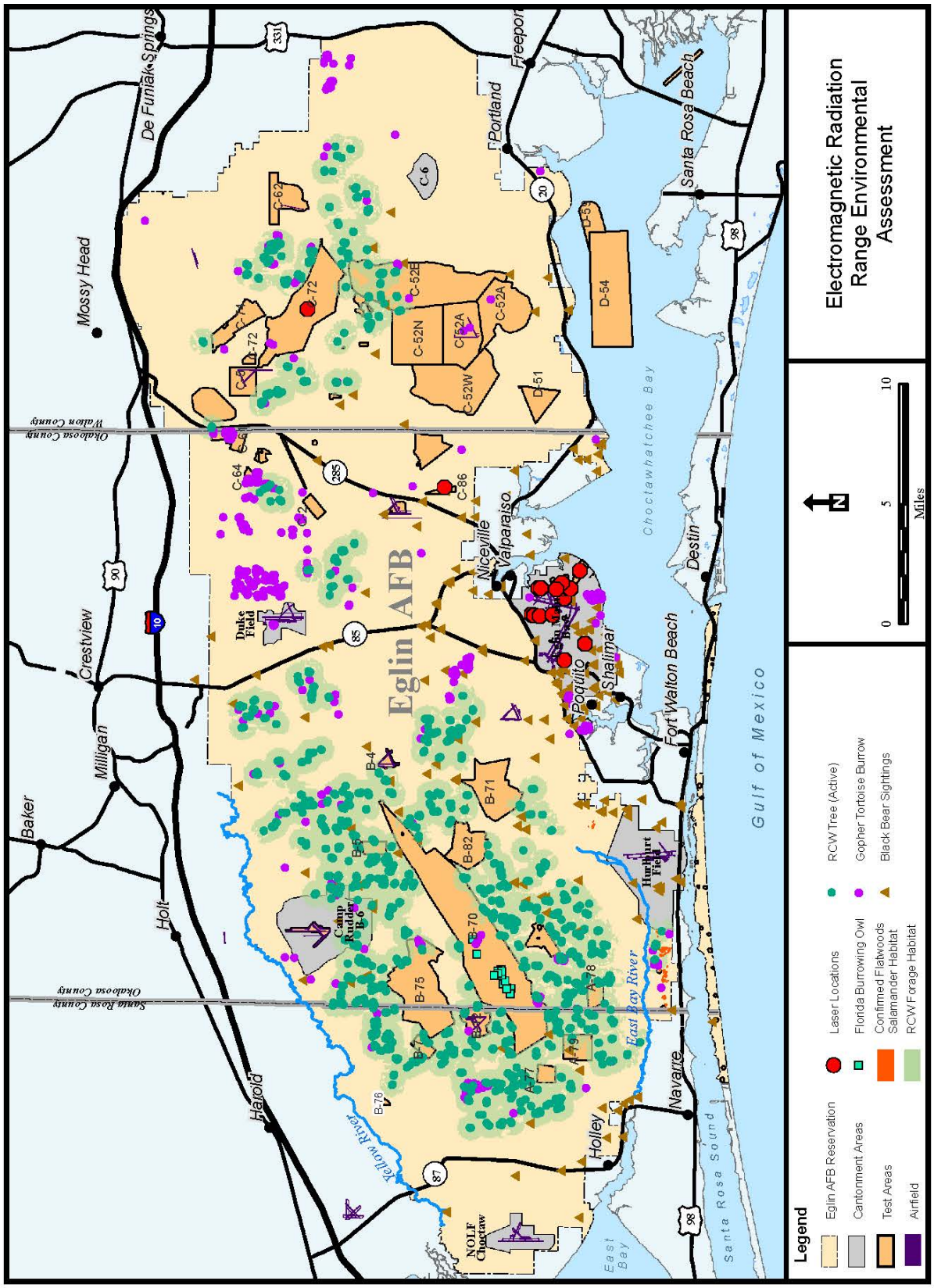

Figure 4-18. Location of Laser Systems and Proximity to Sensitive Species on Eglin AFB with Alternative 1

4.3.2.4 Summary of Alternative 1

As stated in Section 4.3.2, the potential for impacts to sensitive species under Alternative 1 is the same as that under the No Action Alternative; therefore no new analyses have been presented. No significant impacts to sensitive species are anticipated under Alternative 1 since the probability of interaction between EMR exposure and sensitive species is extremely low. Since data sources used to calculate the aggregate volume of hazard area under the No Action Alternative are unavailable, it is difficult to provide a direct comparison between the No Action Alternative and Alternative 1. However, based on data received from Eglin AFB in support of this REA update, it appears that the overall quantity of EMR emitters on Eglin AFB has increased since the 2002 EMR PEA baseline was established. A review of the changes to the EMR baseline under Alternative 1 has not shown a potential for significant impacts to sensitive species.

4.3.3 Alternative 2

Because specific actions in the future involving EMR emitters are dependent on future mission requirements, and because future mission requirements are unknown, Alternative 2 attempts to prescribe guidelines establishing a methodology, or a high-order BMP, based on current EMR safety programs in order to consistently screen EMR requests and facilitate the AF Form 813 process when any future activity involving an EMR emitter would change baseline parameters. There is no anticipated increase in future use of EMR emitters, only the possibility that future mission requirements may call for the relocation, addition, and/or upgrade of EMR emitters at any time.

The movement, upgrade, or addition of EMR emitters to Eglin AFB can have a number of effects on the electromagnetic environment of the range. Upgrade, addition, or relocation can introduce hazard areas to sites previously unexposed to hazardous levels of EMR, increasing the chances that local species will experience hazardous exposure. However, the movement of an emitter can also effectively remove a hazard area from a site, thereby removing the danger of exposure for those species inhabiting the surrounding area. In any event, the current total space occupied by hazard areas on the range is not expected to decrease, but increase in the future. The relocation of a system serves only to relocate the hazard area, thereby shifting the chances for exposure to new or different receptors. However, relocation to an area that is relatively less inhabited than the previous site would be well served. Essentially, the relocation, upgrade, or addition of a new EMR emitter to Eglin AFB should take into account where and how the system is to be used and the proximity of the system to sensitive species.

4.3.3.1 Summary of Alternative 2

The determination of potential impacts under Alternative 2 would be made through the AF Form 813 process. Once the AF Form 813 is submitted, members of the Eglin AFB EIAP Team would have an opportunity to review the proposed action and provide input on the potential impacts to resources within the proposed testing area. The Eglin AFB Safety Office would then use the parameters of the specific EMR source (i.e., laser, radar) to calculate associated safety profiles for each specific testing event. In the case of laser usage, the Eglin AFB Safety Office would calculate the associated NOHD for the particular laser system being proposed for testing.

Further, 96 CEG/CEVSN would evaluate the Proposed Action through the AF Form 813 process and determine if the potential exists for EMR exposure to sensitive species within the area. Based on the specific parameters of the test event and the proximity of the test event to sensitive species, site-specific BMPs could be applied to minimize the potential for effects from EMR sources. Additionally, if it is determined that there could be the potential for sensitive species to receive hazardous exposure to EMR, then a Section 7 consultation with the USFWS may be required. Based on the low probability of species interacting with EMR and since all future actions would be evaluated on a case-by-case basis through the AF Form 813 review process, Alternative 2 is not anticipated to have a significant impact on sensitive species.

5. LIST OF PREPARERS

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APPENDIX A

ASSESSMENT MODELS

ASSESSMENT MODELS

AN/FPS-16 Assessment Model

By taking the volume of space within which the projected power density can reach a hazard threshold (the actual radar beam) and dividing that by the total volume of space within which the hazard volume may exist (the associated hazard distance), the resulting fraction can be thought of as an expression of the probability that a hazard volume exists at any given moment (U.S. Army, 1993). Using this analysis tool first requires the calculation of the hazard distance associated with the hazardous power density given for a particular animal, in this case a bird weighing 25 grams. This may be accomplished using the expression:

$$\frac{P_1}{P_2} = \frac{d_2^2}{d_1^2}$$

Where: P_1 = the Power Density at point one (mW/cm^2)
P_2 = the Power Density at point two (mW/cm^2)
d_1^2 = the square of the distance to point one (ft)
d_2^2 = the square of the distance to point two (ft)

The following calculation is represented graphically in Figure A-1. Knowledge of three of the variables allows for a solution of the fourth unknown. Thus, considering P_1 as 38 mW/cm^2 (the hazardous power density for a bird weighing 25 grams), P_2 as 10 mW/cm^2 (the hazardous power density for humans), d_2 as 2,336 feet (the associated hazard distance for human exposure at 10 mW/cm^2), and d_1 as the unknown hazard distance associated with the hazardous power density for a bird weighing 25 grams at 38 mW/cm^2, solving for d_1 is accomplished:

$$\frac{P_1}{P_2} = \frac{d_2^2}{d_1^2}$$

$$d_1 = \frac{d_2}{\sqrt{\frac{P_1}{P_2}}}$$

$$d_1 = \frac{2{,}336\ \text{ft}}{\sqrt{\frac{38\ \text{mW/cm}^2}{10\ \text{mW/cm}^2}}}$$

$$d_1 = \underline{1{,}198\ ft}$$

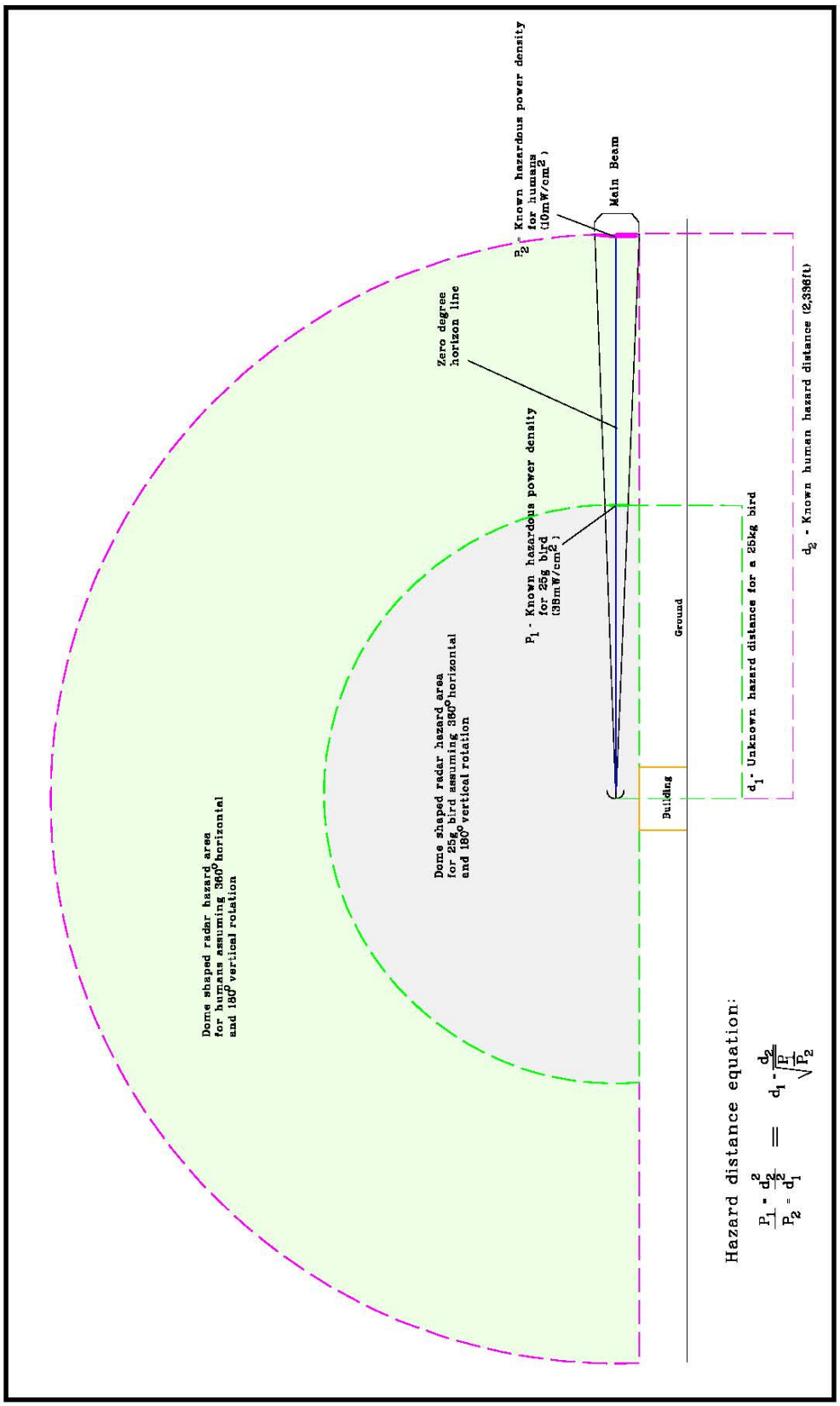

Figure A-1. Estimation of Radar Hazard Area for a 25-gram Bird for AN/FPS-16 Radar Systems

Once the associated hazard distance for a bird weighing 25 grams has been determined, the total volume around the radar system within this hazard distance must be determined. As shown in Figure A-1, assuming 360° horizontal rotation of the radar system as well as 180°vertical rotation, the associated hazard distance is comprises a dome-shaped area surrounding the radar system, within which the radar beam may move in any direction. The volume of the dome is equal to:

$$V = \frac{\frac{4}{3}\pi r^3}{2}$$

Where r = the hazard distance (1,198 ft)

$$V = \frac{\frac{4}{3}\pi (1{,}197\ \text{ft})^3}{2}$$

$$= \underline{3.66 \times 10^9\ \text{ft}^3}$$

Consequently, the total volume of space within which the beam may operate at the power density of 38 mW/cm^2 is equal to 3.66 x 109 ft^3.

The total volume of the beam is equal to the total volume of a cone with an angle represented by the beamwidth of the radar system. The beamwidth of the AN/FPS-16 is 1.1°. The base of a 1.1° cone at a distance of 1,198 feet is approximately 23 feet in diameter. The total volume of the beam is then:

$$V = \tfrac{1}{3}\pi r^2 h$$

Where: r = the radius of base of the radar beam cone (11.491 ft)
h = the hazard distance (1,198 ft)

$$V = \tfrac{1}{3}\pi(11.491\ \text{ft})^2(1{,}198\ \text{ft})$$

$$V = \underline{1.66 \times 10^5\ \text{ft}^3}$$

The total volume of the beam of the AN/FPS-16 within the hazard area is therefore 1.66 x 105 ft^3. Taking the total area of the beam (1.66 x 105 ft^3) and dividing it by the total volume in which the beam may occupy (3.66 x 109 ft^3) at any given time gives a representation of the percent chance that a bird within the hazard area may encounter the radar beam:

$$\%\ \text{chance of encounter} = \frac{1.66 \times 10^5\ \text{ft}^3}{3.66x10^9\ \text{ft}^3}(100)$$

$$= \underline{0.0046\%}$$

This means that, *if* a bird weighing 25 grams were to be in the associated hazard area of 1,197 feet, the bird would have a 0.002 percent chance of encountering the beam. Using the same principles, a bird weighing 3.5 kilogram, with an associated hazardous power density of

61 mW/cm^2 and hazard area of 945 feet, would have a 0.004 percent chance of encountering the beam within the respective hazard area. This, coupled with the fact that a bird would have to remain within the beam for a time average of approximately six minutes, makes the likelihood of adverse effects on birds in this manner extremely small.

AN/FPS-85 Assessment Model

The AN/FPS-85 is a phased array radar system, and is different in many respects to the AN/FPS-16 radar system. Figure A-2 provides a graphical representation of the operational parameters of the AN/FPS-85. The beam direction of the AN/FPS-85 is limited to approximately 60° from the boresight in any direction. The boresight is a line at 45° in elevation with respect to the horizon, bisecting the face of the radar. At boresight, the beam is perpendicular to the face of the radar. The beamwidth is 1.4°, and the associated hazard distance is 4,000 feet with a power density of approximately 5 mW/cm^2. The same theories applied to the AN/FPS-16 radar system apply here, although the nature of the AN/FPS-85 radar system allows for a cone-shaped hazard area pointing only in one direction (due south), rather than a dome-shaped hazard area as with the AN/FPS-16 type radars. The following values have been calculated for a 25-gram bird:

Hazard Distance

$$\frac{P_1}{P_2} = \frac{d_2^2}{d_1^2}$$

$$d_1 = \frac{d_2}{\sqrt{\frac{P_1}{P_2}}}$$

$$d_1 = \frac{4{,}000\ \text{ft}}{\sqrt{\frac{38\ \text{mW/cm}^2}{5\ \text{mW/cm}^2}}}$$

$$d_1 = \underline{1{,}451\ \text{ft}}$$

- 1,451-foot hazard distance for a 25-gram bird
- 1,145-foot hazard distance for a 3.5-kilogram bird

Volume of Hazard Area

$$V = \tfrac{1}{3}\pi r^2 h$$

$$V = \tfrac{1}{3}\pi^2 (1{,}451\ \text{ft})$$

$$V = \underline{3.19\,x\,10^9\ \text{ft}^3}$$

Volume of Radar Beam within Hazard Area

$$V = \tfrac{1}{3}\pi r^2 h$$
$$V = \tfrac{1}{3}\pi(17.7\text{ ft})^2(1{,}451\text{ ft})$$
$$V = \underline{4.76\times10^5\text{ ft}^3}$$

Percent Chance of Beam Encounter

$$\%\text{ chance of encounter} = \frac{4.76\times10^5\text{ ft}^3}{3.19x10^9\text{ ft}^3}(100)$$
$$= \underline{0.015\%}$$

- 0.015% chance of a 25-gram bird to encounter the beam within the hazard area
- 0.015% chance of a 3.5-kilogram bird to encounter the beam within the hazard area

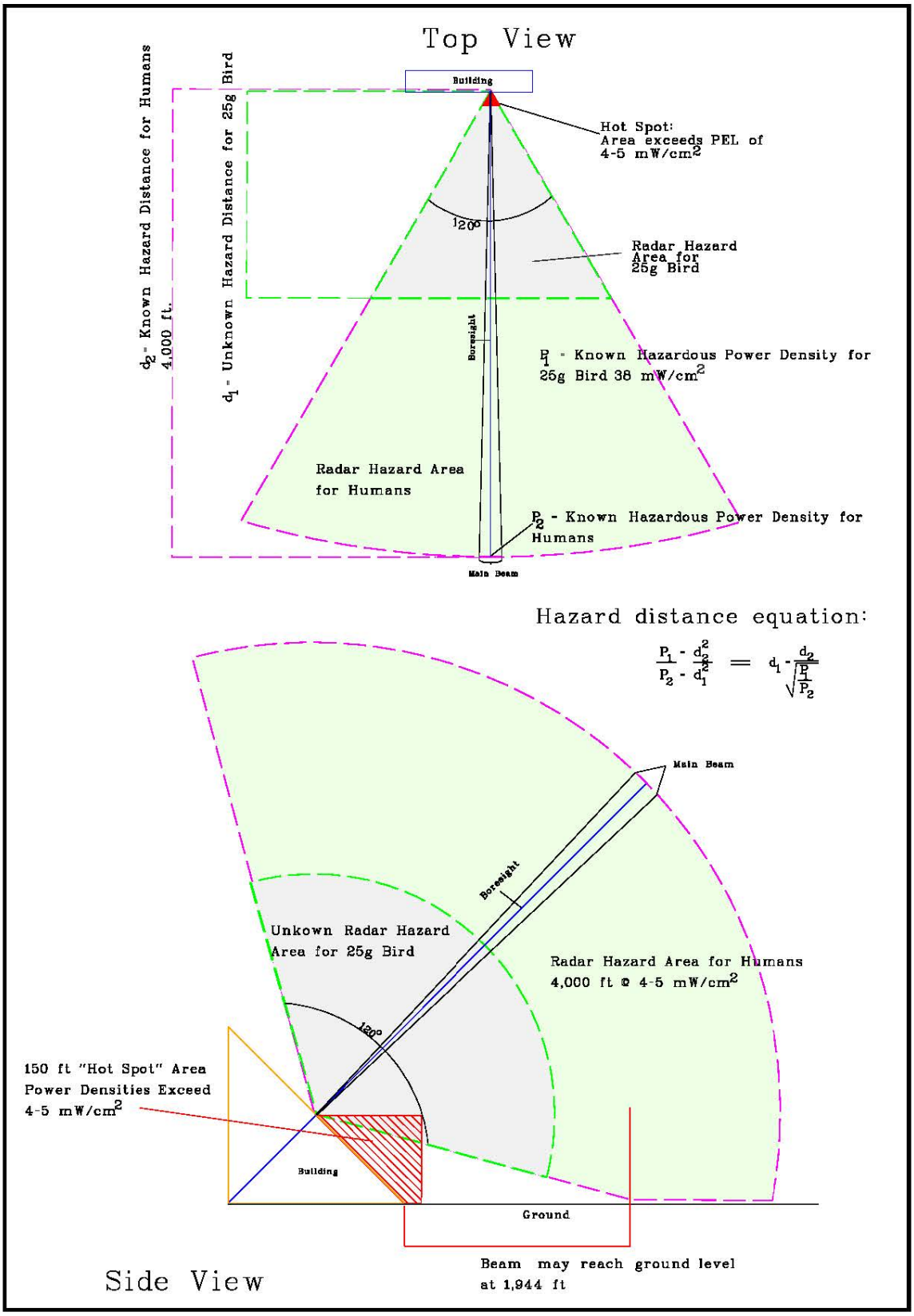

Figure A-2. Estimation of Radar Hazard Area for a 25-gram Bird for the AN/FPS-85 Radar System

Microwave Transmitter System Assessment Model

The equation used to find the hazard distance of a microwave transmitter system is as follows:

$$d = \sqrt{\frac{P(Gn)}{40\,\pi\,S}}$$

Where: d = distance to PEL (meters)
P = the average or actual power available for radiation (Watts)
Gn = numerical antenna gain {Gn = $10^{Gd/10}$ [Gd = absolute antenna gain in decibels (dB)]}
S = PEL (mW/cm^2)

Using this equation to find the hazard distance associated with a 25-gram bird for a microwave transmission tower located at building 44, Eglin Main Base, it is determined that:

d = unknown
P = 7.1 W
Gn = 19,952.6 (where Gd = 43dB, hence Gn = $10^{43/10}$)
S = 38 mW/cm^2

$$d = \sqrt{\frac{(7.1\text{W})(19{,}952.6)}{40\,\pi\,38\,\text{mW/cm}^2}}$$

$$d = \sqrt{\frac{141{,}663.46}{4{,}772.8}}$$

$$d = (\ 5.45\,\text{meters}\ )(\ \frac{3.28\,\text{ft}}{1\,\text{meter}}\ )$$

$$d \approx 17.88\,ft$$

The value of 17.88 feet represents the distance from the microwave transmission dish at which the power density would be 38 mW/cm^2. As a result, since the transmission occurs along a specific pathway, there will be an area in which a 25-gram bird may encounter a hazardous power density equal to the volume of the beam from the antenna to a distance of 17.88 feet. Assuming a 2° beam angle, the volume of the beam from the antenna to a distance of 17.88 feet is 1.83 ft^3. By using the same principles as those of the model that was applied to the radar systems above, the percent chance of a bird flying within 17.88 feet of the tower encountering the beam may be determined. Placing a sphere around the microwave tower with a radius of 17.88 feet, and dividing the volume of the beam by the volume of the associated sphere (2.39×10^4 ft^3), the chances of a 25-gram bird flying within 17.88 feet of the radar tower encountering the beam is approximately 0.0077 percent. The bird would then have to remain in the beam for a time average of six minutes in order to receive a hazardous exposure to EMR.

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APPENDIX B

EMR BACKGROUND INFORMATION

EMR BACKGROUND INFORMATION

Electromagnetic radiation (EMR) is present in the environment as a naturally occurring phenomenon expressed in the form of such things as light, microwave radiation from space, and gamma rays from isotopes; however, EMR also results from human activities. An example of these activities includes using the electromagnetic (EM) energy spectrum for communications and industrial-related uses. The more familiar communication sources include radio and television broadcasting, telecommunications, satellite communications, and microwave data link transmitter. Some common industrial sources include lasers, radar, radio-navigational aids, medical diathermy machines, and microwave ovens. The overall types and number of EMR sources are steadily increasing. Theoretically, the frequency spectrum cannot be depleted, but it can only support a finite number of unique radio frequency (RF) signals without overlapping and causing interference for communication purposes in any given geographical area. Taking this growth into account, human and biological exposure to emissions from RF sources is increasing. With the increased exposure and/or nearness to the source(s) comes the risk of increased exposure to higher levels of EMR, as well as new and unused frequencies.

EMR is part of the EM energy spectrum and is produced whenever a conductor carries an alternating current. EMR may be considered as a series of waves of energy propagated through space and composed of oscillating electric and magnetic fields. The electric and magnetic fields are at right angles to each other and also at right angles to the direction of travel. EM waves are considered to be a radiant form of energy similar to light and heat. These waves are produced by moving electric charges and may be of natural origin, such as sunlight, or of human origin from such electronic devices as mentioned above. EM energy emitted from a source is propagated through space until it is absorbed, reflected, transmitted, and/or diffracted by objects in its path. EM waves contain energy that is referred to as photon energy. Photon energy is expressed as electron volts (eV). Frequency and eV are directly related, so that higher frequencies contain more photon energy. The waves travel at a speed of 186,000 miles per second (300,000,000 meters per second) or at the speed of light. The EM wave energy is characterized, in part, by:

- The strengths of the electric and magnetic fields – the intensity of EM forces.
- The frequency of oscillation – the number of complete oscillations per second of the wave.
- The wavelength – the distance between two consecutive peaks of the wave.

The distance an EM wave travels in one cycle is referred to as its wavelength. Wavelength and frequency are inversely related; as the wavelength increases, the frequency decreases. The energy capacity of EM radiation is inversely proportional to wavelength – the longer the wavelength (lower frequencies), the lower the energy.

After the EM energy leaves the aperture of the antenna, its intensity varies with distance from the antenna. At distances relatively close to the antenna, in the area known as the Fresnel (or near-field) region, the power remains fairly constant with distance, and is collimated in a beam of about the same size as the projected area of the aperture. Beyond the near-field, the radiated beam begins to spread out until the power decreases according to the well-known inverse square

law. The range beyond where the inverse square law takes effect is known as the Fraunhofer region (or far-field).

In the far-field, the amount of energy associated with the typical wave can be expressed as a power density (in units of milliwatts per square centimeter, mW/cm^2). The value of the power density in the far-field can be measured with a power density monitor or can be calculated by measuring the intensity of either the electric field or the magnetic field alone. In the near-field, EM waves have different characteristics than in the far-field. The EM field generally is not uniform, and the energy field is complex and depends on many factors. A power density monitor, designed for use in the far-field, is likely to give exceedingly inaccurate measurements in the near-field. Also in the near-field, as opposed to the far-field, there is no simple mathematics equivalency between values of power density and measurements of either electric or magnetic field strength.

All the EM frequencies together embody the EM spectrum. Figure B-1 shows the EM spectrum and illustrates how the spectrum is divided according to photon energies, wavelengths, or frequencies.

Visible light is only a small portion of the EM spectrum shown in Figure B-1. On one end of the spectrum are radio waves with wavelengths billions of times longer than visible light. On the other end are gamma rays with wavelengths millions of times smaller than visible light. Following is a description of the basic categories of the EM spectrum from the longest to the shortest wavelength:

- Radio waves. Radio waves are used to transmit radio and television signals and have wavelengths that range from less than a centimeter to tens or hundreds of meters.
- Microwaves. Microwaves have a wavelength of about a millimeter, or about the thickness of a pencil lead. Microwaves are used extensively for microwave ovens, transmission of telephone messages, radar systems, transmission of signals between ground stations and satellites, and certain medical therapeutic applications.
- Infrared (IR). IR is in the region of the EM spectrum that extends from the visible region to a wavelength of about one millimeter. IR waves include thermal radiation such as that from an open flame. IR radiation can be measured using electronic detectors and has applications in medicine and satellite imagery.
- Visible. Visible light is the portion of the EM spectrum with wavelengths between 400 and 700 billionths of a meter. It is the part of the spectrum that is visible and coincides with the wavelength of greatest intensity of sunlight.
- Ultraviolet (UV). UV radiation has a range of wavelengths from 400 billionths of a meter to about 10 billionths of a meter. Sunlight contains UV waves, which can burn your skin. Most UV radiation from the sun is blocked by ozone in the earth's upper atmosphere. UV wavelengths are used extensively in astronomical observatories and remote sensing applications.

- X-rays. X-rays are high energy waves, which have great penetrating power and are used extensively in medical and industrial applications. Wavelengths range from about 10 billionths of a meter to about 10 trillionths of a meter.
- Gamma rays. Gamma rays have wavelengths of less than about 10 trillionths of a meter. These rays are more penetrating that x-rays. Gamma rays are generated by radioactive atoms and in nuclear explosions and are used in many medical applications.

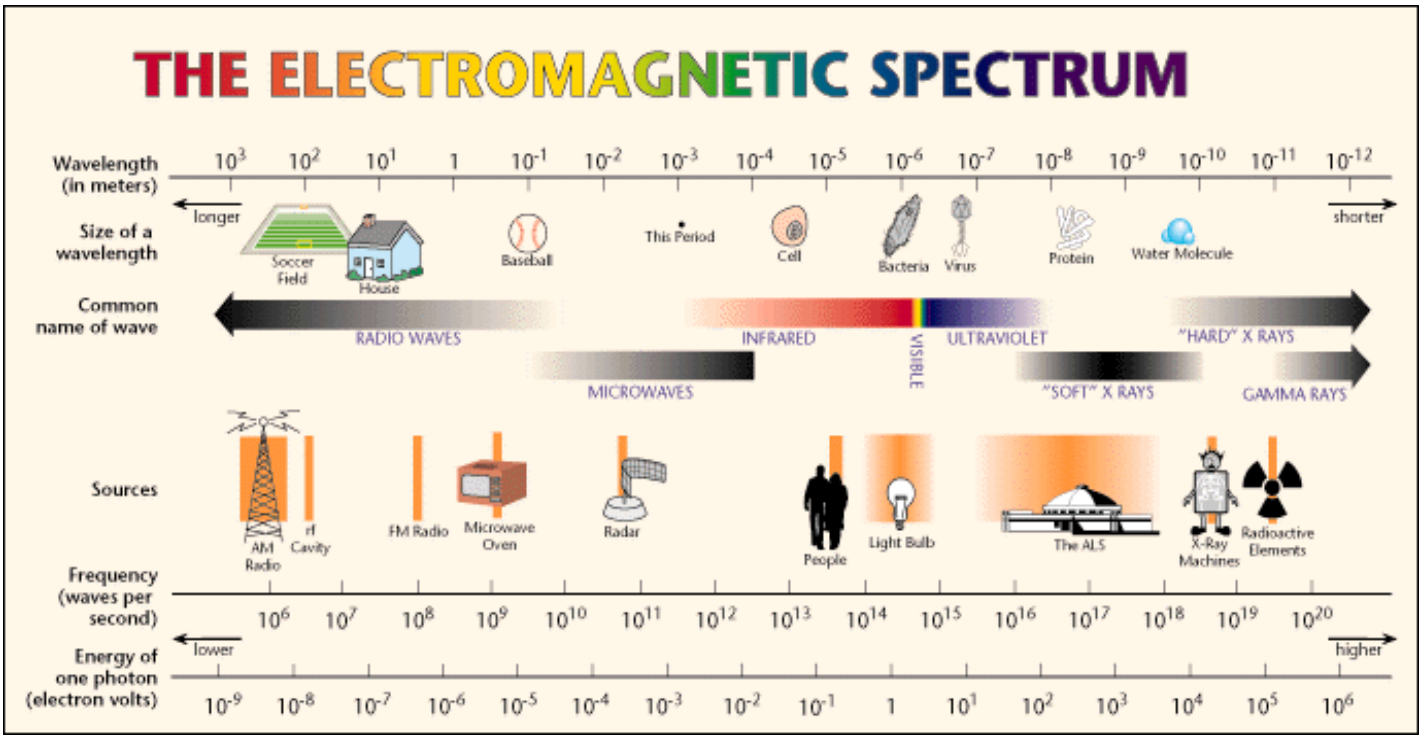

Figure B-1. The Electromagnetic Spectrum (Source: U.S. Department of Energy, 2008)

The RF portion of the EM spectrum includes frequencies with other designations such as radar, microwave, infrared, etc. The RF spectrum is usually considered to include all frequencies from 0.010 megahertz (MHz) to 300,000 MHz. A complete oscillation is called a cycle, and each cycle per second is termed a hertz (Hz); e.g. 10,000 cycles occurring each second denotes a frequency of 10,000 Hz, or 10 kilohertz (kHz). Table B-1 gives the nomenclature for frequency and time interval measurement. The term "microwave" applies to an arbitrary range or band of frequencies from 300 MHz to 300,000 MHz. Such waves are characterized as nonionizing radiation because the intrinsic EM energy absorbed by the body at any frequency within this range is much too low to ionize (eject electrons from) molecules of the body. Table B-2 provides an example of typical transmitters and their operational frequency bandwidth and Figure B-2 provides an example of U.S. Frequency Allocations for the Radio Spectrum.

Table B-1. Frequency and Time Interval Measurement

Frequency (f) 0 Hertz	Written DC AC	Meaning Direct Current Alternating Current	---- Period (= 1/f)	---- Written
1 hertz	1 Hz	1 cycle/sec	1 second	1 s
1 kilohertz	1 kHz	10^3 cycles/sec	1 millisecond	1 ms
1 megahertz	1 MHz	10^6 cycles/sec	1 microsecond	1 µs
1 gigahertz	1 GHz	10^9 cycles/sec	1 nanosecond	1 ns
1 terahertz	1 THz	10^{12} cycles/sec	1 picosecond	1 ps
1 petahertz	1 PHz	10^{15} cycles/sec	1 femtosecond	1 fs
1 exahertz	1 EHz	10^{18} cycles/sec	1 attosecond	1 as

Source: U.S. Air Force, 2002a

Table B-2. Examples of Frequency Bands

Source	Frequency Band
AM Radio Stations	535 kHz to 1.605 MHz
Amateur Radio	1.8 MHz to 250 GHz (multiple bands)
Citizen Band (CB) Radio	27 MHz
Low VHF TV	54 to 88 MHz (Channels 2 to 6)
FM Radio	88 to 108 MHz
High VHF TV	174 to 216 MHz (Channels 7 to 13)
UHF TV	470 to 806 MHz (Channels 14 to 67)
Portable Cellular Phones	824-850 MHz
Household Microwave Ovens	2450 MHz
Military Microwave Communications Systems	1 kHz to 18 MHz
AN/MPS-19 Radar System	2700-3100 MHz
AN/FPS-16 Radar System	5400-5900 MHz

Source: U.S. Air Force, 2002a
GHz = gigahertz; kHz = kilohertz; MHz = megahertz; TV = television; UHF = ultra-high frequency; VHF = very high frequency

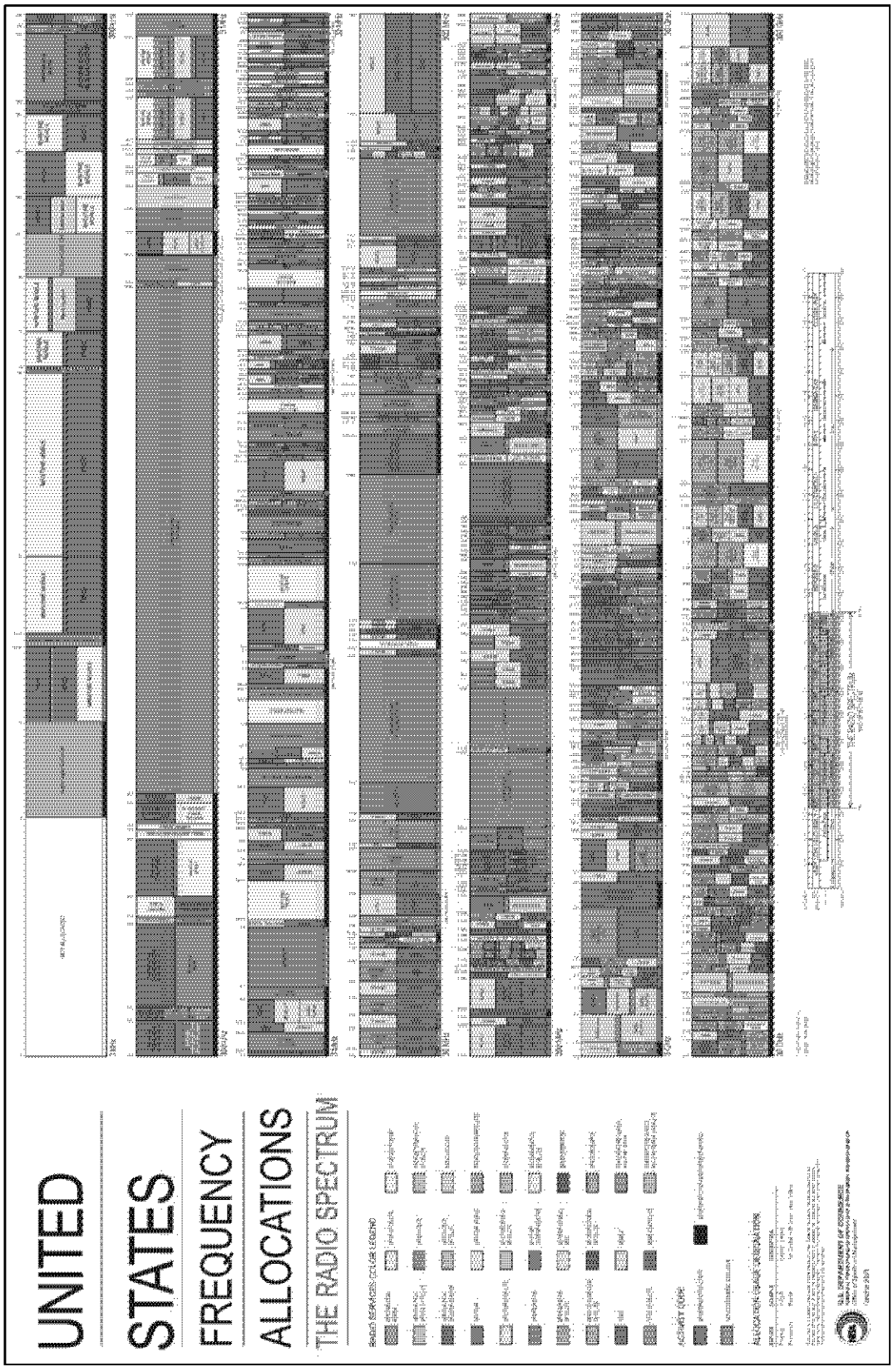

Figure B-2. U.S. Frequency Allocations

EFFECTS OF EMR ON BIOLOGICAL SYSTEMS

When EM radiation contains sufficient energy, it can ionize atoms of the material absorbing the energy (dislodge electrons from the atoms of the absorbing material). This phenomenon occurs at frequencies much higher than RF radiation, such as with X-rays and gamma-rays. Radiation of sufficient energy to cause ionization is termed ionizing radiation; radiation of insufficient energy to cause ionization is referred to as nonionizing radiation. It is important to note that the EMR systems analyzed within this Range Environmental Assessment (REA) are categorized as nonionizing radiation. While nonionizing radiation absorbed by biological tissue is not capable of ionizing atoms, it is capable of producing changes in the vibrational and rotational energies of the biological molecules, leading to changes in the molecules or dissipation of the energy in the form of heat.

The fact that RF exposure induces temperature elevations in biologic tissues has been known for more than 80 years. Energy from the RF field is transferred to tissue by increasing the rotational energies of dipoles or water molecules in the tissue. The water molecule in biologic material is a very good absorber of RF energy. The absorption of RF energy is strongly influenced by the frequency of the incident radiation and by the orientation of the object in the EM field. Studies have shown that whole body absorption is very strongly dependent on the orientation of the long axis of the body relative to the electric field. The optimal absorption occurs at frequencies of about 70 to 80 MHz for adult humans. Based on this optimal absorption range, scientific interest is shifting from the classical microwave region (300 to 300,000 MHz) to include 30 to 300 MHz and lower frequencies.

The biological effects of RF radiation on humans depend on the frequency of the incident radiation field, the polarization of the field (orientation of the electric field in the RF wave: vertical, horizontal, circular, and elliptical), the size and shape of the person, and his or her ability to dissipate the absorbed energy by normal biological functions. The concept of a specific absorption rate (SAR) was developed to relate a particular frequency and power density required to produce the same SAR in man. SARs are given in units of watts per kilogram (W/kg). Research to date has not revealed any deleterious health effects from exposure to RF energy below a SAR of 4 W/kg (U.S. Air Force, 2003a). The permissible exposure limits utilized by the Air Force for humans are based on a SAR of 0.4 W/kg (includes a safety factor of 10 below a SAR of 4 W/kg, which is the threshold for the occurrence of potentially deleterious biological effects in humans). Further, the Federal Communications Commission (FCC) limit for public exposure from cellular telephones is a SAR of 1.6 W/kg (FCC, 2009).

RF radiation interacts with biological tissue and organisms as a complex function of various parameters, including frequency, intensity, and polarization of the radiation; size, shape, and dielectric properties of the exposed body; spatial configuration between the emission source and the exposed body; and the presence of other objects in the vicinity. The EM energy from the emission source is transformed to heat within the exposed body. Most experimental data support the conclusion that the effects on organisms are primarily a response to hyperthermia or altered thermal gradients in the body. Other effects include the "microwave hearing effect" and development of cataracts in experimental animals. The microwave hearing effect is a clicking, buzzing, or chirping sound produced in the inner ear and is dependent on the pulse repetition rate

and pulse width of the RF radiation. Unlike ionizing radiation, exposure to EMR does not result in cumulative effects. The effects of high levels of EMR exposure (i.e., temperature elevations of biological tissues) cease when exposure is inhibited or stopped. A biological organism responds both involuntarily and voluntarily to heat induced by RF radiation exposure. Involuntary reactions are those involuntary biothermal adjustments made within a body when temperatures increase. Voluntary reactions are the volitional actions taken by an organism to change its environmental exposure. RF radiation exposure does not inhibit an organism from either of these types of responses to increase in temperature.

Standards have been developed to prevent biologic damage to humans, and these standards are in the form of Permissible Exposure Limits (PELs). PELs are the exposure level expressed in electric field, magnetic field, or plane wave (far-field) power density (mW/cm^2) to which an individual may be repeatedly exposed and to which, under the conditions of exposure, will not cause detectable bodily injury regardless of the age, sex, or childbearing status. PELs are based on limiting the total body absorbed power to a SAR of 0.4 W/kg or less as averaged over any six-minute period. Exposures separated by more than six minutes are essentially separate physiological events, with noncumulative effects. The PELs used by the Air Force for RF radiation exposure to humans vary with frequency and area restrictions. Restricted areas are those areas where access is controlled or areas where the general public is normally excluded, such as flight lines and communication compounds. Unrestricted areas are those areas where access is uncontrolled, such as public areas of the base, base housing, and recreational areas. PELs are provided in Table B-3.

Table B-3. Permissible Exposure Limits

Controlled Environment		
Frequency Range (MHz)	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.003 – 3.0	100	6
3 – 30	$900/f^2$	6
30 – 300	1.0	6
300 – 3000	$f/300$	6
3,000 – 15,000	10	6
15,000 – 300,000	10	$616{,}000/f^{1.2}$
Uncontrolled Environment		
Frequency Range (MHz)	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.003 – 1.34	100	6
1.34 – 3.0	$180/f^2$	$f^2/0.3$
3.0 – 30	$180/f^2$	30
30 – 300	0.2	30
300 – 3,000	$f/1500$	30
3,000 – 15000	$f/1500$	$90{,}000/f$
15,000 – 300,000	10	$616{,}000\ f^{1.2}$

Source: U.S. Air Force, 2002a

f = frequency; MHz = megahertz; mW/cm^2 = milliwatts per square centimeter

Lasers present a somewhat more specific biological hazard than radars and other microwave transmitters that fall into the general discussion above. The biological effects of laser radiation are considered to be similar to those from radiation generated by UV, visible, and IR sources. However, in some instances, lasers are able to project hazardous levels of optical radiation a considerable distance. Laser systems are used in many military and industrial applications

including communications, training aids, scoring systems, range finding, laser-guided munitions, target designators, direct effect weapons, avionics equipment, welding, cutting, surveying, printing, scanning, research, and medical treatment and surgical procedures.

There are many different types of lasing materials as identified below (Indiana University Purdue University Indianapolis [IUPIU, 2009]):

- **Solid state** – lasers that have lasing material distributed in a solid matrix, e.g. the ruby or neodymium-YAG (yttrium aluminum garnet) lasers. The neodymium-YAG laser emits infrared light at 1.064 micrometers.
- **Gas** – (helium and helium-neon [He-Ne]) are the most common gas lasers and have a primary output of a visible red light. Carbon dioxide lasers emit energy in the far-infrared (10.6 micrometers) and are used for cutting hard materials.
- **Excimer** – use reactive gases such as chlorine and fluorine mixed with inert gases such as argon, krypton, or xenon. When electrically simulated, a pseudomolecule or dimer is produced and when lased, produces light in the ultraviolet range.
- **Dye** – lasers use complex organic dyes like rhodamine 6G in liquid solution or suspension as lasing media. They are tunable over a broad range of wavelengths.
- **Semiconductor** – lasers (also known as diode lasers) that are not solid-state lasers. These electronic devises are generally very small and use low power. They may be built into larger arrays (i.e., the writing source in some laser printers or compact disc players).

Lasers are sources of nonionizing radiation that operate in the IR, visible, and UV regions of the EM spectrum. The light from lasers differs from ordinary light in several ways. Ordinary light from a light bulb travels randomly in all directions. The light is thus incoherent or disordered. The light from a laser is temporally and spatially coherent, meaning that all of the wave fronts of light are lined up in time and space. This means that the waves of light go up and down together and travel in the same direction. In addition, coherent light spreads much less than other types of light. As an example, the beam of a tightly focused flashlight would spread between two degrees and five degrees over 10 feet. The sides of a laser beam are almost parallel and would spread only about 3/20 of a degree over the same distance. The color of laser light is normally expressed in terms of the laser's wavelength. The most common unit used in expressing a laser's wavelength is a nanometer (nm), or one billionth of a meter.

The eye is the most susceptible organ to damage from laser radiation. The tissues of the eye that are vulnerable to damage are highly wavelength dependent. Generally, the retina is susceptible to radiation in the visible and near IR band. The lens and cornea are susceptible to damage from UV-A, while the cornea is susceptible to damage from UV and far-IR.

The skin is of a lesser concern than the eye, because in many cases damage to the skin is usually temporary while damage to the eye can be permanent or can limit visual capabilities for temporary periods. The skin is susceptible to damage from the entire laser emission spectrum; however, emissions in the UV and IR bands raise more of a concern.

Lasers and laser systems are assigned one of four broad Classes (1 to 4) depending on the potential for causing biological damage (Purdue University, 2008).

- Class 1: Any laser that cannot emit accessible laser radiation at known hazard levels. Users of Class I laser products are generally exempt from radiation hazard controls during operation and maintenance. Former Class 2a lasers are considered to be in this category.
- Class 2: Low-power visible lasers that emit above Class 1 levels. These lasers emit in the visible spectrum (400 – 700 nm wavelengths). In the visible spectrum, the human aversion response (a reflex action of blinking and looking away from a strong optical stimulus) occurs when the eye becomes exposed; the response time occurs within 0.25 seconds. Only limited controls are specified.
- Class 3: Medium power lasers: These lasers may be hazardous for direct or specular reflections (normally not a diffuse reflection or fire hazard) and specific controls are recommended. There are two subclasses:
    - Class 3R: Potentially hazardous under some direct and specular reflection viewing conditions (if eye is focused and stable, highly improbable). Not a fire or diffuse reflection hazard.
    - Class 3B: Viewing hazard under direct or specular reflection conditions, normally not a diffuse reflection or fire hazard.
- Class 4: High power lasers. These lasers are hazardous to view under any condition (directly or diffusely scattered) and are a potential fire hazard and a skin/eye hazard. These lasers may be a source of laser generated air contaminants and hazardous plasma radiation. Significant controls are required of Class 4 laser facilities.

Hazards from laser beams exist only when the laser is in operation. The greatest potential for effects from laser beams is to the eyes and skin. Therefore, maximum permissible exposure (MPE) values have been established for both eye and skin exposure. As discussed in Section 3.2 in Chapter 3 of the EMR REA, the MPE is the level of radiation to which a person may be exposed without experiencing hazardous effects or adverse biological changes in the eye or skin (IUPUI, 2009). The MPE is not a distinct line between safe and hazardous exposures. Instead they are general maximum levels, to which various experts agree should be occupationally safe for repeated exposures. The MPE depends on the following laser parameters (1) wavelength, (2) exposure duration, (3) pulse Repetition Frequency [PRF], and (4) nature of the exposure (specular, diffuse reflection) (IUPUI, 2009). The American National Standards Institute (ANSI) Z136.1 standards include methods of calculating MPEs for various lasers.

Based on the MPE, a nominal ocular hazard distance (NOHD) can be determined. The NOHD is the distance along the axis of the unobstructed beam from the laser to the eye beyond which the radiant exposure during operation is not expected to exceed the MPE. Table B-4 provides the wavelengths of the most common lasers in use today. The biological effects of laser exposure are presented in Table B-5.

Table B-4. Wavelengths of Most Common Lasers

Laser Type*	Wave Length (micrometer [μm])	Laser Type	Wave Length (micrometer [μm])
Argon fluoride (Excimer-UV)	0.193	Helium neon (yellow)	0.594
Krypton chloride (Excimer-UV)	0.222	Helium neon (orange)	0.610
Krypton fluoride (Excimer-UV)	0.248	Gold vapor (red)	0.627
Xenon chloride (Excimer-UV)	0.308	Helium neon (red)	0.633
Xenon fluoride (Excimer-UV)	0.351	Krypton (red)	0.647
Helium cadmium (UV)	0.325	Rhodamine 6G dye (tunable)	0.570-0.650
Nitrogen (UV)	0.337	Ruby ($CrAlO_3$) (red)	0.694
Helium cadmium (violet)	0.441	Gallium arsenide (diode-NIR)	0.840
Krypton (blue)	0.476	Nd:YAG (NIR)	1.064
Argon (blue)	0.488	Helium neon (NIR)	1.15
Copper vapor (green)	0.510	Erbium (NIR)	1.504
Argon (green)	0.514	Helium neon (NIR)	3.39
Krypton (green)	0.528	Hydrogen fluoride (NIR)	2.70
Frequency doubled Nd YAG (green)	0.532	Carbon dioxide (FIR)	9.6
Helium neon (green)	0.543	Carbon dioxide (FIR)	10.6
Krypton (yellow)	0.568		
Copper vapor (yellow)	0.570		

Source: IUPUI, 2009

* UV = ultraviolet (0.200-0.400 μm)
VIS = visible (0.400-0.700 μm)
NIR = near infrared (0.700-1.400 μm)

Table B-5. Summary of Basic Biological Effects of Light

Photobiological Spectral Domain	Eye Effects	Skin Effects
Ultraviolet C (0.200-0.280 μm)	Photokeratitis	Erythema (sunburn), skin cancer
Ultraviolet B (0.280-315 μm)	Photokeratitis	Accelerated skin aging, increased pigmentation
Ultraviolet A (0.315-0.400 μm)	Photochemical UV cataract	Pigment darkening, skin burn
Visible (0.400-0.780 μm)	Photochemical and thermal retinal injury	Photosensitive reactions, skin burn
Infrared A (0.780-1.400 μm)	Cataract, retinal burns	Skin burn
Infrared B (1.400-3.00 μm)	Corneal burn, aqueous flare, IR cataract	Skin burn
Infrared C (3.00-1000 μm)	Corneal burn only	Skin burn

Source: IUPIU, 2009

μm = micrometer; IR = infrared; UV = ultraviolet

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APPENDIX C

RELEVANT LAWS, REGULATIONS, AND POLICIES

RELEVANT LAWS, REGULATIONS, AND POLICIES

The Range Environmental Assessment was prepared with consideration and compliance of relevant environmental laws, regulations, and policies; including federal and state laws and regulations, Department of Defense (DoD) directives, and Air Force instructions. A brief description of specific laws and regulations that legally define issues of compliance associated with the mission activities of this document are outlined below.

General

42 USC 4321 et seq; 1969; National Environmental Policy Act of 1969 (NEPA); Requires that federal agencies (1) consider the consequences of an action on the environment before taking the action and (2) involve the public in the decision making process for major Federal actions that significantly affect the quality of the human environment.

Executive Order 12372; 14-Jul-82; Intergovernmental Review of Federal Programs; Directs federal agencies to inform states of plans and actions, use state processes to obtain state views, accommodate state and local concerns, encourage state plans, and coordinate states' views.

Executive Order 12856; 3-Aug-93; Right to Know Laws and Pollution Prevention Requirements; Directs all Federal agencies to incorporate pollution planning into their operations and to comply with toxic release inventory requirements, emergency planning requirements, and release notifications requirements of EPCRA.

Executive Order 12898; 11-Feb-94; Environmental Justice; Directs federal agencies to identify disproportionately high and adverse human health or environmental impacts resulting from programs, activities or policies on minority populations.

Air Force Policy Directive 32-70; 20-Jul-94; Environmental Quality; Develops and implements the Air Force Environmental Quality Program composed of cleanup, compliance, conservation, and pollution prevention.

Air Force Instruction 32-7045; 1-Apr-94; Environmental Compliance and Assessment; Implements AFPD 32-70 by providing for an annual internal self-evaluation and program management system to ensure compliance with Federal, State, local, DoD, and Air Force environmental laws and regulations.

32 CFR 989; 1-Jul-01; Environmental Impact Analysis Process (EIAP)--; This regulation provides a framework for how the Air Force is to comply with NEPA and the CEQ regulations.

Air Force Instruction 32-7062; 1-Apr-94; Air Force Comprehensive Planning; Implements AFPD 32-70 by establishing Air Force Comprehensive Planning Program for development of Air Force Installations, ensuring that natural, cultural, environmental, and social science factors are considered in planning and decision making.

Physical Resources

Air Quality

42 USC 7401 et seq.; 40 CFR Parts 50 & 51; Clean Air Act, National Ambient Air Quality Standards (CAA, NAAQS); Emission sources must comply with air quality standards and regulations established by federal, state, and local regulatory agencies.

Air Force Policy Directive 32-70; 20-Jul-94; Environmental Quality; Develops and implements the Air Force Environmental Quality Program composed of cleanup, compliance, conservation, and pollution prevention. Implements Clean Air Act.

Air Force Instruction 32-7040; 9-May-94; Air Quality Compliance; This AFI sets forth actions for bases to implement to achieve and maintain compliance with applicable standards for air quality compliance, and responsibilities for who is to implement them. Includes requirements for NEPA and RCRA as well as CAA.

F.S. Ch. 403, Part I; Florida Air and Water Pollution Control Act; Regulates air pollution within the state.

FAC Chap. 62-204; Florida State Implementation Plan, with Ambient Air Quality Standards and PSD Program; Establishes state air quality standards and requirements for maintaining compliance with NAAQS.

FAC Chap. 62-213; Operation Permits for Major Sources of Air Pollution; Adopted Prevention of Significant Deterioration (PSD) permit program, designed to control the impact of economic growth on areas that are already in attainment.

Air Space Use

49 USC 106 & Subtitle VII; 1997; Federal Aviation Act of 1958 (FAA); Created the FAA and establishes administrator with responsibility of ensuring aircraft safety and efficient utilization of the National Airspace System.

14 CFR Part 71; 1997; Federal Aviation Regulation (FAR); Defines federal air routes, controlled airspace, and flight locations for reporting position.

14 CFR Part 73; 1997; Federal Aviation Regulation (SFAR No. 53); Defines and prescribes requirements for special use airspace.

14 CFR Part 91; 1997; Federal Aviation Regulation (FAR); Governs the operation of aircraft within the United States, including the waters within 3 nautical miles of the U.S. Coast. In addition, certain rules apply to persons operating in airspace between 3 and 12 nautical miles from the U.S. Coast.

Land Resources

16 USC 670a to 670o; 1997; Sikes Act, Conservation Programs on Military Reservations; DoD, in a cooperative plan with DOI and State, opens AF bases to outdoor recreation, provides the state with a share of profits from sale of resources (timber), and conserves and rehabilitates wildlife, fish, and game on each reservation. AF is to manage the natural resources of its reservations to provide for sustained multipurpose use and public use.

16 USC 1451 to 1465; 1997; Coastal Zone Management Act of 1972 (CZMA); Federal agency activities in coastal zones should be consistent with state management plans to preserve and protect coastal zones. Lands for which the Federal Government has sole discretion or holds in trust are excluded from the coastal zone.

USC 1701 et seq., Public Law 94-579; 1997; Federal Land Policy and Management Act of 1976 (FLPMA); Provides that the Sec. of Interior shall develop land use plans for public lands within BLM jurisdiction to protect scientific, scenic, historical, ecological, environmental and archeological values, and to accommodate needs for minerals, food and timber.

16 USC 3501 to 3510; 1997; Coastal Barrier Resources Act (CBRA); Limits Federal expenditure for activities on areas within the Coastal Barrier Resources System. An exception is for military activities essential to national security, after the Federal agency consults with the Secretary of the Interior.

Air Force Instruction 32-7062; 1-Apr-94; Air Force Comprehensive Planning; Implements AFPD 32-70 by establishing Air Force Comprehensive Planning Program for development of Air Force Installations, ensuring that natural, cultural, environmental, and social science factors are considered in planning and decision making.

Air Force Instruction 32-7063; 31-Mar-94; Air Installation Compatible Use Zone Program (AICUZ); Provides a framework to promote compatible development within area of AICUZ area of influence and protect Air Force operational capability from the effects of land use which are incompatible with aircraft operations.

Air Force Instruction 32-7064 22-Jul-94; Integrated Natural Resources Management; Provides for development of an integrated natural resources management plan to manage the installation ecosystem and integrate natural resources management with the rest of the installation's mission. Includes physical and biological resources and uses.

Noise

42 USC 4901 to 4918, Public Law 92-574; 1972; Noise Control Act of 1972 (NCA); Provides that each Federal agency must comply with Federal, State, interstate and local requirements for control and abatement of environmental noise.

49 USC 44715; 1997; Controlling Aircraft Noise and Sonic Boom; Provides that the Federal Aviation Administration will issue regulations in consultation with the USEPA to control and abate aircraft noise and sonic boom.

Executive Order 12088; 1978; Federal Compliance with Pollution Control Standards; Requires the head of each executive agency to take responsibility for ensuring all actions have been taken to prevent, control, and abate environmental (noise) pollution with respect to federal activities.

Air Force Instruction 32-7063; 1-Mar-94; Air Installation Compatible Use Zone Program (AICUZ); The AICUZ study defines and maps noise contours. Update when noise exposure in air force operations results in a change of Day-Night Average Sound Level of 2 decibels (dBs) or more as compared to the noise contour map in the most recent AICUZ study.

Water Resources

33 USC 426, 577, 577a, 595a; 1970; River and Harbor Act of 1970 (RHA); Keeps navigable waterways open, authorizing the Army Corps of Engineers to investigate and control beach erosion and to undertake river and harbor improvements.

33 USC 1251 et seq.; 1997; Clean Water Act (CWA) (Water Pollution Prevention and Control Act, FWPCA); In addition to regulating navigable water quality, the CWA establishes NPDES permit program for discharge into surface waters and storm water control; Army Corps of Engineers permit and state certification for wetlands disturbance; regulates ocean discharge; sewage wastes control; and oil pollution prevention.

33 USC 1344-Section 404; 1997; Federal Water Pollution Control Act/Clean Water Act (FWPCA/CWA), Dredged or Fill Permit Program; Regulates development in streams and wetlands by requiring a permit from the Army Corps of Engineers for discharge of dredged or fill material into navigable waters. A Section 401 (33 USC 1341) Certification is required from the State as well.

42 USC 300f et seq.; 1997; Safe Drinking Water Act (SDWA); EPA-Requires the promulgation of drinking water standards, or MCLs, which are often used as cleanup values in remediation; establishes the underground injection well program; and establishes a wellhead protection program.

42 USC 6901 et seq.; 29-May-05; Resource Conservation and Recovery Act of 1976 (RCRA); Establishes standards for management of hazardous waste so that water resources are not contaminated: RCRA Corrective Action Program requires cleanup of ground water that has been contaminated with hazardous constituents.

42 USC 9601 et seq., Public Law 96-510; 11-Dec-80; Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA); Establishes the emergency response and remediation program for water and ground water resources contaminated with hazardous substances.

Executive Order 12114, 44 FR, No. 62; 01-04-79; Environmental Effects Abroad of Major Federal Actions. Activities outside the jurisdiction of the United States which significantly harm the natural or physical environment shall be evaluated. An EIS shall be prepared for major federal actions having significant environmental effects within the global commons (i.e., Antarctica, oceans).

Department of Defense Directive 6050.7; 03-31-79; Environmental Effects Abroad of Major Department of Defense Actions. Implements Executive Order 12114.

Air Force Policy Directive 32-70; 20-Jul-94; Environmental Quality; Develops and implements the Air Force Environmental Quality Program composed of cleanup, compliance, conservation, and pollution prevention. Implements Clean Water Act, Safe Drinking Water Act, and Water Quality Act of 1987.

Air Force Instruction 32-7006 04-29-94; Environmental Program in Foreign Countries; Implements DoD Directive 6050.7.

Air Force Instruction 32-7041; 13-May-94; Water Quality Compliance; Instructs the Air Force on maintaining compliance with the Clean Water Act; other federal, state, and local environmental regulations; and related DoD and AF water quality directives.

Air Force Instruction 32-7064; 22-Jul-94; Integrated Natural Resources Management; Sets forth requirements for addressing wetlands, floodplains and coastal and marine resources in an integrated natural resources management plan (INRMP) for each installation.

F.S. Chaps. 253, 258; Florida Aquatic Preserves Act; Establishes state aquatic preserves.

F.S. Chap. 403, Part I; Florida Air and Water Pollution Control Act; establishes the regulatory system for water resources in the State of Florida.

FAC Chap. 62-302; Surface Water Quality Standards; Classify Florida surface waters by use. Identify Outstanding Florida Waters.

FAC Chap. 62-312; Florida Dredge and Fill Activities; Requires a State permit for dredging and filling conducted in, on, or over the surface waters of the State.

Biological Resources

Animal Resources

16 USC 668 to 668d; 1995; Bald and Golden Eagle Protection Act (BGEPA); Makes it illegal to take, possess, sell, barter, offer to sell, transport, export or import Bald and Golden eagles in the United States. Taking may be allowed for scientific, exhibition, or religious purposes, or for seasonal protection of flocks.

16 USC 703 - 712; 1997; Migratory Bird Treaty Act (MBTA); Makes it illegal to take, kill or possess migratory birds unless done so in accordance with regulations. An exemption may be obtained from the Dept. of the Interior for taking a listed migratory bird.

16 USC 1361 et seq.; 1997; Marine Mammal Protection Act of 1972, as amended (MMPA); Makes it illegal for any person to "take" a marine mammal, which term includes significantly disturbing a habitat, unless activities are conducted in accordance with regulations or a permit.

Air Force Instruction 32-7064; 22-Jul-94; Integrated Natural Resources Management; Explains how to manage natural resources on Air Force property, and to comply with Federal, State, and local standards for resource management.

Executive Order 13112; 1999; Instructs federal agencies to monitor for, control, and prevent the introduction of non-native, invasive species of plants and animals.

Executive Order 13186; 2001; Directs federal agencies whose actions may affect migratory birds to establish and implement a Memorandum of Understanding with the U.S. Fish and Wildlife Service (USFWS) to promote the conservation of migratory birds.

DoD and USFWS Memorandum of Understanding (MOU); 2006; Requires the DoD to acquire permits for normal and routine operations, such as installation support functions, that may result in pursuit, hunting, taking, capturing, killing, possession, or transportation of any migratory bird.

50 CFR 21; 2007; Exempts the Armed Forces from the incidental taking of migratory birds during military readiness activities, except in cases where an activity would likely cause a significant adverse effect on the population of a migratory bird species. In this situation, the Armed Forces, in cooperation with the USFWS, must develop and implement conservation measures to mitigate or minimize the significant adverse impacts.

Threatened & Endangered Species

16 USC 1361 et seq., Public Law 92-574; 1997; Marine Mammal Protection Act of 1972, as amended (MMPA); Makes it illegal for a person to "take" a marine mammal, which term includes significantly disturbing the habitat, unless done in accordance with regulations or a permit.

16 USC 1531 to 1544-16 USC 1536(a); 1997; Endangered Species Act 1973 (ESA); Federal agencies must ensure their actions do not jeopardize the continued existence of any endangered or threatened species or destroy or adversely modify the habitat of such species and must set up a conservation program.

50 CFR Part 402; Endangered Species Act Interagency Cooperation; These rules prescribe how a Federal agency is to interact with either the FWS or the NMFS in implementing conservation measures or agency activities.

50 CFR Part 450; Endangered Species Exemption Process; These rules set forth the application procedure for an exemption from complying with Section 7(a)(2) of the ESA, 16 USC 1536(a)(2), which requires that Federal agencies ensure their actions do not affect endangered or threatened species or habitats.

Air Force Policy Directive 32-70; 20-Jul-94; Environmental Quality; Develops and implements the Air Force Environmental Quality Program composed of cleanup, compliance, conservation, and pollution prevention. Implements Endangered Species Act.

Air Force Instruction 32-7064; 22-Jul-94; Integrated Natural Resources Management; This AFI directs an installation to include in its INRMP procedures for managing and protecting endangered species or critical habitat, including State-listed endangered, threatened or rare species; and discusses agency coordination.

Human Safety

29 CFR 1910.120; Occupational Safety and Health Act, Chemical Hazard Communication Program (OSHA); Requires that chemical hazard identification, information and training be available to employees using hazardous materials and institutes material safety data sheets (MSDS) which provide this information.

Department of Defense Instruction 6055.1; Establishes occupational safety and health guidance for managing and controlling the reduction of radio frequency exposure.

Department of Defense Flight Information Publication; Identifies regions of potential hazard resulting from bird aggregations or obstructions, military airspace noise sensitive locations, and defines airspace avoidance measures.

Air Force Instructions 13-212v1 and v2; 1994; Weapons Ranges and Weapons Range Management; Establishes procedures for planning, construction, design, operation, and maintenance of weapons ranges as well as defines weapons safety footprints, buffer zones, and safest procedures for ordnance and aircraft malfunction.

Air Force Instruction 32-2001; 16-May-94; The Fire Protection Operations and Fire Prevention Program; Identifies requirements for Air Force fire protection programs (equipment, response time, and training).

Air Force Instruction 32-7063; 1-Mar-94; Air Installation Compatible Use Zone Program (AICUZ). The AICUZ Study defines and maps accident potential zones and runway clear zones around the installation, and contains specific land use compatibility recommendations based on aircraft operational effects and existing land use, zoning and planned land use.

Air Force Manual 91-201; 12-Jan-96; Explosives Safety Standards; Regulates and identifies procedures for explosives safety and handling as well as defining requirements for ordnance quantity distances, safety buffer zones, and storage facilities.

Air Force Instruction 91-301; 1-Jun-96; Air Force Occupational and Environmental Safety, Fire Protection and Health (AFOSH) Program); Identifies occupational safety, fire prevention, and health regulations governing Air Force activities and procedures associated with safety in the workplace.

Habitat Resources

Executive Order 11990; 24-May-77; Protection of Wetlands; Requires federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands in their activities. Construction is limited in wetlands and requires public participation.

Executive Order 11988; 24-May-77; Floodplain Management; Directs Federal agencies to restore and preserve floodplains by performing the following in floodplains: not supporting development; evaluating effects of potential actions; allowing public review of plans; and considering in land and water resource use.

Air Force Policy Directive 32-70; 20-Jul-94; Environmental Quality; Develops and implements the Air Force Environmental Quality Program composed of cleanup, compliance, conservation, and pollution prevention. Implements Executive Order 11988 and 11990.

Anthropogenic Resources

Hazardous Materials

7 USC 136 et seq., Public Law 92-516; 1997; Federal Insecticide, Fungicide, and Rodenticide Act Insecticide and Environmental Pesticide Control (FIFRA); Establishes requirements for use of pesticides that may be relevant to activities at Eglin Air Force Base.

42 USC Sect. 2011 - Sect. 2259; Atomic Energy Act (AEA); Assure the proper management of source, special nuclear, and byproduct material.

42 USC 6901 et seq.; 1980; Resource Conservation and Recovery Act of 1976 and Solid Waste Disposal Act of 1980 (RCRA); Subchapter III sets forth hazardous waste management provisions; Subchapter IV sets forth solid waste management provisions; and Subchapter IX sets forth underground storage tank provisions; with which Federal agencies must comply.

42 USC 9601 et seq., Public Law 96-510; 1997; Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA); Establishes the liability and responsibilities of federal agencies for emergency response measures and remediation when hazardous substances are or have been released into the environment.

42 USC 11001 to 11050; Emergency Planning and Community Right-to-Know Act (EPCRA); Provides for notification procedures when a release of a hazardous substance occurs; sets up community response measures to a hazardous substance release; and establishes inventory and reporting requirements for toxic substances at all facilities.

42 USC 13101 to 13109; 1990; Pollution Prevention Act of 1990 (PPA); Establishes source reduction as the preferred method of pollution prevention, followed by recycling, treatment, then disposal into the environment. Establishes reporting requirements to submit with EPCRA reports. Federal agencies must comply.

Air Armament Center Plan 32-3; January 2004; Asbestos Management Plan; This plan establishes procedures for the Eglin Air Force Base (AFB) facility asbestos management program. It contains the policies and procedures used in controlling the health hazards created by asbestos containing materials (ACM), and the procedures used in ACM removal required to protect the health of personnel and to comply with applicable federal, state, and Air Force laws and inspections.

Air Armament Center Plan 32-4; January 2004. Lead-Based Paint Management Plan; This plan establishes procedures for the Eglin AFB lead- based paint management program. It contains policies and procedures used in controlling health hazards from exposure to lead-based based paint.

Air Armament Center Plan 32-7; February 2003; Integrated Solid Waste Management Plan; The Eglin AFB Integrated Solid Waste Management Plan documents guidance and procedures with regard to regulatory compliance in the handling, reduction, recycling and disposal of solid waste. It contains requirements necessary to reach the mandated incremental waste diversion goal of 40 percent diversion of municipal solid waste from landfill disposal by fiscal year (FY) 2005. These policies and procedures are designed to preserve landfill space, increase recycling and reuse, address revenues and cost avoidance, provide pollution prevention alternatives and promote Affirmative Procurement. This plan draws from the aspects of two programs, the Integrated Solid Waste Management Program (ISWMP) and the Qualified Recycling Program (QRP).

Air Armament Center Plan 32-9; February 2003; Hazardous Materials Management Plan; The Eglin AFB Hazardous Material Management Plan (HMMP) documents existing policy and procedures for organizations requesting, procuring, issuing, handling, storing and disposing of hazardous material (HM) in accomplishment of the Air Armament Center (AAC) mission. These policies provide guidance for compliance with federal, state, and local occupational safety, health, and environmental regulations.

Air Force Policy Directive 32-70; 20-Jul-94; Environmental Quality; Provides for developing and implementing an Air Force Environmental Quality Program composed of four pillars: cleanup, compliance, conservation and pollution prevention. Implements Resource Recovery and Conservation Act, Comprehensive Environment Response Compensation and Liability Act of 1980, Emergency Planning and Community Right-to-Know Act, Pollution Prevention Act, Executive Order 12088, Executive Order 12777, and Executive Order 12586. Implements DoD Instruction 4120.14, DoD Directive 4210.15, and DoD Directive 5030.41.

Air Armament Center Instruction 32-7003; 26July2004; Hazardous Waste Management; This instruction is intended to provide a framework for complying with environmental standards applicable to Hazardous Waste (HW), Universal Waste (UW, Special Waste (SW) and used petroleum products on Eglin AFB.

Air Force Instruction 32-7020; 19-May-94; The Environmental Restoration Program; Introduces the basic structure and components of a cleanup program under the Defense Environmental Restoration Program. Sets forth cleanup program elements, key issues, key management topics, objectives, goals, and scope of the cleanup program.

Air Force Instruction 32-7042; 12-May-94; Solid and Hazardous Waste Compliance; Provides that each installation must develop a hazardous waste (HW) and a solid waste (SW) management plan; characterize all HW streams; and dispose of them in accordance with the AFI. Plans must address pollution prevention as well.

Air Force Instruction 32-7080; 12-May-94; Pollution Prevention Program; Each installation is to develop a pollution prevention management plan that addresses ozone depleting chemicals; EPA 17 industrial toxics; hazardous and solid wastes; obtaining environmentally friendly products; energy conservation, and air and water.

Air Force Policy Directive 40-2; 8-Apr-93; Radioactive Materials; Establishes policy for control of radioactive materials, including those regulated by the US Nuclear Regulatory Commission (NRC), but excluding those used in nuclear weapons.

Cultural Resources

10 USC 2701 note, Public Law 103-139; 1997; Legacy Resource Management Program (LRMP); Provides funding to conduct inventories of all scientifically significant biological assets of Eglin AFB.

16 USC 431 et seq.; PL 59-209; 34 Stat. 225; 43 CFR 3; 1906; Antiquities Act of 1906; Provides protection for archeological resources by protecting all historic and prehistoric sites on Federal lands. Prohibits excavation or destruction of such antiquities without the permission (Antiquities Permit) of the Secretary of the department that has the jurisdiction over those lands.

16 USC 461 to 467; 1997; Historic Sites, Buildings and Antiquities Act (HAS); Establishes national policy to preserve for public use historic sites, buildings and objects of national significance: the Secretary of the Interior operates through the National Park Service to implement this national policy.

16 USC 469 to 469c-1; 1997; Archaeological and Historic Preservation Act of 1974 (AHPA); Directs Federal agencies to give notice to the Sec. of the Interior before starting construction of a dam or other project that will alter the terrain and destroy scientific, historical or archeological data, so that the Sec. may undertake preservation.

16 USC 470aa-470mm, Public Law 96-95; 1997; Archaeological Resources Protection Act of 1979 (ARPA); Establishes permit requirements for archaeological investigations and ensures protection and preservation of archaeological sites on federal property.

16 USC 470 to 470w-6-16 USC 470f, 470h-2; 1997; National Historic Preservation Act (NHPA); Requires Federal agencies to (1) allow the Advisory Council on Historic Preservation to comment before taking action on properties eligible for the National Register and (2) preserve such properties in accordance with statutory and regulatory provisions.

25 USC 3001 - 3013), (Public Law 101-601; 1997; Native American Graves Protection and Repatriation Act of 1991 (NAGPRA); Federal agencies must obtain a permit under the Archeological Resources Protection Act before excavating Native American artifacts. Federal agencies must inventory and preserve such artifacts found on land within their stewardship.

42 USC 1996; American Indian Religious Freedom Act (AIRFA); Federal agencies should do what they can to ensure that American Indians have access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites in the practice of their traditional religions.

32 CFR Part 200; Protection of Archaeological Resources: Uniform Regulations; Provides that no person may excavate or remove any archaeological resource located on public lands or Indian lands unless such activity is conducted pursuant to a permit issued under this Part or is exempted under this Part.

36 CFR Part 60; Nominations to National Register of Historic Places; Details how the Federal agency Preservation Officer is to nominate properties to the Advisory Council for consideration to be included on the National Register.

36 CFR Part 800; Protection of Historic and Cultural Properties; Sets out the Section 106 process for complying with Sections 106 and 110 of the NHPA: the Agency official, in consultation with the State Historic Preservation Officer (SHPO), identifies and evaluates affected historic properties for the Advisory Council.

Executive Order 11593, 16 USC 470; 13-May-71; Protection and Enhancement of the Cultural Environment; Instructs federal agencies to identify and nominate historic properties to the National Register, as well as avoid damage to Historic properties eligible for National Register.

Executive Order 13007; 24-May-96; Directs federal agencies to provide access to and ceremonial use of sacred Indian sites by Indian religious practitioners as well as promote the physical integrity of sacred sites.

DoD Directive 4710.1; Archaeological and Historic Resources Management (AHRM); Establishes policy requirements for archaeological and cultural resource protection and management for all military lands and reservations.

Air Force Policy Directive 32-70; 20-Jul-94; Environmental Quality; Develops and implements the Air Force Environmental Quality Program composed of cleanup, compliance, conservation, and pollution prevention. Implements National Historic Preservation Act, Executive Order 11593, and DoD Directive 470.1.

Air Force Instruction 32-7065; 13-Jun-94; Cultural Resource Management; Directs AF bases to prepare cultural resources management plans (CRMP) to comply with historic preservation requirements, Native American considerations; and archeological resource protection requirements, as part of the Base Comprehensive Plan.

Air Force Policy Letter; 4-Jan-82; Establishes Air Force policy to comply with historic preservation and other federal environmental laws and directives.

APPENDIX D

BIOLOGICAL RESOURCES

BIOLOGICAL RESOURCES

Sensitive species and habitats that have the potential to be impacted by electromagnetic radiation (EMR) activities are identified and discussed within this Appendix. The majority of the sensitive species found on Eglin Air Force Base (AFB) are included in the affected environment, as the identification of specific locations where EMR testing events could occur is difficult. However, based on the operational parameters of EMR sources and the proximity to sensitive habitat, some sensitive species can be reasonably eliminated from further discussion.

It is unlikely that EMR would reach aquatic species such as the Okaloosa darter and the Gulf sturgeon and therefore, potential impacts to these species have not been addressed within this Range Environmental Assessment (REA). Additionally, since this REA only analyzes the potential impacts from EMR exposure and not related activities such as line-of-sight tree clearing and associated construction, it is not expected that the transfer of invasive species from one area to another would be a concern. For this reason, invasive species found on Eglin AFB are not addressed within this REA. Lastly, based on previous analysis conducted in the 2002 EMR Programmatic Environmental Assessment (U.S. Air Force, 2002a) it was determined that no impacts to vegetation would occur from the use of EMR sources. Therefore, sensitive plant species and sensitive habitats known to contain rare plant species are not further addressed.

ECOLOGICAL ASSOCIATIONS

EMR sources are located base-wide and as such, encompass all of the ecological associations that are found on Eglin AFB. These ecological associations support a variety of plants and wildlife habitat and are defined by their floral, faunal, and geophysical characteristics.

Sandhills Ecological Association

This system is the most extensive natural community type on Eglin AFB, accounting for approximately 78 percent or 362,000 acres of the base. Longleaf Pine Sandhills are characterized by an open, savanna-like structure with a moderate to tall canopy of longleaf pine, a sparse midstory of oaks and other hardwoods, and a diverse groundcover composed mainly of grasses, forbs, and low stature shrubs. The structure and composition is maintained by frequent fires, every three to five years, which controls hardwood, sand pine and titi encroachment.

Longleaf Pine Sandhills consist of a high diversity of species adapted to fire and the heterogeneous conditions that fires create. Variation within the sandhills is recognized by two associations differing in the dominance of grass species (wiregrass versus bluestem). Sandhills are often associated with and grade into Scrub, Upland Pine Forest, Xeric Hammock or slope forests. Associated trees include longleaf pine turkey oak, longleaf pine-xerophytic oak, longleaf pine-deciduous oak or high pine (U.S. Air Force, 2007). The functional significance of the Sandhill ecological association is to provide maintenance of regional biodiversity. Additionally, the sandhills, due to their wide coverage on Eglin AFB, are the ecological association across which fire carries into the other imbedded fire-dependent systems. Eglin AFB is the largest and least fragmented single longleaf pine ownership in the world, and has the best remaining old

growth longleaf pine. Seepage slopes are a common embedded wetland feature found within Eglin's sandhill matrix.

Wetland/Riparian Ecological Association

Wetlands and Riparian ecological associations on Eglin AFB can be divided into the following categories: (1) wetlands, which are dominated by plants adapted to anaerobic substrate conditions imposed by saturation or inundation for more than 10 percent of the growing season; (2) lacustrine wetlands that occur in nonflowing wetlands of natural depressions; and (3) riverine communities, which are natural, flowing waters from their source to the downstream limits of tidal influence and are bounded by channel banks. The above categories are further broken down into the following natural community types, which are found within or adjacent to the action area.

Floodplain wetlands have alluvial sand or peat substrates associated with riverine natural communities and are subject to flooding but not permanent inundation.

(1) Bottomland forest – Bottomland forest occurs on low-lying flatlands, usually bordering streams with distinct banks, where water rarely inundates the forest, such as areas along the Yellow River. On Eglin AFB, these communities are also found on low terraces along the larger streams, such as Alaqua Creek.
(2) Floodplain forest – This term is used to designate river bottoms and low creek bottoms. In swamps with a recent fire history, the common tree is the black titi.

Basin wetlands are shallow, closed basin with an outlet usually only in time of high water. Bottom substrate is typically peat or sand and is usually inundated. Basin wetland vegetation is woody and/or herbaceous.

(1) Depression marsh – These systems are shallow, usually rounded depressions in sand substrate with herbaceous vegetation often in concentric bands. Peaty soil accumulates in the deepest sections where water is most permanent.
(2) River floodplain lake – Fresh water ponds support a variety of aquatic vegetation. Not all ponds on the Reservation support the same vegetation.
(3) Sandhills upland lake – Shallow, rounded depressions, sandy bottom, low nutrient.

Riparian zones may be classified into the following ravine natural community types.

(1) Alluvial stream – Clay and silt carrying, larger streams, perennial (Yellow River). Alluvial streams are characterized as perennial or intermittent seasonal watercourses originating in high uplands that are primarily composed of sandy clays and clayey-silty sands. Surface runoff generally predominates over subsurface drainage.
(2) Blackwater stream – Blackwater streams are characterized as perennial or intermittent seasonal water courses originating deep in sandy lowlands where extensive wetlands with organic soils function as reservoirs, collecting rainfall and discharging it slowly to the stream. The dark, tea-colored water typical of blackwater streams are laden with tannins,

particulates, dissolved organic matter, and iron derived from drainage through swamps and marshes.

(3) Seepage stream – Seepage streams are characterized as perennial or intermittent seasonal water courses, originating from shallow ground waters that have percolated through deep, sandy, upland soils. These streams are typically clear to lightly colored. They are relatively short, shallow, and narrow.

Table D-1 shows the type of Wetlands/Riparian ecological associations found on or adjacent to Eglin AFB.

Table D-1. Wetland Types by Wetland/Riparian Ecological Association on or Adjacent to Eglin AFB

Type of Wetlands	Source of Hydrology	Substrate	Vegetation	Functional Significance
Depression Wetlands	Groundwater or rainwater	Peat or sand	Woody and/or herbaceous	Maintains regional biodiversity Floodwater storage Filters pollutants Maintains water quality
Seepage Slopes	Downslope seepage (sheetflow)	High in clay	Herbaceous	Rare habitats High biodiversity
Floodplain Wetlands	Rivers, streams, and creeks	Peat or sand	Woody and/or herbaceous	Maintains regional biodiversity Floodwater storage Wildlife corridors Maintains water quality

Source: U.S. Air Force, 2007

Flatwoods Ecological Association

Pine flatwoods occur on flat, moderately well drained sandy soils with varying levels of organic matter, often underlain by a hard pan. While the canopy consists of slash pine and longleaf pine, the understory varies greatly from shrubby to an open diverse understory of grasses and herbs. The primary environmental factors controlling vegetation type are soil moisture (soil type and depth to groundwater) and fire history. The average fire frequency in flatwoods is one to eight years, with nearly all of the plants and animals inhabiting this community adapted to recurrent fires. Home to numerous rare and endangered plants and animals, the Flatwoods Matrix plays a significant role in maintaining regional biodiversity, Eglin's more than 300 acres of old growth flatwoods are among the last remaining of such high quality.

Barrier Island Ecological Association

Santa Rosa Island (SRI) falls under the Barrier Island ecological association, and its entire terrestrial area is classified as Coastal Upland Community. The natural communities associated with this complex contain substrate and vegetation that are influenced primarily by such coastal (maritime) processes as erosion, deposition, salt spray, and storms. Vegetative communities include primary and secondary dunes, interdune swales, maritime forests, and sand pine scrub. The functional significance of barrier islands is to provide maintenance of regional biodiversity and protect the mainland and bays from extreme storm events.

Open Grasslands/Shrublands Ecological Association

The Grasslands/Shrublands ecological association occurs in areas of heavily disturbed Sandhills, Flatwoods, and Wetlands/Riparian ecological sites (U.S. Air Force, 2003). This habitat predominantly occurs within the test areas on Eglin AFB. Some portions of Eglin's interstitial areas (areas between the test sites) have been cleared (i.e., Duke Field and auxiliary fields) and have consequently become grasslands/shrublands. The open grassland/shrubland association is characterized by grasses and low shrubs. This habitat is maintained with machinery or fire that removes or prevents future growth. Riparian zones are found throughout theses areas.

SENSITIVE SPECIES

Eastern Indigo Snake (*Drymarchon corais couperi*)

The federally threatened eastern indigo snake is the largest nonvenomous snake in North America and can grow up to 125 inches in length. The primary reason for its listing is population declines resulting from habitat loss and fragmentation. Movement along travel corridors between seasonal habitats also exposes the snake to danger from increased contact with humans. The snake frequents flatwoods, hammocks, stream bottoms, canebrakes, riparian thickets, and high ground with deep, well drained to excessively drained, sandy soils. Habitat preferences vary seasonally. Xeric Sandhill winter dens are used from December to April; from May to July they shift from winter dens to summer territories; from August through November they are frequently located in shady creek bottoms.

The indigo snake is strongly associated with gopher tortoise burrows. They use abandoned burrows in winter and spring for egg laying, shedding, and protection from dehydration and temperature extremes. They also use stump holes, armadillo and gopher holes, and other wildlife ground cavities.

Red-cockaded Woodpecker *(Picoides borealis)*

The Red-cockaded woodpecker (RCW) primarily inhabits the interstitial areas of the Eglin Reservation, although RCW cavity trees can be found on some test areas as well. RCWs are not found on SRI. On Eglin AFB, the RCW typically inhabits mature, open stands of longleaf pine. The RCW does not migrate and maintains year-round territories near nesting and roosting trees. An RCW cluster typically encompasses about 10 acres, with most cavity trees within a 1,500-foot diameter circle. The RCW has shown some preference for mature longleaf pine over other pine species as a cavity tree with the average age of longleaf pines, in which new cavities have been excavated, being 95 years. Currently, 110,834 acres of the interstitial area is designated as RCW foraging habitat, which equates to approximately 23 percent of Eglin AFB property.

The woodpeckers primarily feed on spiders, ants, cockroaches, centipedes, and insect eggs and larvae that are excavated from trees. Dead, dying, and lightning-damaged trees that are infested with insects are a preferred feeding source. High quality RCW forage habitat consists of open pine stands with tree diameter at breast height averaging 9 inches or larger. The birds forage in

intermediate-aged (30-year old) and older pine stands, which also provide an important source of future trees for the construction of cavities. As a result of active management, RCW populations on Eglin AFB have continued to increase. Since 1994 the entire population size has been estimated once each year. In 2008, the population consisted of 390 active clusters and 347 potential breeding pairs.

Figure D-1 outlines this increase in population trends on Eglin AFB.

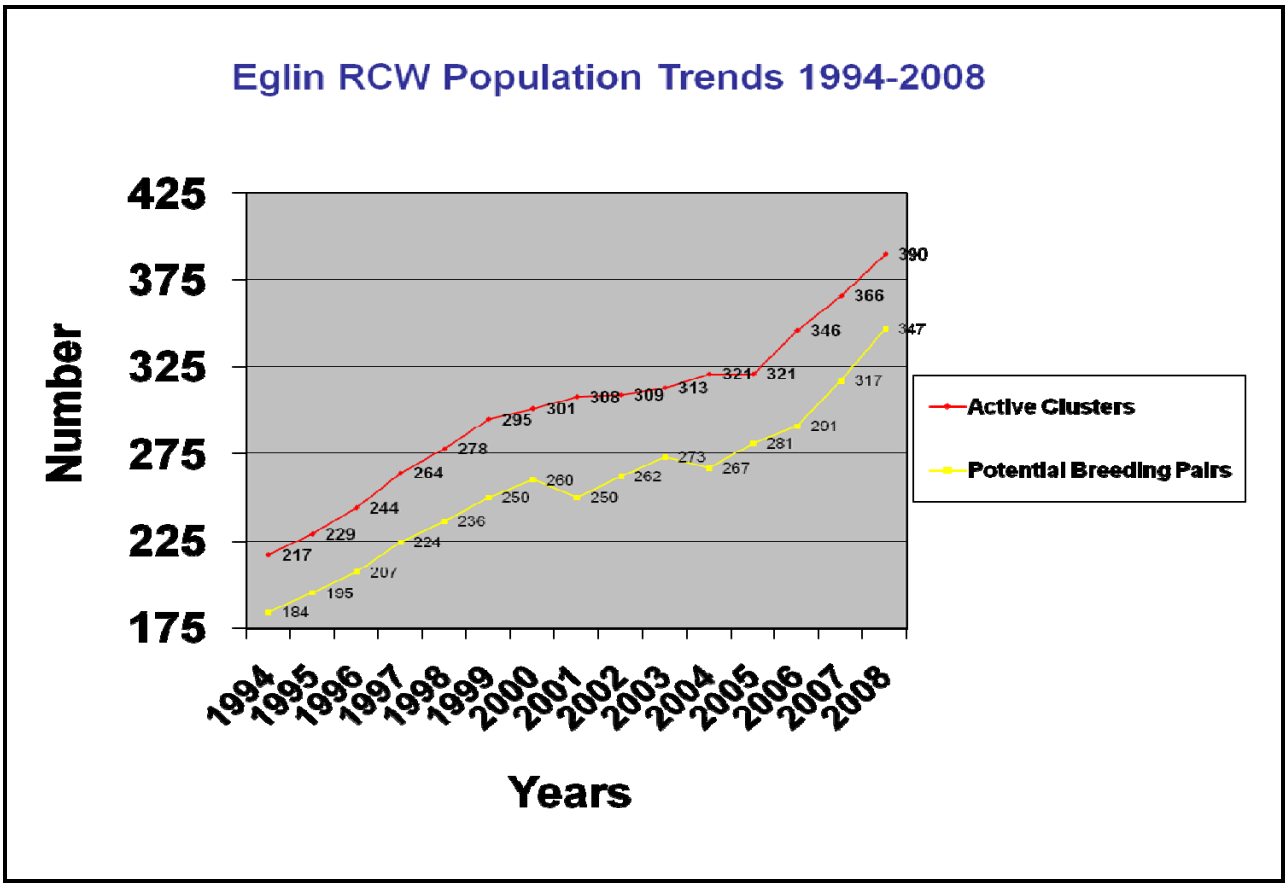

Figure D-1. Red-cockaded Woodpecker Population Trends from 1994 - 2008

Reticulated Flatwoods Salamander *(Ambystoma bishopi)*

The reticulated flatwoods salamander is listed as federally endangered and is a state species of special concern. Based on molecular and morphological analyses, Pauly et al. (2007) proposed the separation of the flatwoods salamander into two species. The division lies along the Apalachicola-Flint Rivers with reticulated flatwoods salamanders (*Ambystoma bishopi*) inhabiting areas to the west and frosted flatwoods salamanders (*A. cingulatum*) ranging to the east of the rivers. There are 18 known breeding ponds for the reticulated flatwoods salamander on the Eglin Range. Additionally, the Eglin Range supports approximately 17,000 acres of potential salamander habitat in mesic flatwoods. On February 10, 2009, the U.S. Fish and Wildlife Service (USFWS) issued a notification in the Federal Register that no critical habitat

would be designated for the reticulated flatwoods salamander on Eglin AFB (Federal Register, 2009).

Optimal habitat for this small mole salamander is open, mesic (moderately wet) woodlands of longleaf or slash pine flatwoods maintained by frequent fires and that contain shallow, ephemeral wetland ponds. Males and females migrate to these ephemeral ponds during the cool, rainy months of October through December. The females lay their eggs in vegetation at the edges of the ponds. Flatwoods salamanders may disperse long distances from breeding sites to upland sites where they live as adults (U.S. Air Force, 2006).

The primary threat to the flatwoods salamander is loss of mesic habitat through the filling in of wetlands and other alterations to the landscape hydrology. Flatwoods salamander habitat is also threatened by the introduction of invasive, non-native species. Flatwoods salamanders and their active breeding wetlands both appear to have declined in number since the original Eglin AFB surveys in 1993 and 1994. This is possibly due in part to several years of drought in the late 1990s and early 2000s. Wetlands used for breeding may not have remained wet long enough for larvae to complete metamorphosis if rainfall amounts were not sufficient. This has resulted in little population recruitment over the last decade at Eglin's wetlands (U.S. Air Force, 2006).

The USFWS guidelines in the *Federal Register*, dated 1 April 1999, establish a 450-meter (1,476-foot) buffer area from the wetland edge of confirmed breeding ponds. Within the buffer area, the guidelines restrict ground-disturbing activities in order to minimize the potential for direct impacts to salamanders, the introduction and spread of invasive non-native plant species, and alterations to hydrology and water quality.

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle is listed as a state-threatened species and is protected by the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act. Eagles are territorial and exhibit a strong affinity for a nest site once a nest has been established. It is common for a breeding pair to rebuild damaged or lost nests in the same tree or in an adjacent tree. Individual pairs return to the same territory year after year and territories are often inherited by subsequent generations. The nesting period in the southeast United States extends from 1 October to 15 May, with most nests completed by the end of November (U.S. Air Force, 2006). Most eagles migrate north during the hot summer season. Bald eagles are known to nest at two locations on Eglin AFB: Eglin Main Base between Cobbs Overrun and Test Area A-22, and near A-12 on SRI. The pair of eagles at the Eglin Main Base site has fledged one to two birds per year in most years, but in some years no young were fledged (U.S. Air Force, 2006).

Loggerhead, Green, Leatherback, and Kemp's Ridley Sea Turtles

Of the five species of marine turtles found in the Gulf of Mexico, two are known to regularly nest on SRI beaches (which include Okaloosa and Santa Rosa Islands in Okaloosa and Santa Rosa Counties). These are the loggerhead sea turtle (*Caretta caretta*) and the green sea turtle (*Chelonia mydas*). Green sea turtles typically nest on Eglin's beaches every other year and in lower numbers. The leatherback sea turtle (*Dermochelys coriacea*) has been documented nesting

on SRI only one year and in 2008, three Kemp's ridley (*Lepidochelys kempii*) sea turtle nests were recorded on SRI.

The Atlantic loggerhead sea turtle is federally and state-listed as threatened. Loggerhead nests in Florida account for 90 percent of all loggerhead nests in the United States. Their nesting sites are on the numerous barrier islands and beaches between the Florida Keys and the northern Gulf of Mexico. Nesting females approach SRI in the spring and summer to dig their nests between the high tide mark and the dune line, and sometimes between dunes.

The Atlantic green sea turtle is listed as federally threatened in all its eastern range of North America, except in Florida where it is listed as endangered. It is also state-listed as endangered. In the United States, the green sea turtle nests on south Florida beaches with a few exceptions in the northern Gulf of Mexico and North Carolina. Eglin AFB SRI property supports the highest number of green sea turtle nests in northwest Florida.

The leatherback sea turtle is federally and state endangered. This species commonly nests along the shorelines of the Atlantic, Pacific, and Indian Oceans. Only infrequent nesting activity has been documented for the leatherback in northwest Florida (LeBuff, 1976; Florida Fish and Wildlife Conservation Commission [FWC], Florida Marine Research Institute [FMRI], unpublished data; Longieliere et al., 1997). Until the spring of 2000, the only confirmed leatherback nesting in northwest Florida was in Franklin and Gulf Counties. In May and June 2000, leatherback nesting activity was documented for the first time in Okaloosa County on Eglin's portion of SRI (Miller, 2000).

The Kemp's ridley turtle is federally listed as endangered throughout its range. The Kemp's ridley is one of the smallest sea turtles with adults reaching about 2 feet in length and weighing up to 100 pounds (USFWS, 2009). The range includes the Gulf coasts of Mexico and the U.S., and the Atlantic coast of North America as far north as Nova Scotia and Newfoundland.

The beachfront at SRI was divided into a 0.5-mile zone for mapping purposes, and nesting data were recorded according to the zone in which they occur. Figure D-2 shows these zones, and also provides a color-coded indication of nesting intensity for each species observed. This color-coded map feature was generated to provide an overall picture of relative nesting intensity on each section of the beach. These data have been collected since 1989 at SRI.

Based on the data collected between 1989 and 2008 on the 17 miles of Eglin AFB SRI beaches, the average annual nesting density for loggerheads is approximately 1.20 nests per mile. During this period, 407 loggerhead nests were recorded. Peak loggerhead nesting on SRI occurs in June and July, with approximately 85 percent of nests established during this period. Slightly higher loggerhead nesting densities have been documented near Test Sites A-2, A-4, between sites A-9 and A-13B, and between A-15A and A-15.

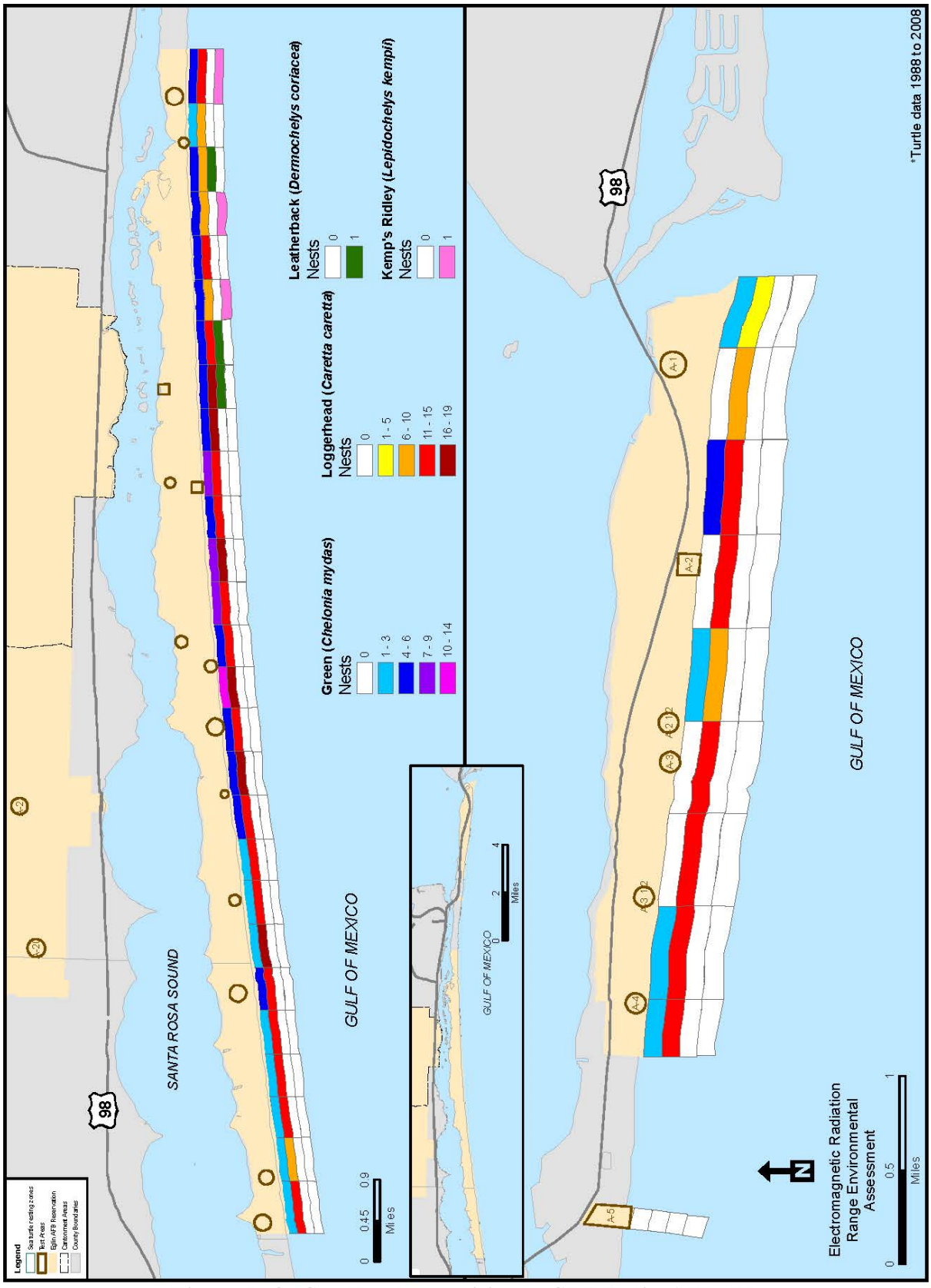

Figure D-2. Sea Turtle Densities on SRI, Eglin AFB, FL

Eglin's SRI property supports the greatest number of green sea turtle nests in northwest Florida. Green sea turtles have nested on SRI every other year from 1990 to 2002. However, in 2003 there were four green sea turtle nests, in 2004 there were none, in 2005 there were seven, and in 2006 there were six, possibly indicating a new trend. Also, there was one nest in 1997. Between 1990 and 2008, 131 green sea turtle nests were recorded. The average annual nesting density for green sea turtles is approximately 0.65 nests per mile. Green sea turtle hatching peaks in August and September. Most green sea turtle nests have been documented between Sites A-7 and A-13B.

Leatherback nesting has been documented only one year on Eglin SRI, during 2000. Three nests were laid in May and June and hatched in September. The three nests were located between sites A-7 and A-10.

In 2008, there were three Kemp's Ridley nests recorded. All three nests were recorded during the month of June in the Okaloosa County portion of SRI.

Eglin conducts monitoring surveys seven days a week from 15 May to 31 October, or until the last nest has either hatched or reached 80 days incubation, at which time the nest is evaluated per state protocol. Turtle crawls are identified as either a true nesting crawl or false crawl (no nesting activity associated with the crawl). The sea turtle nests are marked with stakes and surrounded with surveyor flagging tape. Nests are then monitored throughout the entire incubation period for potential storm damage, hatching activity, and predation. Nests are only relocated if threatened by erosion, inundation, or predation.

Piping Plover (*Charadrius melodus*)

The piping plover is state- and federally listed as threatened. Piping plovers are found in nonbreeding (migration and wintering) habitats along the Gulf as early as mid-July and leave by mid-May. On Eglin AFB, piping plovers are on SRI. They have not been documented on Okaloosa Island. Piping plovers are known to forage in exposed wet sand areas such as wash zones, intertidal ocean beachfronts, wrack lines, washover passes, mud and sand flats, ephemeral ponds, and salt marshes. They are also known to use adjacent areas for sheltering in dunes, debris, and sparse vegetation. Although it is possible that piping plovers could use any one of these habitat types at any time during the nonbreeding season, studies have shown that nonbreeding plovers spend 76 percent of their time foraging for invertebrates found just below the surface of wet sand (Johnson and Baldassarre, 1988).

Piping Plover Critical Habitat

Critical habitat for nonbreeding piping plovers was designated in 2001. Nonbreeding (wintering and migrating) piping plover season is 15 July through 15 May. Critical habitat is defined by the Endangered Species Act as specific areas that contain physical or biological features essential to the conservation of threatened and endangered species and that may require special management considerations or protection. The boundaries of critical habitat are subject to change due to the

changing morphology of the shoreline at SRI. Guidelines published in the *Federal Register* should be referenced if there is any question regarding boundaries.

According to the USFWS ruling, the primary constituent elements for piping plover nonbreeding habitat are those components essential for foraging, sheltering, and roosting, and the physical features necessary for maintaining the natural processes that support these habitat components. These elements are found in coastal areas that support intertidal beaches and flats and associated dune systems and flats above annual high tide. On SRI Eglin property, critical habitat is located on the north shore, near Test Site A-18 (Figure 3-4 in Chapter 3 of the EMR REA). Critical habitat at SRI includes land from the mean lower low water (MLLW) line to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur (Federal Register, 2001). Areas used by piping plovers are ephemeral habitats that change over time, so when surveys document new locations being used, these areas will be given the same protection afforded the piping plover critical habitat units already established.

Gopher Tortoise (*Gopherus polyphemus*)

The gopher tortoise is a state-threatened species. The tortoise is found primarily within the sandhills and open grassland ecological associations on the Eglin Range, where it excavates a tunnel-like burrow for shelter from climatic extremes and refuge from predators. The primary features of good tortoise habitat are sandy soils, open canopy with plenty of sunlight, and abundant food plants (forbs and grasses). Prescribed fire is often employed to maintain these conditions. Nesting occurs during May and June and hatching occurs from August through September. Gopher tortoise burrows serve as important habitat for many species, including the federally listed eastern indigo snake (U.S. Air Force, 2006).

Santa Rosa Beach Mouse (*Peromyscus polionotus leucocephalus*)

The Santa Rosa beach mouse is one of five beach mouse subspecies and is the only subspecies not currently listed by either the state or the federal government; however, it may be considered for federal listing in the near future. Santa Rosa beach mice are mostly nocturnal and burrow nest in dunes. They prefer sand-covered dune slopes with patches of grasses and herbs, and their diet consists of various plant seeds and insects. This population, which occurs only on SRI, was decimated after storm surge from Hurricane Opal in 1995 destroyed dune habitat. Monthly track count surveys conducted by Eglin's Natural Resources Section (NRS) personnel indicate a 40 percent increase in population from 1996 to 2001 (U.S. Air Force, 2002). Currently, quarterly surveys are used to monitor population status. Current threats to this population include predation by feral cats and loss of dune habitat from recreational foot traffic and storms.

American Alligator (*Alligator mississippiensis*)

The American alligator is currently federally listed as threatened due to similarity of appearance to the crocodile (federally listed as endangered, does not occur on Eglin AFB). The state of Florida considers the American Alligator a species of special concern. They typically prefer fresh and brackish water within the flatwoods, swamp, and salt marsh ecological associations. Adult alligators can reach up to 18 feet in length, although the average is 13 feet. On average, they weigh from 450 to 600 pounds (National Parks Conservation Association, 2004).

Florida Black Bear (*Ursus americanus floridanus*)

The Florida Black Bear was proposed for federal listing in 1990, however in 1998 the USFWS removed it from listing consideration. The Florida Black Bear is currently listed as a state-threatened species except in Baker and Columbia Counties and Apalachicola National Forest. Black bear populations are currently found in Florida, Georgia, and a small population in Alabama. Eglin AFB is considered to be the smallest population, with an estimated 60 to 100 individuals; however, Eglin's black bear population has shown signs of increase since the early 1990s (U.S. Air Force, 2002). Eglin's NRS frequently receives reports of bear sightings and has responded to a growing number of bear/vehicle collisions and nuisance bear complaints. Most black bears on Eglin AFB utilize the large swamps and floodplain forests in the southwest and northern portions of the Reservation. Black bear sightings have occurred in numerous locations throughout the Eglin Reservation, the majority of which have been within the interstitial areas.

Black bears eat a wide variety of food items. Their seasonal and annual diet consists primarily of fruits, acorns, beetles, and yellow jackets. Black bear in Florida breed in June and July. Implantation is delayed about four months. Gestation lasts 7-7.5 months (average 220 days) (U.S. Air Force, 2002). Females give birth every two years at most. Young are born in January and February, and stay with their mother until fall of the second year. Litter size is typically two to four cubs and females generally give birth at three to four years old (U.S. Air Force, 2002).

Southeastern American Kestrel (*Falco sparverius paulus*)

The Southeastern American kestrel is state-listed as threatened. The Kestrel is a small falcon with pointed wings, a reddish back and tail, and two black stripes on each side of the white sides of its head. Kestrels are relatively common on Eglin AFB. The clutch size is 3 to 7 birds (usually 4 to 5). Incubation is conducted mainly by females, and usually lasts 29 to 31 days. Young are cared for by both parents and usually leave the nest in about 29 to 31 days. Kestrels will readily renest if the first clutch is lost.

Kestrels prefer open or partly open sandhills habitat. On Eglin AFB, kestrels frequently utilize the cleared test areas as foraging areas and nest in cavities most often in longleaf pine trees. Cavity trees may be dead or alive. Kestrels frequently nest in old growth longleaf pines that contain cavities originally excavated by RCWs. These cavities are usually enlarged by fox squirrels, pileated woodpeckers, or fire, making them large enough for kestrel use. Kestrels will readily use nest-boxes; however, Eglin appears to contain an abundance of suitable nesting habitat. Kestrels feed on insects (e.g., grasshoppers and crickets) and small vertebrates (e.g., snakes, lizards, birds, mice, and sometimes bats). They often utilize the tree line or utility poles adjacent to and within cleared test areas.

Gopher Frog (*Rana capito*)

The gopher frog is listed as a species of special concern by the state of Florida. These frogs are typically 2.5 to 4 inches long, excluding their legs, and have a wide body characterized by cream-colored, gray, or brown blotches (USFWS et al., 2003). Their chin and throat are spotted, and the belly is usually plain. Gopher frogs prefer habitats of the sandhills ecological association

and are typically found in dry, sandy uplands. They are nocturnal and spend most of the day in tunnels or gopher tortoise burrows. Breeding occurs in ponds and other permanent water bodies. The gopher frog is found throughout Florida, with the exception of the Everglades and the Keys (USFWS et al., 2003).

Florida Bog Frog (*Rana okaloosea*)

The Florida bog frog is listed as a species of special concern by the state. The entire global distribution of this species lies within Walton, Okaloosa, and Santa Rosa Counties, most of it on Eglin AFB property, and all known locations are in small tributary streams of the Yellow, Shoal, or East Bay Rivers. Bog frogs typically reach a maximum of two inches long (not including the legs) (USFWS et al., 2003). Bog frogs are primarily found in early successional shrub bog communities; in or near shallow, nonstagnant, acid (pH 4.1 to 4.5) seeps and along shallow, boggy overflows of larger seepage streams that drain extensive sandy uplands, frequently in association with sphagnum moss (U.S. Air Force, 2002). Their habitat is best maintained by burning uplands to retard the growth of hardwood forests and shrubs along streams.

Alligator Snapping Turtle (*Macrochelys temminckii*)

The alligator snapping turtle is one of the largest turtles in existence. Males typically reach up to 200 pounds with a shell length of 30 inches (USFWS et al., 2003). Alligator snapping turtles have rough brown shells and long tails similar to other snapping turtles. Preferential habitat includes rivers (particularly those with muddy bottoms), as well as water bodies and wetlands connected to rivers, such as swamps, marshes, sloughs, and lakes (USFWS et al., 2003). This species has been sighted in the brackish water within the Flatwoods and Swamps ecological associations.

Florida Pine Snake (*Pituophis melanoleucus mugitus*)

The Florida pine snake has physically adapted to digging in the loose sand and also enters rodent burrows and occasionally gopher tortoise burrows. It is currently listed as a species of special concern by the state of Florida. Adults of this species are generally between four and seven feet long, with an indistinct pattern of light brown blotches with a rusty background (USFWS et al., 2003). The Florida pine snake prefers sandhills, sand pine scrub, and pastures with dry, sandy soils and open canopies. They are found throughout most of the state, however are absent from the Keys. Pine snake habitat is best managed by maintaining gopher tortoise populations and by keeping soil and ground disturbance to a minimum.

Florida Burrowing Owl (*Athene cunicularia floridana*)

The burrowing owl is a state species of special concern. The owl creates burrows, similar to gopher tortoise burrows, in which to hide from predators. They are typically found in open habitats with short grasses and few trees. These small owls have been seen on many test areas across the Eglin Range, but the only confirmed population is on Test Area B-70 (U.S. Air Force, 2006).

SHOREBIRDS AND WADING BIRDS

Shorebirds and wading birds on Eglin beach property include the state-threatened least tern (*Sterna antillarum*) and southeastern snowy plover (*Charadrius alexandrinus*), the state species of special concern black skimmer (*Rynchops niger*); snowy egret (*Egretta thula*); little blue heron (*Egretta caerulea*); tricolored heron (*Egretta tricolor*); and white ibis (*Eudocimus albus*). The snowy plover is also considered a species of concern by the USFWS. These birds breed and nest in a variety of habitats including open, flat areas, wrack line habitats, and coastal ponds. Shorebird nesting season runs from 1 April through 31 August. Most shorebird colonies have been documented on the easternmost portion of Eglin's SRI property, with one additional colony near Test Site A-17 **(**Figure 3-4 in Chapter 3 of the EMR REA**).**

MIGRATORY BIRDS

The Migratory Bird Treaty Act (16 U.S. Code [USC] 703-712; 1997-Supp) and Executive Order (EO) 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, protect migratory birds and their habitats and establish a permitting process for legal taking. A migratory bird is defined by the USFWS as any species or family of birds that lives, reproduces, or migrates within or across international borders at some point during their annual life cycle. For normal and routine operations such as installation support functions, actions of the Department of Defense (DoD) may not result in pursuit, hunting, taking, capturing, killing, possession, or transportation of any migratory bird, bird part, nest, or egg thereof, except as permitted. The DoD must address these routine operations through the Memorandum of Understanding (MOU) developed in accordance with EO 13186 (DoD and USFWS, 2006). Under the 2003 National Defense Authorization Act, the Armed Forces are exempted from the incidental taking of migratory birds during military readiness activities, except in cases where an activity would likely cause a significant adverse effect to the population of a migratory bird species. As detailed in the final rule in the *Federal Register* [50 Code of Federal Regulations (CFR) 21], in this situation the Armed Forces, in cooperation with the USFWS, must develop and implement conservation measures to mitigate or minimize the significant adverse impacts (Federal Register, 2007).

Numerous migratory bird species can be found utilizing a variety of habitats on Eglin AFB. Many of the shorebirds that are known to occur on SRI beaches are protected under the Migratory Bird Treaty Act. Table 3-2 and Table 3-3 in Chapter 3 of the EMR REA identify some of the common migratory birds found on Eglin AFB and SRI, respectively. Since numerous migratory bird species can be found on Eglin AFB, this list is not exhaustive and is merely representative.

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APPENDIX E
FEDERAL AGENCY COASTAL ZONE MANAGEMENT ACT DETERMINATION

FEDERAL AGENCY COASTAL ZONE MANAGEMENT ACT (CZMA) CONSISTENCY DETERMINATION

Introduction

This document provides the State of Florida with the U.S. Air Force's Consistency Determination under CZMA Section 307 and 15 C.F.R. Part 930 sub-part C. The information in this Consistency Determination is provided pursuant to 15 C.F.R. Section 930.39 and Section 307 of the Coastal Zone Management Act, 16 U.S.C. § 1456, as amended, and its implementing regulations at 15 C.F.R. Part 930.

This consistency determination addresses the proposed action for the use of Electromagnetic Radiation (EMR) during mission activities on Eglin Air Force Base (AFB), Florida (Figure 1).

Proposed Federal agency action:

The Eglin Range supports a variety of weapons system testing and range support facilities with a wide range of capabilities. The test areas are equipped with a precision instrumentation for radio communication systems, and a large complex of threat simulators which support the electronic countermeasures system testing in the Multi-Spectra Test and Training Environment (MSTTE). In addition, there are numerous range support tenant units that may operate EMR sources.

Testing operations involving radar systems, microwave transmission systems and lasers are designed to test, verify, validate, demonstrate, or prove that the new or improved hardware system, software, or tactics will work safely and accomplish the desired effect. Training missions are designed to teach, maintain, or increase the operator's proficiency to perform mission operations.

The Region of Influence (ROI) for EMR emitters consists of all Eglin's range support facilities that are known to operate EMR sources during testing and training activities. Since some EMR sources are portable and not fixed on a test range (i.e. portable lasers and portable radars), it is difficult to determine the exact location where a test event could occur. Therefore, the ROI will also include any portions of Eglin AFB that could be utilized for EMR testing. EMR sources at Eglin AFB are categorized into three groups (1) radar, (2) range communication transmitters, and (3) lasers, which are depicted in Figures 2, 3, and 4.

Federal Review

Statutes addressed as part of the Florida Coastal Zone Management Program consistency review and considered in the analysis of the Proposed Action are discussed in the following table.

Pursuant to 15 C.F.R. § 930.41, the Florida State Clearinghouse has 60 days from receipt of this document in which to concur with or object to this Consistency Determination, or to request an extension, in writing, under 15 C.F.R. § 930.41(b). Florida's concurrence will be presumed if Eglin AFB does not receive its response on the 60th day from receipt of this determination.

Florida Coastal Management Program Consistency Review

Statute	Consistency	Scope
Chapter 161 *Beach and Shore Preservation*	The proposed action would not affect beach and shore management, specifically as it pertains to: • The Coastal Construction Permit Program. • The Coastal Construction Control Line (CCCL) Permit Program. • The Coastal Zone Protection Program. All land activities would occur on federal property.	Authorizes the Bureau of Beaches and Coastal Systems within DEP to regulate construction on or seaward of the states' beaches.
Chapter 163, Part II *Growth Policy; County and Municipal Planning; Land Development Regulation*	The proposed action would not affect local government comprehensive plans.	Requires local governments to prepare, adopt, and implement comprehensive plans that encourage the most appropriate use of land and natural resources in a manner consistent with the public interest.
Chapter 186 *State and Regional Planning*	The proposed action would not affect state plans for water use, land development or transportation.	Details state-level planning efforts. Requires the development of special statewide plans governing water use, land development, and transportation.
Chapter 252 *Emergency Management*	The proposed action would not affect the state's vulnerability to natural disasters. The proposed action would not affect emergency response and evacuation procedures.	Provides for planning and implementation of the state's response to, efforts to recover from, and the mitigation of natural and manmade disasters.
Chapter 253 *State Lands*	All activities would occur on federal property; therefore the proposed action would not affect state public lands.	Addresses the state's administration of public lands and property of this state and provides direction regarding the acquisition, disposal, and management of all state lands.
Chapter 258 *State Parks and Preserves*	The proposed action would not affect state parks, recreational areas and aquatic preserves.	Addresses administration and management of state parks and preserves.
Chapter 259 *Land Acquisition for Conservation or Recreation*	The proposed action would not affect tourism and/or outdoor recreation.	Authorizes acquisition of environmentally endangered lands and outdoor recreation lands.
Chapter 260 *Recreational Trails System*	The proposed action would not include the acquisition of land and would not affect the Greenways and Trails Program.	Authorizes acquisition of land to create a recreational trails system and to facilitate management of the system.

Florida Coastal Management Program Consistency Review, Cont'd

Statute	Consistency	Scope
Chapter 375 *Multipurpose Outdoor Recreation; Land Acquisition, Management, and Conservation*	The proposed action would not affect opportunities for recreation on state lands.	Develops comprehensive multipurpose outdoor recreation plan to document recreational supply and demand, describe current recreational opportunities, estimate need for additional recreational opportunities, and propose means to meet the identified needs.
Chapter 267 *Historical Resources*	The proposed action would not affect cultural resources of the state.	Addresses management and preservation of the state's archaeological and historical resources.
Chapter 288 *Commercial Development and Capital Improvements*	The proposed action would not affect future business opportunities on state lands, or the promotion of tourism in the region.	Provides the framework for promoting and developing the general business, trade, and tourism components of the state economy.
Chapter 334 *Transportation Administration*	The proposed action would not affect transportation.	Addresses the state's policy concerning transportation administration.
Chapter 339 *Transportation Finance and Planning*	The proposed action would not affect the finance and planning needs of the state's transportation system.	Addresses the finance and planning needs of the state's transportation system.
Chapter 370 *Saltwater Fisheries*	The proposed action would not affect saltwater fisheries.	Addresses management and protection of the state's saltwater fisheries.
Chapter 372 *Wildlife*	The proposed action would not have significant adverse impacts to wildlife and no effect to threatened or endangered species at the baseline level of EMR emitters analyzed. Therefore, the proposed action would be consistent with the State's policies concerning wildlife resource management.	Addresses the management of the wildlife resources of the state.
Chapter 373 *Water Resources*	The proposed action would not affect water resources of the state.	Addresses the state's policy concerning water resources.
Chapter 376 *Pollutant Discharge Prevention and Removal*	The proposed action would not affect the transfer, storage, or transportation of pollutants.	Regulates transfer, storage, and transportation of pollutants, and cleanup of pollutant discharges.
Chapter 377 *Energy Resources*	The proposed action would not affect energy resource production, including oil and gas, and/or the transportation of oil and gas.	Addresses regulation, planning, and development of oil and gas resources of the state.

Florida Coastal Management Program Consistency Review, Cont'd

Statute	Consistency	Scope
Chapter 380 *Land and Water Management*	The proposed action would not affect development of state lands with regional (i.e. more than one county) impacts. The proposed action would not include changes to coastal infrastructure such as capacity increases of existing coastal infrastructure, or use of state funds for infrastructure planning, designing or construction.	Establishes land and water management policies to guide and coordinate local decisions relating to growth and development.
Chapter 381 *Public Health, General Provisions*	The proposed action would not affect the state's policy concerning the public health system.	Establishes public policy concerning the state's public health system.
Chapter 388 *Mosquito Control*	The proposed action would not affect mosquito control efforts.	Addresses mosquito control effort in the state.
Chapter 403 *Environmental Control*	The proposed action would not affect water quality, air quality, pollution control, solid waste management, or other environmental control efforts.	Establishes public policy concerning environmental control in the state.
Chapter 582 *Soil and Water Conservation*	The proposed action would not affect soil and water conservation efforts.	Provides for the control and prevention of soil erosion.

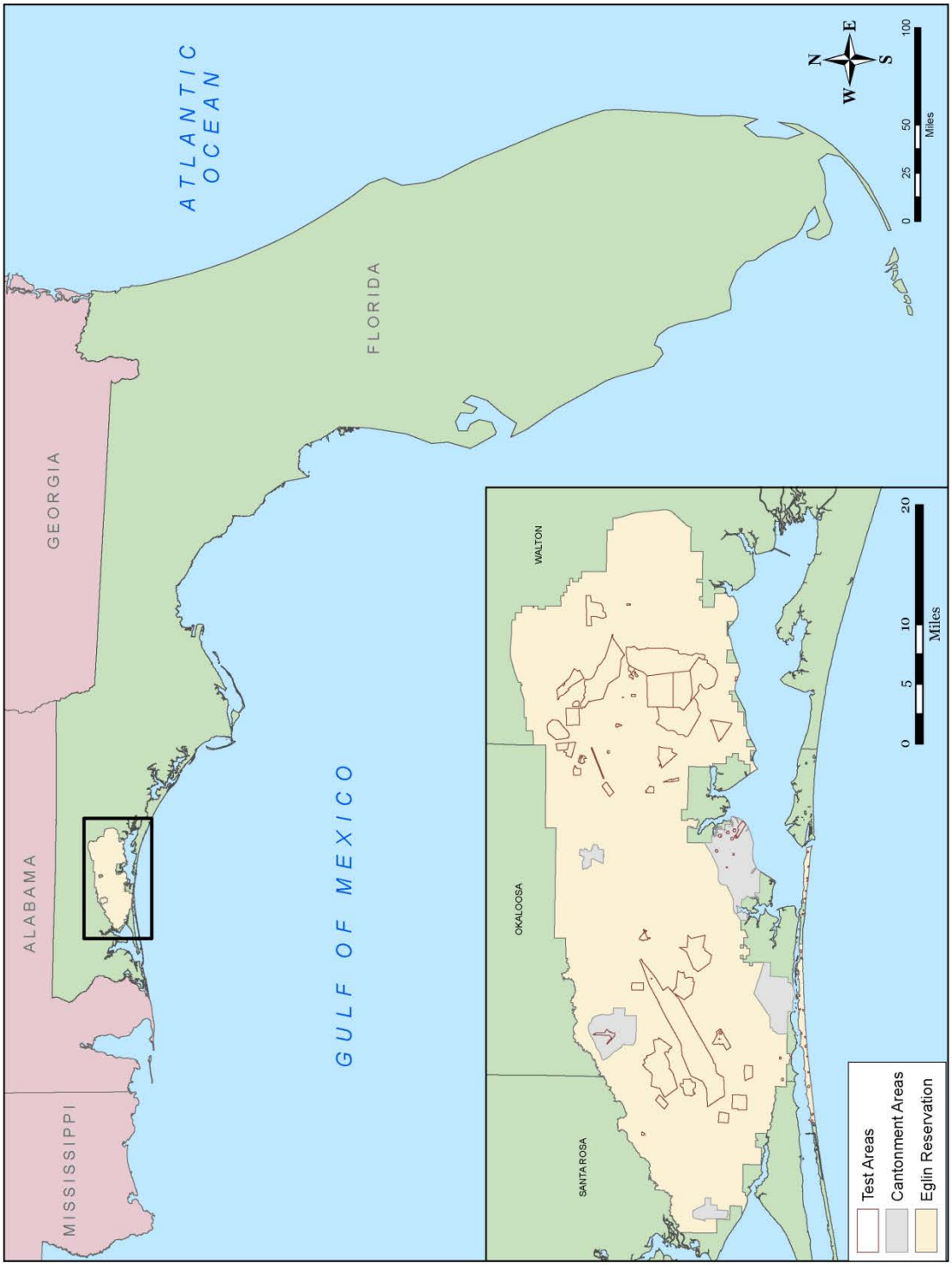


Figure 1. Eglin AFB, Florida

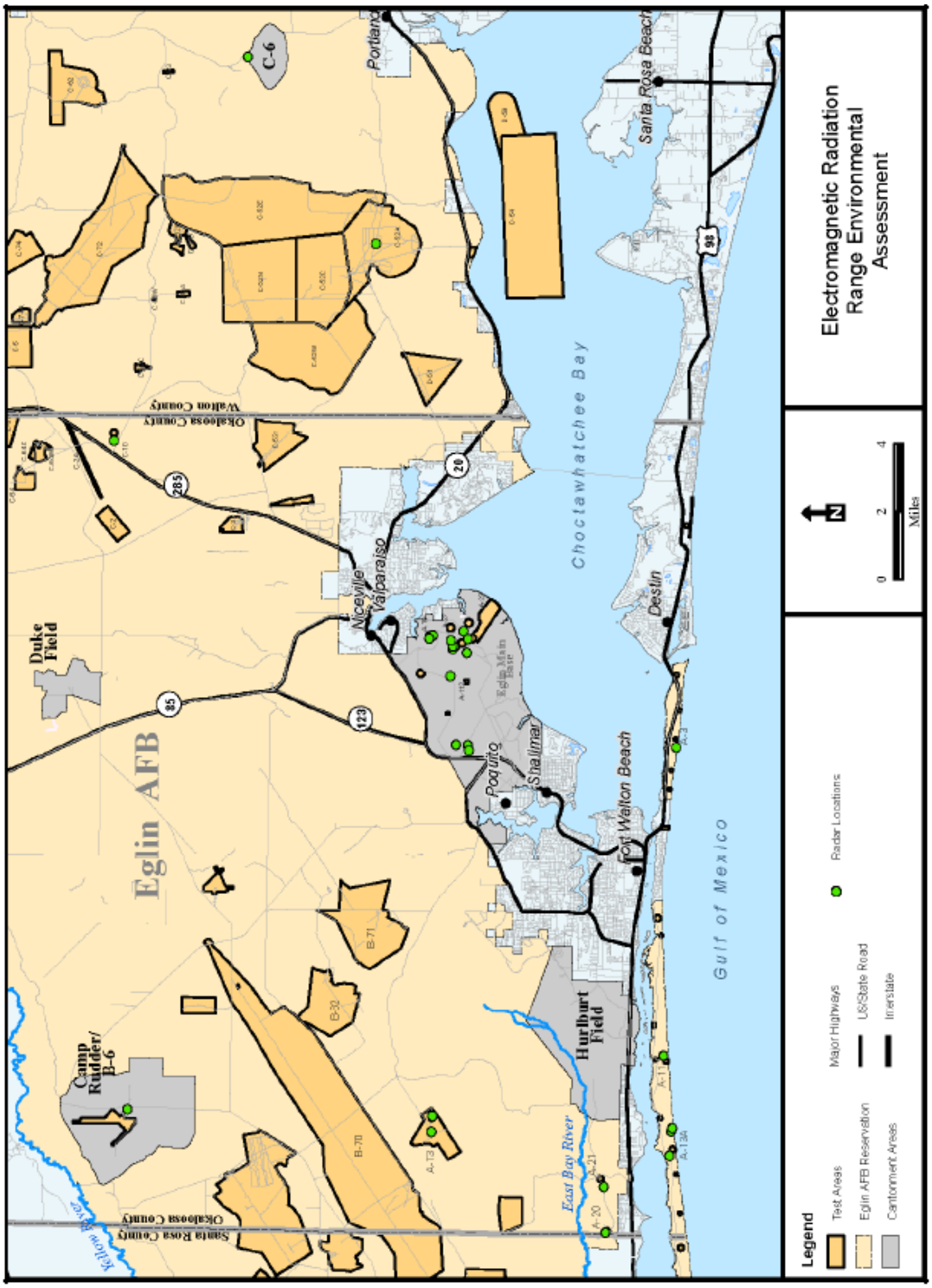


Figure 2. Location of Radar Systems on Eglin AFB

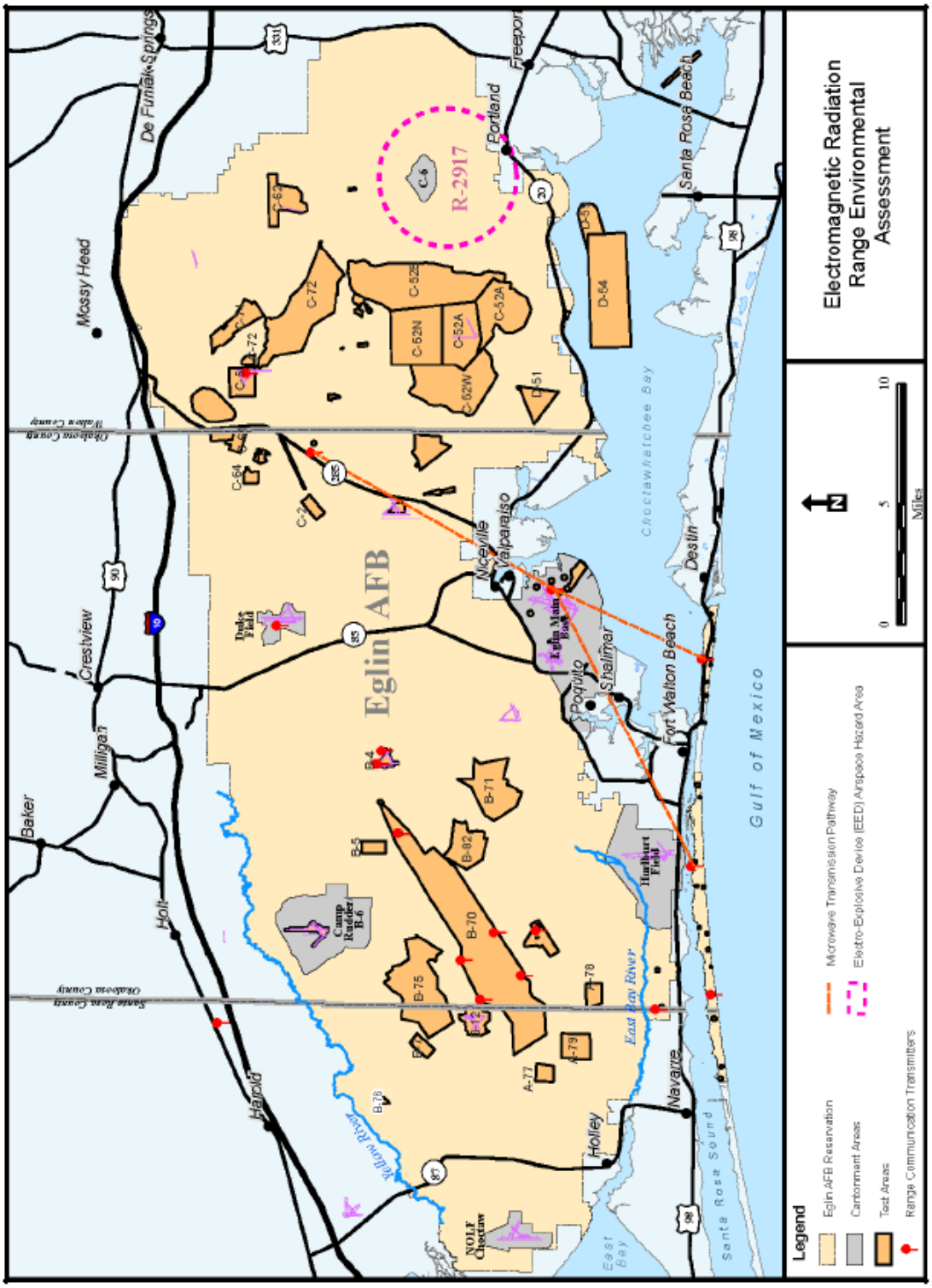


Figure 3. Location of Range Communication Transmitters on Eglin AFB

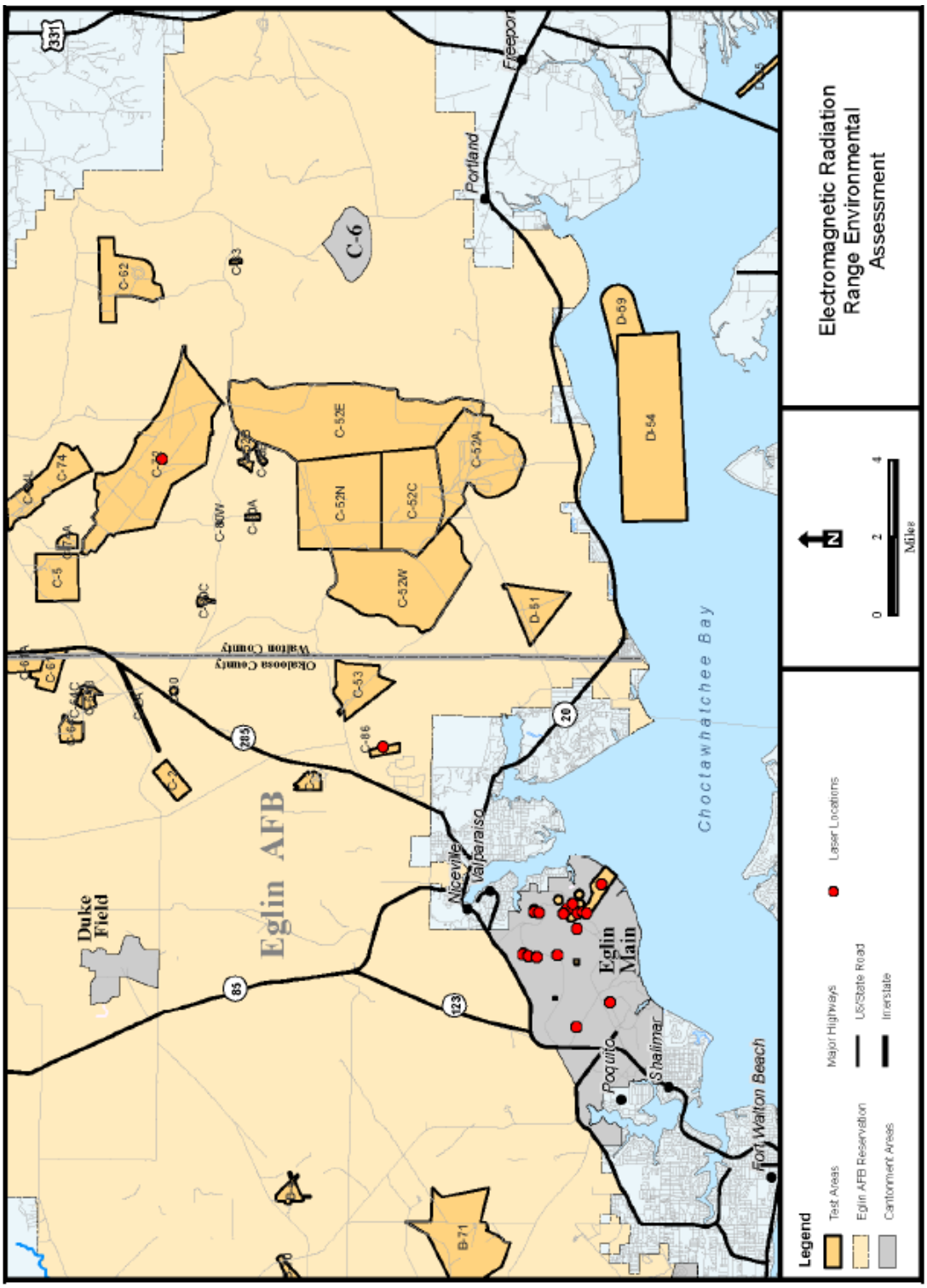


Figure 4. Location of Laser Systems on Eglin AFB

APPENDIX F
PUBLIC INVOLVEMENT
NOTICE OF AVAILABILITY, AGENCY COMMENTS, AND AIR FORCE RESPONSES TO COMMENTS

Notice of Availability

The following Notice of Availability was published in the Northwest Florida Daily News on October 5, 2009. No public comments were received.

Public Notification

In compliance with the National Environmental Policy Act, Eglin Air Force Base (AFB) announces the availability of the *Electromagnetic Radiation Draft Range Environmental Assessment (REA), Revision 1 for Eglin Air Force Base, FL*, and Draft Finding of No Significant Impact (FONSI) for public review.

The Proposed Action is for the 46th Test Wing Commander to establish a new authorized level of activity regarding the use of Electromagnetic Radiation (EMR) emitters (radar systems, microwave communication systems, and lasers) on Eglin AFB that is based on an anticipated maximum usage, with known or minimal environmental impacts.

The Preferred Alternative, Alternative 2, would authorize the current level of activity plus include projected future EMR systems on Eglin AFB and designate a process to approve future EMR systems on Eglin AFB. Alternative 2 attempts to prescribe guidelines and establish a methodology based on current EMR safety programs. These guidelines would be established to consistently screen EMR requests and facilitate the Environmental Impact Analysis Process when any future activity involving an EMR emitter would change baseline parameters.

There is no anticipated increase in future use of EMR emitters, only the possibility that future mission requirements may call for the relocation, addition, and/or upgrade of EMR emitters at any time. The movement, upgrade, or addition of EMR emitters at Eglin AFB has the potential to affect the electromagnetic environment of the range. The methodology under Alternative 2 would first verify that all human safety concerns associated with EMR emitters have been properly addressed according to all applicable Air Force regulations and guidelines. It would then be determined whether the addition, relocation, or upgrade of the EMR emitter would meet permitting requirements (i.e., construction, storm water, drinking water, and/or air quality permits), as each individual action may require compliance with these permitting requirements. Finally, a determination would be made as to whether the emitter would pose a proximal threat to sensitive species.

Your comments on this Draft REA are requested. Letters and other written or oral comments may be published in the Final REA. As required by law, comments will be addressed in the Final REA and made available to the public. Any personal information provided, including private addresses, will be used to identify your desire to make a statement during the public comment period and/or to compile a mailing list to fulfill requests for copies of the Final REA or associated documents. However, only the names and respective comments of respondent individuals will be disclosed; personal home addresses and phone numbers will not be published in the Final EA.

Copies of the Draft REA and Draft FONSI may be reviewed at the Fort Walton Beach Public Library, 185 S.E. Miracle Strip Pkwy, Fort Walton Beach; Navarre Public Library, 8484 James M. Harvell Rd, Navarre; Milton Library, 5541 Alabama St, Milton; Robert L. F. Sikes Library, 1445 Commerce Dr, Crestview; Niceville Library, 206 Partin Dr, Niceville; and Freeport Public Library, 76 State Highway 20 W, Freeport.

Copies will be available for review from October 5 through 19, 2009. Comments must be received by October 22, 2009.

For more information or to comment on these proposed actions, contact: Mike Spairs, Environmental Public Affairs, 101 West D Street, Suite 110, Eglin AFB, Florida 32542, email: mike.spairs@eglin.af.mil, phone: (850) 882-3931, or fax: (850) 882-4894.

Agency Comments

Florida Department of Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

November 18, 2009

Ms. Amy L. Sands, Project Manager
Science Applications International Corp.
1140 North Eglin Parkway
Shalimar, FL 32579

RE: Department of the Air Force – Draft Range Environmental Assessment, Electromagnetic Radiation, Eglin Air Force Base – Santa Rosa, Okaloosa and Walton Counties, Florida.
SAI # FL200910094976C

Dear Ms. Sands:

The Florida State Clearinghouse has coordinated a review of the referenced Draft Range Environmental Assessment (REA) under the following authorities: Presidential Executive Order 12372; Section 403.061(40), *Florida Statutes*; the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended; and the National Environmental Policy Act, 42 U.S.C. §§ 4321, 4331-4335, 4341-4347, as amended.

The Florida Department of Environmental Protection's (DEP) Northwest District Office in Pensacola notes that the draft document indicates a stormwater permit would be sought for the proposed activities, if required. Please be advised that Phase II of the Northwest District's new Environmental Resource Permit (ERP) rule, Chapter 62-346, *Florida Administrative Code*, is scheduled to be implemented on January 1, 2010. At which time, stormwater ERPs and wetland resource permits will be consolidated and processed by either the DEP or Northwest Florida Water Management District (NWFWMD), depending on the degree of wetland impacts proposed. Under the new ERP rule, impacts to isolated wetlands will also be regulated. The applicant is encouraged to contact Mr. Cliff Street in the DEP Northwest District Office, at (850) 595-8300, ext. 1135 for further information regarding ERP permitting requirements.

Based on the information contained in the Draft REA and comments provided by our reviewing agencies, the state has determined that, at this stage, the proposed federal activities are consistent with the Florida Coastal Management Program (FCMP). The concerns identified above must, however, be addressed prior to project implementation. The state's continued concurrence with the project will be based, in part, on the adequate

resolution of any issues identified during this and subsequent reviews. The state's final concurrence of the project's consistency with the FCMP will be determined during the environmental permitting stage, if applicable.

Thank you for the opportunity to review the proposed project. Should you have any questions regarding this letter, please contact Ms. Lori E. Cox at (850) 245-2187.

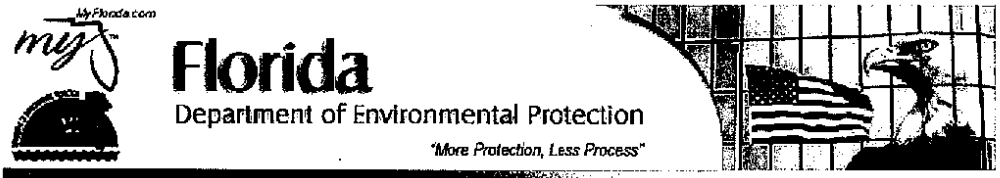
Yours sincerely,

Sally B. Mann

Sally B. Mann, Director
Office of Intergovernmental Programs

SBM/lec
Enclosures

cc: Darryl Boudreau, DEP, Northwest District



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Project Information	
Project:	FL200910094976C
Comments Due:	11/09/2009
Letter Due:	11/19/2009
Description:	DEPARTMENT OF THE AIR FORCE - DRAFT RANGE ENVIRONMENTAL ASSESSMENT, ELECTROMAGNETIC RADIATION, EGLIN AIR FORCE BASE - SANTA ROSA, OKALOOSA AND WALTON COUNTIES, FLORIDA.
Keywords:	USAF - EA, ELECTROMAGNETIC RADIATION, EGLIN AFB - SANTA ROSA/OKALOOSA/WALTON CO.
CFDA #:	12.200

Agency Comments:
FISH and WILDLIFE COMMISSION - FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
NO COMMENT BY PAUL SCHARINE ON 11/18/09.
STATE - FLORIDA DEPARTMENT OF STATE
No Comment/Consistent
ENVIRONMENTAL PROTECTION - FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
The DEP Northwest District Office in Pensacola notes that the draft document indicates a stormwater permit would be sought for the proposed activities, if required. Please be advised that Phase II of the Northwest District's new Environmental Resource Permit (ERP) rule, Chapter 62-346, Florida Administrative Code, is scheduled to be implemented on January 1, 2010. At which time, stormwater ERPs and wetland resource permits will be consolidated and processed by either the DEP or Northwest Florida Water Management District (NWFWMD), depending on the degree of wetland impacts proposed. Under the new ERP rule, impacts to isolated wetlands will also be regulated. The applicant is encouraged to contact Mr. Cliff Street in the DEP Northwest District Office, at (850) 595-8300, ext. 1135 for further information regarding ERP permitting requirements.

For more information or to submit comments, please contact the Clearinghouse Office at:

3900 COMMONWEALTH BOULEVARD, M.S. 47
TALLAHASSEE, FLORIDA 32399-3000
TELEPHONE: (850) 245-2161
FAX: (850) 245-2190

Visit the Clearinghouse Home Page to query other projects.

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COUNTY: ALL
SCH-106-USAF-EG
2009-5941

DATE: 10/6/2009
COMMENTS DUE DATE: 11/9/2009
CLEARANCE DUE DATE: 11/19/2009
SAI#: FL200910094976C

MESSAGE:
PLEASE EXPEDITE, 11/09/09

STATE AGENCIES	WATER MNGMNT. DISTRICTS	OPB POLICY UNIT	RPCS & LOC GOVS
ENVIRONMENTAL PROTECTION			
FISH and WILDLIFE COMMISSION			
X STATE			

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evaluation and is categorized as one of the following:

- _ **Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.**
- X **Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.**
- _ **Outer Continental Shelf Exploration, Development or Production Activities (15 CFR 930, Subpart E). Operators are required to provide a consistency certification for state concurrence/objection.**
- _ **Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.**

Project Description:

DEPARTMENT OF THE AIR FORCE - DRAFT RANGE ENVIRONMENTAL ASSESSMENT, ELECTROMAGNETIC RADIATION, EGLIN AIR FORCE BASE - SANTA ROSA, OKALOOSA AND WALTON COUNTIES, FLORIDA.

To: Florida State Clearinghouse

AGENCY CONTACT AND COORDINATOR (SCH)
3900 COMMONWEALTH BOULEVARD MS-47
TALLAHASSEE, FLORIDA 32399-3000
TELEPHONE: (850) 245-2161
FAX: (850) 245-2190

EO. 12372/NEPA
- ☑ No Comment
- ☐ Comment Attached
- ☐ Not Applicable

Federal Consistency
- ☑ No Comment/Consistent
- ☐ Consistent/Comments Attached
- ☐ Inconsistent/Comments Attached
- ☐ Not Applicable

From:
Division/Bureau: Division of Historical Resources
Bureau of Historic Preservation

Reviewer: S. Edwards — Laura A. Kammerer, Deputy SHPO

Date: 10/23/09 — 10.26.2007

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2009 OCT 13 P 3:41
BUREAU OF HISTORIC PRESERVATION

RECEIVED
OCT 27 2009
DEP Office of Intergovt'l Programs

Air Force Responses to Comments on the Draft REA

Comment	Response
The Florida Department of Environmental Protection's (DEP) Northwest District Office in Pensacola notes that the draft document indicates a stormwater permit would be sought for the proposed activities, if required. Please be advised that Phase II of the Northwest District's new Environmental Resource Permit (ERP) rule, Chapter 62-346, *Florida Administrative Code,* is scheduled to be implemented on January 1, 2010. At which time, stormwater ERPs and wetland resource permits will be consolidated and processed by either the DEP or Northwest Florida Water Management District (NWFWMD), depending on the degree of wetland impacts proposed. Under the new ERP rule, impacts to isolated wetlands will also be regulated. The applicant is encouraged to contact Mr. Cliff Street in the DEP Northwest District Office, at (850) 595-8300, ext. 1135 for further information regarding ERP permitting requirements.	Thank you for your comment, your comment has been noted.

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