64

ESTUARINE AND RIVERINE AREAS FINAL PROGRAMMATIC ENVIRONMENTAL ASSESSMENT

DEPARTMENT OF THE AIR FORCE

Air Armament Center

Eglin Air Force Base, Florida

June 2004

Finding of No Significant Impact
For
Estuarine and Riverine Areas for the Air Armament Center
Programmatic Environmental Assessment
Eglin AFB FL

RCS 02-891

The Air Armament Center at Eglin Air Force Base, Florida, proposes to authorize an increased level of military test and training activities in the estuarine and riverine areas (E&R) in the immediate vicinity of Eglin AFB, Florida. The areas under consideration include the waters and adjacent shoreline areas of Choctawhatchee Bay, Santa Rosa Sound, Yellow and East Bay Rivers, and East Bay. During the baseline period, fiscal years 1995 to 1999, these areas supported nearly 10,000 missions.

The proposed action will allow the Commander, 46th Test Wing, to authorize levels of activity for the E&R based upon estimates of increased use. Five alternatives were considered:

- Alternative 1: Maintain the baseline level of activity (FY95-99 Range Utilization Report) (No Action).
- Alternative 2: Authorize activity at the baseline level (same as Alternative 1).
- Alternative 3: Authorize the activities contained in Alternative 2 and increase the mission intensity by 100 percent.
- Alternative 4: Authorize the activities contained in Alternative 3 and add live-fire estuarine/marine shoreline range.
- Alternative 5: Authorize the activities in Alternative 4 and add live-fire riverine range.

SUMMARY OF POTENTIAL ENVIRONMENTAL EFFECTS
The programmatic environmental assessment focused on the subject areas with the greatest likelihood for potential environmental impacts. In each case, the assessment found that the preferred alternative would not result in significant impacts. Some of the areas studied include:

- Noise from watercraft operations.
- Hazardous materials from the residue of military munitions.

BASIS FOR FINDING OF NO SIGNIFICANT IMPACT
The Estuarine & Riverine Programmatic Environmental Assessment was prepared in compliance with the requirements of the National Environmental Policy Act, the Council on Environmental Quality Regulations and 32 CFR 989 (Air Force Instruction 32-7061, The Environmental Impact Analysis Process). Selection of Alternative 5, the preferred alternative, for the E&R would not have a significant impact upon human health or the environment.

Therefore, an environmental impact statement is not warranted and will not be prepared.

11 Sep 04
Date

Edmond B Keith
EDMOND B. KEITH, Col, USAF
Commander

RCS 02-891

EGLIN AIR FORCE BASE
Florida

ESTUARINE AND RIVERINE AREAS

FINAL PROGRAMMATIC ENVIRONMENTAL ASSESSMENT

AIR ARMAMENT CENTER

June 2004

ESTUARINE AND RIVERINE AREAS

FINAL PROGRAMMATIC ENVIRONMENTAL ASSESSMENT

Submitted to:

AAC
46 TW/XPE
Range Environmental Planning Office
Eglin Air Force Base, FL 32542-6808

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June 2004

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TABLE OF CONTENTS

Page

TABLE OF CONTENTS CONT'D

LIST OF TABLES

Page

LIST OF FIGURES

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

°	Degrees
<	Less than
≤	Less than or Equal to
#/100 mL	Number per 100 Milliliters
6 RTB	U.S. Army 6^{th} Ranger Training Battalion
16^{th} OSS	16^{th} Operations Support Squadron
16 SOW CES/CEV	16^{th} Special Operations Wing, Civil Engineering Squadron, Environmental Flight
16 SOS/DOO	16^{th} Special Operations Squadron Current Operations
23 STS	23^{rd} Special Tactics Squadron
46 OG/OGMT	46^{th} Operations Group, Munitions Test Division
46 OG/OGP	46^{th} Operations Group, Special Operations Division
46 TS/OGEX	46^{th} Test Squadron
46 TW/XPE	46^{th} Test Wing Range Environmental Planning Office
720 STG	720^{th} Special Tactics Group
96 CEG/CEF	96^{th} Civil Engineer Group Fire Protection
96 SFS	96^{th} Security Forces Squadron
AAC	Air Armament Center
AAC/EMC	Environmental Management Directorate, Environmental Compliance Division
AAC/EMCE	Environmental Management Directorate, Environmental Compliance Division, Environmental Engineering Branch
AAC/EMH	Environmental Management Directorate, Historic Preservation Division
AAC/EMSN	Environmental Management Directorate, Stewardship Division, Natural Resources Branch
AAC/PA	Eglin Public Affairs Office
AAC/SEU	Range Safety Office
AFB	Air Force Base
AFDTC	Air Force Development Test Center
AFDTC/XPE	Range Environmental Planning Office
AFI	Air Force Instruction
AFIERA	Air Force Institute for Environment, Safety, and Occupational Health Risk Analysis
AFMC	Air Force Materiel Command
AFOSH	Air Force Occupational Safety and Health
AFSOC	Air Force Special Operations Command
AGL	Above Ground Level
AL/OBEN	Air Force Acoustic Effects Branch
AOC	Area of Concern
ASEL	A-weighted Sound Exposure Level (in decibels)
BAF	Bioaccumulation Factors
bgs	Below Ground Surface
BMPs	Best Management Practices
C	Celsius
CAA	Clear Air Act
cal	Caliber
CARL	Conservation and Recreation Lands Program
CATEX	Categorical Exclusion
CEQ	Council on Environmental Quality
CFA	Controlled Firing Area
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CoC	Community of Comparison
CSS	(Navy) Coastal Systems Station
CWA	Clean Water Act
CZMA	Coastal Zone Management Act

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS CONT'D

dB	Decibel
dBA	A-Weighted Decibels or A-Weighted Noise
dBC	C-Weighted Decibels or C-Weighted Noise
dBP	Unweighted Peak Sound Pressure Level in Decibels
DDT	Dichlorodiphenyltrichloroethane
DNL	Day-Night Level
DoD	Department of Defense
DOF	Division of Forestry
DPI	Direct Physical Impact
EA	Environmental Assessment
EEL	Environmental Endangered Lands
EFH	Essential Fish Habitat
EGTTR	Eglin Gulf Test and Training Range
EIAP	Environmental Impact Analysis Process
EMAP	Estuarine Monitoring and Assessment Program
EOD	Explosive Ordnance Disposal
ESA	Endangered Species Act
ETL	Engineering Technical Letter
F	Fahrenheit
FAA	Federal Aviation Administration
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDNR	Florida Department of Natural Resources
FMRI	Florida Marine Research Institute
FNAI	Florida Natural Area Inventories
FONSI	Finding of No Significant Impact
FWC	Florida Fish and Wildlife Conservation Commission
FY	Fiscal Year
g/hp-hr	Grams per Horsepower-Hour
g/kg	Grams per Kilogram
GFC	Florida Game and Fresh Water Fish Commission (now known as FWC)
GIS	Geographic Information System
GPS	Global Positioning System
GPU	Gun Pod Unit
GSMFS	Gulf States Marine Fisheries Service
H_2O	Water
H_2S	Hydrogen Sulfide
HAVE ACE	An Air Force Special Operations Command program
Hp	Horsepower
HTE	Higher Than Expected
Hz	Hertz
IRP	Installation Restoration Program
JLOTS	Joint Logistics Over The Shore
kg	Kilogram
kg/d	Kilograms per Day
kHz	Kilohertz
km	Kilometer
km^2	Square Kilometer(s)
LATF	Land Acquisition Trust Fund
lb	Pound(s)
LCAC	Landing Craft Air Cushion
L_{Cdn}	Day-Night Average Noise Level Associated with C-Weighted Noise
LD_{50}	Dosage Causing Lethality in 50 Percent of Test Animals
L_{dn}	Day-Night Average Sound Levels

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS CONT'D

L_{dnmr}	Monthly Day-Night A-Weighted Noise
L_{eq}	Equivalent Sound Level
$L_{eq(24)}$	24-Hour Equivalent Sound Level
m^2	Square Meter
m^3	Cubic Meter
m^3/s	Cubic Meters per Second
µg/L	Micrograms per Liter
$\mu g/m^3$	Micrograms per Cubic Meter
µPa	MicroPascal
µmhos	Micromhos
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
mg/m^3	Milligrams per Cubic Meter
mi	Mile(s)
mi^2	Square Mile(s)
mL	Milliliter
mm	Millimeter
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MPE	Minimum Population Estimate
mph	Miles per Hour
MR_NMAP	MOA and Range Noise Map
MRTFB	Major Range Test Facility Base
MUDSS	Mobile Underwater Debris Survey System
N_2	Nitrogen Gas
NA	Not Applicable (also N/A)
NAAQS	National Ambient Air Quality Standards
NAVSCOLEOD	Naval School Explosive Ordnance Disposal
ND	No Data
NEPA	National Environmental Policy Act
NFA	No Further Action
NMFS	National Marine Fisheries Services
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOAA	National Oceanographic and Atmospheric Administration
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NPDES	National Pollutant Discharge Elimination System
NRC	National Resource Council
NTU	Nephelometric Turbidity Unit
NWFWMD	Northwest Florida Water Management District
O_3	Ozone
OFW	Outstanding Florida Water
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OSS	Operations Support Squadron
PAH	Polynuclear Aromatic Hydrocarbon
Pb	Lead
PBR	Potential for Biological Removal
PBTA	Pine Bluff Training Area
PCB	Polychlorinated Biphenyls
PEA	Programmatic Environmental Assessment

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS CONT'D

pH	Potential of Hydrogen (symbol for the degree of acidity or alkalinity of a solution)
PM_{10}	Particulate Matter Less than 10 Microns in Diameter
$PM_{2.5}$	Particulate Matter Less than 2.5 Microns in Diameter
POI	Point of Interest
POL	Petroleum, Oil, and Lubricant
ppm	Parts per Million
RAIS	Risk Analysis Information System
RCS	Report Control System
RCW	Red-cockaded Woodpecker
re 1 μPa	Referenced to One MicroPascal
RR	Range Road
RTB	Ranger Training Battalion
SACON	Shock-Absorbing Concrete
SAS	Synthetic Aperture Sonar
SAW	Squad Automatic Weapon
SCUBA	Self-Contained Underwater Breathing Apparatus
SEAL	Sea, Air, Land
SEFSC	Southeast Fisheries Science Center
SEL	Sound Exposure Level
SESOIL	Seasonal Soil Compartment Model
SHPO	State Historic Preservation Officer
SO_2	Sulfur Dioxide
SOC	Save Our Coast
SOF	Special Operations Forces
SPL	Sound Pressure Levels
SRI	Santa Rosa Island
SSL	Soil Screening Level
STG	Special Tactics Group
STS	Special Tactics Squadron
T&E	Threatened and Endangered
TA	Test Area
TCLP	Toxicity Characteristic Leaching Procedure
TP	Target Practice
TTS	Temporary Threshold Shift
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USDA SCS	U.S. Department of Agriculture Soil Conservation Service
USEPA	U.S. Environmental Protection Agency
USF	University of South Florida
USFWS	U.S. Fish and Wildlife Service
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
WWTP	Wastewater Treatment Plant
yr	Year

1. PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

The Eglin Military Complex is a Department of Defense (DoD) Major Range Test Facility Base (MRTFB) that exists to support the DoD mission (Figure 1-1). Its primary function is to support research, development, test, and evaluation of conventional weapons and electronic systems. Its secondary function is to support training of operational units. The range is composed of four components:

1) Test Areas/Sites (Figure 1-2)
2) Interstitial Areas (areas beyond and between the test areas)
3) Water Ranges (the Eglin Gulf Test and Training Range (EGTTR) and estuarine and riverine areas)
4) Airspace (over land and water)

The 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, AAC provides 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 with support from the 96th Air Base Wing. The 46th Test Wing 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's operations. Eglin controls airspace overlying 127,868 square miles (mi^2), of which 2.5 percent (3,226 mi^2) is over land and 97.5 percent (124,642 mi^2) is over water, as shown in Figure 1-1.

The 46th Test Wing is analyzing the cumulative environmental impacts of all current and anticipated future operations conducted within the estuarine and riverine areas adjacent to Eglin AFB (Figure 1-2) in this Programmatic Environmental Assessment. These areas include Choctawhatchee Bay, Santa Rosa Sound, Yellow River, East Bay, and East Bay River. The environmental analysis of the estuarine and riverine mission activities is part of the development of a range *Living Environmental Baseline* to support the diverse array of warfighters that use the Eglin Military Complex for research, development, testing, evaluation, and training. All mission operations (known as effectors) and physical and biological resources (known as receptors) are detailed within the *Estuarine and Riverine Areas Environmental Baseline Document*.

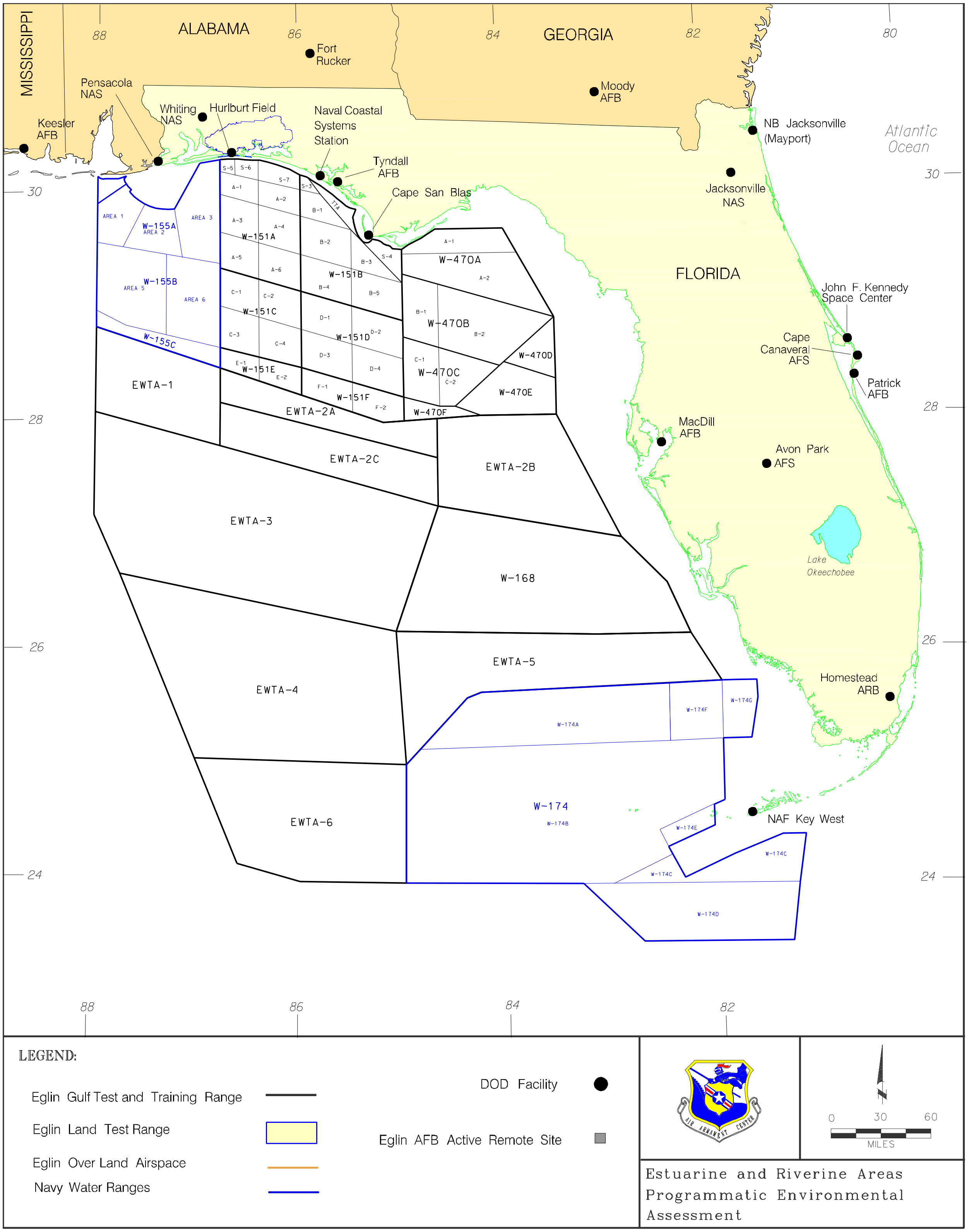

Figure 1-1. The Eglin Military Complex

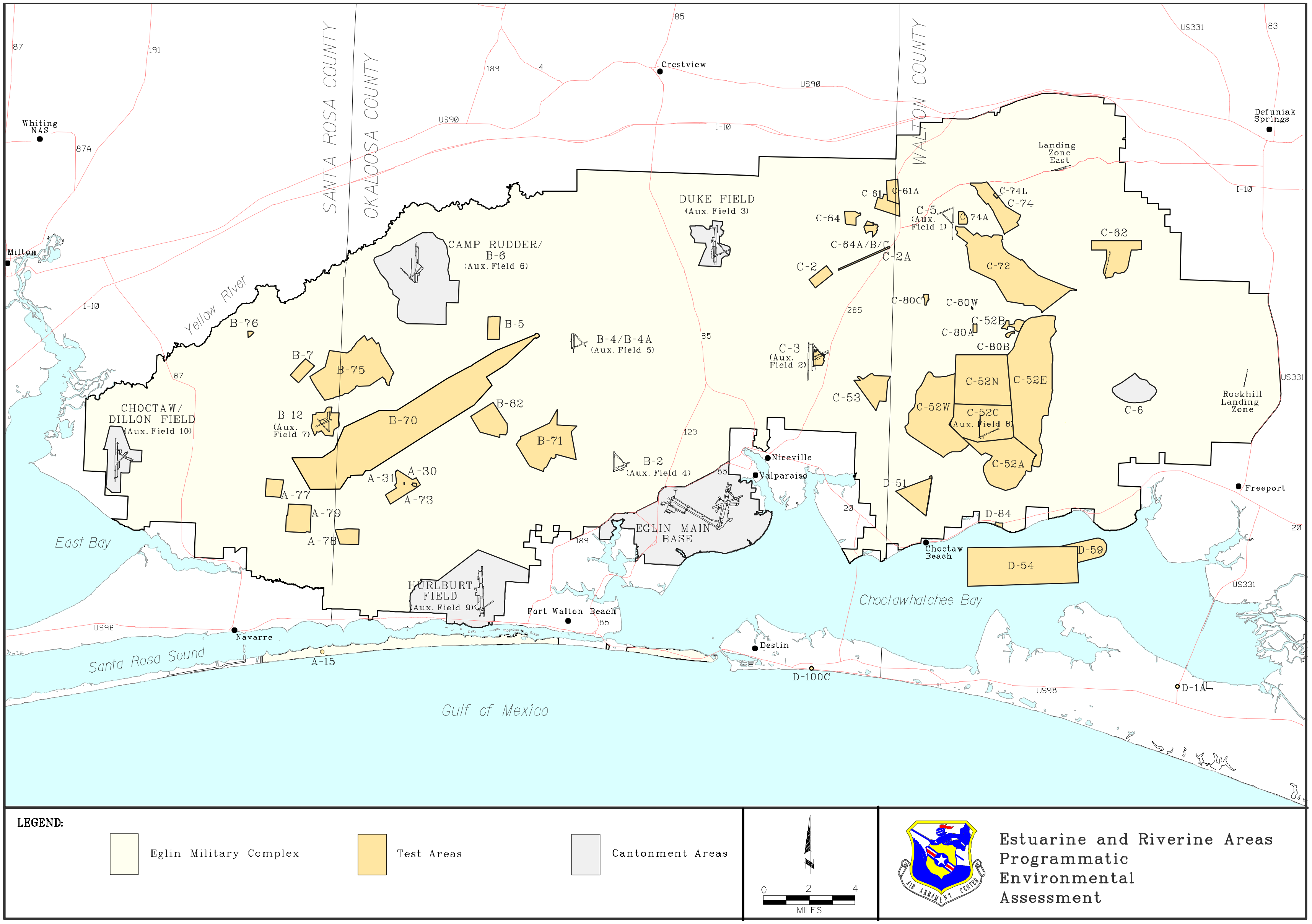

Figure 1-2. Land Test Areas and Interstitial Areas of the Eglin Military Complex

1.2 PROPOSED ACTION

The **Proposed Action** is for the 46th Test Wing Commander to establish an authorized level of activity within the estuarine and riverine areas based on an anticipated maximum usage, plus the establishment of live-fire riverine and beach ranges, with minimal environmental impacts. The purpose and need for this proposed action is three-fold. **First**, to quickly and efficiently process new programs requesting use of the land test areas during routine and crisis situations. The need associated with this purpose is to provide military users a quick response to priority needs during war or other significant military involvement, as well as improve the current approval process for routine uses. **Second**, to update the NEPA analysis by reevaluating the mission activities and by performing a cumulative environmental analysis of all mission activities. The need associated with this purpose is multifaceted and described below. **Third**, sustainable use of the ranges depends on an improved understanding and compliance with current environmental laws, including the conduct of analysis where it may be lacking. The need is to provide the armed services with suitable arenas in which to test and train in order to maintain proficiency and readiness for situations in which the military is needed.

Eglin has performed environmental analyses on its mission activities on a case-by-case (i.e., each individual mission) basis since NEPA was enacted in 1970. Many of Eglin's mission activities have not ceased since the original environmental analyses were done to initiate the mission; thus no new environmental reviews have been required or performed. 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) and AFI 32-7061).

Since some of these ongoing mission activities were originally assessed, and also since similar mission activities were assessed and CATEXed, changes have occurred at Eglin that could affect environmental analysis. These changes, outlined below, create a need to reevaluate the NEPA analysis individually and cumulatively.

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

Additionally, with work performed during the 1990s by Eglin in conjunction with The Nature Conservancy, the Eglin ecosystems are better understood now than ever before.

Finally, while each mission has been analyzed individually, a cumulative analysis of potential environmental impacts from all mission activities has not been performed. The programmatic analysis performed in this report allows for a cumulative look at the impact on Eglin receptors from all mission activities. By implementing an authorized level of activity, sustainable range management will be streamlined and cumulative environmental impacts will be more fully considered.

1.3 SCOPE OF THE PROPOSED ACTION

The scope of the proposed action includes military missions conducted within the waters and adjacent shoreline habitats and wetlands of Choctawhatchee Bay, Santa Rosa Sound, the Yellow River, Blackwater Bay (near the mouth of the Yellow River), East Bay, and East Bay River from a baseline period of 1995 to 1999.

The baseline level of activity is established to represent the variety of users, mission activities, and maximum amount of expended items that comprise estuarine and riverine missions at the Eglin Military Complex. Three principal sources of information shaped the baseline: personal interviews and meetings with user groups, data on missions and expended items obtained from Range Utilization Reports, and Air Force Environmental Impact Analysis Process (EIAP) documentation (e.g., AF813s and environmental assessments) from the five year baseline period. Selected missions addressed through the EIAP process are listed in Table 1-1. Expended items are referred to throughout this report as "expendables" and are broadly defined as anything deposited onto the range during a mission even though later retrieved. Expendables include items such as ammunition rounds, smokes, flares and pyrotechnics, but also include personnel that parachute or drop onto the range and equipment and boats that are dropped from helicopters or aircraft.

Table 1-1. Occurrence of Estuarine and Riverine Activities

Action	Choctawhatchee Bay	Santa Rosa Sound	Yellow River	East Bay	East Bay River
Special Operations Training					
Water To Land Transition: Boat Ops	•	•	•	•	•
Air To Water Transition: Paratroop/Paradrop	•	•	•	•	
Navy EOD Training	•	•			
Test Support:					
Sensor Testing	•				
LCAC/Live Fire	•	•			

Geographical Description of the Baseline

Choctawhatchee Bay and Santa Rosa Sound are adjacently located in the northwest Florida panhandle. The Bay is located within Okaloosa and Walton counties and is bordered by the Choctawhatchee River and forestland on the east and northeast and by urbanized areas on the west and northwest. The surrounding basin drains an area of over 10,400 km^2 (4000 mi^2) and extends up into portions of Alabama. Destin, Fort Walton Beach, Eglin Air Force Base (AFB), and Niceville-Valparaiso are all situated along the western end of the Bay. Choctawhatchee Bay has a surface area of 335 km^2 (129 mi^2) and is 48 km (30 mi) long and 1.6 to 9.6 km (1 to 6 mi) wide. The Bay basin covers 1,817 km (699 mi^2) (Livingston, 1986). Resource descriptions for Choctawhatchee Bay are provided in greater detail in the Choctawhatchee Bay Resource Summary Report, a synopsis of selected research projects and data on the Bay (U.S. Air Force, 1996). Choctawhatchee Bay has one active test area, D-54.

Santa Rosa Sound is a narrow, brackish water lagoon that separates Santa Rosa Island (SRI) from the mainland. There are no major direct freshwater (i.e., riverine) inputs into Santa Rosa Sound and saltwater exchange occurs via the Choctawhatchee Bay and Pensacola Bay systems, located at either end of the 40 mile long body of water. The Sound is located in Okaloosa, Santa Rosa and Escambia Counties.

The Yellow River forms 38 miles of the northwest boundary of the Eglin reservation beginning at a point 5 miles northwest of Camp Rudder and winding in a southwesterly direction until flowing into Blackwater Bay near Choctaw Field. East Bay borders approximately 1.6 miles of the Eglin reservation's westernmost edge, and the East Bay River forms approximately 4 miles of the southern boundary of the reservation. East Bay and Blackwater Bay are part of the larger estuarine system of Pensacola Bay.

Baseline Activities

The baseline period estuarine and riverine military mission operations were primarily ground training (i.e., special operations training) and occasional testing or technology demonstrations. Table 1-1 presents the primary activities occurring in the estuarine and riverine areas. Figures 1-3 through 1-6 identify general areas of military activity in each of the estuarine and riverine areas.

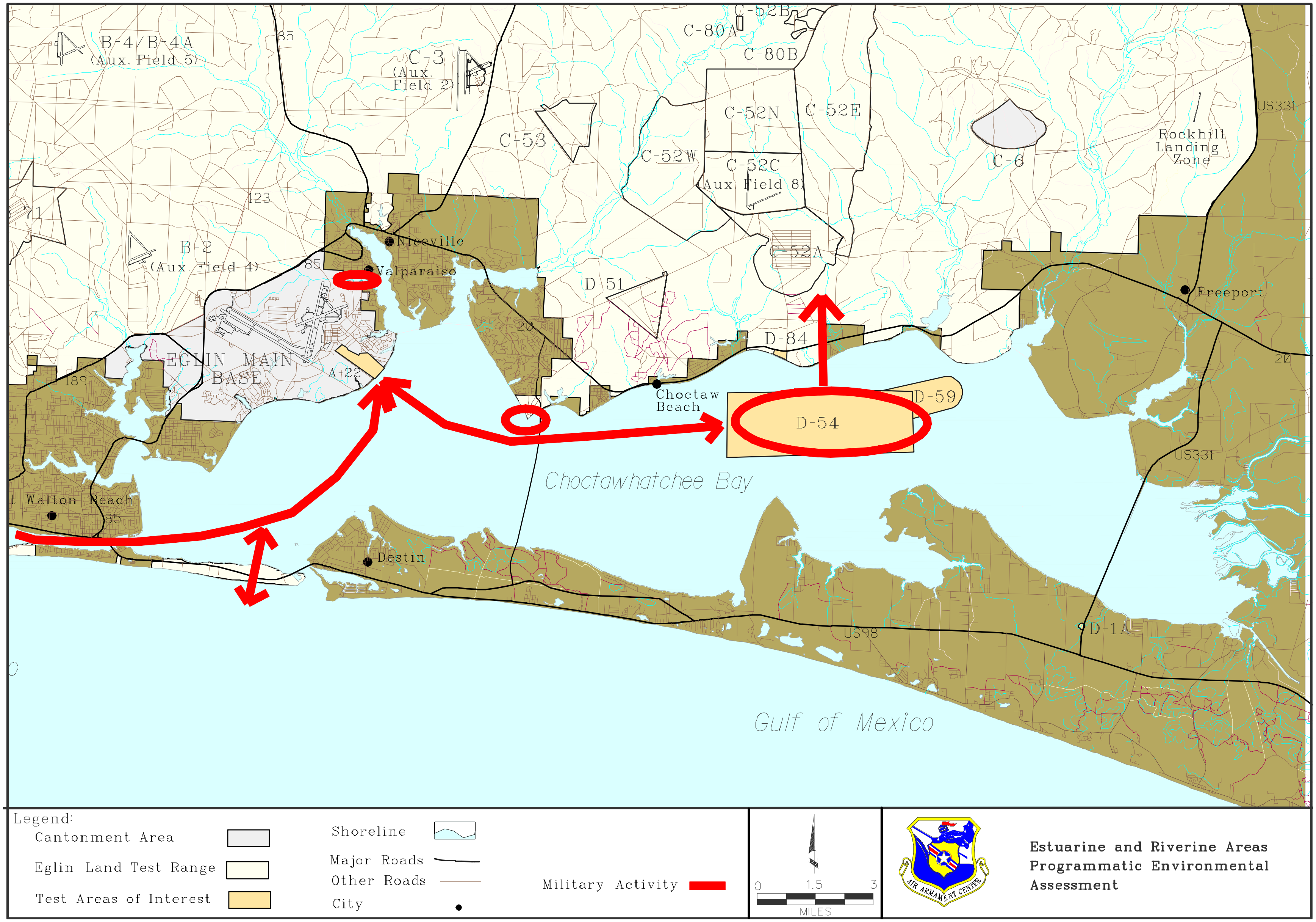

Figure 1-3. Choctawhatchee Bay

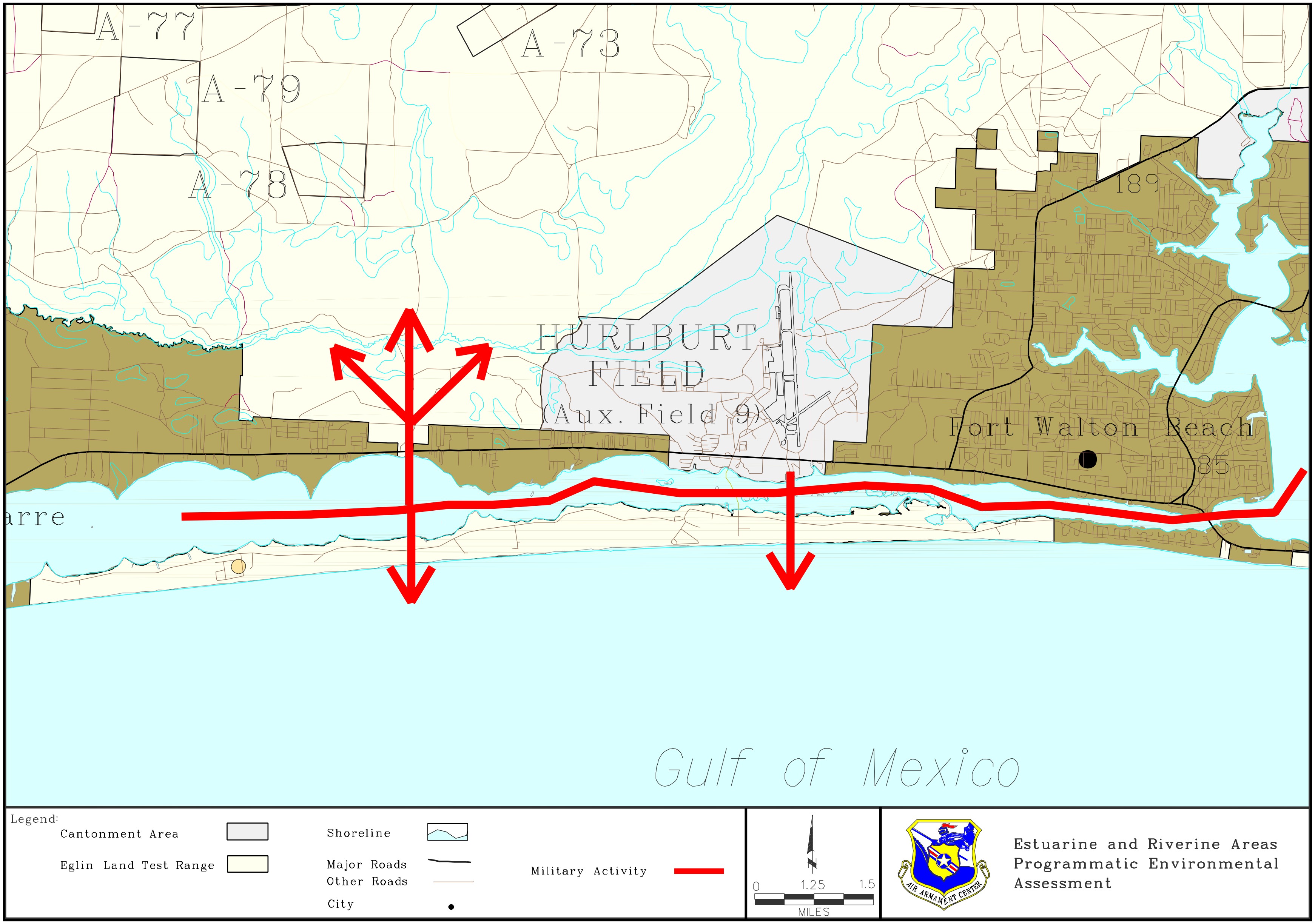

Figure 1-4. Santa Rosa Sound

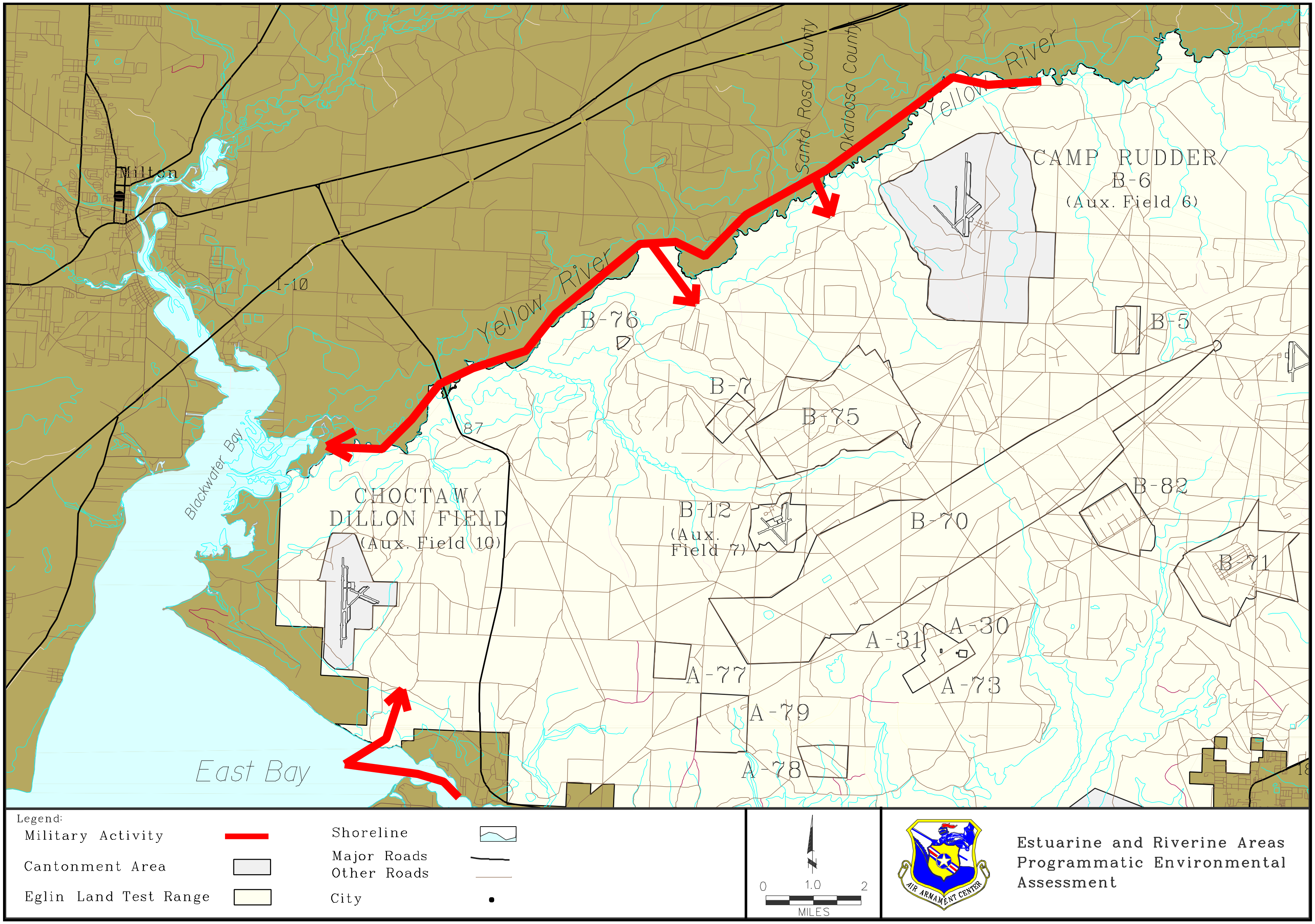

Figure 1-5. Yellow River

Figure 1-6. East Bay and East Bay River

1.4 DECISION DESCRIPTION

The 46th Test Wing wishes to authorize a level of activity for the land test areas, replacing the current approval process, which evaluates each program individually. A decision is to be made on the *level* of activity to be authorized. Currently, any new program requiring testing or training activities on the Eglin Range must anticipate at least a 60-day planning cycle. This period is required to complete the Test Directive, which includes the Method-of-Test, safety analysis and the environmental impact analysis. If the action does not qualify for a categorical exclusion, or if further environmental analysis is required, this process can be adjusted. **By authorizing a level of activity and analyzing the effects of this 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.

Procedures are in-place, which, in time of crisis, allow the AAC Commander to authorize an accelerated process. This process reduces planning time from 60 days to three days. These crisis procedures operate at the expense of all other work and cause major disruptions in the process. Authorization should streamline the environmental process, enhancing Eglin's ability to quickly respond to high priority or crisis requirements.

1.5 ISSUES

Issues are the general categories used to distinguish the potential environmental impacts of the effectors on the receptors. Specifically, an issue is a mission effector product, by-product, and/or emission that may directly or indirectly impact the physical, biological and/or cultural environment receptors. 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. The issues arising from the proposed action or alternatives that were determined to be of potential consequence to the estuarine and riverine environments include noise, restricted access, habitat alteration, direct physical impact, and chemical materials.

1.5.1 Noise

Noise is defined for estuarine and riverine areas as the unwanted sound produced by munitions testing and training mission activities. Noise may directly annoy and/or stress humans and some wildlife species or it may be substantial enough to cause hearing loss or damage in animals; mission personnel are required to take adequate precautions for shielding harmful noise, and harmful noise is not allowed to leave the reservation. Thus, the public would not be exposed to harmful levels of noise. Scientific data correlating the effects of noise on humans is well documented; however, information regarding the effects of noise events on wildlife species is limited. The impacts of noise to the public and wildlife, particularly threatened and endangered species, are a primary concern in many environmental documents. For this document, the proposed alternatives of adding or increasing live-fire operations would potentially affect people or wildlife.

1.5.2 Restricted Access

Restricted access refers to the level of availability of Eglin resources to the general public. Some areas of the Eglin Military Complex, including adjacent estuarine areas have been classified as closed or open to public recreation or passage within certain recreational or navigational guidelines. Closure of areas normally open for to the public for navigation is occasionally necessary for mission activities in Choctawhatchee Bay and Santa Rosa Sound for safety reasons. The authority to temporarily close “prohibited” and “restricted” areas in the Sound and Bay is given to the base commander by the Department of Commerce (U.S. Department of Commerce, 2003). Closures are required for safety of the public as well as safety to military personnel. None of the riverine areas have restricted or prohibited areas. The issues of restricted access are potential impacts to commercial shipping and fishing and public recreational use of waters. Remnant target materials also may restrict access. For example utility poles from an inactive range, D-55, are spread out over a two-mile length in the eastern end of Choctawhatchee Bay.

1.5.3 Debris

Debris includes the physical materials, analogous to litter, that are deposited on the surface of terrestrial or aquatic environments during the mission activities. The potential impacts are primarily related to physical disturbances to people, wildlife or other users of the range, rather than the chemical alterations that could result from the residual materials. Examples of debris deposited from estuarine and riverine activities may potentially include shell casings, canisters from signal smokes, flares, chutes from flares, and historical debris.

1.5.4 Habitat Alteration

Habitat alterations characterize the physical damage, stress, or disruptions that may adversely alter or degrade estuarine and riverine habitats. Some habitat alterations may be beneficial as well. A habitat in this instance refers to the ecologic and geomorphologic components that support organisms such as vegetation, soil, topography, and water. Subsequent degradation of unique and diverse habitats may impact sensitive species. Examples of habitat alteration include shoreline erosion, sedimentation of aquatic habitats, physical changes in topography (e.g., changes to floodplain), wildfires (often beneficial), and physical stress, injury, or mortality to the biological components of habitats. The mission activities of potential consequence to the estuarine and riverine habitats include the following:

- Erosion of shoreline areas at boat landing sites.
- Live fire and pyrotechnic use would increase wildfire potential at urban interface areas, as would general mission increases.
- Physical impacts to vegetation through paradrops, troop movements into sensitive vegetative communities, and boat landings.

During analysis for the Interstitial PEA, less impactive training routes through the reservation were identified and in many cases adopted by ground training organizations.

1.5.5 Direct Physical Impact

Direct physical impact is the physical harm that can occur to a natural or cultural resource as a result of mission activities. Examples include vessel collisions with animals, vehicle-animal road collisions, crushing an organism by vehicle or foot traffic, and ordnance shrapnel or debris striking an organism. Such impacts can lead to other effects like loss of vegetation and erosion. Direct physical impact is also a threat to prehistoric and historic cultural features; significant features, structures, artifacts, and site integrity may be damaged or lost due to physical disruptions. Control of training areas prevents direct physical impact to members of the public. Consultation between user groups such as the 6 RTB with the Eglin Historic Preservation Division (AAC/EMH) has identified which areas to avoid. The mission activities of potential consequence to directly impact the estuarine and riverine environment include the following:

- Additional live-fire ranges, if created could result in some vegetation/habitats, cultural resources, and potentially some wildlife being affected by target placement and maintenance and from munitions.
- Landings and troop movements through areas containing sensitive vegetation or cultural resources.
- Excavations for personal fighting and bivouac (foxholes).

Continued communication with Eglin Cultural Resources would minimize impacts to cultural resources.

1.5.6 Chemical Materials

Chemical materials encompass liquid, solid, or gaseous substances that are released to the environment as a result of mission activities. For estuarine and riverine activities, these would include pyrotechnic combustion by-products, residual fuel leaks, and air emissions from outboard motors. Combusted by-products of munitions and smoke dyes may potentially affect air quality, water quality and sediments.

The environmental analysis of chemical materials describes the amounts, extent, and estimated concentration of chemical materials produced by these mission activities with regard to potential impacts to vegetation, wildlife species, and surface water and sediment quality. The potential influences of the sediment and water environment and food chain on the availability and translocation of chemical contaminants are also evaluated.

1.6 FEDERAL AND STATE PERMITS REQUIRED

According to the Florida Administrative Code (FAC) 62-621, a NPDES Stormwater Permit is required for construction projects that disturb more than one acre of land. Alternatives 4 and 5 may require this permit. According to the U.S. Coast Pilot (U.S. Department of Commerce, 2003), the establishment of new danger zones (e.g., for new live-fire areas) in the estuarine areas would require consultation between the U.S. Army Corps of Engineers District Engineer and USFWS and NMFS to evaluate potential impacts to commercial fishing.

1.7 ENVIRONMENTAL JUSTICE

On 11 February 1994, Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, was issued with the directive that during the National Environmental Policy Act (NEPA) process, federal agencies adopt strategies to address the environmental concerns of minority and low-income communities that may be impacted by the implementation of federal missions. The intent of the Executive Order is to ensure that no individual or community, regardless of race, ethnicity, or economic status, should shoulder a disproportionate share of adverse environmental impacts to human health or environmental condition resulting from the execution of federal missions. The purpose of environmental justice is to identify disproportionately high and adverse socioeconomic and/or environmental impacts and identify appropriate alternatives.

There are no low-income or minority individuals or communities that are anticipated to be adversely impacted socioeconomically or environmentally by the execution of military missions within the estuarine and riverine areas. The Environmental Justice issues that could potentially be associated with the decision regarding the preferred alternative for the estuarine and riverine areas are public access to the waters of Choctawhatchee Bay and the Yellow River, noise from increased operations, and safety from live-fire operations. An environmental justice analysis is included as part of Appendix G, an analysis of candidate live-fire riverine sites.

The access of the public to estuarine and riverine areas during mission activities is restricted regardless of socioeconomic status for safety and security reasons and does not adversely impact individuals or communities of concern. Estuarine and riverine areas are currently not closed during the majority of military activities, rather military activities are ceased if a nonparticipant enters the area. Any increase in noise would primarily affect communities along the waterfront. Live-fire exercises present potential increased safety issues but would be managed by activation of safety footprints. Firing would cease if a nonparticipant were to enter the controlled firing area (CFA). No disproportionate adverse effects would result to low income or minority groups from increased activation of the existing controlled firing area in Santa Rosa Sound since the CFA is military controlled restricted airspace and overlies restricted Eglin property on SRI. No communities exist under the CFA.

The Executive Order also requires the application of equal consideration for Native American Programs. This may include the protection of Native American tribal lands and resources such as treaty-protected resources, cultural resources, and/or sacred sites. This issue, along with the associated public participation mechanisms, is fully addressed via Eglin's compliance with the following.

- The Antiquities Act of 1906
- The Sites Act of 1935
- The National Historic Preservation Act of 1974
- The Archaeological Resources Protection Act of 1979
- The Native American Graves and Repatriation Act of 1990
- The American Indian Religious Freedom Act

Procedures for compliance with the above laws are outlined in Eglin's Cultural Resource Management Plan (U.S. Air Force, 1997). As a result, an additional analysis was not included in this Programmatic Environmental Assessment.

1.8 RELEVANT ENVIRONMENTAL LAWS AND REGULATIONS

Previous available NEPA and Air Force Environmental Impact Process documentation is summarized in Table 1-2. Federal and state laws that may be applicable to the proposed action are summarized in Appendix A.

Table 1-2. Estuarine and Riverine Activities Reviewed Under the Environmental Impact Analysis Process

Action	Choctawhatchee Bay	Santa Rosa Sound	Yellow River	East Bay	East Bay River
Special Operations Training: *Water To Land Transition/Boat Ops*	RCS#98-341: With the 720th, various types of training (SCUBA, zodiak, infil/exfil) by units of other branches of the military, eight times a year. **CATEXed** with reference to existing PEAs and EAs.	RCS#98-062: 10th Mountain Division Army Rangers boat operations training in the Sound. **CATEXed** with coordination with AAC/EMH and AAC/EMSN notification prior to each mission. RCS#98-341: With the 720th, various types of training (SCUBA, zodiak, infil/exfil) by units of other branches of the military, eight times a year. **CATEXed** with reference to existing PEAs and EAs.	RCS#98-007: 51st Infantry training in Yellow River, 125 persons, 1 week. **CATEXed.** RCS#97-311: 6 RTB nighttime ship to shore ops on Weaver River. **CATEXed** with coordination with EMSH. RCS#98-341: With the 720th, various types of training (SCUBA, zodiak, infil/exfil) by units of other branches of the military, eight times a year. **CATEXed** with reference to existing PEAs and EAs.	RCS#97-311: 6 RTB nighttime ship to shore ops from East Bay to Choctaw. **CATEXed** with coordination with EMSH. RCS#98-341: With the 720th, various types of training (SCUBA, zodiak, infil/exfil) by units of other branches of the military, eight times a year. **CATEXed** with reference to existing PEAs and EAs.	RCS#98-397: 6 RTB training/movement through East Bay Swamp during the winter months, 150 to 170 students in groups of 35 to 40. **CATEXed** with reference to Interstitial PEA. RCS#99-186: DET 1, 334th TRS request for additional training area in East Bay Swamp. **CATEXed** provided vehicles stay on range roads, units avoid rare plant sites (reference Interstitial PEA), and do not disturb cultural resources.
Special Operations Training: *Air To Water Transition/ Paratroop/ Paradrop*	RCS#98-341: With the 720th, various types of training (SCUBA, zodiak, infil/exfil) by units of other branches of the military, eight times a year. **CATEXed** with reference to existing PEAs and EAs.	RCS#98-341: With the 720th, various types of training (SCUBA, zodiak, infil/exfil) by units of other branches of the military, eight times a year. **CATEXed** with reference to existing PEAs and EAs.	**NA**	RCS#98-341: With the 720th, various types of training (SCUBA, zodiak, infil/exfil) by units of other branches of the military, eight times a year. **CATEXed** with reference to existing PEAs and EAs.	**NA**

Table 1-2. Estuarine and Riverine Activities Reviewed Under the Environmental Impact Analysis Process Cont'd

Action	Choctawhatchee Bay	Santa Rosa Sound	Yellow River	East Bay	East Bay River
Navy EOD Training	RCS#93-362: Conduct EOD underwater tools and techniques training in Weekly Bayou, Alaqua Point and White Point. An **EA** was prepared.	**NA**	**NA**	**NA**	**NA**
Test Support: *Sensor Testing*	RCS#98-343: Demonstration of the Mobile Underwater Debris Survey System (MUDSS), which used sonar and electro-optic and magnetic sensors. **CATEXed** provided Eglin Natural Resource representative on board as a marine mammal observer.	**NA**	**NA**	**NA**	**NA**
Test Support: *LCAC Testing*	RCS#97-511: LCAC/GPU-5 Integration involving live fire from the Sound and travel through the Bay. An EA was prepared and **FONSI** signed. RCS#98-289: LCAC target acquisition tests involving transport through Choctawhatchee Bay. **CATEXed.** RCS#00-160: LCAC GPS Anti-jamming test involving transport from Choctawhatchee Bay to	RCS#97-511: LCAC/GPU-5 Integration involving live fire from the Sound and travel through the Bay. An EA was prepared and **FONSI** signed.	**NA**	**NA**	**NA**

Table 1-2. Estuarine and Riverine Activities Reviewed Under the Environmental Impact Analysis Process Cont'd

Action	Choctawhatchee Bay	Santa Rosa Sound	Yellow River	East Bay	East Bay River
Test Support: *LCAC Testing (Continued)*	Gulf and positioning in Gulf no closer than 1,500 feet from Test Site A-15. **CATEXed** with observance of certain restrictions regarding onshore activities.				
Live Fire	**NA** Note: Two active aerial gunnery ranges exist in Choctawhatchee Bay.	RCS#97-511: LCAC/GPU-5 Integration involving activation of the controlled firing area (CFA), live fire from the Sound and travel through the Bay. An EA was prepared and **FONSI** signed. RCS#99-056: A request for Navy Littoral Warfare Support Training including boat and live-fire training in Santa Rosa Sound, the Yellow River and East Bay River. No CATEX or EA exists for this activity, which has not been conducted. Environmental analysis is included in this PEA.	RCS#99-056: A request for Navy Littoral Warfare Support Training including boat and live-fire training in Santa Rosa Sound, the Yellow River and East Bay River. No CATEX or EA exists for this activity, which has not been conducted. Environmental analysis is included in this PEA.	**NA**	RCS#99-056: A request for Navy Littoral Warfare Support Training including boat and live-fire training in Santa Rosa Sound, the Yellow River and East Bay River. No CATEX or EA exists for this activity, which has not been conducted. Live fire on the East Bay River is not an alternative of this PEA.

NA = not applicable; the activity does not occur in this water body or no documentation has been found.

2. ALTERNATIVES

2.1 INTRODUCTION

This section introduces the alternatives that will be evaluated for potential environmental impacts in the Programmatic Environmental Assessment for military activities within the estuarine and riverine areas. Alternatives identify an action or a series of actions that achieve the desired results. For the purposes of this document, the alternatives for the estuarine and riverine areas are formulated with the following attributes:

- Support the current level of mission activities
- Accommodate increases in military missions especially during surge and crisis needs in an environmentally responsible manner
- Identify potential options for the addition of live-fire capabilities to riverine, estuarine and marine shoreline areas

The proposed action and alternatives, which are analyzed in this document, are:

- Alternative 1 (No Action Alternative): Current level of activity as defined in the baseline period, FY95 through FY99
- Alternative 2: Authorize current level of activity (as described in Alternative 1)
- Alternative 3: Alternative 2 plus a 100 percent increase in all missions
- Alternative 4: Alternative 3 plus live-fire estuarine/marine shoreline range
- Alternative 5: Alternative 4 plus live-fire riverine range

A brief description of each alternative is provided that includes the activity and expendables associated with it.

2.2 ALTERNATIVES CONSIDERED

This section provides a description of the alternatives.

2.2.1 Alternative 1 (No Action): Current Level of Activity

The No Action Alternative is based on the current level of activity for a baseline period between FY95 and FY99. This alternative is defined as continuing the current practice of analyzing each estuarine/riverine area action on an individual basis. This process has served Eglin well and has allowed good stewardship of the Eglin resources for many years. ***This alternative does not authorize any level of activity***. Therefore, each action is identified by the proponent and evaluated by a working group. If further environmental analysis is required, an Environmental Assessment is prepared. This is a time and resource intensive process. Crisis or surge activities can be handled reasonably quickly, but at the expense of other programs. The current user groups, mission activities and expenditures are presented under the Alternative 2 expenditures in Table 2-1.

Currently the major groups utilizing the estuarine and riverine areas include the U.S. Army 6th Ranger Training Battalion (6 RTB), the U.S. Air Force Special Operations Command (AFSOC)/HAVE ACE, 23rd Special Tactics Squadron, 16th Special Operations Squadron Current Operations (16SOS/DOO), 720th Special Tactics Group, Navy EOD, 46 OG/OGP, 46 OG/OGMT and 46 TS/OGEX. A description of the groups and missions follows.

U.S. Army 6th Ranger Training Battalion

The 6 RTB trains small unit operations in a coastal swamp environment. Eleven courses are run throughout the year, lasting 18 days per cycle. Four days during the cycle (four times per month) students operate in the Yellow River and adjoining swamps. River movements consist of up to 24 RB-15 zodiac boats (without motors) utilizing portions of the Yellow River from Metts Creek landing in the east down to the Weaver River (a branch of the Yellow River) in the west. For safety, instructors use up to four motor-powered safety boats in the river to support training. No blank ammunition or pyrotechnics are used while on the river (U.S. Air Force, 2001).

Typically, no less than three and no more than six platoons of 38 to 40 trainees per platoon participate in each course. The minimum number of trainees would then be 114 per month and the maximum would be 240 trainees per month for a yearly range of 1,254 to 2,640 trainees per year, an average of about 1,950. The number of platoons varies from three to six such that neither the minimum nor maximum number per year would ever be achieved but some number in between (U.S. Army, 2001).

The three locations for movement through the swamps are near Sweet Gum Landing, Whitmier Island, and the Weaver River. Swamps are used as infiltration lanes only. No blank ammunition or pyrotechnics are used while in the swamps (U.S. Air Force, 2001). The estimated number of boat landings per year (up to 28 boats during each cycle) at the four landing sites (Metts Creek, Sweet Gum, Whitmier, and Weaver) is 1,232 total (U.S. Army, 2001).

The Rangers use a portion of SRI once per cycle (once a month). Students paddle zodiac boats from Wynnhaven Beach across the Sound to the Island. They conduct blank fire training on fixed sites on the beach, and are air-lifted off the Island using UH-60 Blackhawk helicopters. Up to five motor-powered boats support Zodiac crossings of the Sound (U.S. Air Force, 2001). The estimated number of boat landings per year (up to 29 boats during each cycle) at the Wynnhaven Beach and Santa Rosa Sound sites is 638 total (U.S. Air Force, 2001; U.S. Army, 2001).

For purposes of analysis, each day of travel over the Yellow River is considered as a single mission. Thus, for eleven cycles, of which four days are spent on the river, the total number of missions per year is equal to 44. The number of days the Rangers train in the Sound is approximately one day per cycle, 11 times per year; thus, the number of missions that use Santa Rosa Sound is 11 (U.S. Army, 2001).

Table 2-1. Alternative 1 (No Action): Representative Estuarine and Riverine Mission Scenarios and Metrics for the Baseline Period

Location	Use Category	Activity	Max Yearly Missions	No. of People/Year	No. of Days/ Mission	No. of Mission Days/Year	People-Days/ Year [a]	Boats/ Mission	Boat-Miles/ Mission
Estuarine	Special Ops	Training, Testing[b]	220	4,100	1	220	4,100	4	4
Estuarine	Navy EOD Training[c]	Classes	6	150	10	60	1,500	2	2
Estuarine	Navy EOD Training[c]	Misc.	12	120	1	12	120	2	30
Estuarine	Testing Support[d]	Sensor/ technology, LCAC	5	80	5	25	400	3	150
Estuarine	Live Fire	LCAC, TA A-22	1	10	1	1	20	3	50
Riverine	Special Ops	Training, Testing[e]	20	2,300	4	80	9,200	25	16

Location	Use Category	Activity	Boat-Miles/ Year	Landings/ Year[f]	Paradrop/ Paratroop/ Mission	Helo/ Paradrop/ Mission	Helo Drops/Year[g]	Hover-Hours[h]	Expendables/ Year
Estuarine	Special Ops	Training, Testing	1,600	880	20	<1	90	90	315 M-18 100 flares
Estuarine	Navy EOD Training[c]	Classes	340	240	0	0	0	0	20 recall devices
Estuarine	Navy EOD Training[c]	Misc.	360	50	0	0	0	0	0
Estuarine	Testing Support	Sensor/ technology, LCAC	4,200	40	10	0	0	0	10 M-18s
Estuarine	Live Fire	LCAC, A-22	150	2	0	0	0	0	<1,000 30 m m TP rounds
Riverine	Special Ops	Training, Testing	8,000	2,000	10	<1	10	10	30 lightsticks

[a]No. of people/year x No. of mission days.
[b]Testing missions account for approximately <1% of all special operations missions and involve similar activities as training missions.
[c]Includes 6 classes per year of 25 students plus other miscellaneous training events that occur in Santa Rosa Sound and Choctawhatchee Bay.
[d]Majority of test missions involved LCAC and two safety boats; mileage based on round trip from A-22 to A-13B.
[e]Riverine missions typically cover four miles a day. Approximately 20% of all boats motorized.
[f]Landings refers to boat ramp use and LCAC crossovers and land transitions; other testing boats and large Navy EOD boats use docking facilities.
[g]Helo drops based on maximum number of missions involving paratroop/paradrop from a given year. For D-54, approximately 78 missions in 1999 involved helo drops and retrievals. East Bay usually has two per year and Santa Rosa Sound about 10.
[h]Assumes that each drop and retrieval phase takes approximately 30 minutes.

23rd Special Tactics Squadron

The 23rd Special Tactics Squadron (23 STS) is comprised of pararescuemen, combat controllers, and various support specialties with diverse mission specialties. The 23 STS functions in remote hostile environments as a cohesive unit to deploy specially organized, trained, and equipped forces to survey and assess assault zones; establish and control landing and drop zones; set up and operate forward area refueling and rearming points; establish and manage casualty collection, triage and evacuation sites; participate in Air Force Special Operations Command foreign internal defense efforts; and provide special operations terminal attack control capability. Tactical insertion methods include static-line or military free-fall parachuting, SCUBA or amphibious methods, mounted or unmounted overland infiltration, and fixed or rotary wing aircraft. Special skills include demolitions, weapons, air traffic control, small unit tactics, trauma medical response, communications, and forward weather observation (U.S. Air Force, 2001a).

The 23 STS activities in the estuarine and riverine areas consist of armed route escort training on the Yellow River approximately twice a year (zero to four times a year) and diving in the Santa Rosa Sound. The maximum foreseeable number of armed route escort training events would not exceed six. This activity would likely decrease during wartime or conflict situations because most of the unit would be deployed during this time. This type of training lasts a maximum of eight hours and occurs at night, with rare instances of the mission carrying over into the daytime. A maximum of 10 personnel are involved in this activity, which begins with armed route escorts infiltrating into the Yellow River either at the Highway 87 bridge or by helicopter drop. The escorts move up the river towards Metts Bluff, after which they may exit the water environment at Metts Bluff or anywhere west of the bluff. After leaving the river, the escorts move on foot towards TA A-77 or Auxiliary Field 6. The 23 STS does not use blanks or smoke grenades while on the river. Chemlites™ or lightsticks are attached to the boat for safety but these are not discarded. Blanks may be used during foot movement toward TA A-77 and Auxiliary Field 6, but the cartridges are retrieved. The 23 STS operates on a “take out what you take in” policy (U.S. Air Force, 2001a).

The number of missions conducted by the 23 STS in the Yellow River averages two per year (U.S. Air Force, 2001a).

U.S. Air Force Special Operations Command HAVE ACE Program

HAVE ACE consists of 11 flights and provides training and testing support to seven operational squadrons and the group commander of the Air Force 16th Operations Group. Army Special Forces, Navy SEAL, and Air Force personnel man the Joint Liaison Flight, which offers realistic and intense combat training for special operations forces. Along with the Joint Liaison Flight, other flights of the 16th OSS utilize the riverine and estuarine areas to accomplish part of their training objectives (U.S. Air Force, 2001b). Training comprises 99 percent of the activities that HAVE ACE supports with the remaining 1 percent as testing. All of the units supported are from other military bases. Boats used include various inflatable and rigid craft with outboard engines 35 to 200 hp, and 26-foot aluminum boats with diesel inboard engines (U.S. Air Force, 2002).

Personnel and rubber boats are dropped from helicopters and aircraft onto TA D-54 in Choctawhatchee Bay. This activity occurs both during daylight hours and at night on a bimonthly basis (6 times per year). Approximately 15 personnel and 1 boat are dropped from a height of 10 feet from a hovering helicopter, after which groups may come ashore at Choctaw Beach. Other than the boat and personnel, and possibly a few lightsticks, no other items are dropped. Approximately once a year, personnel may move onto shore at one of two Air Force controlled locations, the D-84 (closed to all forms of outdoor recreation) or an area near Choctaw Beach. Other missions (approximately once a year) may involve personnel in boats leaving from the Eglin shoreline on the west side of Choctawhatchee Bay and traveling to TA D-54 (U.S. Air Force, 2001b).

Similar activities (i.e., helicopter jumps, boat drops, and retrievals) take place in Santa Rosa Sound at the drop zone off of Wynnhaven Beach. Approximately 15 personnel participate in this bimonthly activity (U.S. Air Force, 2001b).

In the Yellow River, groups enter the water in boats at the mouth of river and travel up to Whitmier Island approximately once a year. Generally, personnel do not go ashore. Navy SEALs may train occasionally (less than once a year) on the Yellow River and will travel up past Whitmier. The SEALs go ashore around the Bear Creek area (U.S. Air Force, 2001b).

Drops and retrievals are conducted in East Bay approximately twice yearly. Personnel and boats are cast from helicopters from a height of 10 feet and then hoisted via cable from a height of approximately 80 feet. Occasionally (less than once a year) personnel may travel from the East Bay onto the Eglin reservation (U.S. Air Force, 2001b).

720th Special Tactics Group

The 720th Special Tactics Group (STG) provides direct command and control for Air Force special tactics units during special operations missions by conducting airfield or assault zone reconnaissance, assessment, and control, providing immediate emergency trauma medical treatment and patient retrieval, as well as combat search-and rescue. The training of other units from other military branches by the 720th approximately eight times a year was CATEXed in 1998, provided that the Overland Air Operations PEA, the Test Area B-70 PEA, and the B-5 Small Arms Training EA are referenced. Combat controllers and pararescuemen comprise rapidly deployable units that support joint or combined special operations task forces. Parachuting, amphibious and aquatic employment, combat diving, and combat rubber raiding craft, rough terrain motorcycles, specialized four-wheeled drive vehicles, and fast rope/rappelling from helicopters are skills and methods used for accomplishing mission objectives, though vehicles are not used in the swamp/wetland areas. Santa Rosa Sound, Yellow River, East Bay, and Choctawhatchee Bay are used for activities such as scuba training, zodiak boat operations, and infiltration and exfiltration operations.

Groups supported by the 720 STG appear to be infrequent users of the estuarine and riverine areas. In 1999, the 720 STG supported three missions in Choctawhatchee Bay involving a total of 75 paratroops. Fifteen smoke grenades were expended (U.S. Air Force, 2000).

16th Special Operations Squadron Current Operations (16SOS/DOO)

The 16SOS/DOO conducts missions similar in nature to that of the 6 RTB and the 23 STS. Approximately six times a year, they conduct water drops of usually two inflatable boats and six personnel in the Yellow River. The group size may range from 4 to 20, though six is the norm. Boat landing locations vary depending on the objective. Pyrotechnics are only used on solid ground of the interstitial areas and test areas. Pyrotechnics are not discharged in the swamps or wetland areas (U.S. Air Force, 2001c).

Navy Explosive Ordnance Disposal School

Naval School Explosive Ordnance Disposal (NAVSCOLEOD) conducts mine location and retrieval training off of White Point in Choctawhatchee Bay. There are approximately six classes per year, consisting of about 25 participants. Participants locate inert mines in shallow waters off of White Point using a handheld low-energy sonar device, the AN/PQS-2A. Once located, the mines are brought to the surface via a lift balloon, which is actuated by a small self-contained explosive valve, and then towed ashore. Weekly Bayou is also used for inert mine training, including the removal of inert limpet mines from vessels. Open water swims and dives are occasionally conducted in Choctawhatchee Bay and Weekly Bayou. Expended items are few and explosive discharges associated with Navy EOD inert mine retrieval training in Choctawhatchee Bay or any of the other Navy EOD activities are limited to an audible recall device. Instructors onshore or in small boats carry an audible recall device, which contains a small quantity of explosive powder, for signaling class participants underwater. In cases of emergency, this signal device is tossed into the water. It emits a pop similar to a firecracker, and the sound notifies personnel underwater to return to the surface. Current usage does not exceed 20 per year. The number of Navy EOD training missions in Choctawhatchee Bay is approximately six per year. Mission surge requirements would allow for the Navy EOD School to increase the level of training by two classes per year, or 33 percent (U.S. Navy, 2001).

The Navy EOD School currently employs the following watercraft:

- One 90-foot LCM-8 diver support craft
- Two 27-foot Boston Whalers
- One 25-foot Boston Whaler
- One 24-foot Monark
- Two 18-foot Boston Whalers
- Five 19-foot Zodiacs (Mk V)

Except for the LCM-8, all boats are used as dive/transportation platforms for Underwater Explosive Ordnance Disposal (EOD) Mine Countermeasure and limpet procedures, diving training/requalification and support craft for open water swims. The LCM-8 (commonly known as a Mike 8) is used to transport students from Weekly Bayou and Choctawhatchee Bay to the Gulf of Mexico for seeding of training minefields. All boats are used for coxswain (boat driver) training.

In addition to current activities, the Navy EOD School is planning to conduct helicopter casting and small boat operations 30 days per year. Paradrop operations, similar to those conducted by HAVE ACE and the 23 STS, could possibly be conducted for proficiency sustainment training.

Test Area A-22

TA A-22 is an active land test area located on Eglin Main behind the McKinley Climatic Laboratory with an impact area that extends into Choctawhatchee Bay. The impact area was not activated during the baseline years, but activation may be required for future tests. The existence of the impact area makes Test Area A-22 pertinent to the study of estuarine and riverine military activities that are the subject of this environmental assessment. Tests that do not involve activation of the impact area would have no effect on estuarine areas, including noise, since the edge of Choctawhatchee Bay is over a mile from firing points. Activation of the impact area is initiated by the Eglin Safety Office on a case-by-case basis for tests involving munition firings. Test facilities at A-22 are designed to provide data on gun, ammunition and projectile performance, and prototype models. Guns may also be fired from the McKinley Climatic Laboratory during environmental testing. Specific types of tests that can be conducted include developmental gun test firings, gun firing demonstrations, aircraft mounted gun tests and harmonization firings, laser boresight range, indoor ballistic research for bomblet and submunition launchers; indoor static gun firing impact area, indoor flare tests, and flare testing in an arena.

The firing range is 6,000 feet in length and has an authorized impact area that extends into the bay. The impact area as delineated in the U.S. Coast Pilot extends a total of approximately eight miles into the Bay and munitions impacts are authorized within the first three miles according to the AFDTC Technical Facilities Manual, Volume 2. Four concrete target butts are located downrange at the 200, 400, 600 and 1,000-yard intervals.

The Eglin Safety Office evaluates the size of munitions expended on a case-by-case basis. Since 1976, test and evaluation of aircraft guns, small arms, and ammunition up to 40 mm have been conducted. Rocket firings, except from an air gun, are not permitted.

Targets have included gun harmonization targets on trucks on 1,000-inch tracks and on 1000-foot target foundations, miscellaneous dispersion targets, the four concrete target butts, barricades for ammunition disposal, an enclosed firing bay with concrete butts, soft earth targets, cloth targets, and sand-filled target butts.

Navy Coastal Systems Station

With support from Eglin AFB sponsor organizations, the Navy Coastal Systems Station (CSS), located in Panama City, Florida, conducted sensor demonstration tests and a series of LCAC maneuver, refueling, live-fire and anti-jamming tests in Santa Rosa Sound, Choctawhatchee Bay, and the Gulf of Mexico over the baseline period.

Sensor Testing: Mobile Underwater Debris Survey System (MUDSS)

In 1998, the 46OG/OGP supported CSS for a demonstration of MUDSS in which several types of underwater sensors were used to detect underwater debris and buried unexploded ordnance (UXO). In Choctawhatchee Bay, UXO is present according to historical records and is presumed to primarily consist of 250-pound WWII practice bombs. Because UXO is present, the Bay makes a potentially good site in which to test sensor equipment of this nature.

Over a six-day period in November, a towboat launched from Postl Point in west Choctawhatchee Bay and towed laser line scan electro-optical, passive magnetic, trace chemical and three sonar sensors through selected areas of Choctawhatchee Bay. The sonar sensors included a high frequency (180-kilohertz (kHz)) and a low frequency (20 kHz) synthetic aperture sonar and a SeaBat forward-looking sonar with an operating frequency of 455 kHz (Carroll et al., 2000). Source levels at one meter from the high frequency and low frequency sonar were 214 and 212 dB re 1 microPascal respectively. The laser electro-optical sensor operated at wavelengths of 532 nanometers with an output of 300-500 milliwatts (Carroll et al., 2000). A safety feature shut off the laser if the roll of the boat exceeded 40 degrees to ensure that the sensor was always directed downward. A safety boat accompanied the towboat to observe for other craft and watch for marine mammals (i.e., bottlenose dolphins) within the MUDSS hazard area (approximately 330 feet from the vessel), which could be potentially affected by the low frequency sonar. The high frequency sonar and the SeaBat sonar operate beyond the hearing sensitivity range of bottlenose dolphins.

The surveyed area was a square 1.4 nautical miles wide located near the mouths of Rocky and Boggy Bayous in waters 15 to 30 feet deep. The bottom type was sand and mud. One hundred fifty seven potential targets were identified, but none were confirmed to be UXO (Carroll et al., 2000). The activity was CATEXed with the stipulation that a marine mammal observer be present and that the demonstration occurs during daylight hours.

LCAC Testing

From 1995 to 2000, Eglin AFB testing organizations sponsored LCAC maneuvers and tests for CSS in Choctawhatchee Bay. Tests usually originated at TA A-22 in Choctawhatchee Bay and involved maneuvers and transit through the Bay, Sound, and Gulf. Target acquisition, refueling, anti-jamming, obstacle tests, and weapons testing were key components of LCAC testing over the baseline period. Potential environmental effects of 1998 live-fire tests were addressed in an environmental assessment; tests that did not involve live fire were CATEXed. Tests were conducted during the day.

LCAC Target Acquisition Tests

LCAC target acquisition tests involved, in part, transit through Choctawhatchee Bay and acquisition of a land-based array of various simulated targets. Other locations of the Eglin reservation supported various facets of this test. In the Choctawhatchee Bay portion of the test, the target acquisition system on the LCAC was engaged without expenditure of ammunition. Targets were of framed cloth located on the shoreline of Test Area A-22 at distances from the

LCAC of 750 to 1,500 feet. Target acquisition occurred while the LCAC was underway in Choctawhatchee Bay and also after the vehicle transitioned from water to land at Test Area A-22. The LCAC was washed down periodically by a pumper truck and refueled with JP-5. Since similar activities had been conducted before, LCAC target acquisition tests were CATEXed.

LCAC 30-mm Live-Fire Test

In 1998, the Navy tested the integration of the LCAC with the GPU-5 (gun pod unit-five) 30-mm weapon system in a feasibility demonstration. In addition, the effectiveness of the GPU-5 against beach obstacles was verified as well as structural limits of the craft and gun mount actuators. Recordings of sound levels produced by firing indicated an acceptable noise hazard to personnel given that hearing protection was worn. A refueling site on TA-13B on SRI was temporarily established to reduce the number of trips to the normal refueling location on TA-22 for more efficient use of resources and time.

After installation of the GPU-5 at TA A-22, the LCAC left TA A-22 and traveled out Destin Pass into the Gulf. The LCAC crossed the Island at A-13B, then moved along Santa Rosa Sound to the test location. The LCAC engaged targets on SRI from a position in Santa Rosa Sound approximately 1,000 feet from the shore, firing south in the direction of the Gulf. Targets were placed approximately 20 feet from the high water line of Santa Rosa Sound and included three each of concrete cubes, jersey barriers, steel hedgehogs, steel tetrahedrons, and 60 sea urchins (welded steel rods). Target practice (TP) rounds were fired in burst lengths of less than 100 rounds. A total of 353 30-mm TP (training) rounds were expended from Santa Rosa Sound into the Gulf. After engaging the targets, the LCAC crossed back over SRI and returned to TA A-22.

Rinse down and refueling was initially accomplished at TA A-22, and later approval was granted to establish a temporary refueling site on SRI. Target debris was recovered and removed where possible. A helicopter, two watercraft, and four all-terrain vehicles were employed to observe for nonparticipants within the testing area. Notices to airmen and mariners (NOTAMs and NOTMARs) were published or broadcast notifying the activation of the restricted airspace and controlled firing area within which the test was conducted. A fire truck was present at Test Area A-22 during refueling.

Other LCAC Tests

Since 1995, no more than four tests during any given year involving primarily transit and maneuvering of the craft from TA A-22 on the eastern shore of Eglin AFB to Santa Rosa Sound, SRI, or the Gulf of Mexico have occurred. In 2000, an LCAC Tank Transport test was conducted near TA-13B on SRI, which involved transport of a Hercules Tank Retriever from TA-22 to through Santa Rosa Sound and over the Island. Also in that same year, the 46TS/OGEX supported a GPS anti-jamming test with the LCAC, which exited TA A-22 and then moved through Choctawhatchee Bay into the Gulf of Mexico. No tests using the estuarine areas were conducted in 2001.

Missions and Expended Items: Representative Scenarios

In order to analyze the potential environmental effects of estuarine and riverine missions over a five-year period so that the expected impacts of future missions may be understood, and to account for slight variations in training/testing methods, frequency and munition type, a typical yearly representation of the three mission categories was constructed in Table 2-1, with metrics applied to quantify usage. An example of a metric might be the number of personnel per day, expressed as people-days. Riverine boat activity would be expressed as boat-miles. Expendable items such as smokes would be represented by the amount or number expended; effects analysis (in Chapter 4) may express smoke grenade usage in terms of acreage exposed. Special operations training was further subdivided as estuarine and riverine areas. Yearly expendables and missions data for Choctawhatchee Bay (i.e., Test Area D-54) fluctuate such that calculating the average number of missions is inadequate to portray the increases that may occur in any given year and expendables data for other estuarine and riverine water bodies are not recorded in a way that can be identified with a particular water body. Thus, the maximum number of expendables for Choctawhatchee Bay from any given year was selected as a representative level of expendables for that water body. For other estuarine and riverine water bodies, representative levels of missions and expendables were estimated primarily from interviews with user groups and also reflect the maximum usage from any given year over the five-year baseline period.

Precise locations of expended items are not always recorded, particularly in non-TAs for training type missions. The reason for this is that missions not associated with a particular TA are often scheduled according to airspace blocks and these blocks are expansive, often covering both water and land habitats. The exact location of a particular expendable is often not recorded. Thus, it is not possible to discern from the Range Utilization database the expended items for all groups that use the riverine and estuarine areas. Where expendables data is not available, mission descriptions, previously provided in this section, are used to estimate the number and kind of items expended in the estuarine and riverine areas.

The baseline level of activity depicted in Table 2-1 represents Alternative 1, the No Action Alternative.

2.2.2 Alternative 2: Authorize Current Level of Activity

This alternative is defined as *authorizing* the current level of activity (as presented in Table 2-1) for the baseline period between FY95 and FY99. Alternative 2 includes a cumulative evaluation of all activities within the estuarine and riverine areas. By authorizing this level of activity, similar mission requests may be quickly and efficiently approved.

2.2.3 Alternative 3: Alternative 2 Plus 100 Percent Increase in All Missions

Alternative 3 includes the activities proposed in Alternatives 1 and 2, with an overall mission and/or expendables increase of 100 percent of the maximum baseline, which is double the current maximum amount from any one baseline year. Table 2-2 presents missions and expendables for Alternative 3. Changes over the previous alternatives are shaded.

Table 2-2. Alternative 3: Increase Missions and Expendables by 100 Percent (Changes Shaded)

Location	Use Category	Activity	Max Yearly Missions	No. of People/Year	No. of Days/ Mission	No. of Mission Days/Year	People-Days/Year[a]	Boats/ Mission	Boat- Miles/ Mission
Estuarine	Special Ops	Training, Testing[b]	440	8,200	1	440	8,200	4	4
	Navy EOD Training[c]	Classes	8	200	10	80	2,000	2	2
		Misc.	12	120	1	12	120	2	30
		Para/boat ops training[d]	30	300	1	30	300	1	4
	Testing Support[e]	Sensor/ technology, LCAC	10	160	5	50	800	3	150
	Live Fire	LCAC, TA A-22	2	20	1	2	40	3	50
Riverine	Special Ops	Training, Testing	20	2,300	4	80	9,200	25	16

Location	Use Category	Activity	Boat-Miles/ Year	Landings/ Year[f]	Paradrop/ Paratroop/ Mission	Helo/ Paradrop/ Mission	Helo Drops/Year[g]	Hover-Hours[h]	Expendables/ Year
Estuarine	Special Ops	Training, Testing	3,200	1,760	20	<1	180	180	630 M-18 200 flares
	Navy EOD Training[c]	Classes	450	320	0	0	0	0	30 recall devices
		Misc.	360	50	0	0	0	0	0
		Para/boat ops training	120	30	10	1	30	30	0
	Testing Support	Sensor/ technology, LCAC	4,200	40	10	0	0	0	20 M-18s
	Live Fire	LCAC, TA A-22	300	4	0	0	0	0	<2,000 30 mm TP rounds
Riverine	Special Ops	Training, Testing	8,000	2,000	10	<1	10	10	60 lightsticks

[a]No. of people/year x No. of mission days.
[b]Testing missions account for approximately <1% of all special operations missions and involve similar activities as training missions.
[c]The Navy EOD School could accommodate an additional two classes (an increase of 33%) for a total eight classes per year of 25 students plus other miscellaneous training events that occur in Santa Rosa Sound and Choctawhatchee Bay.
[d]Small boat ops and paradrop operations are desired at an estimated level of 30 days per year similar to activities currently conducted by the 23 STS.
[e]Majority of test missions involved LCAC and two safety boats; mileage based on round trip from A-22 to A-13B.
[f]Landings refers to boat ramp use and LCAC crossovers and land transitions; other testing boats and large Navy EOD boats use docking facilities.
[g]Helo drops based on maximum number of missions involving paratroop/paradrop from a given year. For D-54, approximately 78 missions in 1999 involved helo drops and retrievals. East Bay usually has two per year and Santa Rosa Sound about 10.
[h]Assumes that each drop and retrieval phase takes approximately 30 minutes.

2.2.4 Alternative 4: Alternative 3 Plus the Establishment of a Live-Fire Estuarine/Marine Beach Range

Alternative 4 proposes all of the activities described in Alternatives 1, 2, and 3 with the establishment and weekly day/night use of a Live-Fire Estuarine/Marine Beach Range (Table 2-3). Two locations would be used, Alaqua Point/D-84 in Choctawhatchee Bay, and SRI near Test Site A-13B, each possessing slightly different capabilities in terms of the caliber of munitions that could be accommodated. An estimated ten trainees would participate in a given mission.

Mission Description for Santa Rosa Island Live-Fire Range

The SRI live-fire range would be a designated area a maximum of one mile in width extending from the Gulf side of SRI to the Sound side, and located near Test Site A-13B (Figure 2-1). This range would enable Special Operations Forces (SOF) to conduct hot insert/extraction and "break contact" training drills using boats and/or swimmers in a coastal beach environment. The frequency of use would be biweekly. Guards posted in bunkers flanking the east-west bounds of the range would call a cease-fire in the event of a boat or aircraft entering the firing fan. Eligible cultural resources exist on SRI; therefore, AAC/EMH must be notified before activities commence.

Some live-fire capability exists within the SRI and Santa Rosa Sound airspace. The airspace has an established controlled firing area, previously used during a live-fire LCAC Test. During this test, an LCAC positioned in Santa Rosa Sound fired 30-mm rounds at targets on SRI and in the direction of the Gulf of Mexico.

For biweekly training use as projected under an established Live-Fire Beach Range, small caliber weapons between 5.56 mm and .50 caliber (cal) would be used and fired in a seaward direction only. If available, soldiers would use frangible munitions with a 200-meter range or those of non-lead composition (i.e., tungsten) to reduce or eliminate potential environmental and safety concerns. Larger caliber weapons such as the 30 mm would potentially be used on an intermittent basis.

The general mission requirements would include transit by boat to an approved live-fire site, where trainees could engage in fixed or pop-up targets. The live-fire engagement scenario would last approximately 30 minutes, while the actual firing duration would be on the order of 2 or 3 minutes, after which troops would move ashore to capture an objective. In addition to inflatable boats, larger boats such as the Mark 5 would also be potentially employed. The Mark 5 is 81 feet long and highly maneuverable and can achieve speeds of 51 knots. Mark 5 guns include either a GAU-19 or a GAU-13, which is the type of gun that fired the 30 mm in a previous LCAC test mission. Rounds fired would potentially include 20 mm, 30 mm, 40 mm and small-caliber munitions from 5.56 mm to .50 cal. High explosive rounds would not be used; practice rounds would be employed.

Table 2-3. Alternative 4: Alternative 3 Plus Live-Fire Estuarine/Beach Range Capability

Location	Use Category	Activity	Max Yearly Missions	No. of People/ Year	No. of Days/ Mission	No. of Mission Days/Year	People-Days/Year [a]	Boats/ Mission	Boat-Miles/ Mission
Estuarine	Special Ops	Training, Testing[b]	440	8,200	1	220	4,100	4	4
	Navy EOD Training[c]	Classes	8	200	10	80	2,000	2	2
		Misc.	12	120	1	12	120	2	30
		Para/boat ops training[d]	30	300	1	30	300	1	4
	Testing Support[e]	Sensor/technology, LCAC	10	160	5	50	800	3	150
	Live Fire	LCAC Testing, TA A-22	2	20	1	2	40	3	50
		Special Ops Bi-weekly Training	24	240	1	24	240	5	20
		Quarterly Mk-5 Boat Training	4	40	1	4	40	3	50
Riverine	Special Ops	Training, Testing	20	2,300	4	160	18,400	25	400

Location	Use Category	Activity	Boat-Miles/ Year	Landings/ Year[f]	Paradrop/ Paratroop/ Mission	Helo/ Paradrop/ Mission	Helo Drops/Year [g]	Hover-Hours[h]	Expendables/ Year
Estuarine	Special Ops	Training, Testing	3,200	1,760	20	<1	180	180	630 M-18 200 flares
	Navy EOD Training[c]	Classes	450	320	0	0	0	0	30 recall devices
		Misc.	360	50	0	0	0	0	0
		Para/boat ops training	120	30	10	1	30	30	0
	Testing Support	Sensor/technology, LCAC	4,200	40	10	0	0	0	20 M-18s
	Live Fire	LCAC Testing, TA A-22	300	4	0	0	0	0	<2,000 30 mm TP rounds
		Special Ops Bi-weekly Training[i]	480	240	10	1	30	30	30,000 rounds small caliber (5.56 to 50 cal)
		Quarterly Mk-5 Boat Training	600	0	0	0	0	0	4,000 rounds 5.56 to 40 mm practice grenades
Riverine	Special Ops	Training, Testing	16,000	4,000	10	<1	20	20	60 lightsticks

[a]No. of people/year x No. of mission days.
[b]Testing missions account for approximately <1% of all special operations missions and involve similar activities as training missions.
[c]The Navy EOD School could accommodate an additional 2 classes (an increase of 33%) for a total 8 classes per year of 25 students plus other miscellaneous training events that occur in Santa Rosa Sound and Choctawhatchee Bay.
[d]Small boat ops and paradrop operations are desired at an estimated level of 30 days per year similar to activities currently conducted by the 23 STS.
[e]Majority of test missions involved LCAC and two safety boats; mileage based on round trip from A-22 to A-13B.
[f]Landings refers to boat ramp use and LCAC crossovers and land transitions; other testing boats and large Navy EOD boats use docking facilities.
[g]Helo drops based on maximum number of missions involving paratroop/paradrop from a given year. For D-54, approximately 78 missions in 1999 involved helo drops and retrievals. East Bay usually has two per year and Santa Rosa Sound about 10.
[h]Assumes that each drop and retrieval phase takes approximately 30 minutes.
[i]Number of rounds estimated at 1,000 rounds or less per mission of all calibers; small caliber rounds would be expended in greater numbers than large caliber rounds.

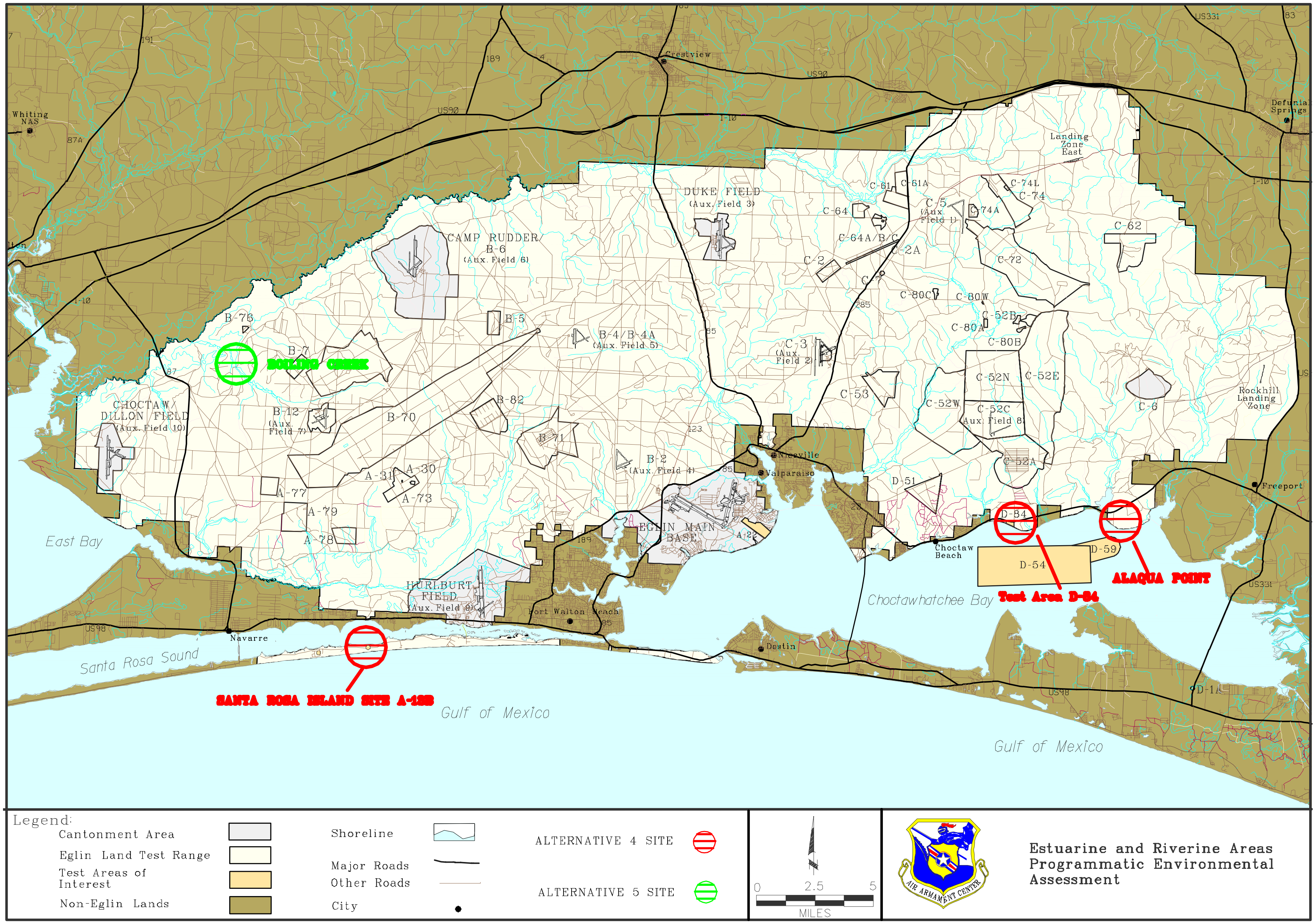

Figure 2-1. Potential Sites for Alternative 4 and 5

The Alaqua Point/D-84 Live-Fire Area

The Alaqua Point/D-84 live-fire area would enable small teams of special operations units to drop into D-54 or D-59 from helicopters or fixed-wing aircraft and boat or swim ashore to conduct live fire on fixed targets (Figure 2-1). Existing buildings would serve as mission objectives. Ammunition would be 5.56 mm and targets would be of wood or cardboard construction erected in front of earthen berms. The berms would serve as ammunition stops. Boats would either be motorized, or nonmotorized rubber rafts. Each mission would consist of one team of about six people. At either location, troops would be retrieved via helicopter or truck. Due to the proximity of Highway 20, only blank fire would be conducted at the D-84 area. Eligible cultural resources are present at Alaqua Point/D-84; therefore, AAC/EMH must be notified before activities commence.

2.2.5 Alternative 5: Alternative 4 Plus the Establishment of a Live-Fire Riverine Range

Mission Description

The Live-Fire Riverine Range would consist of a one-mile section of Boiling Creek that special operations units could use to conduct live fire and maneuver riverine warfare training. Frequency of use would typically be less than five times per year but analysis addresses a biweekly usage scenario to capture potential maximum usage periods. Lead-free training ammunition would be employed as practicable. Approximately 36,000 rounds annually would be expended during bi-weekly use. Less than 7,000 rounds annually would be expended for typical expected use (i.e. less than 5 times/year). This range would extend inward onto the reservation for an approximate distance of seven kilometers to accommodate the safety footprint of the weapons and subsequent placement of a safety or firing fan. If possible targets would be located in areas where the adjacent inland areas increase in topography; hilly terrain provides a natural bullet stop. Small caliber weapons between 5.56 mm and .50 caliber would be used. Approximately ten trainees per mission are estimated. Missions and expendables are listed in Table 2-4.

Six potential locations were reviewed for this alternative, one of which is the Boiling Creek area (Figure 2-1). Boiling Creek is located off of the Yellow River on Eglin property. It is nearby a seldom used Test Area, B-76, which would be used as a mission objective for units engaged in live-fire riverine training. Live fire would be directed at targets on Eglin property, preferably in an area where hilly terrain could provide a natural backstop. After live fire at shoreline targets, troops would come ashore and proceed to Test Area B-76, one mile to the northeast. Test Area B-76 is suitable for constructing a mock embassy or other types of buildings desired for realistic training objectives.

Table 2-4. Alternative 5: Alternative 4 Plus Riverine Live-Fire Capability

Location	Use Category	Activity	Max Yearly Missions	No. of People/Year	No. of Days/ Mission	No. of Mission Days/Year	People-Days/Year [a]	Boats/ Mission	Boat-Miles/ Mission
Estuarine	Special Ops	Training, Testing[b]	440	8,200	1	220	4,100	4	4
	Navy EOD Training[c]	Classes	8	200	10	80	2,000	2	2
		Misc.	12	120	1	12	120	2	30
		Para/boat ops training[d]	30	300	1	30	300	1	4
	Testing Support[e]	Sensor/ technology, LCAC	10	160	10	50	800	3	150
	Live Fire	LCAC Testing, TA A-22	2	20	1	2	40	3	50
		Special Ops Bi-weekly Training	24	240	1	24	240	5	20
		Quarterly Mk-5 Boat Training	4	40	1	4	40	3	50
Riverine	Special Ops	Training, Testing	20	4,600	4	160	18,400	25	400
	Live Fire	Special Ops Bi-Weekly Training[f]	24	240	1	24	240	5	20

Location	Use Category	Activity	Boat-Miles/ Year	Landings/ Year[g]	Paradrop/ Paratroop/ Mission	Helo/ Paradrop/ Mission	Helo Drops/Year [h]	Hover-Hours[i]	Expendables/ Year
Estuarine	Special Ops	Training, Testing	3,200	1,760	20	<1	180	180	630 M-18 200 flares
	Navy EOD Training[a]	Classes	450	320	0	0	0	0	30 recall devices
		Misc.	360	50	0	0	0	0	0
		Para/boat ops training	120	30	10	1	30	30	0
	Testing Support	Sensor/ technology, LCAC	4,200	40	10	0	0	0	20 M-18s
	Live Fire	LCAC Testing, TA A-22	300	4	0	0	0	0	<2,000 30 mm TP rounds
		Special Ops Training[j]	480	240	10	1	30	30	30,000 rounds small caliber (5.56 to .50 cal)
		Quarterly Mk-5 Boat Training	600	0	0	0	0	0	4,000 rounds 5.56 to 40 mm practice rounds
Riverine	Special Ops	Training, Testing	16,000	4,000	10	<1	20	20	60 lightsticks
	Live Fire	Special Ops Bi-Weekly Training	480	240	0	0	0	0	36,000 rounds of 5.56 to .50 cal

[a]No. of people/year x No. of mission days.
[b]Testing missions account for approximately <1% of all special operations missions and involve similar activities as training missions.
[c]The Navy EOD School could accommodate an additional 2 classes (an increase of 33%) for a total 8 classes per year of 25 students plus other miscellaneous training events that occur in Santa Rosa Sound and Choctawhatchee Bay.
[d]Small boat ops and paradrop operations are desired at an estimated level of 30 days per year similar to activities currently conducted by the 23 STS.
[e]Majority of test missions involved LCAC and two safety boats; mileage based on round trip from A-22 to A-13B.
[f]The distance from the nearest ramp to the target objective (B-76) on the Yellow River is 4 miles. Each training mission would involve four miles of travel with two special operations boats and three safety boats.
[g]Landings refers to boat ramp use and LCAC crossovers and land transitions; other testing boats and large Navy EOD boats use docking facilities.
[h]Helo drops based on maximum number of missions involving paratroop/paradrop from a given year. For D-54, approximately 78 missions in 1999 involved helo drops and retrievals. East Bay usually has two per year and Santa Rosa Sound about 10.
[i]Assumes that each drop and retrieval phase takes approximately 30 minutes.
[j]Number of rounds estimated at 1,000 rounds per mission of all calibers; small caliber rounds would be expended in greater numbers than large caliber rounds.

Live-fire targets would be portable, placed by hand in areas accessible by existing roads, or by small boat. Targets would be fixed or pop-up, constructed of cardboard or wood with wood or metal frames. Small areas (<10-feet diameter) of vegetation around the target may be hand-cleared, and extensive vegetative removal would not be required. Ground-burst simulators would be employed to simulate opposing fire and add an element of realism. Illumination flares would be employed during nighttime to illuminate the target area; 40-mm TP rounds are sometimes used for this purpose. Smoke grenades would also be used during this type of training.

The river trip would take about three hours in a rigid-hull inflatable or zodiac with outboard motor. The live-fire engagement scenario would last less than 30 minutes with actual firing time on the order of a couple of minutes. The weapons employed would include the Squad Automatic Weapon (SAW) capable of firing 5.56- or 7.62-mm rounds at a normal rate of 750 rounds per minute. Nine millimeter rounds may also be fired but to a lesser extent. The 9 mm is fired from a pistol one round at a time from a 15 round magazine. The SAW is belt-fed or M16 magazine-fed. A belt holds 200 rounds of ammunition with "disintegrating metallic split-link belts." A magazine holds 30 rounds. The effective range of the SAW is 1,000 meters for an area target; the maximum range is 3.6 kilometers (2.23 miles). The rate of fire is 725 rounds per minute cyclic and 85 rounds per minute sustained. Typically two gunners per boat would fire a total of 1,500 rounds for this exercise. The gunners' basic load is 600 rounds of ammunition (Federation of American Scientists, 2001). The preferred combination of ball ammo (M855) to tracer (M856) is 4 to 1 for the M249 (the SAW). If available, soldiers would use frangible munitions with limited range, or those of non-lead composition (i.e., tungsten) to reduce or eliminate potential environmental and safety concerns. The frequency of use is expected to be twice a month.

Larger calibers such as .50 cal and 40 mm require guns too heavy for use on an inflatable boat; thus if used, a sturdier vessel would be required.

Patrol boats would be stationed at each end of the Live-Fire Riverine Range during the exercise to prevent nonparticipants from entering the firing fan.

Controlling the Firing Area

The Eglin land area stops at the high water mark of the Yellow River. Initially, a Yellow River Live-Fire Training Range was considered (Appendix G), but in order to be able to conduct live-fire training exercises on the Yellow River, Eglin would have to **lease, own or otherwise control** both sides of the river to the extent that the entire safety footprint of the live-fire exercises were contained within the leased or controlled land (U.S. Air Force, 2002a).

Since the water area is a navigable waterway, it is federally owned. The river bottom is considered state of Florida submerged lands. An agreement with the state would be necessary to temporarily close a one-mile section of the Yellow River. Eglin has previously negotiated such agreements with the state, in particular for temporary highway closures.

2.3 COMPARISON OF ALTERNATIVES

Major differences are apparent between Alternative 1 (No Action) through Alternative 3 and the latter alternatives. Alternative 1 and Alternative 2 represent the baseline level of activity with no increase in intensity nor types of missions. Alternative 3 represents a 100 percent increase in activity of the same types of missions identified in Alternatives 1 and 2. New actions are introduced in Alternatives 4 and 5. Alternative 4 proposes to conduct small arms live-fire training in estuarine areas of the region of influence, whereas Alternative 5 proposes to conduct small arms live-fire training in a riverine location of the region of influence.

Whereas Alternatives 1, 2 and 3 represent a continuation of the present use of the estuarine and riverine areas, Alternatives 4 and 5 involve marked changes in mission profiles, and have inherently greater potential for environmental effects particularly with issues of restricted access, direct physical impact and habitat alteration.

Table 2-5 presents a comparison of environmental impact analysis results for all alternatives.

2.4 PREFERRED ALTERNATIVE

The Preferred Alternative is Alternative 5, which establishes a small arms live-fire training range on Boiling Creek. This alternative also incorporates actions from the previous alternatives, including a 100 percent increase in activity (Alternative 3), and the establishment of a live-fire range on SRI, Alaqua Point and D-84 (Alternative 4). Potential environmental impacts would be managed through careful placement of targets and the use of limited range, non-lead projectiles as well as several live-fire range best management practices. Target placement would consider the locations of sensitive plant and animal species, cultural resources, and proximity of populated areas in order to avoid the most impactive areas while meeting mission requirements. Using limited range munitions would reduce safety footprints and minimize concerns to the public and reduce the damage to vegetative habitats.

Table 2-5. Comparison of Environmental Impact Analysis Results for All Alternatives

Environmental Issues	No Action Alternative	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Restricted Access Impacts					
Number of Closures/Year (one hour duration)					
Choctawhatchee Bay	1	1	2	28	28
Santa Rosa Sound (closures cannot exceed 2x weekly for more than one hour per U.S. Coast Pilot)	1	1	2		
East Bay/River	0	0	0	0	0
Yellow River	0	0	0	0	28
Noise Impacts					
To the Public from Aircraft: Average Noise Criteria: Not Exceed 65 L_{dn} for Annoyance					
Helicopter: Estuarine Areas	49.3 L_{dn}	49.3 L_{dn}	53.0 L_{dn}	53.0 L_{dn}	53.0 L_{dn}
Helicopter: Riverine Areas	42.8 L_{dn}	42.8 L_{dn}	45.8 L_{dn}	45.8 L_{dn}	45.8 L_{dn}
LCAC (at 500 feet)	43.5 L_{eq}	43.5 L_{eq}	46.5 L_{eq}	46.5 L_{eq}	46.5 L_{eq}
To the Public from Aircraft: Single Event Noise Criteria for Annoyance					
Helicopter: No exposure to 95 dBA	No occurrence	No occurrence	No occurrence	No occurrence	No occurrence
LCAC: No exposure to 90 dBA	May occur – can be managed	May occur – can be managed	May occur – can be managed	May occur – can be managed	May occur – can be managed
To the Public from Live Fire					
Noise from 30-mm Live Fire (leading edge at 500 feet): Not Exceed 62 L_{Cdn}	29.8 L_{Cdn}	29.8 L_{Cdn}	32.8 L_{Cdn}	32.8 L_{Cdn}	32.8 L_{Cdn}
Noise from Live Fire Small Arms Ranges (at 500 feet)	Not applicable	Not applicable	Not applicable	52.8 L_{Cdn}	53.0 L_{Cdn}
To Marine Mammals from Underwater Noise from Sensor Tests					
No marine mammals within hazard area. For MUDSS sensor testing, hazard area was 330-ft circle	Attainable with monitoring	Attainable with monitoring	Attainable with monitoring	Attainable with monitoring	Attainable with monitoring
Habitat Alteration					
Impacts to Wetlands	No Impacts	No Impacts	No Impacts	Potential to Affect. A section 404 permit would be required.	Potential to Affect. A section 404 permit would be required.
Impacts to Beach Dune from LCAC (acres)	Minimal effects to 20 acres	Minimal effects to 20 acres	Minimal effects to 20 acres	Minimal effects to 20 acres	Minimal effects to 20 acres
Impacts to Tier 1 (acres)	0	0	0	0 from frangible .50 cal	0 from frangible .50 cal

Table 2-5. Comparison of Environmental Impact Analysis Results for All Alternatives Cont'd

Environmental Issues	No Action Alternative	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Habitat Alteration Cont'd					
Impacts to Tier 2 (acres)	0	0	0	0 from frangible .50 cal	9.9 acres from frangible .50 cal
Impacts to Potential Flatwoods Salamander Habitat	0	0	0	50 acres	54.2 acres (4.2 from Boiling Creek) from frangible .50 cal
Debris					
Irretrievable Debris (lb/yr)	Minimal	Minimal	Minimal	390 lb brass shell casings	650 lb brass shell casings (260 lb Alt.5 + 390 lb Alt. 4)
Chemical Materials					
Estuarine and Riverine Boat Emissions (lb pollutant/yr)					
Nitrogen Oxides	24.7	24.7	49.4	51.5	52.4
Carbon Monoxide	9,300	9,300	18,600	19,381	19,733
Total Hydrocarbons	2,533	2,533	5,066	5,278	5,374
Helicopter Air Emissions (lb pollutant/yr)					
PM_{10}	497	497	993	993	993
Sulfur Oxides	522	522	1,044	1,044	1,044
Nitrogen Oxides	2,298	2,298	4,596	4,596	4,596
Carbon Monoxide	570	570	1,140	1,140	1,140
Volatile Organic Compounds	18.6	18.6	37	37	37
Live-Fire Emissions (lb pollutant/yr)					
Carbon Monoxide	Negligible	Negligible	Negligible	10	19
Hydrogen Sulfide	Negligible	Negligible	Negligible	2.6	4.9
Lead	Negligible	Negligible	Negligible	.16	.3
Live-Fire Projectile By-products (mg/kg) in Soil for 5-year Period with BMPs over a 1-Acre Target Area					
Copper	Negligible	Negligible	Negligible	67.1	67.1
Lead	Negligible	Negligible	Negligible	80.7	80.7
Tin	Negligible	Negligible	Negligible	79.0	79.0
Tungsten	Negligible	Negligible	Negligible	89.6	89.6
Zinc	Negligible	Negligible	Negligible	72.7	72.7

Table 2-5. Comparison of Environmental Impact Analysis Results for All Alternatives Cont'd

Environmental Issues	No Action Alternative	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Direct Physical Impact					
Impacts to Submerged Vegetation (acres) from Boats	0	0	0	0	0
Impacts to Threatened and Endangered Species (Flatwoods Salamander) from Foot Traffic	Low Potential	Low Potential	Low Potential	Low Potential	Low Potential
Impacts to Sensitive Plant Communities (acres) from Foot Traffic	0	0	0	0	0
Impacts to Cultural Resources from Foot Traffic	None with continued coordination with AAC/EMH	None with continued coordination with AAC/EMH	None with continued coordination with AAC/EMH	Potential to affect. Coordination with AAC/EMH required for Alaqua Point/ D-84 locations	Potential to affect. Coordination with AAC/EMH required for Boiling Creek location
Impacts to Mission: Erosion at Riverine Boat Landings	Major Degradation of Landing – intervention Required	Major Degradation of Landing – intervention Required	Major Degradation of Landing – intervention Required	Major Degradation of Landing – intervention required	Major Degradation of Landing – intervention required
Impacts to Threatened and Endangered Species from Live Fire	Low Potential	Low Potential	Low Potential	Potential to affect Flatwoods Salamanders, Piping Plover; consultation required	Potential to affect Flatwoods Salamanders, Piping Plover; consultation required
Impacts to Sensitive Plant Communities from Live Fire	Low Potential	Low Potential	Low Potential	Potential to affect Tier 1 habitat at Alaqua Point.	Potential to affect Tier I at Alaqua and Significant Botanical Site at Boiling Creek
Impacts to the Public from Live Fire	None	None	None	None with management/ safety procedures in place	None with management/ safety procedures in place

dBA = A-Weighted Decibels; L_{dn} = Day-Night Average Sound Levels; L_{Cdn} = Day-Night Average Noise Level Associated with C-Weighted Noise;
L_{eq} = Equivalent Sound Level; $L_{eq(24)}$ = 24-Hour Equivalent Sound Level; mg/kg = Milligrams per Kilogram; lb/yr = Pounds per Year

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3. AFFECTED ENVIRONMENT

The Affected Environment includes physical, biological, and anthropogenic resources of the estuarine and riverine areas in and around Eglin AFB that are subject to effects from military testing and training, and in particular surface operations testing and training. Physical resources include sediments, surface water and water quality, groundwater, geology, and the air. Descriptions of the local climate and weather are provided as they may often play a role in the fate, transport, and propagation of many of the effectors.

The biological resources discussion includes a description of the ecology, plant and animal species, and habitats of the estuarine and riverine areas within which operations take place. Of particular importance is the discussion of threatened and endangered species, their occurrences and status, and Florida Natural Area Inventories (FNAI) sensitive botanical habitats that occur along the banks of Choctawhatchee Bay, Santa Rosa Sound, the Yellow River, Blackwater Bay, East Bay, and the East Bay River.

The anthropogenic environment encompasses human disturbances and constructed resources, either historical or current, that may be potentially affected or whose presence may create a conflict with the proposed riverine-based missions. Anthropogenic resources include structures and materials from past and current military and nonmilitary activities such as cultural resources (i.e., historic and prehistoric sites), Installation Restoration Program/Area of Concern (IRP/AOC) sites, UXO, roads, targets, and facilities.

3.1 PHYSICAL RESOURCES

3.1.1 Setting Description

Estuarine

Choctawhatchee Bay and Santa Rosa Sound are adjacently located in the northwest Florida panhandle. The Bay is located within Okaloosa and Walton counties and is bordered by the Choctawhatchee River and forestland on the east and northeast and by urbanized areas on the west and northwest. The Sound is located in Okaloosa and Santa Rosa counties. The Bay is supplied with freshwater by the Choctawhatchee River, the fourth largest river (in terms of flow) in the state. The surrounding basin drains an area of over 10,400 km^2 (4,000 mi^2) and extends up into portions of Alabama. Destin, Fort Walton Beach, Eglin AFB, and Niceville-Valparaiso are all situated along the westernmost shore of the Bay. Choctawhatchee Bay is characterized by five primary hydrographical features that support distinct habitat types: bayous; western saline areas and the East Pass, which connects directly with the Gulf of Mexico, providing the primary source of saltwater; the eastern river delta, which provides the primary source of freshwater; deep central sections; and shallow shelf areas (Livingston, 1986). Resource descriptions for Choctawhatchee Bay are provided in greater detail in the Choctawhatchee Bay Resource Summary Report, a synopsis of selected research projects and data on the Bay (U.S. Air Force, 1996).

Choctawhatchee Bay has a surface area of 335 square kilometers (129 square miles) and is 48 kilometers (30 miles) long and 1.6 to 9.6 kilometers (1 to 6 miles) wide. The Bay basin covers 1,817 square kilometers (699 square miles) (Livingston, 1986). The accompanying river drainage basin covers an area of 11,398 to 12,142 square kilometers (4,384 to 4,670 square miles) (McNulty et al., 1972; Barnett and Teehan, 1989; Livingston, 1986). The estuarine drainage area encompasses 5,873 square kilometers (2,259 square miles). Water depth averages between 3 meters (10 feet) in the eastern third of the Bay and 9 meters (30 feet) in the western portion. The deepest area, in the westernmost section of the Bay, is 13 meters (43 feet) (USDA SCS, 1993).

Santa Rosa Sound is a narrow, brackish water lagoon that separates SRI from the mainland. There are no large direct freshwater (i.e., riverine) inputs into Santa Rosa Sound, although there are some small drainages. Saltwater exchange occurs via the Choctawhatchee Bay and Pensacola Bay systems, located at either end of the 50-mile-long body of water.

Riverine

The Yellow River forms 38 miles of the northwest boundary of the Eglin reservation beginning at a point 5 miles northwest of Camp Rudder and winding in a southwesterly direction until flowing into Blackwater Bay near Choctaw Field. East Bay borders approximately 1.6 miles of the Eglin reservation's westernmost edge, and the East Bay River forms approximately 4 miles of the southern boundary of the reservation. East Bay and Blackwater Bay are part of the larger estuarine system of Pensacola Bay.

3.1.2 Climate

Generally, Eglin experiences a mild, subtropical climate as a consequence of its latitude (30° to 31°) and the stabilizing effects of the Gulf of Mexico and inland bays. The climate is characterized by warm, humid summers and mild winters, prevailing southerly winds, and intense thunderstorm events and hurricane cycles (U.S. Air Force, 1996a). The Gulf of Mexico, Choctawhatchee Bay, and numerous marshes and swamps add moisture to the air and moderate winter and summer temperatures (Wolfe et al., 1988).

Temperature and Rainfall

The proximity of these water bodies coupled with terrain that slopes from sea level to 266 feet 15 miles northeast creates a dominant summer weather phenomena known as the Crestview Line (so named because of its proximity to the town of Crestview, Florida). This weather formation creates a line of showers and thunderstorms parallel to the coast 10 to 25 miles inland based on the strength of the Gulf sea breezes. During peak summer periods, rainfall may occur almost daily. The effects of this weather phenomenon are also observed to a lesser extent throughout the year.

For the baseline period, the mean annual temperature was 68 °F (degrees Fahrenheit) with temperatures equal to or below 32 °F on an average of 18 days and equal to or above 90 °F on an average of 50 days. The mean annual precipitation was 61.8 inches. Thunderstorms occurred on an average of 80 days and measurable amounts of precipitation occurred on an average of 106 days. Mean annual wind speed was 5 knots and the prevailing surface wind directions were northerly with calm winds occurring 18.9 percent of the time (Brano, 1994). The two peak rainfall periods are the primary period June through August and the secondary period February through April. Although the area experiences large amounts of rainfall, extensive droughts occur (Wolfe et al., 1988). A monthly weather summary for the baseline period is presented in Table 3-1.

Table 3-1. Monthly Summary of Eglin AFB Baseline Climatic Data

Month	Temperature (mean °F)	Precipitation (mean inches)	Comments
January	51	4.2	Coldest month; polar fronts passed on average every 4 to 5 days; severe thunderstorms rare
February	54	4.5	Similar to January
March	60	6.0	Transitional warming and rainfall trend between winter and spring particularly toward the end of the month; squall lines ahead of polar fronts produce severe afternoon thunderstorms
April	67	4.5	Warmer temperatures and general decrease in frontal passage precipitation; Crestview line showers active as sea breeze fronts push inland
May	74	3.6	Normally the driest spring month; beginning of long warm to hot, humid season; Crestview line showers active as sea breeze fronts push inland
June	80	5.4	Warm and humid; scattered afternoon thunderstorms, beginning of tropical storm and hurricane season
July	82	8.0	Wettest month; intermittent scattered thunderstorms as southern maritime sea breezes move inland
August	82	6.9	Warm, wet, and humid; intermittent scattered thunderstorms as southern maritime sea breezes move inland
September	78	6.6	Transition between hot, humid summer and fall; sea breeze-related precipitation gives way to frontal passage storms; increase in tropical storm and hurricane potential
October	69	3.5	Driest month; cooler with occasional weak frontal system storms; decline in tropical storm and hurricane potentials
November	60	3.8	Cooler, drier air; weak frontal passage storms; end of tropical storm and hurricane season
December	54	4.6	Polar fronts passed on average of every 4 to 5 days with associated moderate rainfall; severe thunderstorms rare

Source: Brano, 1994

Rainfall data for Niceville, situated on the north shore of Choctawhatchee Bay, was obtained from the Northwest Florida Water Management District (NWFWMD) and is presented in Table 3-2. From 1996 to 1999, average monthly amounts varied from 3.04 to 11.82 inches; annual totals ranged from 50.35 to 94.04 inches. The natural pH of Florida rainwater is 4.65 to 4.75.

Table 3-2. Monthly Rainfall Data for Niceville (1996 – 1999)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1996	5.42	7.53	8.64	13.52	1.87	7	7.62	9.16	9.66	4.33	2.4	6.85	84
1997	8.06	6.69	3.05	7.94	6.38	3.72	10.71	7.3	4.26	3.58	7.28	6.49	75.46
1998	10.91	12.59	6.74	2.2	0.88	1.37	7.48	10.58	31.41	0.41	3.22	6.25	94.04
1999	4.26	1.5	4.3	1.66	5.18	5.19	7.02	4.83	1.95	3.85	4.05	6.56	50.35
AVG	**7.16**	**7.08**	**5.68**	**6.33**	**3.58**	**4.32**	**8.21**	**7.97**	**11.82**	**3.04**	**4.24**	**6.54**	**75.96**

Rainfall data for Milton, which is 35 miles from Niceville and situated near the Yellow River, is presented in Table 3-3 below. From 1996 to 1999, average monthly amounts varied from 2.68 to 7.56 inches; annual totals ranged from 53.07 to 66.61 inches.

Table 3-3. Monthly Rainfall Data for Milton (1996 – 1999)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1996	5.67	4.72	10.62	8.92	0.64	4.36	6.87	9.29	5.24	1.3	2.67	5.13	65.43
1997	4.67	6.86	3.86	6.24	3.73	9.12	6.51	6.5	1.94	4.75	10.68	ND	64.86
1998	ND	8.24	8.95	3.83	2.99	0.97	5.31	4.42	21.73	0.21	5.91	4.05	66.61
1999	6.32	1.45	5.55	2.52	6.04	8.51	6.47	3.71	1.33	4.47	2.97	3.73	53.07
AVG	**5.55**	**5.32**	**7.25**	**5.38**	**3.35**	**5.74**	**6.29**	**5.98**	**7.56**	**2.68**	**5.56**	**3.89**	**62.49**

ND = no data

Winds

Prevailing winds are usually from the south in summer and the north in winter. Warm westerly winds originate from the Gulf of Mexico during the summer providing cooling on-shore breezes along the coast. The Gulf of Mexico moderates extremes in winter temperatures by providing heat in the winter. Winds from the northwest bring frontal systems of low precipitation and long duration in the winter. The lowest average velocity winds occur in August and the windiest month is March.

For northwest Florida, daytime-mixing heights are higher than most of the continental United States. Average morning mixing heights for northwest Florida range from 1,650 to 3,300 feet above ground level (AGL) in the summer to 1,650 to 2,300 feet AGL in the winter. Average afternoon-mixing heights are from 2,650 to 3,300 feet AGL in the winter to 4,600 to 5,250 feet AGL in the summer. Measurements of wind speed for 1995 through 1996 at Eglin Main showed a monthly average ranging from 6 to 9 knots.

Inversions

Almost every morning, ground-based inversions occur at the base and break during the morning with surface heating. When the air temperature increases with height at a rate such that the air remains very stable and little mixing of the air occurs, there is an inversion. Ground-based inversions occur due to radiative cooling at the ground. For approximately five to seven days in the winter, the inversion does not break up due to a deep layer of sea fog that slows surface heating. Low wind speeds in these situations are typical (U.S. Air Force, 1996a).

Storm Systems

Thunderstorms during the warmer months normally last from 2 to 3 hours (Brano, 1994). Tropical storms and hurricanes are additional weather events that have had a pronounced impact on the landscape.

Eglin AFB is vulnerable to tropical storms and hurricanes that originate off the west coast of North Africa and the Caribbean. The hurricane season lasts from 1 June to 30 November with Eglin historically being most impacted by storms that occur in August and September.

3.1.3 Air Quality

Air quality in a given location is described by the concentration of various pollutants in the atmosphere, generally expressed in units of parts per million (ppm) or micrograms per cubic centimeter. Air quality is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions.

Identifying the affected area for an air quality assessment requires knowledge of pollutant types, source emissions rates and release parameters, proximity relationships of project emission sources to other emissions sources, and local and regional meteorological conditions. For inert pollutants (those that do not participate in photochemical reactions; i.e., all pollutants other than ozone and its precursors), the affected area is generally limited to an area extending a few miles downwind from the source.

Pollutant concentrations are compared to federal and state ambient air quality standards to determine potential affects. These standards represent the maximum allowable atmospheric concentration that may occur and still protect public health and welfare, with a reasonable margin of safety. The national ambient air quality standards (NAAQS) are established by the U.S. Environmental Protection Agency (USEPA). In order to protect public health and welfare, the USEPA has developed numerical concentration-based standards or NAAQS for six "criteria" pollutants (based on health-related criteria) under the provisions of the Clean Air Act Amendments of 1970 (CAA). There are two kinds of NAAQS: primary and secondary standards. Primary standards prescribe the maximum permissible concentration in the ambient air to protect public health including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards prescribe the maximum concentration or level of air quality required to protect public welfare including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. NAAQS have been established for: (1) ozone, (2) nitrogen dioxide, (3) carbon monoxide, (4) sulfur oxides, (5) lead, and (6) particulate matter with an aerodynamic diameter less than or equal to 10 microns (Table 3-4). The NAAQS are the cornerstone of the CAA. Although not directly enforceable, they are the benchmark for the establishment of emission limitations by the states for the pollutants that USEPA determines may endanger public health or welfare.

Table 3-4. National and Florida Ambient Air Quality Standards

CRITERIA POLLUTANT	AVERAGING TIME	PRIMARY STANDARD[a,b,c]	SECONDARY STANDARD[a,b,d]	FLORIDA STANDARDS
Carbon monoxide (CO)	8-hour	10 mg/m^3	No standard	10 mg/m^3
	1-hour	40 mg/m^3	No standard	40 mg/m^3
Lead (Pb)	Quarterly	1.5 µg/m^3	1.5 µg/m^3	1.5 µg/m^3
Nitrogen dioxide (NO_2)	Annual	100 µg/m^3	100 µg/m^3	100 µg/m^3
Ozone (O_3)	1-hour[e]	235 µg/m^3	235 µg/m^3	235 µg/m^3
	8-hour[f]	157 µg/m^3	157 µg/m^3	157 µg/m^3
PM_{10}	Annual	50 µg/m^3	50 µg/m^3	50 µg/m^3
	24-hour[g]	150 µg/m^3	150 µg/m^3	150 µg/m^3
$PM_{2.5}$	Annual	15 µg/m^3	15 µg/m^3	15 µg/m^3
	24-hour[h]	65 µg/m^3	65 µg/m^3	65 µg/m^3
Sulfur Dioxide (SO_2)	Annual	80 µg/m^3	No standard	60 µg/m^3
	24-hour	365 µg/m^3	No standard	260 µg/m^3
	3-hour	No standard	1,300 µg/m^3	1,300 µg/m^3

Sources: Clean Air Act, 42 USC 7401 et seq.: Official Compilation of the Rules and Regulations of the State of Florida; Title 62 - Department of Environmental Protection, Chapter 62-272 - Air Pollution, Part III, Ambient Air Quality; MMS, 1990.

[a]National standards (other than ozone, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year.

[b]Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25 °C (degrees Celsius) and a reference pressure of 760 mm of mercury; ppm refers to parts per million by volume.

[c]National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

[d]National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[e]The ozone 1-hour standard still applies to areas that were designated nonattainment when the ozone 8-hour standard was adopted in July 1997.

[f]The ozone 8-hour standard is attained when the fourth highest 8-hour concentration in a year, averaged over three years, is equal to or less than the standard.

[g]The PM_{10} 24-hour standard is attained when 99 percent of the daily concentrations, averaged over three years, are equal to or less than the standard.

[h]The $PM_{2.5}$ 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard.

Florida has adopted the NAAQS except for sulfur dioxide (SO_2). USEPA has set the annual and 24-hour standards for SO_2 at 0.03 ppm (80 micrograms per cubic meter (µg/m^3)) and 0.14 ppm (365 µg/m^3), respectively. Florida has adopted the more stringent annual and 24-hour standards of 0.02 ppm (60 µg/m^3) and 0.01 ppm (260 µg/m^3), respectively. In addition, Florida has adopted the national secondary standard of 0.50 ppm (1,300 µg/m^3).

The fundamental method by which the USEPA tracks compliance with the NAAQS is the designation of a particular region as “attainment,” “nonattainment,” or “unclassifiable.” Areas meeting or having better air quality than the NAAQS are said to be in attainment. Areas that exceed the NAAQS are said to be in nonattainment. Areas that cannot be classified on the basis of available information as attainment or nonattainment are defined as unclassifiable and are treated as attainment areas. Attainment areas can be further classified as maintenance areas. Maintenance areas are areas that were previously nonattainment but have reduced pollutant concentrations below the standard and must maintain some of the nonattainment area plans to stay in compliance.

Information regarding the coastal areas of the northern Gulf indicates that most incidences of poor air quality are associated with large metropolitan areas (SAI et al., 1995). Episodes of poor air quality, termed exceedances by the USEPA, are an indication that the federal air quality standard for a regulated pollutant was surpassed.

Sources of emissions in and near the Bay and Sound are commercial fishing vessels, recreational vessels, intra-coastal barges, vehicles traveling along adjacent highways, wildfires, and control burns of adjacent land habitats.

3.1.4 Water Resources

Hydrogeography

Estuarine

Primary fresh and saline input sources in Choctawhatchee Bay are located at opposite ends of the system. The Choctawhatchee River at the eastern end supplies most of the freshwater with saline Gulf waters entering from East Pass at the western end. Groundwater entering through bayous is a secondary source of freshwater (Wolfe et al., 1988). Major drainage areas, including the Choctawhatchee River, are Rocky, Boggy, Alaqua, and LaGrange Bayous (Table 3-5). Pait et al. (1992) estimated the average daily inflow of freshwater into the Bay via the Choctawhatchee River to be 243 cubic meters per second (m^3/s) (8,500 cubic feet per second (cfs)). From 1992 through 1994, the average daily amount of river water discharged into the Bay was 203 m^3/s (7,093 cfs) (Hudson, 1995), which approximates the 1986 NWFWMD estimate of 219 m^3/s (7,664 cfs) (Livingston, 1986). Nearly twice as much river water was discharged into the Bay during 1994 than during the previous year, partly because Tropical Storm Alberto deposited a tremendous amount of rainfall into the Choctawhatchee River drainage basin. The Choctawhatchee River exerts the greatest influence on average Choctawhatchee Bay salinity since when river inflow is high, salinities are lower, and when river inflow is low, salinities are higher (Orlando et al., 1993).

Tides in Choctawhatchee Bay are minimal, currents are small, and the exchange of clean saline water from the Gulf of Mexico is generally low (Jones and Huang, 1994; Morang, 1992; Livingston, 1986; and Blaylock, 1983). Saline water enters the Bay primarily through East Pass and extends up to the Choctawhatchee River. Little mixing occurs with the overlying freshwater except during certain weather conditions. This bottom saltwater layer, known as a salt wedge, is not continually refreshed through exchange with the Gulf (Jones and Huang, 1994). This condition of vertical stratification of saline and fresh waters is not unusual in estuaries, but the low tidal exchange of Choctawhatchee Bay establishes a unique set of circumstances. The large quantities of freshwater entering the system through the river cause a net flow of water from the Bay through East Pass. Ebb flows have been noted to occasionally exceed incoming tidal waters. Current data collected by the U.S. Army Corps of Engineers (USACE) in 1983, 1984, and 1987 demonstrate that ebb currents in East Pass are stronger than flood currents (Morang, 1992). Small volumes of fresh water also exit through the Gulf Intracoastal Waterway at the eastern end of the Bay. The Bay bathymetry or range of water depths (deep at the western end with a shallow entrance to East Pass) and the normally low tidal range of the northern Gulf of

Mexico, are the primary causes for the vertical stratification. The average annual tidal range in the Bay is about 0.12 meters (0.5 feet). Tidal flows through East Pass peak at about 1,120 m^3/s (40,000 cfs), while flows through Santa Rosa Sound peak at about 280 m^3/s (10,000 cfs). Flow through the Intracoastal Waterway to the east peaks at about 84 m^3/s (3,000 cfs) (Maristany and Cason, 1984). The flushing rate has been estimated by Ross et al. (1974) to be less than 14 percent of new Gulf of Mexico oceanic water per tidal cycle. As a result of the low flushing and low currents, residence time of nutrients entering the Bay from the river and exiting through East Pass exceeds one year (Blaylock, 1983).

Table 3-5. Percent Drainage Area and Average Flow – Major Freshwater Sources for Choctawhatchee Bay (1982)

Freshwater Source	Drainage Area (square miles)	Percent of Total	Average Flow (1982)	Percent of Total Flow
Choctawhatchee River	4,670	90.92	7,664	83.3
Rocky Bayou	101.0	1.97	450	4.9
Boggy Bayou	89.8	1.75	400	4.3
Alaqua Bayou	127.0	2.47	329	3.6
LaGrange Bayou	64.3	1.25	160	1.7
Garnier Bayou	29.6	0.60	100	1.1
Basin Bayou	43.0	0.84	53	0.6
Cinco Bayou	11.7	0.23	40	0.4
TOTAL	5,136.4		9,196	

Source: NWFWMD, 2001; Livingston, 1986

Water temperatures fluctuate with season, influenced primarily by solar insulation and the surrounding air temperature. In some estuaries, tidal flow contributes to the regulation of water temperature. Tidal exchange in Choctawhatchee Bay is minimal, and its direct effect on temperature is probably restricted to the western area of the Bay near East Pass. Water temperature is one of many important biological limiting factors in estuaries. Increases in water temperature are often linked to phytoplankton blooms (along with nutrient increases), and during the summer, increased biological and chemical oxygen demand and ultimately low dissolved oxygen. Blaylock (1983) reported temperatures to be relatively constant spatially throughout the Bay, varying seasonally with changes in air temperature. Average water temperatures from the western and central portion of the Bay are 2 to 3 °C warmer than the eastern end, which receives a constant flow of river water. The mean annual water temperature of the Bay was reported to be 21.1 °C (70.0 °F) bay-wide (Blaylock, 1983).

Riverine

The riverine region of influence lies in the physiographic province of the Western Highlands, a subdivision of the Northern Highlands and the Gulf Coastal Lowlands. In general, the northern half of the Eglin reservation lies in the Western Highlands and the southern half lies within the Gulf Coastal Lowlands (Wolfe et al, 1988). Soil of the Western Highlands are derived from undifferentiated sands and clays of the Citronelle Formation and are dry on the upland slopes and ridge crests and frequently wet on the downslope areas as water seeps through to form seepage slope bogs. Within the region of influence, the Gulf Coastal Lowlands form an elevated sandy plateau, generally flat with many low coastal terraces.

Sediments of the East Bay and Blackwater Bay originated as a mixture of Pleistocene and Citronelle deposits and marine terrace sediments deposited during the Pleistocene epoch as a result of erosion occurring throughout the watershed (Wolfe et al., 1988). Presently, these sediments are eroding. Today, sediments primarily consist of unconsolidated sand, silts, and clays of the Coast Plain Province deposited before the last rise in sea level. Streams and wave action are the primary mechanism for sediment transport into the Pensacola Bay system to which East Bay and Blackwater Bay belong. Sediments are mainly composed of quartz, kaolinite, montmorillonite, and calcite, with finer grain sizes found in the center of the bay and coarse grain sizes along the edges of the system (Wolfe, et al., 1988).

The Yellow River originates in Covington County, Alabama, in the Conecuh National Forest, drains an area approximately 1,365 square miles, and empties into Blackwater Bay. The average flow of the Yellow River entering Blackwater Bay is 2,500 cfs. The Yellow River drains some of the highest elevations in Florida resulting in faster flows than other rivers in Florida (FDNR, 1991). It is composed of multiple channels with the main channel flowing through terrain as varied as swampy floodplain in Santa Rosa County to 40 foot high bluffs further north up the river (FDNR, 1991).

East Bay and Blackwater Bay are small tidally influenced shallow water bodies. The average depth of East Bay is 8 feet and the total areal coverage is 44 square miles. Blackwater Bay averages 6 feet deep and covers 10 square miles. Both receive drainage from numerous creeks, bayous, and ditches.

Tides in Blackwater Bay and East Bay are diurnal (i.e., one high and one low daily) with an average range of 1.6 feet (Wolfe et al., 1988). Approximately 19 percent of the entire water volume of the Pensacola Bay system is exchanged with each tidal cycle; complete exchange is estimated to occur every 18 days (FDNR, 1991). Tidal movements generate a net counterclockwise circulation in East Bay. Generally, fresh water from the Yellow River and Blackwater River moves south along the west shore of Blackwater Bay and water from the Gulf of Mexico moves north along the east shore. At times, winds may cause reversals in flow direction (FDNR, 1991).

Floodplain Management

Executive Order 11988, Floodplain Management, requires examination of actions involving construction (i.e., buildings, roads) within a floodplain for the potential to impact drainage patterns within the floodplain, or for the potential for people or structures to be impacted by flooding in order to minimize or prevent loss of life and property. The areas immediately surrounding the Yellow River, East Bay, and East Bay River are susceptible to flooding and are mainly located in the 100-year floodplain, with the potential for additional flood hazards at the mouth of the Yellow River. Areas within the 100-year floodplain have a 1 percent chance of being flooded in any given year. Specific flood-safe elevations have been identified for structures along the Yellow River and East Bay. Floodplains and elevation contours for the region of influence are presented in Figures 3-1 through 3-3.

Water Quality

Estuarine

Overall water quality in Choctawhatchee Bay is reported to be good, as defined by a Florida Department of Environmental Protection (FDEP) water quality index (Hand et al., 1994). FDEP's Environmental Regulation Commission has classified Rocky Bayou, located in northwest Choctawhatchee Bay, as Outstanding Florida Water (OFW), which is recognized as having exceptional recreational or ecological significance.

State waters are classified as Class I, II, III, IV, or V where Class I is potable water, Class II is for shellfish harvesting or propagation, Class III is for recreation and maintenance of a healthy fish and wildlife population, Class IV is for agricultural water, and Class V for navigation and industrial use. FDEP further regulates the harvest of shellfish from state waters by an additional classification based on the quality of water, and primarily the degree of pollution in Class II waters. Shellfish classification for Choctawhatchee Bay is presented in Figure 3-4. Water quality criteria for Class I, II and III waters are presented in Table 3-6.

The FDEP rates water quality in the Sound as "good" with little change over the last ten years (FDEP, 2000). Currents and tidal exchange are low due to the elongated shape of the Sound and the fact that water exchange and input takes place at opposite ends of the 50 mile long water body with no significant input in between. Water quality around the Navarre Waste Water Treatment Plant, which discharges into the Sound west of the region of influence, was deemed acceptable according to USEPA Water Quality Criteria for Class III waters, which are suitable for recreation and fishing (Butts and Ray, 1995). Most of the waters in the Sound are Class II waters, approved for shellfish harvesting (Florida Department of Agriculture, 2001).

The Sound, like other Gulf coastal waters, is susceptible to toxic dinoflagellate (a type of algae) blooms commonly known as red tide. Rapid increases in numbers of certain dinoflagellates, such as *Gymnodinium breve*, sometimes cause reddish, brownish, or yellow-green discoloration of the water. *Gymnodinium sp.* produces a neurotoxin that can create respiratory discomfort for some people as the toxins in the water become airborne through wind and surf, and can cause shellfish (clams and oysters) to become inedible and result in massive fish mortalities. The blooms are naturally occurring and typically originate 40 to 80 miles offshore before moving into coastal areas. In the northern Gulf, red tides are not associated with man-made pollution (Mote Marine Laboratory, 1996).

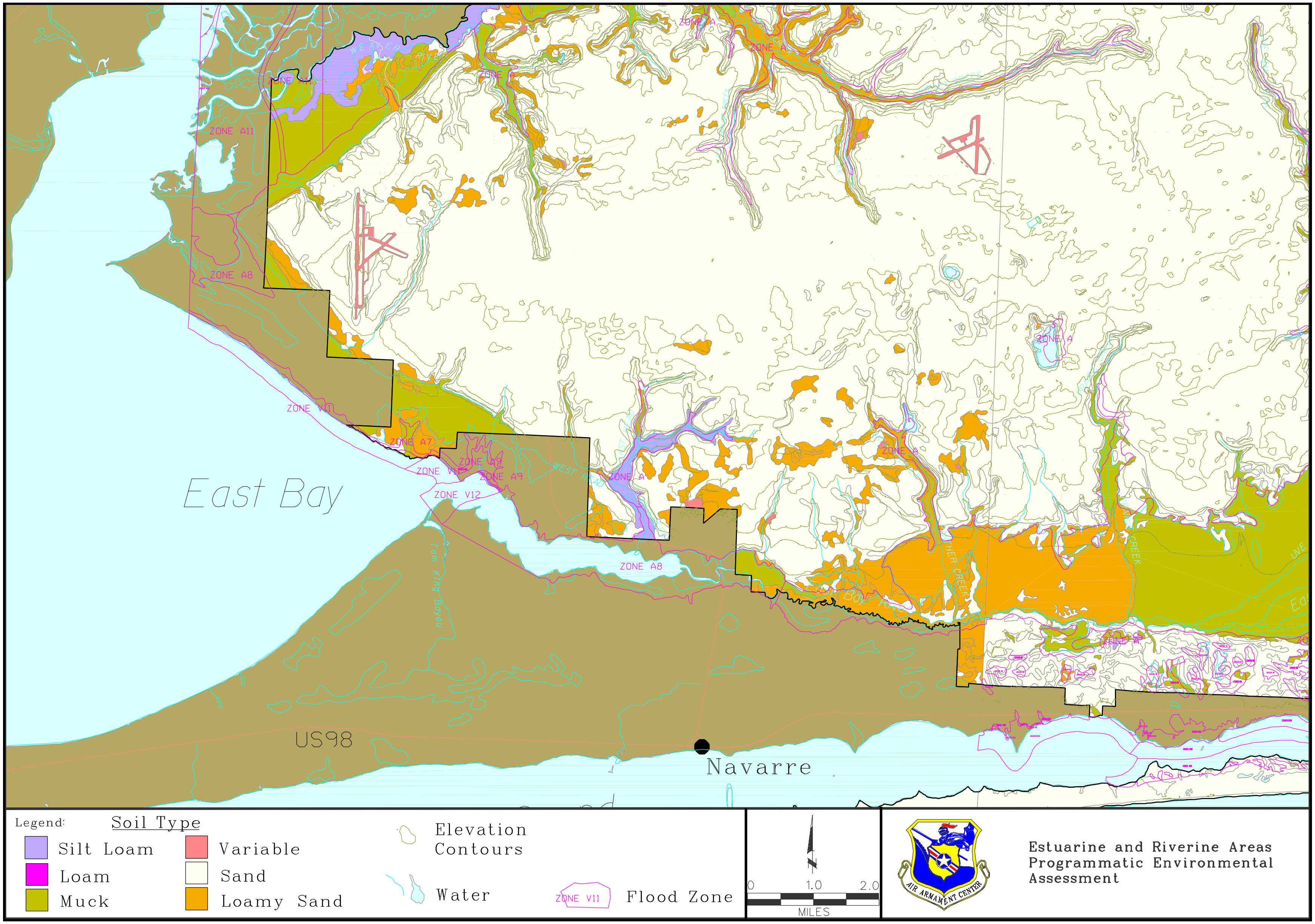

Figure 3-1. Topography and Soils Near East Bay and the East Bay River

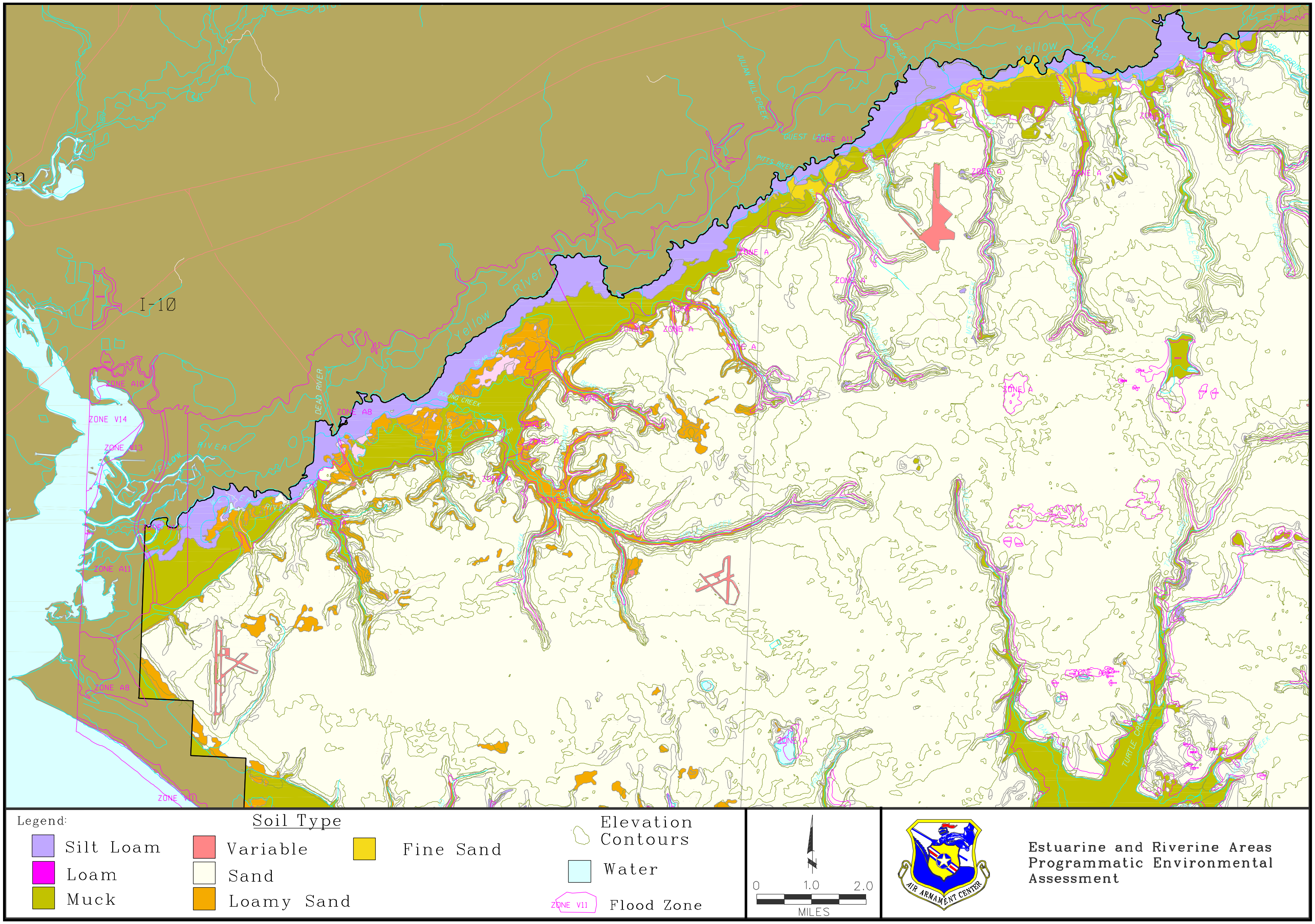

Figure 3-2. Topography and Soils Near the Yellow River

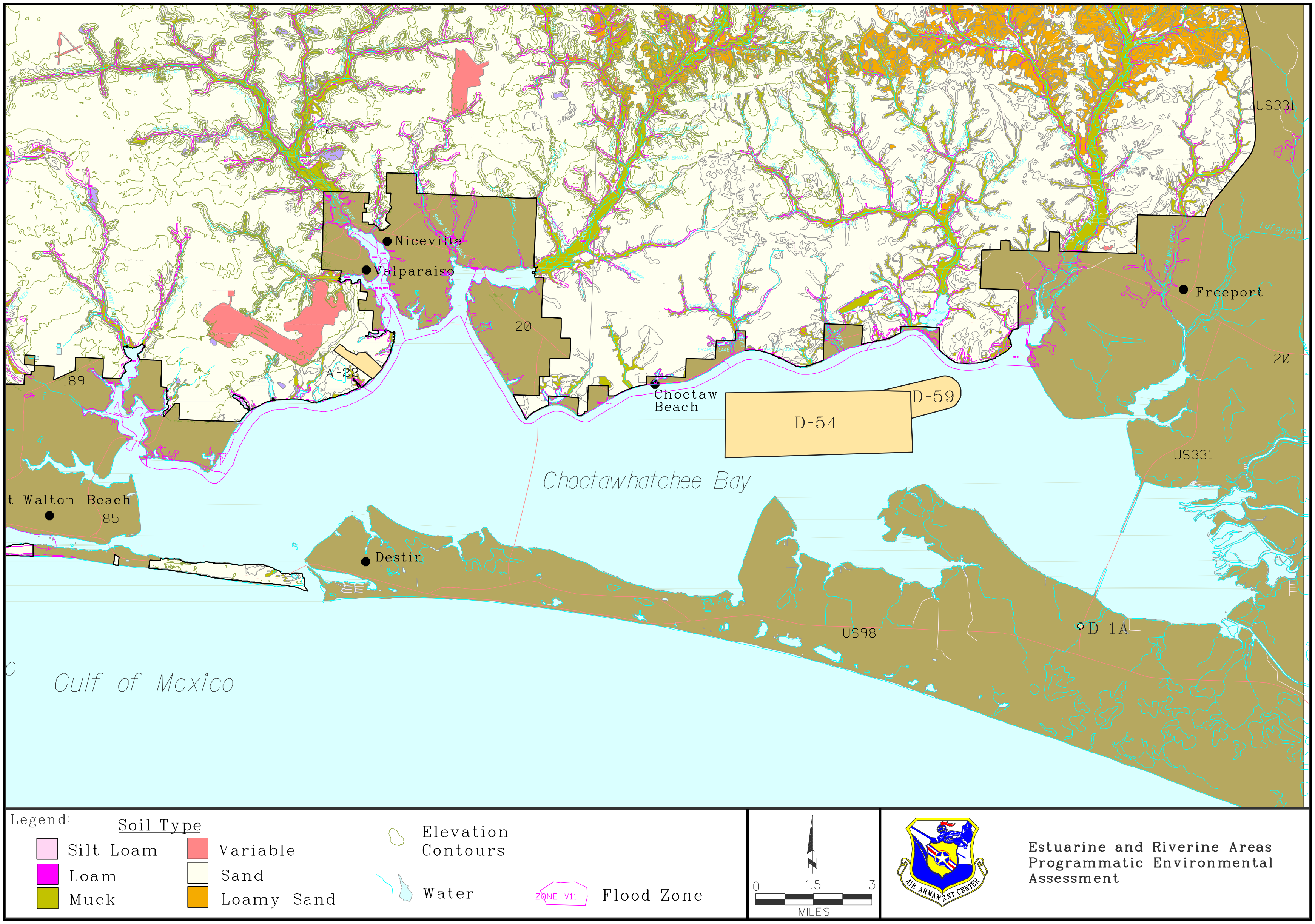

Figure 3-3. Topography and Soils Near Choctawhatchee Bay

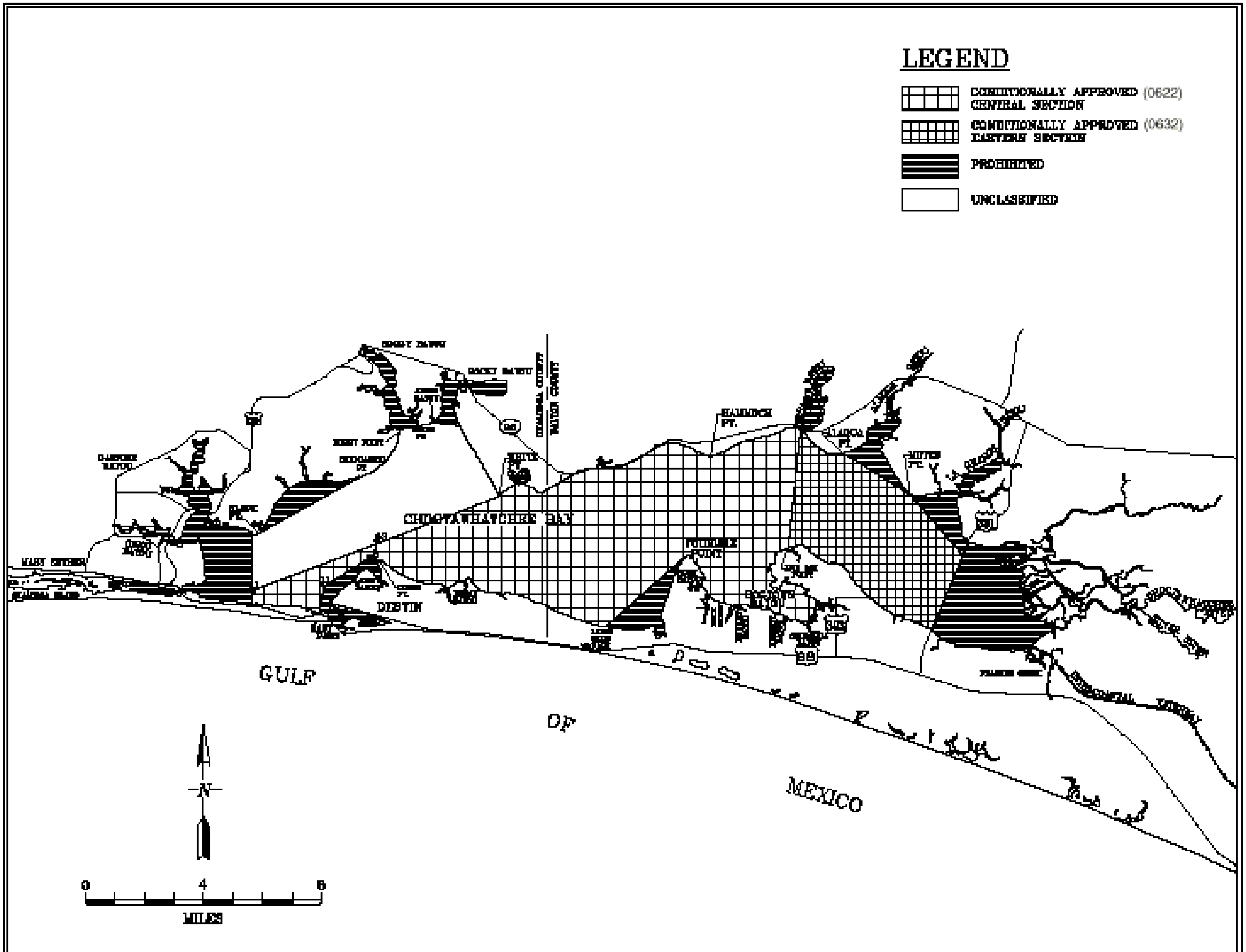

Figure 3-4. Shellfish Harvesting Classification of Choctawhatchee Bay

Table 3-6. Water Quality Criteria for Class I, II, and III Waters

Parameter	Units	Class I	Class II	Class III	
				Fresh	Marine
Turbidity	NTU	≤29 above background	≤29 above background	≤29 above background	≤29 above background
Dissolved solids	mg/L	≤500 monthly average, ≤1,000 maximum	None	None	None
pH	pH units	No change more than one unit above or below background.	No more than one unit change for coastal waters or .02 unit change for open waters.	No more than one unit change above or below background.	No more than one unit change for coastal waters or .2 unit change for open waters.
Chlorides	mg/L	≤250	No increase >10 percent above background.	None	No increase >10 percent above background.
Fluorides	mg/L	≤1.5	≤1.5	≤10.0	≤5.0
Conductivity	µmhos	No increase above 50 percent of background or 1,275.	None	No increase above 50 percent of background or 1,275.	None.
Dissolved oxygen	mg/L	Not less than 5.0.	Not average less than 5.0 and never be less than 4.0	Not less than 5.0.	Not average less than 5.0 and never be less than 4.0.
BOD	mg/L	No increase such that DO drops below limit for any class.			
Nutrients: total phosphorus, total nitrogen		No alteration in nutrients such that an imbalance in natural populations of aquatic flora or fauna results.			
Total coliform	#/100 mL	No more than 20% of samples exceed 1,000 in any given month.	No more than 10% of samples exceed 230.	No more than 20% of samples exceed 1,000 in any given month.	No more than 20% of samples exceed 1,000 in any given month.
Fecal coliform	#/100 mL	≤800 in any one sample.	≤800 in any one sample	≤800 in any one sample	≤800 in any one sample
Copper	µg/L	≤ (.8545[in hardness] – 1.465)	≤2.9	≤ (.8545[in hardness] – 1.465)	≤2.9
Iron	mg/L	≤0.3	≤0.3	≤1.0	≤
Lead	µg/L	(1.273[in hardness] – 4. 705)	≤5.6	(1.273[in hardness] – 4. 705)	≤
Zinc	µg/L	(0.8473[in hardness] + 0.7614)	≤86	(0.8473[in hardness] + 0.7614)	≤86
Mercury	µg/L	≤0.012	≤0.025	≤0.012	≤0.025

Source: FDEP, 2000

East Bay and Blackwater Bay are part of the Pensacola Bay system, which due to decreasing water and sediment quality and loss of habitat was designated a priority Surface Water Improvement and Management water body in the 1980s (FDNR, 1991). East Bay rated good during the 1980s and 1990s and showed a trend toward improving water quality. East Bay is a Class II water. Oysters are the only shellfish species commercially harvested from East Bay. Depending on the season, areas of East Bay are classified as Conditionally Approved or Conditionally Restricted, classifications that allow oyster harvesting with closures of oyster beds potentially occurring following pollution events such as rainfall or increased river flow.

Riverine

Information on water quality was obtained from the Yellow River Marsh Aquatic Preserve Management Plan and from the FDEP 2000 305(b) report. In the 305(b) database, FDEP maintains water chemistry, metals analysis, and biological data on water bodies throughout the state. The Yellow River is regarded as a pristine riverine system with good water quality on an FDEP scale of good, fair, and poor, having been designated in 1979 as an OFW by the Florida state legislature (FDNR, 1991). Data from the 1990s support that water quality is generally good at stations in Blackwater Bay and Yellow River, with one historical rating of fair for mercury violations occurring at one station along the Yellow River in the 1980s (FDEP, 2001). The Yellow River is designated as a Class III water. The East Bay River rated fair in 1995 for conventional water analysis violations (dissolved oxygen and coliform bacteria) but good overall as other chemical parameters (e.g., suspended solids, nutrients, and chlorophyll) were acceptable (FDEP, 2001). East Bay River and Blackwater Bay are classified as Prohibited; oyster harvesting is not permitted in these areas due to actual or potential pollution (Florida Department of Agriculture, 2001). The reason for such restrictions is that oysters filter the surrounding waters to feed and in doing so may concentrate water pollutants in their tissues (Barnett and Teehan, 1989). Water quality criteria for Class I, II, and III waters are presented in Table 3-6.

Nutrients

Nutrient data collected by FDEP near the region of influence indicate Santa Rosa Sound waters are phosphorus limited, meaning an increase of phosphorus could cause algal blooms. Phosphorus levels are high, averaging 0.04 mg/L in the Navarre Beach area. USEPA water quality criteria limits for phosphorus are 0.05 mg/L. Control of phosphorus inputs from point sources, carwashes, and laundry facilities is recommended by FDEP to prevent algal blooms and subsequent decreases in water quality (Butts and Ray, 1995).

Water Chemistry

Salinity in Choctawhatchee Bay is lowest from December to April at around 1.3 parts per thousand at the river mouth and highest in western areas, peaking from July to October to the low 30s at East Pass (Livingston, 1986). The pH of Bay water is relatively uniform, measuring above 6.2 for most locations and lowest in areas of freshwater runoff (Livingston, 1986). Dissolved oxygen averages above 6.0 mg/L for most surface areas, and is low (<4.5 mg/L) in the summer in the center and bottom of the Bay where deeper waters prevent sufficient oxygen exchange with the surface and periodically low in the many of the bayous. Turbidity (a measure of the cloudiness of the water from suspended particles) increases as one moves closer to the Choctawhatchee River, and is lower at the surface (1.5 nephelometric turbidity units (NTUs)) than at the bottom (8.8 NTUs). Color as measured by platinum-cobalt color units ranged 16.7 to 90.7 with increasing color toward the river. Coliform bacteria are typically higher at the surface and in the bayous.

Outstanding Florida Waters

Waters listed as OFWs include surface waters in national parks, aquatic preserves, wildlife refuges, marine sanctuaries, wild and scenic rivers, state aquatic preserves, and waters in areas acquired through donation, trade, or purchase under the Environmental Endangered Lands (EEL) Bond Program; Conservation and Recreation Lands (CARL) Program, Land Acquisition Trust Fund (LATF) Program, and Save Our Coast (SOC) Program. Special Waters, also listed as OFWs, have ecological and recreational importance but are not protected. State-designated OFWs occurring within the Bay include Fred Gannon Rocky Bayou State Park (state aquatic preserve), Point Washington (EEL, CARL, LATF, and SOC)/Eden State Garden (state park), and the Choctawhatchee River (state special water).

3.1.5 Geology and Sediments

Choctawhatchee Bay was formed during the Pleistocene Era, 7,000 to 20,000 years ago, when rising sea levels inundated local river valleys (which exist today as bayous). At the time, the region was about 300 feet above sea level. As the level of the Gulf of Mexico rose, a westward littoral drift of sand created Moreno Point (now Destin), which eventually separated the Bay from the Gulf of Mexico except for a narrow passage now known as Old Pass Lagoon. Periodically, shoaling would close the pass and Choctawhatchee Bay would become a freshwater lake (Wolfe et al., 1988). The isolation from the Gulf of Mexico affected the Bay's sedimentary environment, altering biological and physical conditions. Once prolific shell-producing organisms decreased in abundance, possibly as a result of the increased entrapment of fine sediments introduced by the Choctawhatchee River, surface sediments became more acidic with a high reducing capacity (Wolfe et al., 1988).

Sediment grain size, percent silt, clay, sand, and organic content were analyzed quarterly at 47 stations in 1986 (Livingston, 1987) and at 26 of those same stations in April 1987 (Livingston, 1987). Bayous were characterized by relatively fine sediments with high organic content originating from urban runoff and natural freshwater sources (i.e., streams and creeks). Bay shelf-slope margins, the river mouth, and extreme western sections were characterized by coarser particles (Livingston, 1987).

An estimated 600,000 tons of sediment is deposited annually in Choctawhatchee Bay (USDA SCS, 1993). Depth and freshwater runoff are two factors affecting sediment distribution. Distribution in the deeper sections, which is primarily influenced by the River, follows an east-to-west gradient of coarse to fine particles. Coarser particles characterize sediments at the river mouth and around the shallow shelf areas of the Bay. Fine, silty particles are a major component of deeper water sediments and bayous, although the origins for each differ:

deep-water fine sediments are primarily of river origin, while those in bayous are deposited by urban runoff (Livingston, 1987).

Sediment Quality

Metal and organic contaminants at concentrations below detection in the water column are incorporated and often concentrated in the sediments (USEPA, 1993). Their availability then becomes dependent on the number of physical, chemical, and biological factors. Sediments with smaller grain size (e.g., silts) and high organic carbon bind contaminants tightly making them less available to aquatic organisms. Burrowing organisms and dredging activity can release these contaminants to the water column. Benthic organism communities impacted by contaminated sediments can in turn lead to negative impacts for species higher in the food web.

Estuarine

Generally, low benthic infaunal numbers, biomass, and diversity characterize Choctawhatchee Bay, but these values may reflect natural properties of sediment type and the sparse seagrass bed coverage (Livingston, 1987). Finer sediments such as silt and clay tend to have lower diversity. Infaunal numbers and biomass are highest near the shallow seagrass bed areas in proximity to Joe's Bayou, Santa Rosa Sound entrance, Black Point, Horseshoe Bayou, and the shallow middle-western bay. Areas of relatively decreased benthic fauna were the deep middle areas of the bay as well as, Basin, Boggy, lower Rocky, and Garnier Bayous (Livingston, 1987).

Metals were found in Choctawhatchee Bay at several sites in amounts that indicate an anthropogenic source, such as urban stormwater runoff, agriculture or industry. A "higher than expected" (HTE) determination in Table 3-7 and Figure 3-5 was derived using methods that compare the concentration of metals that would naturally be expected to occur in the earth's crust with concentrations found in the sediments. Using FDEP's aluminum normalization method, Livingston (1987) identified some areas as being enriched with one or more metals. Arsenic, cadmium, chromium, copper, iron, lead, nickel, and zinc were found at Old Pass Lagoon, Black Point, Garnier Bayou, LaGrange Bayou, Alaqua Bayou, Boggy Bayou, and the Choctawhatchee River mouth (Livingston, 1987). The extents of the areas of enrichment were not determined, nor were the sources. Boggy Bayou was enriched with the most metals. Toxic organic compounds such as pesticides, polychlorinated biphenyls (PCBs), and dioxin were not found at any of the sample stations in 1987. Similar analyses were not available for Santa Rosa Sound sediments.

Sampling by FDEP from 1984 to 1991 identified high levels of organic contaminants (polynuclear aromatic hydrocarbons (PAHs)), PCBs, and pesticides in Boggy Bayou, Old Pass Lagoon, and Alligator Point and metals (lead) three times HTE in Boggy Bayou and Old Pass Lagoon (Seal et al., 1994, 1994a).

Table 3-7. Metal Enrichment in Choctawhatchee Bay Sediment Samples

Location	Metal(s)	Amount HTE
River mouth	Arsenic	20.56
LaGrange Bayou (upper)	Arsenic	4.87
	Copper	5.82
	Lead	2.09
Alaqua Bayou	Lead	2.03
Hogtown Bayou	Arsenic	5.24
Indian Bayou	Arsenic	4.91
	Copper	3.04
	Lead	2.22
	Nickel	2.34
Rocky Bayou (upper)	Lead	2.54
Rocky Bayou (lower)	Copper	2.91
	Lead	2.61
	Nickel	2.58
Boggy Bayou (upper)	Cadmium	4.81
	Copper	3.70
	Chromium	3.79
	Lead	4.57
	Nickel	2.94
	Zinc	2.35
Boggy Bayou (lower)	Cadmium	10.35
	Lead	2.50
Central Bay off Buccaroo Point	Arsenic	5.77
	Nickel	2.39
Central Bay area north of East Pass	Lead	2.23
West of Black Point (off Shalimar)	Arsenic	18.83
Central Bay area northwest of East Pass	Lead	3.21
Garnier Bayou	Cadmium	4.88
	Copper	3.92
	Lead	5.91
	Nickel	2.82
	Zinc	3.04
Santa Rosa Sound entrance	Lead	3.74

Source*:* Livingston, 1987.
HTE = higher than expected.

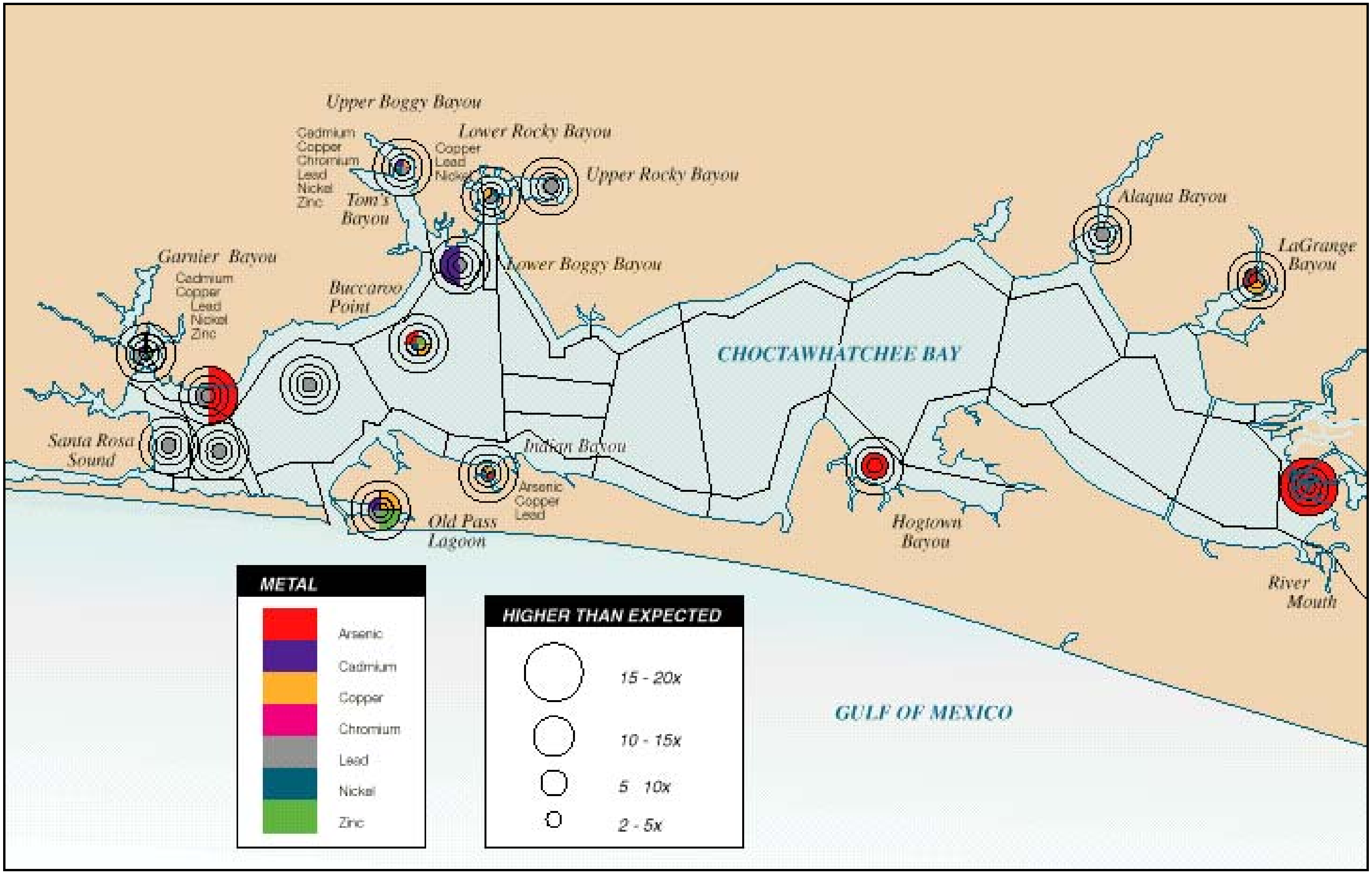

Figure 3-5. Metals in Choctawhatchee Bay Sediments
(Source: Livingston, 1987)

Sediment samples collected in 1984 through 1986 through National Oceanic and Atmospheric Administration's (NOAA's) National Status and Trends Benthic Surveillance Program revealed "high" levels of metals and organics in the vicinity of Shirk's Bayou (Conner, 1990). Contaminants found were lead and silver, and dichlorodiphenyltrichloroethane (DDT), chlordane, PCBs, and PAHs. USEPA Estuarine Monitoring and Assessment Program (EMAP) data indicated slight toxicity to amphipods exposed to Choctawhatchee Bay sediments from two locations, which, incidentally, were low in contaminants. Stations with higher contaminant levels displayed no toxicity during tests. EMAP results contained analysis of Bay sediments collected at 15 stations from 1991 through 1993. Sediment samples were analyzed for metals and organic compounds; demersal fish were collected and tissue samples analyzed for metals and organics; and crustacean toxicity bioassays of the sediment samples were conducted. Metals analysis was not normalized with aluminum to distinguish between natural and anthropogenic contributions. Four stations were located within water range D-54 and D-59; tissue samples from these stations had the highest total DDT and PCB concentrations, and the second highest metal concentrations.

A decline in oyster reef areas and submerged aquatic vegetation throughout East Bay may be attributable to declines in sediment quality; pollution tolerant macroinvertebrate species are found in the East Bay and are an indication of low sediment quality (FDNR, 1991).

Riverine

Macroinvertebrate species (e.g., worms, crustaceans) indicative of good water quality were collected from Yellow River (FDNR, 1991). In general, rivers that are faster flowing and have higher flushing and mixing rates than bays and basins are less susceptible to effects from pollution.

3.2 BIOLOGICAL RESOURCES

3.2.1 Aquatic Habitats

Emergent and Submerged Vegetation

In some Gulf of Mexico estuarine systems, the breakdown of emergent vegetation such as salt marsh forms the basis of the detrital food web, supplying many parts of the system with nutrients (Wolfe et al., 1988). In addition to supplying nutrients to the estuarine system, marsh grasses provide habitat for many birds and invertebrates, prevent erosion, absorb surface water, and act as a filter for agricultural and industrial pollutants (Field et al., 1991).

Submerged vegetation (e.g., seagrasses) is a major component of productive coastal estuaries, equal in importance to marsh grass ecosystems. Seagrass communities provide sediment stabilization, primary production, detrital and nutrient production, habitat, nursery foraging grounds, and protection for many species of fish, turtles, and invertebrates (Livingston, 1986, Dawes, 1987, and Wolfe et al., 1988).

Florida panhandle marshes typically support *Juncus roemerianus* (black needlerush), *Spartina* sp. (smooth cordgrass), *Distichlis spicata*, *Scirpus* spp., *Salicornia* spp., and *Phragmites australis* among others (Wolfe et al., 1988).

Estuarine

Field verification of Live Oak Point and other areas of highly concentrated marsh vegetation revealed the dominant species in Choctawhatchee Bay to be the salt-tolerant perennial *Juncus roemerianus* (Livingston, 1986); *Spartina alterniflora* was also documented. Emergent vegetation coverage is presented in Figure 3-6. Emergent vegetation in Choctawhatchee Bay is estimated to cover an approximate 2,700 acres (NOAA, 1991).

Two species of submerged vegetation have been documented in Choctawhatchee Bay: *Halodule wrightii* (Cuban shoalgrass) and a freshwater species, *Ruppia maritima* (widgeon grass). Widgeon grass is most common in brackish waters but can tolerate higher salinities (Dawes, 1987). Cuban shoalgrass has been characterized as rather tolerant of environmental stresses, withstanding heat, desiccation, and turbidity with greater success than other Florida species (Dawes, 1987). Populations of shoalgrass occur primarily west of the county line in the vicinity of Moreno Point, Joe's Bayou, East Pass, Santa Rosa Sound entrance, Black Point, and White Point (Burch, 1983 and Livingston, 1986). Widgeon grass occurs at Hogtown Bayou, east of the Okaloosa-Walton county line (Burch, 1983).

Seagrass habitat has been declining since the 1940s as indicated from an analysis of aerial photographs (Burch, 1983, and Livingston, 1986). Historical accounts given by local residents, though not scientifically validated, place losses since 1929 at about 80 percent (Livingston, 1986). The Florida Marine Research Institute (FMRI) estimates seagrass coverage in Choctawhatchee Bay and the Okaloosa County portion of Santa Rosa Sound at 4,160 acres (Sargent et al., 1995).

Compared to other Gulf Coast estuaries such as Apalachicola and St. Joseph Bays, Choctawhatchee Bay has relatively little emergent vegetation and, therefore, exhibits low productivity in some areas (Livingston, 1986). Reyer et al. (1988) presented data on coastal wetlands coverage of Gulf of Mexico estuaries. Choctawhatchee Bay was reported to have 2,700 acres of salt marsh coverage and 3,700 acres of fresh marsh coverage. Salt marsh occurs at the interface of SRI and Santa Rosa Sound.

Riverine

Salt marsh, also known as tidal marsh, occurs along the intertidal areas of East Bay and Blackwater Bay in areas of low wave energy that are influenced by fresh water from the Yellow River and occasionally inundated with salt water from rising tides. Typical salt marsh vegetation is non-woody (e.g., reeds and grasses) and salt-tolerant. In Florida, common salt marsh plants are black needlerush and smooth cordgrass. Sawgrass, saltwort, saltgrass, and glasswort, sea ox-eye daisy, and sedges also occur. The health of salt marsh plants is often indicative of the overall health of the salt marsh community.

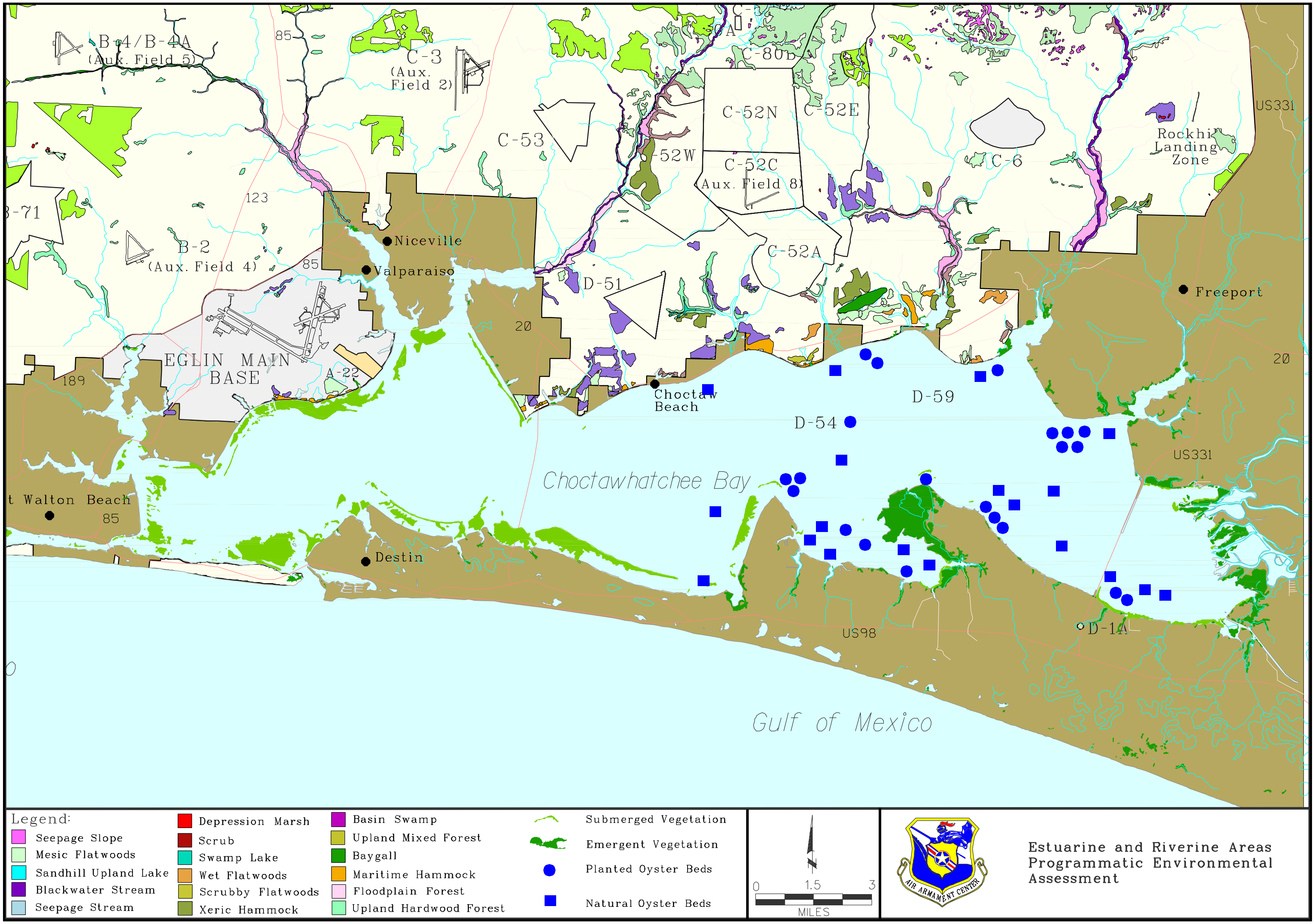

Figure 3-6. Emergent and Submerged Vegetation Coverage in Choctawhatchee Bay

Approximately 2,400 acres of seasonally inundated floodplain marsh occurs at the mouth of the Yellow River in the river floodplain. Dominant emergent species include maidencane, pickerelweed, sagittaria, buttonbush, wax myrtle, and other mixed emergents. Other floodplain species include giant cutgrass, cattail, spadderdock, beak rush, bulrush, sedges, spike rush, and sawgrass (FDNR, 1991). On areas of higher elevation, stands of hardwoods and water tolerant pine trees are found in the marsh.

Tapegrass (*Vallisneria americana*) is the dominant submerged vegetation species in grassbeds of the Yellow River Marsh Aquatic Preserve and Blackwater Bay. Other species include lemon bacopa, southern naiad, widgeon grass, and bladderwort. Grassbeds once existed in East Bay, most notably in the area between Escribano Point and Miller Point, but by 1977 had died out.

Oyster Reefs

Oyster reefs are a separate ecosystem formed from aggregations of live oysters, oyster shells, and other organisms growing on accumulations of generations of oyster shell substrate (Wolfe et al., 1988). Oyster reefs are important to estuarine systems because they remove suspended particles from the water column, affect current patterns, filter out phytoplankton, and produce large quantities of oyster biomass. The reef structure provides habitat for algae, hydroids, bryozoans, barnacles, mussels, worms, sponges, and crabs (Wolfe et al., 1988).

Oyster reef coverage in East Bay was estimated to be 3,395 hectares (1,371 acres) (Wolfe et al., 1988).

Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act require, among other things, that the National Marine Fisheries Service (NMFS) and regional Fishery Management Councils designate essential fish habitat (EFH) for species included in a fishery management plan. EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Federal agencies that fund, permit, or carry out activities that may adversely affect EFH are required to consult with NMFS regarding potential impacts, and respond in writing to NMFS and Fishery Management Council recommendations. Adverse impacts are defined as impacts that reduce quality and/or quantity of EHF, and may include contamination, physical disruption, loss of prey, and reduction in species' fecundity. The management of sensitive habitats on Eglin is the responsibility of the Natural Resources Management Branch (AAC/EMSN).

EFH has been identified by the NMFS for several species within the area encompassed by the proposed action. These species and their habitat by life stage are presented in Table 3-8. EFH present in the area includes submerged aquatic vegetation (seagrasses) and oyster reefs, which are shown in Figure 3-6 for Choctawhatchee Bay. The estuarine waters of Choctawhatchee Bay are also listed as essential fish habitat for various species. The general extent of these areas expand or contract as salinity regimes fluctuate with the seasons.

Seagrass generally does not occur in East Bay. In the Proposed Action area, oyster reefs occur in Choctawhatchee Bay and East Bay. The primary species is the American oyster, *Crassostrea* *virginica*. In Choctawhatchee Bay, oyster beds are located east of the Mid-Bay Bridge with several locations near TA D-84. Detailed maps showing Essential Fish Habitat in Choctawhatchee Bay are present in the 2003 *Eglin Environmental Baseline Study Resource Appendices.*

Table 3-8. Managed Species for Which Essential Fish Habitat Has Been Identified for the Proposed Action

Species	Life Stages	Habitat
Stone crab	Juvenile	Shell, SAV
	Adult	Shell, SAV
Black grouper	Juvenile	Estuarine and Gulf of Mexico
Gag grouper	Juvenile	SAV and oyster beds in lagoons and estuaries
Gray snapper	Postlarvae/juvenile	SAV, mud
	Adult	SAV, sand, mud
Lane snapper	Juvenile	SAV, sand, mud
	Adult	Reefs, sand 0 – 130 m
Red drum	Post larvae/juvenile	SAV, estuarine
	Subadult	Estuarine, mud bottoms, oyster reefs
	Adult	Mud bottoms, oyster reefs
Red grouper	Juvenile	Hard bottom, SAV, reefs
Red snapper	Larvae	Structure
	Postlarvae/juvenile	Structure
Spanish mackerel	Juvenile	Estuarine
Yellowtail snapper	Juvenile	SAV, sand, mud

Source: Gulf of Mexico Fishery Management Council, 1998; NOAA, 1985; National Marine Fisheries Service, 2002.
m = meters
SAV = submerged aquatic vegetation

3.2.2 Aquatic Species

Plankton

Plankton are free-floating organisms that lack sufficient mobility to move against prevailing currents. Plankton species can be roughly classified as phytoplankton (microscopic plantlife), zooplankton (microscopic animals), and ichthyoplankton (fish eggs and larvae). Plankton function as an important food source for many higher aquatic organisms. Phytoplankton in particular serve as indicators of water quality; phytoplankton blooms have been documented to adversely affect growth of seagrasses and to decrease benthic community quality by interfering with light penetration (Livingston, 1986).

Estuarine

Dominant phytoplankton species collected from Choctawhatchee Bay by Livingston (1986) were *Chaetoceros* spp., *Coscinodiscus* spp., *Skeletonema costatum*, *Pyrocystis* sp. 1, *Chaetoceros coarctatus*, *Cyclotella* sp., and *Ceratium tripos*. Crustacean larvae and the copepod *Acartia tonsa* are dominant zooplankton. Ichthyoplankton collections reflect estuarine fish spawning influence and peak activity as well as offshore species whose larvae move into the Bay on a seasonal basis. The dominant pelagic fish larval species from ichthyoplankton collections in 1975 and 1986 was *Anchoa* spp. (anchovies) (Blaylock, 1983; Livingston, 1986).

Invertebrates

Estuarine

Pelagic Invertebrates

Pelagic invertebrates include species floating or swimming in the water column above the bottom (Barnes, 1980). As a group, they have not been selectively sampled, although larval and adult forms can be found in collections targeting other categories such as non-fish captured in ichthyoplankton collections, zooplankton studies, and commercial harvests. Some pelagic invertebrates occurring in Choctawhatchee Bay at various times of the year are comb jellies (ctenophores), jellyfish, squid, and shrimp. Ctenophore and jellyfish occurrence was highest from May to June (Blaylock, 1983). The pelagic tunicate *Oikiopleura* sp. and the ctenophore *Mnemiopsis* sp. were identified in 1975 from zooplankton collections (Blaylock, 1983). In trawls or epibenthic invertebrates, the pink shrimp (*Penaeus duorarum*) was dominant (Livingston, 1986). Other abundant species were the blue crab (*Callinectes sapidus*), brief squid (*Lolliguncula brevis*), and crab (*Portunus gibbesii*). Stations with high numerical abundance include Rocky Bayou and western Bay areas. Stations with few invertebrates (species and numbers) include the river delta, deep central areas, Old Pass Lagoon, and Santa Rosa Sound entrance (Livingston, 1986). Squid and shrimp are discussed later as important commercial species.

Benthic Invertebrates

Benthic invertebrates may be described as epifaunal (living on the surface of the substrate) or infaunal (living within the substrate). These macroscopic animals, which are an important food source for fish and larger invertebrates, are primarily comprised of annelids (worms), amphipods, isopods (crustaceans), and mollusks (clams and snails). Because of their close contact and interaction with the sediment, benthic invertebrates are most likely to be affected by contaminated sediments.

Areas of the Bay with high metal concentrations were often characterized by depauperate benthic communities (Livingston, 1987). Habitat considerations such as proximity to seagrasses and sediment type were the main determining factors affecting benthic community diversity and abundance, with metal contamination playing a smaller but significant role (Livingston, 1987).

Overall, the greatest abundance of benthic macroinvertebrates was associated with seagrass beds and deeper western areas with coarse sandy sediments (Livingston, 1986). The lowest numbers of organisms were collected in the eastern end of the Bay and in bayous such as Boggy, Garnier, lower Rocky, and Old Pass Lagoon. The polychaete annelid, *Mediomastus ambiseta*, was numerically dominant throughout the Bay.

Riverine

Information was available for benthic invertebrates in the Yellow River, primarily the marsh areas near the river mouth. Fine sand and mud with vegetation present are more productive than coarse clean sands absent of silt. Dominant East Bay and shoreline benthic species include polychaete and oligochaete worms, clams, snails, mysid shrimp, amphipod and isopod crustaceans, crayfish, and insect larvae (FDNR, 1991).

Vertebrates

Estuarine

Information on Choctawhatchee Bay vertebrates includes fish surveys, commercial fisheries landings, Bay area bird inventories, and bottlenose dolphin stock assessments.

Fish

Species with recreational, commercial, and ecological value include bull shark, tarpon, Alabama shad, Gulf menhaden, bluefish, pinfish, spotted seatrout, red drum, mullet, and Spanish mackerel (Nelson, 1992). Livingston (1986) identified areas of high and low fish abundance through net and trawl sampling of 45 stations. Areas near the mouth of the Choctawhatchee River, seagrass beds, and LaGrange, Alaqua, Basin, Rocky, and Boggy Bayous supported larger fish populations than eastern areas of the Bay and areas such as Cinco Bayou, Garnier Bayou, and Old Pass Lagoon. Spot, pinfish, and anchovies were dominant species in trawl collections, with peak abundances occurring during summer and winter months (Livingston, 1986). Mullet and silversides were common in seine collections.

Spring and fall are the primary juvenile fish recruitment periods in Choctawhatchee Bay. In 1993, FDEP collected over 270,000 individuals with seines, trawls, and gillnets. Baseline finfish data for dominant species collected in spring 1993 are presented in Table 3-9. This sampling program for Choctawhatchee Bay was discontinued in 1995.

The Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), federally listed as threatened, is known to occur in Choctawhatchee Bay, and the Okaloosa darter (*Etheostoma okaloosae*), federally and state-listed as endangered, occurs in the Rocky Bayou Aquatic preserve. Critical habitat was designated for the Gulf sturgeon in March 2003 to include the Yellow River, Santa Rosa Sound, and Choctawhatchee Bay. See Appendix D for more information on this species.

Table 3-9. Numbers of Dominant Fish Species Collected in Spring 1993 by FDEP Monitoring Program

Species		Gear Type			
		Beach Seine	**Offshore Seine**	**Trawl**	**Total**
Pinfish	*Lagodon rhomboides*	20,261	112,717	7,078	134,237
Spot	*Leiostomus xanthuras*	19,419	18,897	41,227	79,543
Silverside minnow	*Menidia spp.*	20,261	2,390	-----	22,651
Menhaden	*Brevoortia spp.*	3,088	3,833		7,455
Mullet	*Mugil spp.*	6,310	-----	-----	6,310
Atlantic croaker	*Micropogonias undulates*	-----	-----	6,167	6,167
Penaeid shrimp	*Penaeus spp.*	472	975	791	2,238
Pigfish	*Orthospristis chrysoptera*	-----	1,394	254	1,648
Anchovy	*Anchoa spp.*	-----	-----	1,294	1,294
Code goby	*Gobiosoma robustum*	-----	902	-----	902
Clown goby	*Microgobius gulosus*	133	421	-----	554

Source*:* FDEP, 1993

Migratory Birds

All migratory birds are protected under the Migratory Bird Treaty Act, originally passed in 1918. The Act applies to all birds included in the international conventions between the United States and Great Britain, the United States and the former Soviet Union, the United States and Mexico, and the United States and Japan.

It is illegal to "take" (hunt, poison, wound, pursue, kill, capture, trap, or collect), import, export, possess, buy, sell, purchase, or barter any migratory bird. Products made or obtained from migratory birds, which include their eggs and nests, are also covered under the Act. There are a few exceptions to the Act. The U.S. Fish and Wildlife Service (USFWS) has established migratory bird hunting regulations that would allow the "taking" of a few species, such as ducks, during designated seasons. A permit may also be granted for noncommercial activities that involve captive-bred migratory birds (USFWS, 1996).

Hill et al. (1996) surveyed migratory birds on Eglin from 1994 to 1996, noting few transient, neotropical migratory species during any season. They concluded that Eglin is neither a major stopover site for migrating birds nor is it in a major flyway. Migratory ducks that may be hunted with a permit are known to occur around the Yellow River (FDNR, 1991).

Information on birds around Choctawhatchee Bay was obtained from the local Audubon chapter's annual Christmas Bird Count conducted each December. The count area is defined by a circle, 15 statute miles diameter, centered 1.8 miles south of the intersection of the Eglin AFB runways. Yellow-rumped warblers, red-winged blackbirds, gulls, mourning doves, European starlings, buffleheads, and American robins were among the most numerous species sighted in the annual Christmas Bird Counts from 1992 through 1995.

North American migratory birds are counted annually in mid-May in Okaloosa and Walton counties (Ware, 1995). Gulls, cattle egrets, martins, dove, blue jays, northern mockingbirds, starlings, cedar waxwings, and grackles were sighted in relatively high numbers in 1994 and 1995 migratory surveys.

Pelicans, terns, and herons are waterfowl and shorebird species found in the Bay (FDNR, 1991). A nesting colony of great egrets and great blue herons is located near the west shore of East Pass as it joins the Bay (Runde et al., 1991).

Threatened and endangered species known to occur in the Bay area are the bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliatus*), southeastern snowy plover (*Charadrius alexandrinus tenuirostris*), marsh hawk (*Circus cyaneus*), and southeastern American kestrel (*Falco sparverius paulus*). See Appendix D for more information on threatened and endangered species.

Marine Mammals

Two marine mammal species occur in East Bay, Choctawhatchee Bay, and Santa Rosa Sound. The bottlenose dolphin (*Tursiops truncatus*) occurs year-round and the endangered West Indian manatee (*Trichechus manatus*) is sighted on rare occasions. Winters in north Florida prevent the cold-sensitive manatees from occurring year round. Their occasional presence is most probably a result of chance migration from warmer regions. Bottlenose dolphins are thought to form discrete communities in Gulf of Mexico estuaries and are afforded protection under the Marine Mammal Protection Act (MMPA) (Waring et al., 1999). Manatees are also protected under the Endangered Species Act. Appendix D provides additional information on Threatened and Endangered Species in the estuarine and riverine areas and an explanation of the Endangered Species Act and Marine Mammal Act.

Bottlenose Dolphins

Based on aerial surveys, the National Marine Fisheries estimated Choctawhatchee Bay bottlenose dolphin abundance at 242, which is approximately .58 to .74 dolphins per square kilometer. The minimum population estimate (MPE) is 188 and the potential for biological removal (PBR) for the Choctawhatchee Bay stock is 1.9. The PBR is the number of human-caused mortality events that a population could withstand and not be in jeopardy.

Bottlenose dolphins in East Bay belong to the Pensacola Bay community. The abundance, MPE and PBR, of the Pensacola Bay stock is 33, 18 and .2, respectively (Waring et al., 1999).

The diet of Atlantic bottlenose dolphins consists mainly of fish, crabs, squid, and shrimp (Caldwell and Caldwell, 1983).

Manatees

Manatees occur infrequently in the north Florida panhandle with occasional sightings documented in the news media. In December 1999, a manatee was sighted in the Blackwater River and a month later a manatee carcass, presumably of the previously sighted animal was found in Blackwater Bay (Naples Daily News, 2000).

Riverine

The Yellow River marsh area and Blackwater Bay contain over 100 species of fish, with approximately one-third of these inhabiting brackish water. Five species (Alabama shad, skipjack herring, hogchoker, Atlantic sturgeon, and American eel) move from saltwater into freshwater only to spawn. Cyprinodon minnows, sunfish, freshwater catfish, killifish, drums, and perches are other common species found in the Yellow River.

Marine species inhabiting Blackwater Bay and East Bay include Gulf menhaden, tidewater silverside, silver perch, sand seatrout, spot, croaker, and striped mullet.

The river mouth is a nursery area to several marine and freshwater fish species including bay anchovy, worm eel, Gulf pipefish, bluegill, redear sunfish, naked goby, longnose gar, coastal shiner, spot, striped mullet, spotted gar, chain pickerel, brook silverside, and bluespotted sunfish.

Terrestrial Habitats

Adjacent to the shores of the estuarine and riverine systems are several types of terrestrial habitats that have been grouped by ecologists into various ecological associations based on soil characteristics and plant and animals species. Only the Eglin property has been characterized; private and state property along Choctawhatchee Bay, Santa Rosa Sound, East Bay, and the Yellow River have not been grouped into ecological associations.

Ecological Associations

Eglin has seven major ecological associations that surround or occur near the estuarine and riverine areas. The Swamp Ecological Association predominates along the Yellow River and the East Bay River. The Flatwoods Ecological Association occurs in isolated patches along the Yellow River and East Bay/River at higher elevations, surrounded by the Swamp Ecological Association. Sandpine and flatwoods are interspersed along the north shore of Choctawhatchee Bay while the Barrier Island ecological association borders the entire length of the south shore of the Santa Rosa Sound. Saltmarsh, swamp, and open grassland occur with less frequency along the shores of Choctawhatchee Bay. Most of the Eglin reservation belongs to the Sandhills Ecological Association, except for the test areas that are largely grassland/shrubland. A brief description of these ecological associations follows. Ecological associations are presented in Figures 3-7 through 3-10. Landscaped and urban areas, though not an ecological association, are depicted as well. Individual plant communities are depicted in Figures 3-11 through 3-13.

Grassland/Shrubland

The Grassland/Shrubland Association is a product of vegetation control and management. This association occurs in disturbed, open areas of the Sandhill association. Mowing is employed to remove and prevent reestablishment of tall vegetation. Native grasses such as switchgrass, broomsedge, big bluestems, yellow Indiangrass, purple lovegrass, woolly panicum, and various forbs dominate vegetation within the Grassland/Shrubland.

Sandhills

The Sandhills are generally described as a forest of widely spaced overstory of longleaf pines, a sparse midstory of xeric oaks and other hardwoods, and a dense understory of grasses, forbs, and ferns on rolling hills of sand. This association commonly occurs on deep, sandy Lakeland soil characterized by relatively flat to steeply sloped ridges, hilltops, gently rolling hills, and stream terraces. Loamy sands, sandy loams, loamy clay, and muck soil are found in lower lying areas (U.S. Air Force, 1996a).

The predominate physical feature of Sandhills is the extent and nature of the sandy soil. The xeric environment created by the sandy soil is accentuated by the absence of a closed longleaf pine overstory. Sunlight readily penetrates the scattered overstory, which warms the ground during the day, increases the rate of cooling at night, and reduces air moisture retention. Generally, these fluctuations in temperature and humidity are greater in the Sandhills compared to a closed canopy forest association.

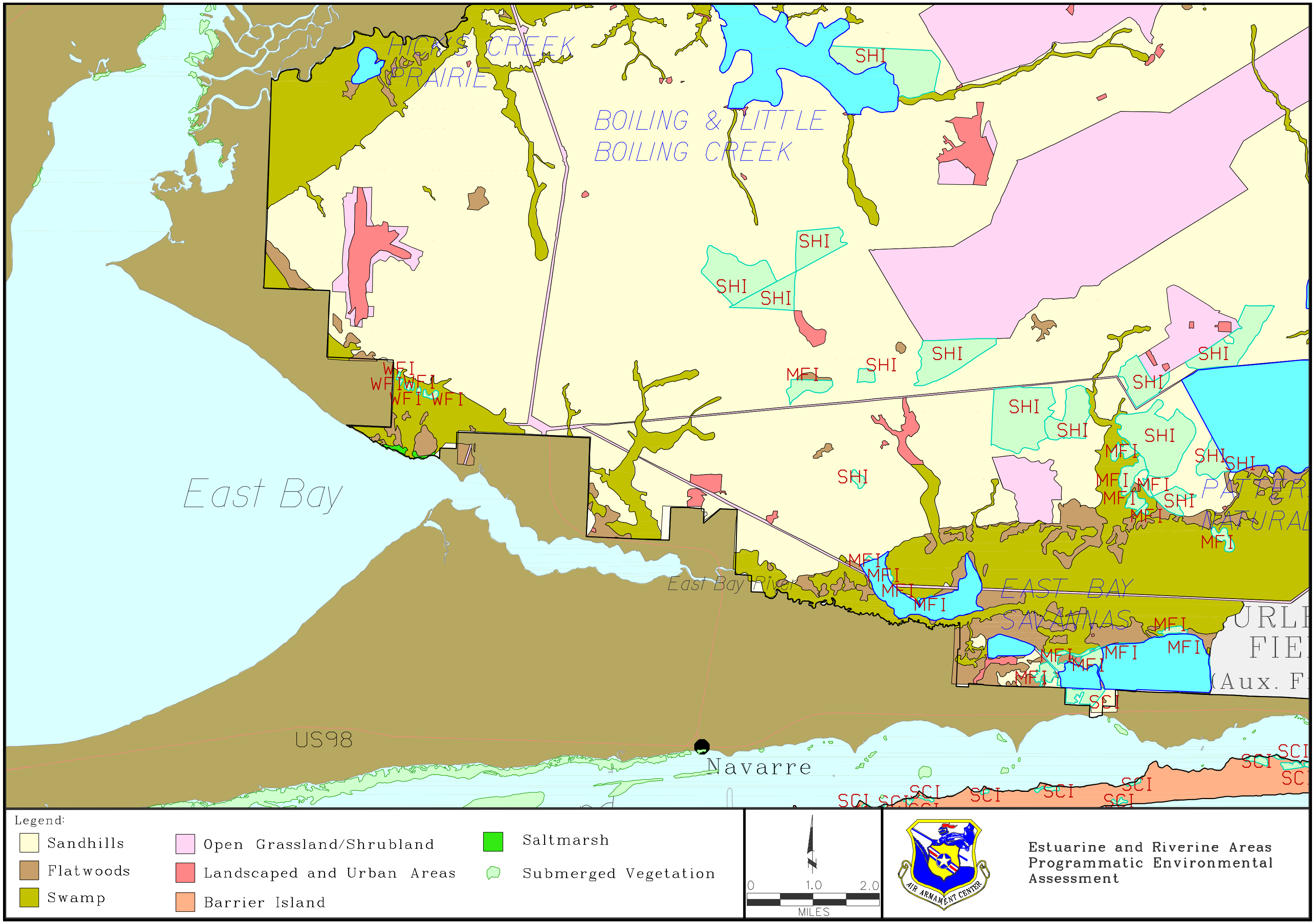

Figure 3-7. Ecological Associations and Tier I Communities Adjacent to the East Bay and East Bay River

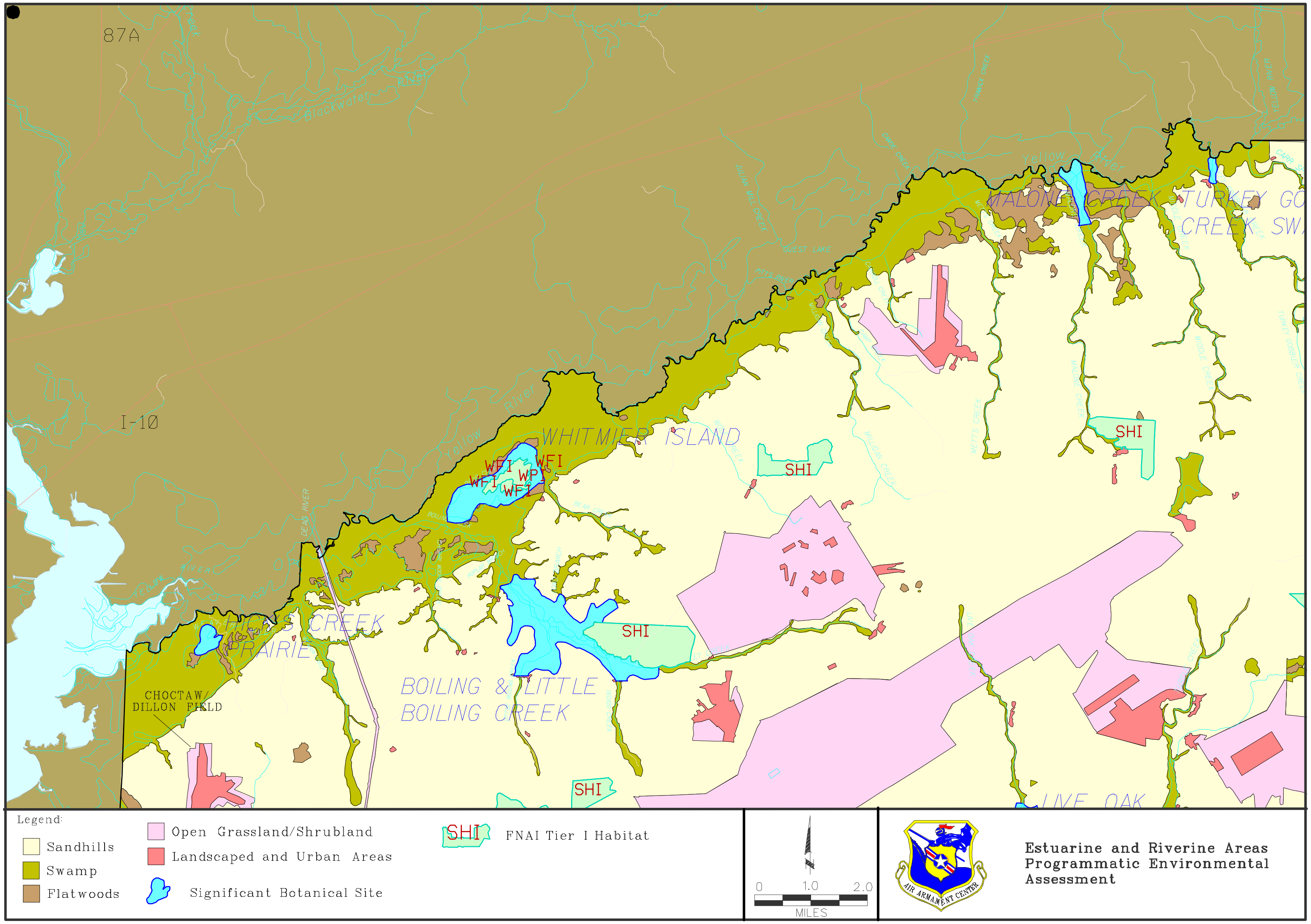

Figure 3-8. Ecological Associations and Tier I Communities Adjacent to the Yellow River

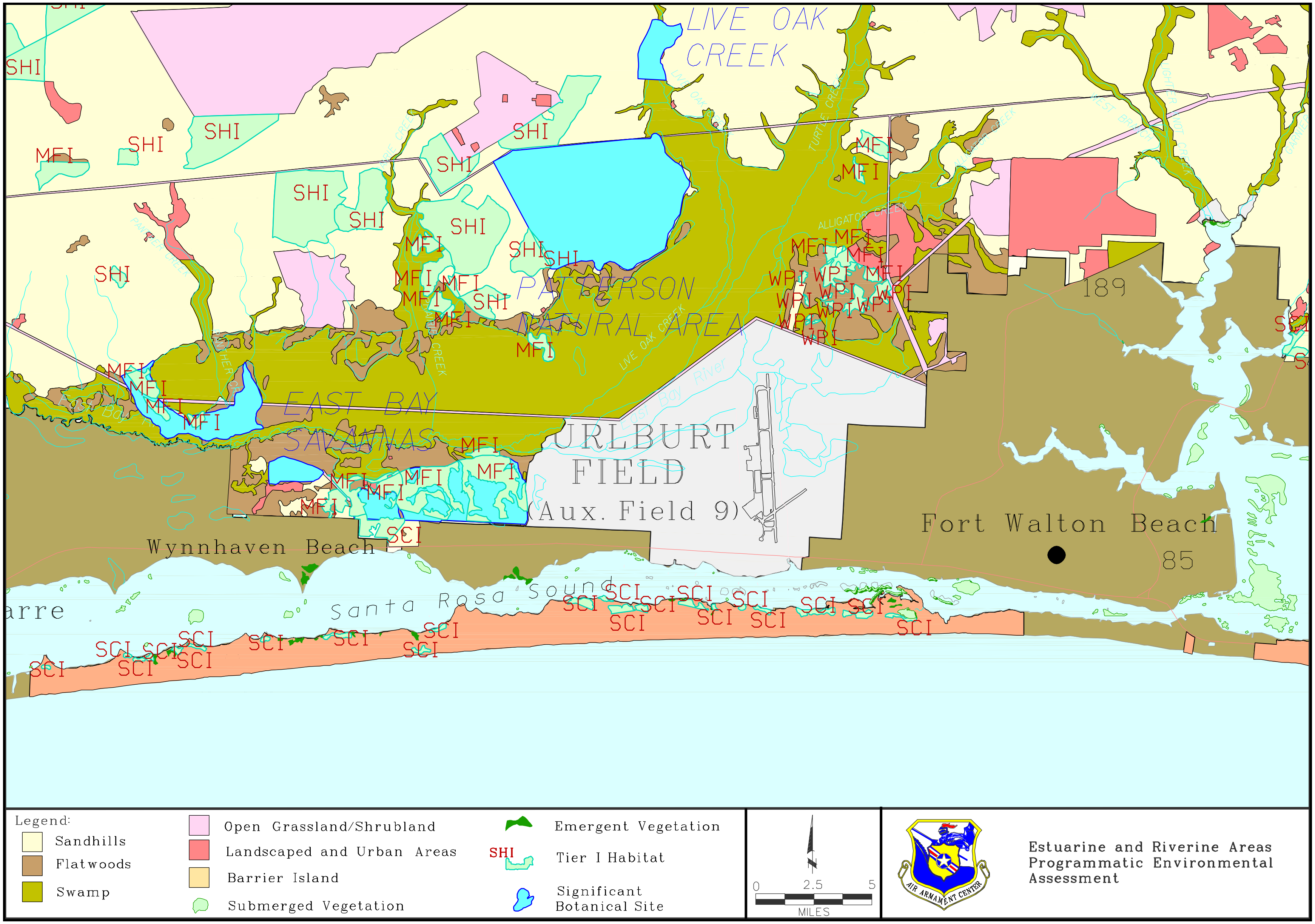

Figure 3-9. Ecological Associations and Tier I Communities Adjacent to the Santa Rosa Sound

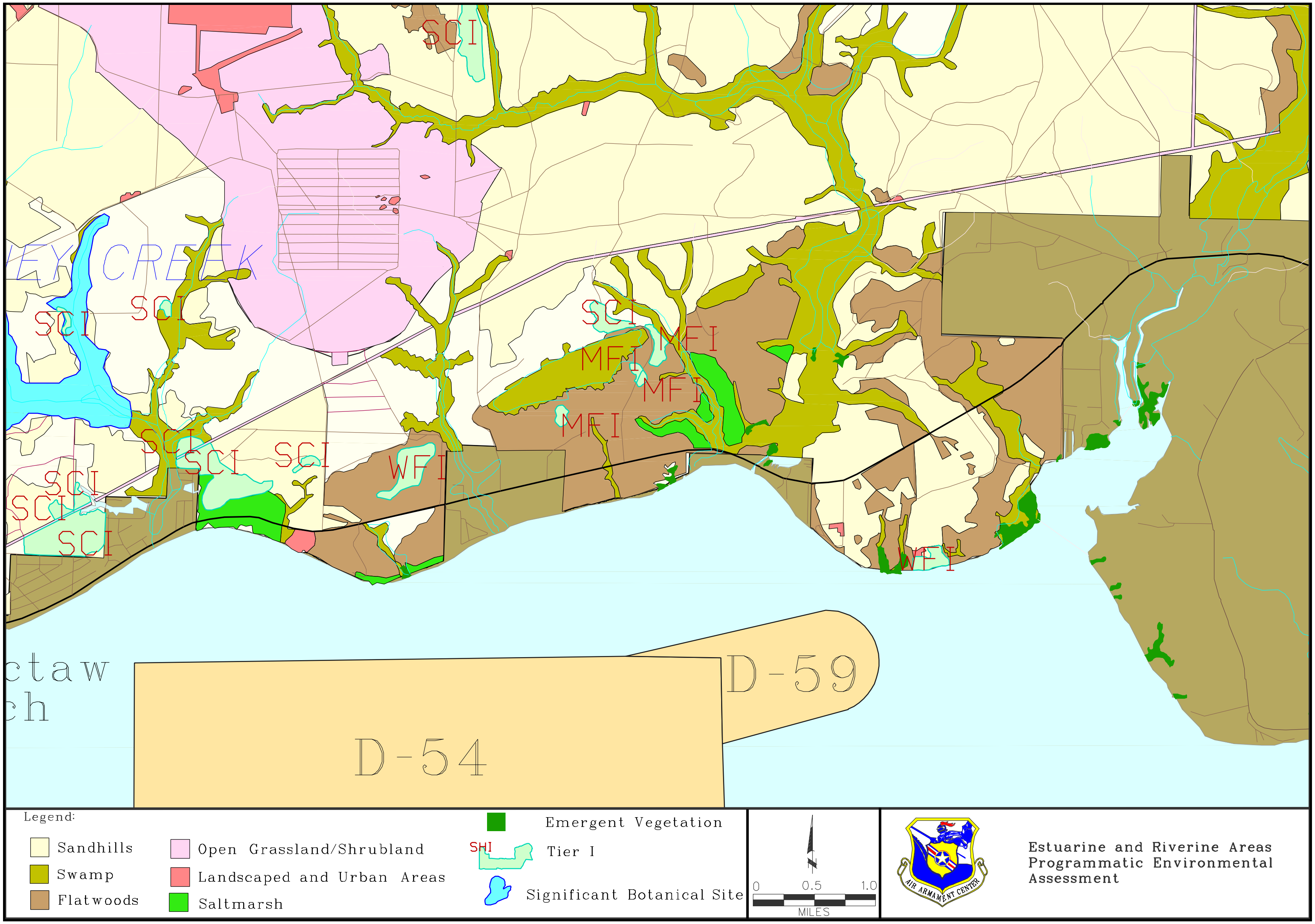

Figure 3-10. Ecological Associations and Tier I Communities Adjacent to Choctawhatchee Bay

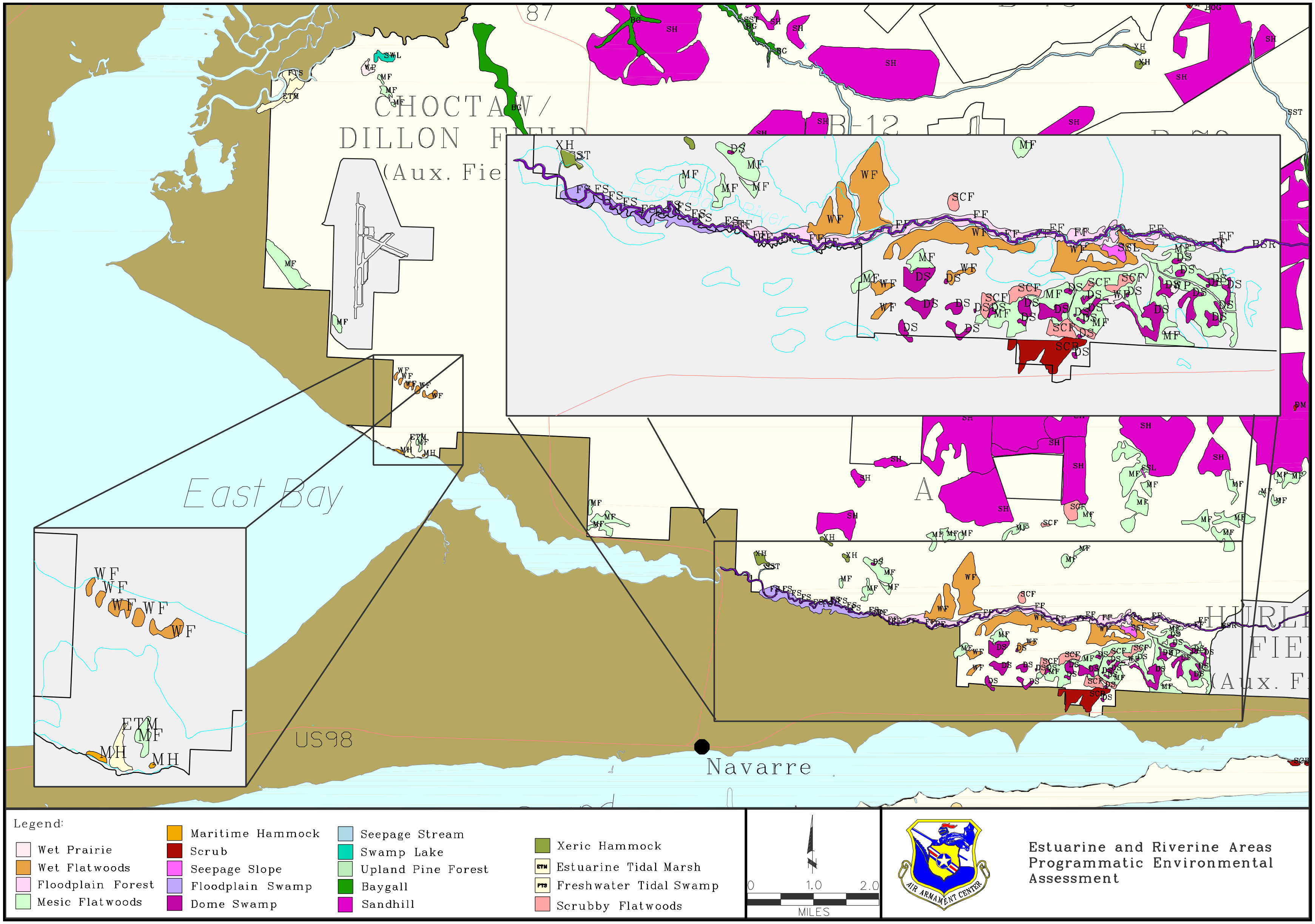

Figure 3-11. FNAI Plant Communities Adjacent to East Bay and the East Bay River

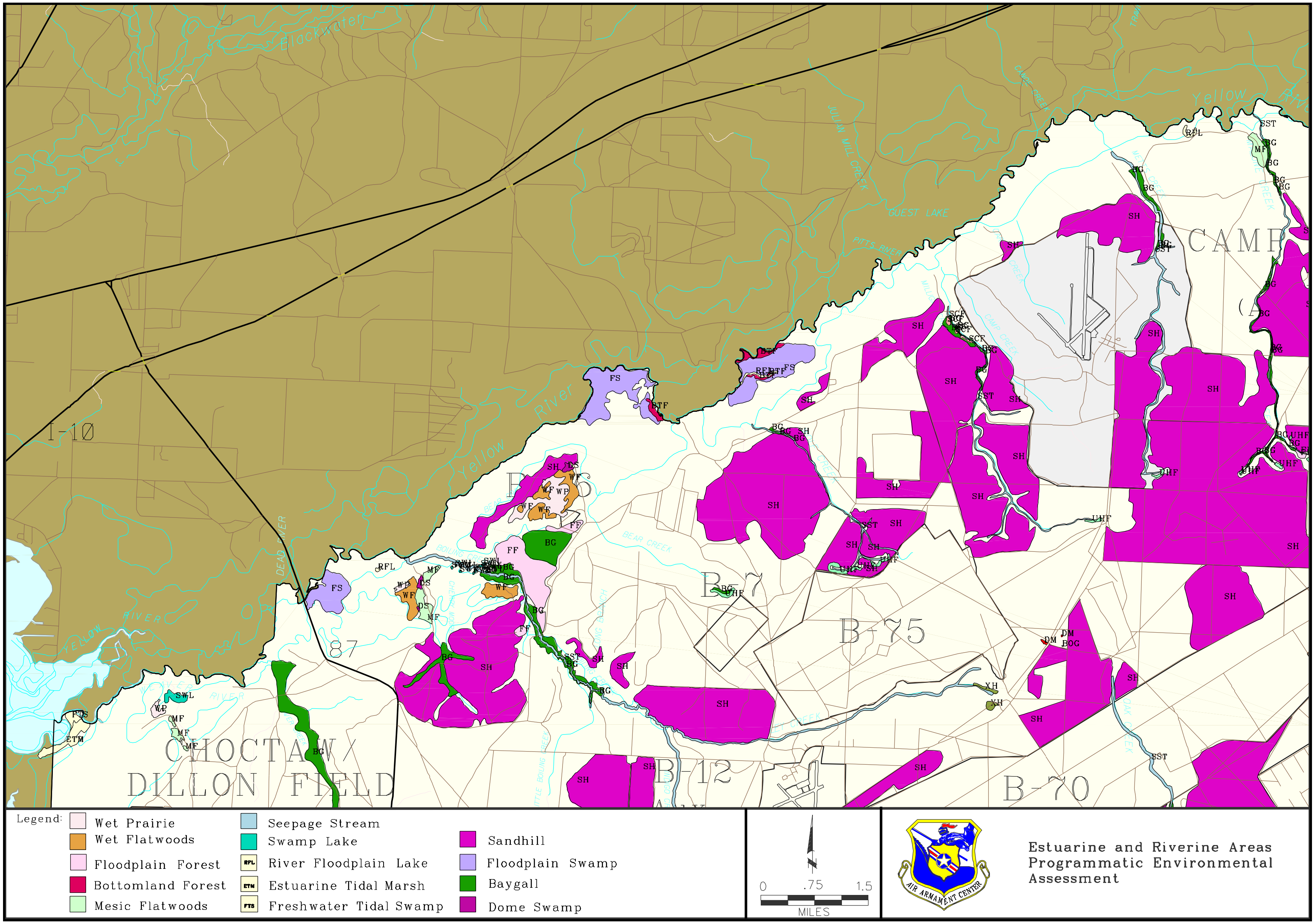

Figure 3-12. FNAI Plant Communties Adjacent to the Yellow River

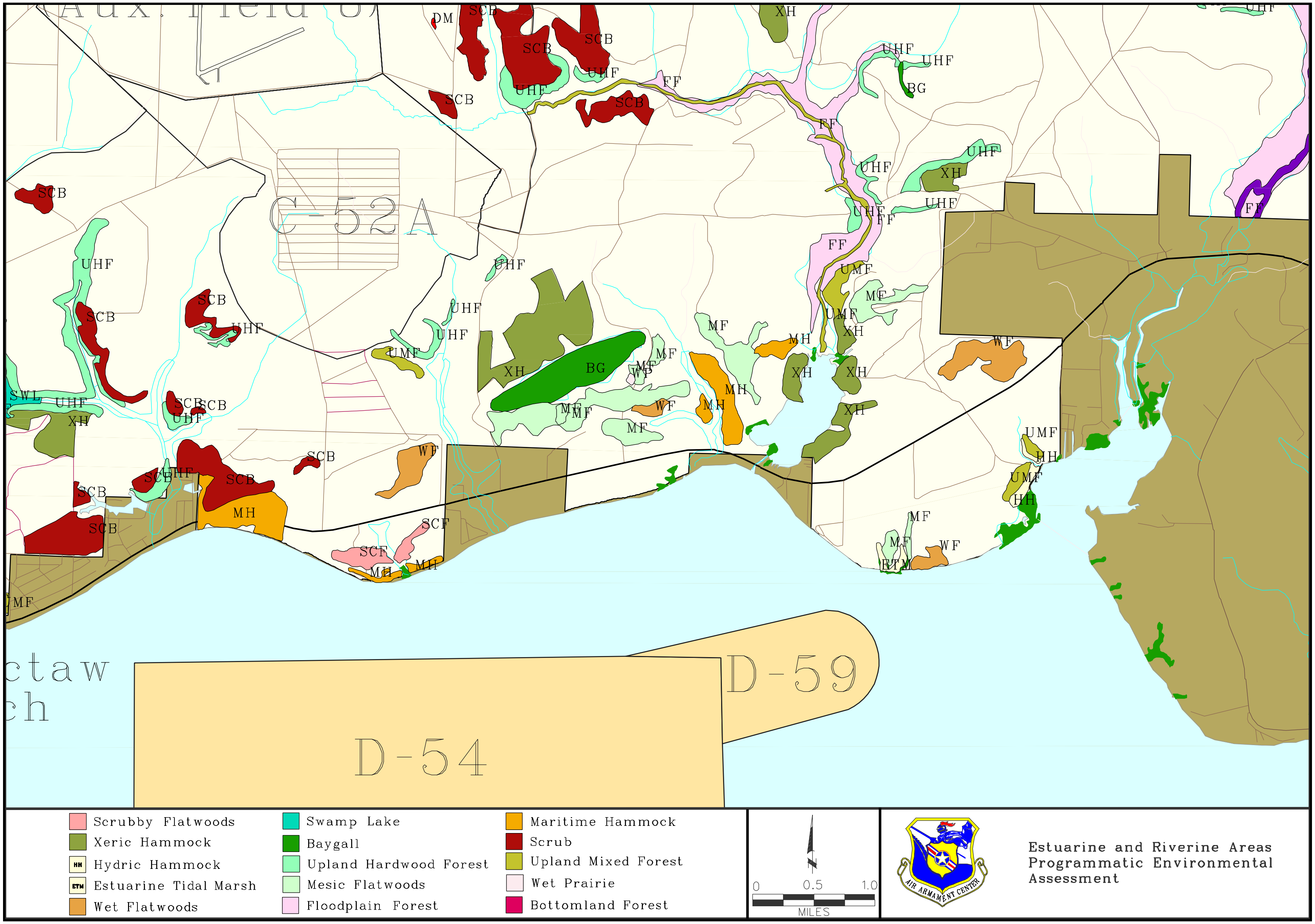

Figure 3-13. FNAI Plant Communties Adjacent to Choctawhatchee Bay

Burrowing animals such as gophers and gopher tortoises play an important role in recycling nutrients that easily leach through the sandy soil (Noss, 1989). The sandy soil makes the Sandhills important to aquifer recharge by allowing water to quickly infiltrate the surface with little runoff and evaporation.

The Sandhills are a fire climax community that is dependent on frequent fire events to restrict hardwood competition and promote timber stands dominated by longleaf pines and grasses such as wiregrass. Without frequent fires every two to five years, the Sandhills succeed to a Xeric Hammock dominated by scrub oaks, live oaks, and southern magnolia.

The Sandhills Association is primarily comprised of a longleaf pine overstory, a midstory of xerophytic hardwood trees such as southern magnolia, sweetbay, live oak, persimmon, sparkleberry, winged sumac, and scrub oaks including turkey oak, bluejack oak, and sand post oak. Although tree species diversity is relatively low, there is a wide variety of understory herbaceous plants such as wiregrass, Indian grass, wild buckwheat, beggars' tick, partridge pea, yellow foxglove, milk pea, queen's delight, bracken fern, goats rue, dollarweeds, wild indigo, gopher apple, golden-aster, and other plants that provide fairly complete ground cover.

Swamp Ecological Association

This association consists of flat, poorly drained areas and vegetation characteristic of wet environments and can include floodplain forest, floodplain swamp, bottomland forest, wet prairie, hydric hammock, blackwater stream, marsh lake, and bogs (U.S. Air Force, 1996).

Because of the many types of habitat found within this ecological association, there are many different types of wildlife. The gray squirrel, opossum, bear, raccoon, river otter, and beaver are typical mammals. Reptiles and amphibians such as the bog frog, green anole, Alabama waterdog, dwarf salamander, cottonmouth, and American alligator are also found (U.S. Air Force, 1996).

The riparian areas and bottomland hardwood swamps associated with major drainages provide the most important habitat for neotropical migrants (U.S. Air Force, 1996). Belted kingfishers forage in shallow riparian habitats where fish are common and the rapidly flowing water produces small choppy waves. The marshes provide habitat for the great blue heron, black-crowned heron, and northern harrier (U.S. Air Force, 1996).

Salt Marsh Ecological Association

Salt marsh, also known as tidal marsh, occurs along the intertidal areas of East Bay, Blackwater Bay, Choctawhatchee Bay, and Santa Rosa Sound in areas of low wave energy that are usually inundated. Typical salt marsh vegetation is non-woody (e.g., reeds and grasses) and salt-tolerant. In Florida, common salt marsh plants are black needlerush and smooth cordgrass. Sawgrass, saltwort, saltgrass, glasswort, sea ox-eye daisy, and sedges also occur. The health of salt marsh plants is often indicative of the overall health of the salt marsh community. Commonly occurring animal species include fiddler crabs, green crabs, marsh snail, diamondback terrapin, saltmarsh snake, wading birds, waterfowl, osprey, and raccoon. Fish species include menhaden, sardines, anchovy, catfish, seatrout, and gobies.

Flatwoods Ecological Association

There are several plant communities within this association that are found on gently sloping to flat topography (U.S. Air Force, 1996a). On Eglin AFB, this association includes seven separate plant communities, ranging from those that are rarely inundated to those that are permanently flooded. One example of the wet flatwoods community exists along the Yellow River, adjacent to the swamp ecological association. In this community, water may stand for one month or longer on the surface during the rainy season. Rare plants include southern milkweed, white-top pitcher plant, sweet pitcherplant, Chapman's butterwort, and Curtiss' sandgrass (U.S. Air Force, 1996a).

The wet flatwoods community supports a wide variety of aquatic birds such as wood ducks, clapper rails and red-winged blackbirds, and neotropical migrants (U.S. Air Force, 1996a). Amphibians include the Alabama waterdog, flatwoods salamander, and dwarf salamander. The black racer, corn snake, cottonmouth, and eastern diamondback rattlesnake are typical reptiles. Mammals include the river otter, beaver, Florida black bear, white-tailed deer, gray fox, bobcat, raccoon, gray and flying squirrels, and several species of bat. The creeks and ponds support several fish species that include the speckled madtom, weed shiner, and starhead top minnow (U.S. Air Force, 1996a).

Sand Pine Ecological Association

Little variation among habitat and typically few wildlife species in a closed canopy forest setting characterize the Sand Pine Ecological Association. Raccoon, white-tailed deer, feral pig, eastern fence lizard, eastern diamondback rattlesnake, and gopher tortoise are found in this association. Bird species include pileated woodpecker, white-breasted nuthatch, and pine siskin.

Barrier Island Ecological Association

The Barrier Island Ecological Association consists of coastal dune and beach habitat. Bird species typical of this association include wading and shorebirds such as herons, egrets, plovers, sandpipers, black skimmers, and least terns. Dune species include the rufous-sided towhee, loggerhead shrike, and yellow-rumped warbler. White-tailed deer, raccoon, fox, opossum, coyote, and marsh rabbit are common mammals. Sea turtles, salt marsh snake, gopher tortoise, and lizards are some of the reptiles known to occur on barrier islands.

3.2.3 Sensitive Species and Habitats

Sensitive species and habitats include plant and animal species with endangered, threatened, or special status, either locally or on a national scale, animals covered under the Marine Mammal Protection Act (MMPA), and habitats that are of pristine quality or are known for their productivity. Sensitive species locations, where known, are depicted in Figures 3-14, 3-15, and 3-16.

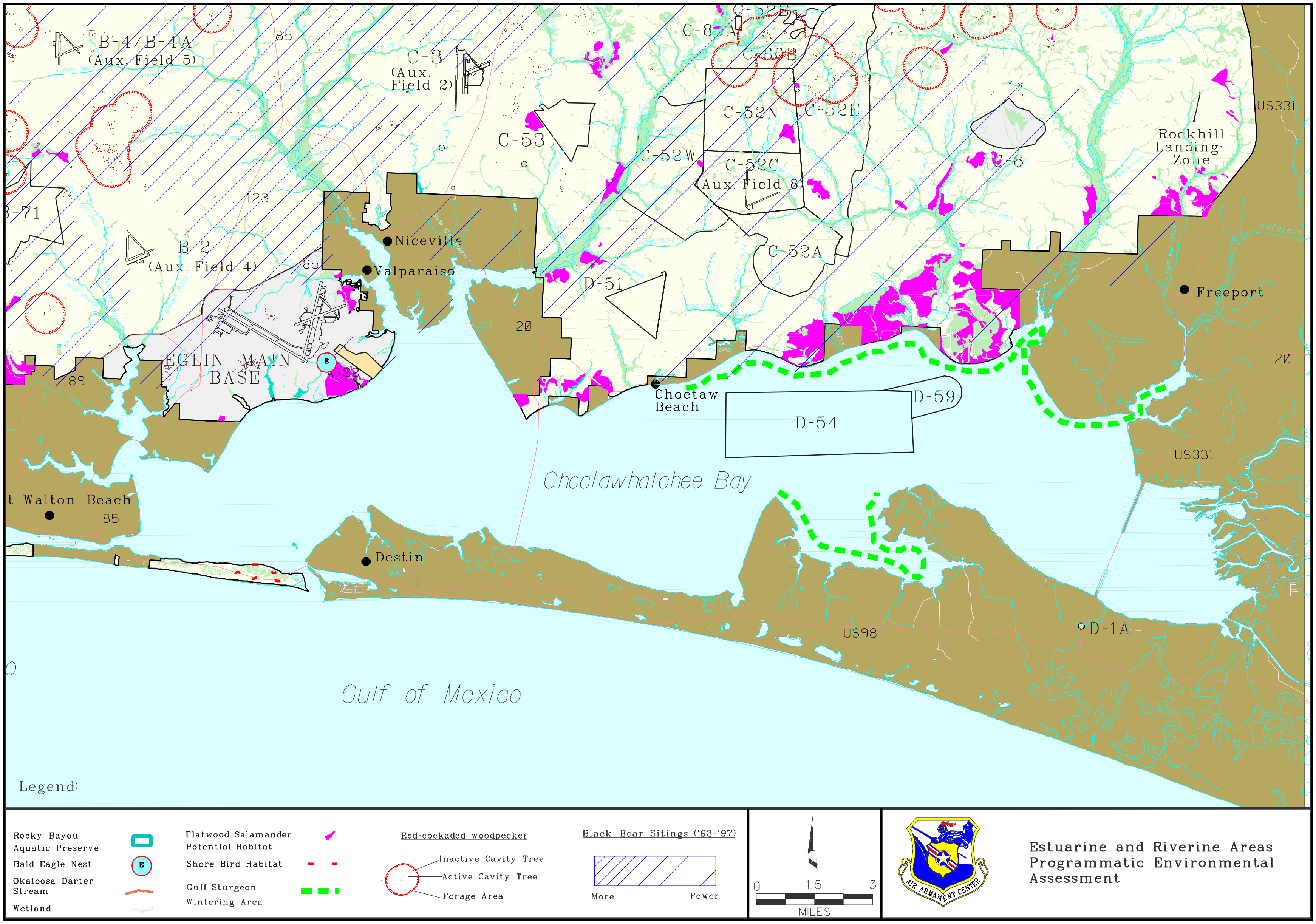

Figure 3-14. Protected Species In or Near Choctawhatchee Bay

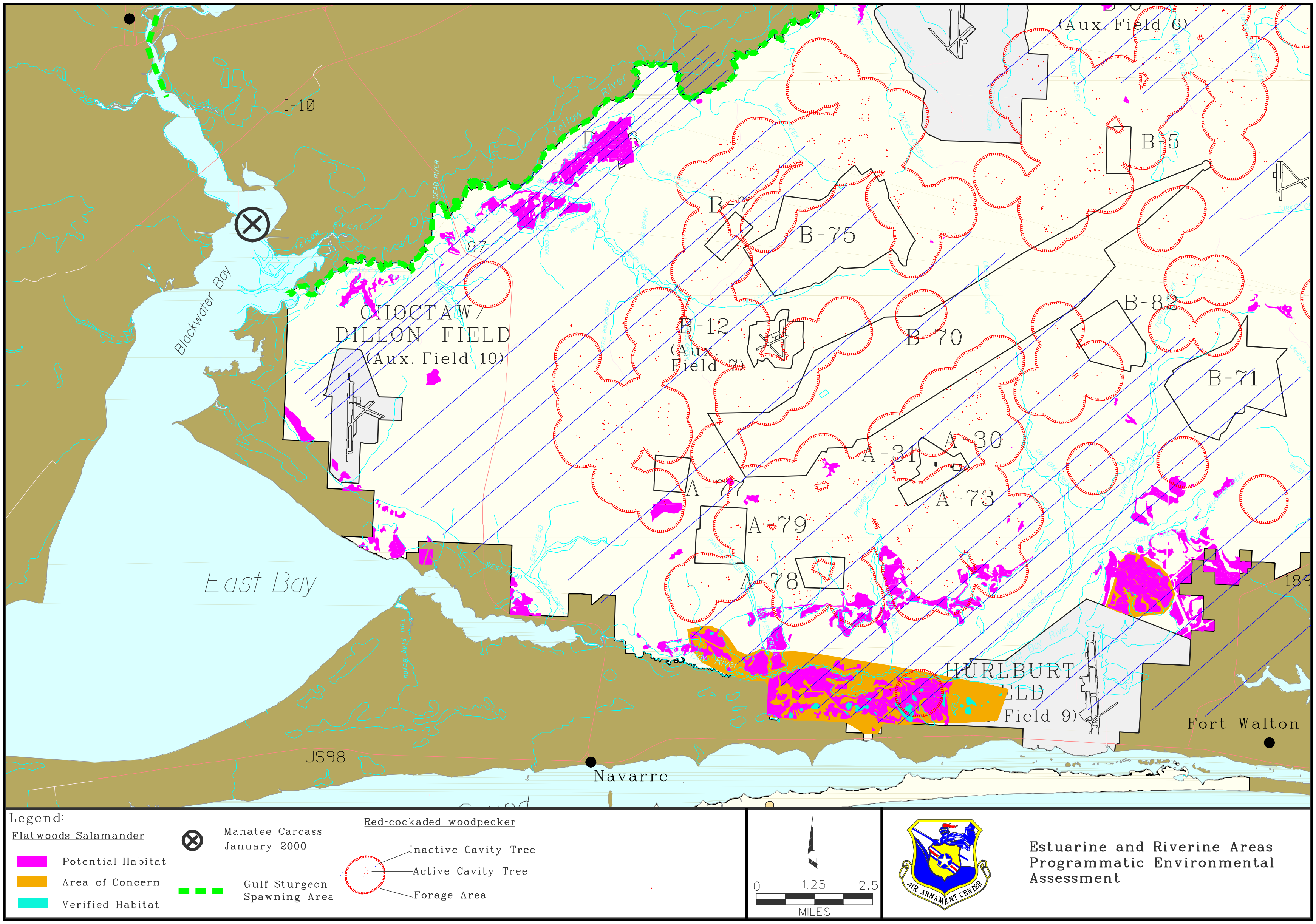

Figure 3-15. Protected Species In or Near East Bay and the East Bay River

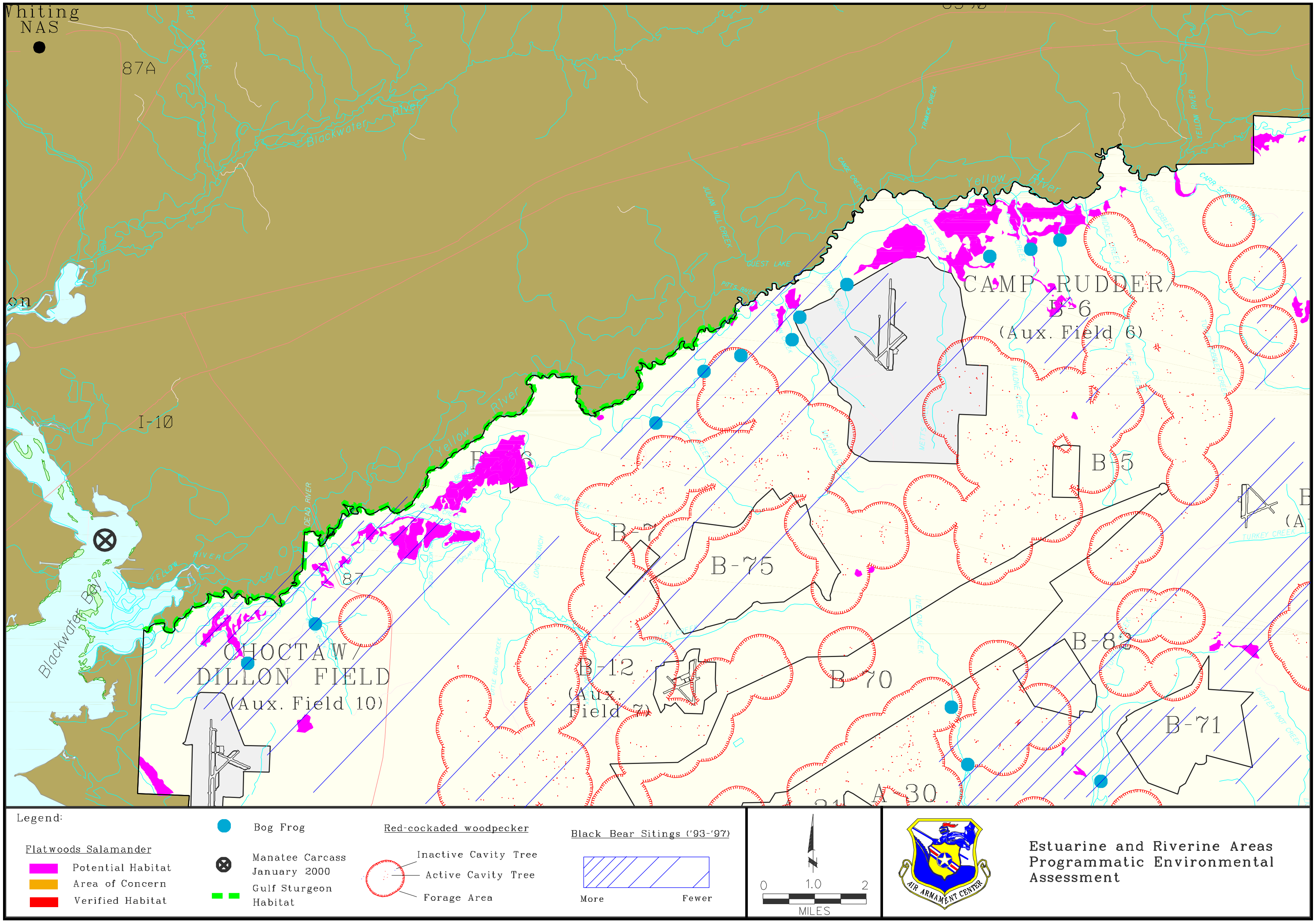

Figure 3-16. Protected Species In or Near the Yellow River

Threatened, Endangered, and Special Status Species

An endangered species is one that is in danger of extinction in a significant portion of its range or throughout all of its range. A threatened species is a species that is likely to become endangered in the future resulting from human impacts and degradation of habitat. The USFWS publishes endangered or threatened species listings in the Federal Register. A species may either be a candidate, proposed, or listed. Species protected under the Florida Endangered Species Act (ESA) of 1990 also receive consideration at Air Force bases when activities are being proposed and planned (U.S. Air Force, 1996a).

The ESA of 1973, as amended (16 USC §§ 1531 through 1544), provides a means whereby the habitats of endangered and threatened species may be conserved. The Act also sets a regulatory framework for the conservation of those species. Implementing regulations are found in Volume 50 of the *Code of Federal Regulations* (CFR). Under the ESA, it is prohibited to take any listed species. This includes harassment, harm, pursuit, hunting, shooting, wounding, killing, trapping, capture, collection, or any attempts at these activities. All cetaceans are protected by the MMPA (1972, amended 1988) administered by the NOAA/National Marine Fisheries Service (NMFS), and USFWS. Off-shore species are under the jurisdiction of the NMFS and coastal species are monitored by the USFWS (Patrick, 1996). A memorandum of understanding (MOU) is in place that establishes a plan for cooperation and participation of federal agencies such as the MMS, the U.S. Department of Defense (DoD), and NMFS in regard to their responsibilities under the ESA. Their common goal is to conserve species that are listed as threatened or endangered under the ESA by protecting and managing populations and the ecosystems upon which they depend for survival. A summary of federal- and state-listed species for the estuarine and riverine areas are presented in Tables D-1 and D-2 of Appendix D. Descriptions of threatened or endangered species follow with detailed information presented for those species potentially most affected or that have a federal- or state-threatened or endangered listing. Candidate species are not discussed at length though their consideration is encouraged by state and federal agencies.

Gulf Sturgeon

The USFWS and NMFS designated the Gulf sturgeon (*Acipenser oxyrhynchus desotoi)* as threatened under the ESA. A special rule is in place to allow the taking of Gulf sturgeon for educational and scientific purposes, propagation or survival of the fish, zoological exhibition, and other conservation purposes consistent with the ESA (USFWS and Gulf States Marine Fisheries Commission, 1995). The USFWS and NMFS officially designated the Gulf sturgeon as threatened as applicable to the ESA on 30 September 1991. Sturgeon occur in the Yellow River and Choctawhatchee River in the spring and summer, and in Choctawhatchee Bay and the Gulf of Mexico in the winter. During the winter, sub-adult sturgeon frequent LaGrange and Alaqua Bayous while adults are primarily found in Hogtown Bayou in Choctawhatchee Bay. Areas east of the Highway 331 Bridge are generally not used as winter habitat (USFWS, 2001). Critical habitat was designated for the Gulf sturgeon in March 2003 to include the Yellow River, Santa Rosa Sound, and Choctawhatchee Bay. More information on this species and its critical habitat is available in Appendix D.

Okaloosa Darter

The Okaloosa Darter is both federally and state-listed as endangered. Downlisting the darter to threatened status could occur if certain criteria related to habitat improvement and population stability over time are met. Delisting the darter is not likely in the near future due to the extremely limited range of the darter and its vulnerability to habitat alteration and catastrophic events. In order to protect the Okaloosa darter, the quantity and quality of water in the streams must be protected. Delisting could occur if historic habitat of all six streams is restored, cooperative and enforceable agreements to protect habitats, water quality, and stream flows are in effect, and populations are demonstrated to be stable or increasing over the 20-year hydrogeologic cycle (U.S. Air Force, 2000a). Principal factors in the initial listing of the darter were the amount of its habitat degraded by road and dam construction, as well as siltation from land clearing (Jelks, 1981). The Okaloosa Darter is found in small, shallow tributaries of Choctawhatchee Bay and the Rocky Bayou Aquatic Preserve. More information on this species is available in Appendix D.

Flatwoods Salamander

The Final Ruling for listing the flatwoods salamander (*Ambystoma cingulatum)* as a federally threatened species was published in the Federal Register in April 1999, effective May 1999 (CFR, 1999). The reasons for listing include loss of more than 80 percent of flatwoods due to agriculture, logging, and urban growth—activities that continue to degrade the habitat of remaining populations (CFR, 1999). More information on this species is available in Appendix D.

Bog Frog

The Florida bog frog (*Rana okaloosae*) is a small, yellow-green frog, which makes a distinct call comprised of a series of chucks. It was first discovered in 1982 and is listed in the state as a Species of Special Concern. The entire global distribution of this species lies within Walton, Okaloosa, and Santa Rosa counties, with the only known sites found on Eglin AFB and three locations to the north of the base. The species' restricted distribution may be due to characteristics of the area's streams and soil. All known locations are small tributary streams to the Yellow, Shoal, or East Bay Rivers.

Santa Rosa Beach Mouse

The Santa Rosa beach mouse (*Peromyscus polionotus leucocephalus*) 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. This population, which occurs only on SRI, was decimated after storm surge from Hurricane Opal destroyed dune habitat in 1995. Monthly track count surveys conducted by Eglin AFB Natural Resources Branch personnel indicate a 40 percent increase in population from 1996 to 2001 (U.S. Air Force, 2002b). 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.

Sea Turtles

Five species of sea turtles inhabit the waters in, or near, the eastern Gulf and may enter the estuarine areas. Of the five species protected by state and federal governments, all but the loggerhead is classified as endangered. The loggerhead is classified as threatened by both the Florida and the federal governments (Patrick, 1996). Sea turtles are identified in Appendix D according to their status of federal protection in the Gulf of Mexico. Sea turtles may venture into Choctawhatchee Bay and Santa Rosa Sound but are primarily oceanic.

Manatees

The USFWS and the Florida Game and Freshwater Fish Commission (GFC) (GFC, 1994) list the West Indian manatee (*Trichechus manatus*) as federally and state-endangered. In 1893 Florida passed a law to protect manatees, which were historically hunted for oil, meat, and leather (USFWS, 1990). In July 1978, the Florida Manatees Sanctuary Act established the entire state as a "refuge and sanctuary for the manatees" (USFWS, 1991). More information on this species is presented in Appendix D.

Atlantic Bottlenose Dolphin

Blaylock et al. (1995) determined density and population estimates of the Atlantic bottlenose dolphin (*Tursiops truncatus)* in Gulf of Mexico coastal bays, sounds, and estuaries through aerial surveys in fulfillment of MMPA requirements for assessing stocks of cetacean populations. Their studies of the Florida panhandle were conducted during September through October 1993. They estimated bottlenose dolphin abundance in Choctawhatchee Bay to be between 188 and 242 bay-wide, or approximately 0.58 to 0.74 dolphins per square kilometer. More information on this species is presented in Appendix D.

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*), initially listed as endangered on 14 February 1978 throughout most of lower 48 states, was listed as threatened effective 11 August 1995 (USFWS, 2000). The status was changed due to the recovery of the population. A bald eagle nest occurred in Rocky Bayou up until 1999 when the nest fell out of the tree. The birds have rebuilt their nest on Eglin Main Base just west of A-22. Bald eagles have been sighted near the mouth of the Yellow River.

Piping Plover

The piping plover *(Charadrius melodus*) was federally listed as an endangered species in the Great Lakes watershed and as a threatened species elsewhere in its range on 10 January 1986. Critical habitat designation for wintering and breeding grounds for the piping plover was published in the Federal Register on 10 July 2001. "Critical habitat" is a term defined in the Endangered Species Act that refers to specific geographic areas that contain the essential habitat features necessary for the conservation of threatened and/or endangered species. Portions of SRI have been identified as units or parcels of land in Florida containing designated critical habitat for wintering piping plovers. Wintering piping plovers may arrive as early as July and continue through September, with some individuals remaining year-round. Piping plovers utilize the intertidal mud and sand flats of the beach areas in search of prey items such as marine worms, crustaceans, insects, and clams. More information on this species and its critical habitat is available in Appendix D.

Least Tern

The least tern *(Sterna antillarum)* is the smallest of the North American tern species. It is currently state-listed as threatened, with only interior U.S. populations federally listed as endangered. On Eglin AFB, nesting colonies have been documented on open, flat areas on SRI and several gravel rooftops on Eglin Main. Successful nesting on SRI is rare, primarily due to heavy predation from feral cats. While most colonies have been documented on the easternmost portion of Eglin's SRI property, another colony was recently documented near Test Site A-17 (Miller, 2003).

Southeastern Snowy Plovers

The southeastern snowy plover (*Charadrius alexandrinus*) is state-listed as a threatened species and is one of several shorebird species found on Eglin barrier island property. During the breeding season, these birds may be found foraging anywhere along the SRI beachfront. Nests are typically laid in the wrack line near vegetated areas and will be abandoned if disturbed. Vehicular and foot traffic, storms, and predation by feral cats are considered the primary causes of nest failure. Eglin beach property contains the highest densities of snowy plovers (37 percent of Florida's breeding pairs), making it one of the most productive nesting areas in the state (U.S. Air Force, 2002b).

Sensitive Plant Species

- **Curtiss' sandgrass**, listed by the state of Florida as threatened, is found in wet prairies, wet flatwoods, and the edges of dome swamps within the Flatwoods ecological association. Frequent fires that control shrub encroachment serve to maintain this species (U.S. Air Force, 1996).
- The **panhandle lily**, a state endangered species, occurs within the Swamp ecological association along streamside, baygall plant communities in organic soil.
- **Spoon-leaved sundew**, a state threatened species, may be found in low-lying areas of baygall, wet prairie, and wet flatwoods of the Flatwoods and Swamp ecological association and has been noted to occur in swamps north of Choctaw Field, along the East Bay River, and in wet areas of SRI.
- **Baltzell's sedge**, a state threatened species, is a grass-like sedge that occurs in the Sandhill ecological association in upland and mixed hardwood forest plant communities in shaded undisturbed slopes of steephead ravines.
- **Ashe's magnolia**, a state endangered species, is a large flowering tree found in steephead ravines of the Sandhills ecological association.

- **Orange azaleas**, listed by the state as endangered, are small flowering shrubs found in the slope forest communities of the Sandhills ecological association.
- **Chapman's butterwort**, a state threatened species, occurs on seepage slopes, in cypress domes, and on wet prairies in the Swamp ecological association. This fire-maintained species is documented to occur on Whitmier Island, north of Choctaw Field, and near Hurlburt Field.
- The **white-topped pitcher plant**, a state endangered species, occurs on fire-maintained seepage slopes, wet prairies, wet flatwoods, and at the edges of dome swamps in the Flatwoods ecological association. This species feeds on insects.
- The **red-flowered pitcher plant,** also known as the sweet pitcher plant, is listed as endangered by the state of Florida. This species feeds on insects and is found in shrub bogs, wet prairies, wet flatwoods, and baygall communities throughout Eglin.
- **Cruise's golden aster**, a state-listed endangered species, is a yellow-flowered herb that occurs on SRI on the crests and leeward sides of sand dunes.
- The **perforate reindeer lichen**, a state- and federally listed endangered species, is a small, ground lichen that occurs in three very distinct locations (SRI, Lake Wales Ridge, and the east coast of Florida). This lichen occurs at fewer than 30 sites throughout its range, most of which are threatened by some combination of habitat loss due to development or agricultural conversion, human disturbance, and hurricane overwash.

Wetlands Habitat

Wetland areas are sensitive habitat that are inundated (water covered), or where water is present either at or near the surface of the soil for distinguishable periods of time throughout the year. Local hydrology and soil saturation largely affects soil formation and development, as well as the plant and animal communities found in wetland areas. Hydric (wet), anaerobic (lacking oxygen) sediments resulting from the presence of water typify wetlands.

Typical plant species inhabiting the coastal wetlands and floodplains of Eglin AFB and Choctawhatchee Bay include, *Juncus roemerianus* (black needlerush), *Spartina* sp. (smooth cordgrass), *Distichlis spicata*, *Scirpus* spp., *Salicornia* spp., and *Phragmites australis,* to name a few (Wolfe et al., 1988). Field verification of areas of highly concentrated marsh vegetation revealed the dominant species in Choctawhatchee Bay to be the salt-tolerant perennial *Juncus roemerianus* (Livingston, 1986). *Spartina alterniflora* was also documented.

Wetlands support both aquatic and terrestrial organisms. Large varieties of microbes, vegetation, insects, amphibians, reptiles, birds, fish, and mammals can be found living in concert in wetland ecosystems. Through a combination of high nutrient levels, fluctuations in water depth, and primary productivity of plant life, wetlands provide the base of a complex food-web, supporting the feeding and foraging habits of these animals for part of or all of their life cycle. During migration and breeding, many nonresident and transient bird and mammal species also rely on wetlands for food, water, and shelter.

Activities that may affect wetlands (protected by the Clean Water Act) go through a permit process with the state as well as with the U.S. Army Corps of Engineers (USACE). Activities minimizing impacts to wetlands are preferred, and the planning process should reduce or minimize ground-disturbing projects or actions occurring in a wetland (U.S. Air Force, 1996). Wetlands are most prominent in the swamp ecological association, although some wetlands are also found in the flatwoods ecological association. The swamp ecological association, which is predominantly wetlands, covers approximately 37,000 acres of Eglin AFB. Under the Clean Water Act, modifications to wetlands are a permitted activity, requiring a Section 404 permit from the U.S. Corps of Engineers.

Commercial and Recreational Species

Choctawhatchee Bay

Mullet (*Mugil cephalus*), flounder (*Paralichthys* spp.), and spotted seatrout (*Cynoscion nebulosus*) are the primary commercial fish species in the Bay (Irby, 1974; Livingston, 1986; FDEP, 1995). Commercially valuable invertebrates include oysters (*Crassostrea virginica*), blue crab (*Callinectes sapidus*), shrimp (*Penaeus*) spp., and squid (*Lolliguncula brevis*).

Finfish, blue crab, shrimp, and squid are harvested primarily from Okaloosa County waters. Although the shrimp fishery exists in the western end of the Bay, shrimp nursery areas are located in the eastern end of the Bay. Oyster beds are located in Walton County. Beds are open to harvesting depending on river flow, rainfall, or amounts of trace metals in oyster tissues. Classifications used by FDEP are conditionally approved (open to harvest but subject to closure as necessary), prohibited (no harvesting), conditionally restricted (harvesting permitted under certain conditions; and purification of shellfish required before consumption), restricted (special permit and purification of shellfish required), or unclassified (unsurveyed for shellfish by FDEP) (Hudson, 1995). All areas east of the 331 causeway are closed to harvesting because of the increased potential for shellfish to bioaccumulate river-borne bacterial and chemical contaminants (Barnett and Teehan, 1989). Oyster landings decreased slightly from 1990 to 1994, with a marked decrease in the number of oyster harvesting trips in 1994 that could reflect closures due to high rainfall.

A total of 54,163 acres of Choctawhatchee Bay waters are approved for shellfish harvesting, while 10,131 acres of prohibited waters and 22,159 acres of unclassified waters have been delineated in the Bay (Barnett and Teehan, 1989). The primary species and only commercially valuable bivalve is the American oyster, *Crassostrea virginica*. Oyster beds are located in the eastern half of the Bay; however, the actual acreage of oyster shell beds is not known. Since 1957, over 8 million cubic yards of clam or oyster shell have been planted to encourage growth of oyster resources. Shells were planted in 1993 near Hammock Point. From 1975 to 1985, 98,000 pounds of oysters were harvested, averaging 8,909 pounds/year. From 1990 to 1994, 28,000 pounds were harvested, an average of 5,600 pounds/year. Because of periodic closures, the duration of oyster harvesting seasons may vary.

East Bay

Crabbing, oystering, and mullet netting are moderate commercial endeavors in East Bay (FDNR, 1991). Two commercial fish camps with boat launching facilities, a restaurant, and a marina are present within the Yellow River Aquatic Preserve (FDNR, 1991). In 1985 approximately 94,000 pounds of oyster meats with a value of $108,000 were harvested from East Bay (FDNR, 1991).

Aquatic Preserves

Rocky Bayou

The 480-acre Rocky Bayou Aquatic Preserve (FDNR, 1991) is the smallest of the 42 aquatic preserves in Florida. It encompasses the northernmost end of Rocky Bayou on north Choctawhatchee Bay, just east of Niceville. Rocky Creek, Turkey Creek, and several steephead streams originating on Eglin AFB provide direct or indirect freshwater input to this system. The area is used for recreational boating and fishing and is bounded by residential use on the north shore and state park use on the south shore. The aquatic plant communities found within the preserve include slope forests, salt marsh, and floodplain marshes.

Bottom-dwelling macroinvertebrates (e.g., worms, crustaceans) indicate the sediment and water quality of this system is unpolluted, unlike many of the other bayous on the Bay (FDNR, 1991). Many members of shellfish and finfish families are found in Rocky Bayou and nearby waters. The Gulf sturgeon could occur in this aquatic preserve and in the larger rivers.

Yellow River Marsh

The Yellow River Marsh Aquatic Preserve includes parts of the Yellow River, East Bay, and Blackwater Bay, covering an area of 16,435 acres. As an example of a pristine river/bay system in northwest Florida, it was designated an outstanding resource and designated as a preserve on 9 April 1970. Part of the preserve lies on Eglin AFB.

Sensitive Habitats

The FNAI has surveyed Eglin AFB for occurrences of rare plants and important assemblages of plant communities. Sensitive habitats found along, or adjacent to, Choctawhatchee Bay and Santa Rosa Sound include wetlands, FNAI Tier I vegetative communities and FNAI Significant Botanical sites (U.S. Air Force, 1996). The management of sensitive habitats is the responsibility of the Natural Resources Management Branch (AAC/EMSN).

Activities that may affect wetlands (protected by the Clean Water Act (CWA)) go through a permit process with the state as well as with the USACE. Activities minimizing impacts to wetlands are preferred, and the planning process should reduce or minimize ground-disturbing projects or actions occurring in a wetland (U.S. Air Force, 1996). Wetlands are most prominent in the Swamp ecological association, although some wetlands are also found in the Flatwoods ecological association.

The FNAI is part of Florida State University's Institute for Science and Public Affairs, through the Florida Resources and Environmental Analysis Center. The mission of FNAI is to collect, interpret, and disseminate ecological information critical to the conservation of Florida's biological diversity (FNAI internet site, http://www.fnai.org). FNAI maintains a state-wide database on the distribution, status, and management of exemplary natural communities; endangered and rare plants and animal taxa; and managed areas in Florida. Eglin classifies land areas into the following four-tiered classification system (FNAI, 1995):

- ***Tier I:*** Vegetative communities that are in, or closely approximate to, their natural state and undisturbed condition. The goal of management is to maintain the natural community. FNAI recommends these areas be managed to maintain this natural state.
- ***Tier II:*** Vegetative communities that retain a good representation and distribution of associated species typical of the undisturbed state, but have been exposed to moderate amounts and intensities of disruptive events. Through careful management, the community may be restored or maintained.
- ***Tier III:*** Vegetative communities that do not retain good representation and distribution of associated species and have been exposed to severe amounts and intensities of disruptive events. Significant and intensive management over extended periods would be required to restore these communities (e.g., pine plantations).
- ***Tier IV:*** Areas on Eglin that have a designated land use, such as TAs, developed areas, sewage disposal areas, roads, power line rights-of-way, and other uses. The nature of the designated use determines the management goal.

This classification system has been developed at Eglin AFB. Consequently, several Tier I communities have been identified (Figures 3-7 through 3-10). Tier I *hydric/hydric/mesic* communities are the most sensitive to degradation because they are wetlands; surface alterations can result in changes in water flow/amounts and potentially affect the viability of plant and animal species. Three types of Tier I habitats have been identified within one mile of the north shore of Choctawhatchee Bay (Figure 3-10). They are mesic flatwoods (46 acres), wet flatwoods (81 acres), and scrub (772 acres).

FNAI Significant Botanical Sites/Outstanding Natural Areas

An FNAI survey was conducted at Eglin AFB from 1992 through 1994 for populations of federally listed endangered, threatened, and candidate plant species, state-listed endangered and threatened plant species, and other rare plant species (Chafin and Schotz, 1995). As a result of this survey, a number of areas on the Eglin reservation have been identified as significant botanical sites due to value as habitat for rare plant species or because of the high quality or rarity of their natural vegetative communities on Eglin (Chafin and Schotz, 1995). Special protection at these sites is warranted for two reasons: high density of federal and/or state protected plant species, and uniqueness of habitat that supports sensitive animals as well as plants. No state-listed threatened and endangered plant species at these sites can be taken or disturbed unless a permit is authorized by the Florida Fish and Wildlife Conservation Commission (FWC). In addition, habitat that supports federally listed species must be conserved in accordance with the Endangered Species Act (ESA).

Santa Rosa Island is considered an Outstanding Natural Area based on the excellent condition of much of its beach dune, coastal grassland, coastal interdunal swale, mesic flatwood, and scrub communities, along with a number of populations of the federally listed perforate reindeer lichen. Based on a 1992 FNAI report on coastal upland communities (Johnson et al., 1992) Coastal Protection Areas were designated on Santa Rosa Island. These were areas that had extremely good scrub habitat and areas where the reindeer lichen was found; however, the current condition of these sites is not known since numerous hurricanes have impacted the island since the sites were designated. Table 3-10 identifies significant botanical sites within the region of influence that are shown in Figures 3-7 and 3-9.

Table 3-10. Significant Botanical Sites within 1.0 Mile of Choctawhatchee Bay and Santa Rosa Sound

Site Name	Vegetation Community	Comments
Piney Creek	Upland hardwood forests, Xeric hammocks/Baygall	• Alabama spiny pod, silky camellia, Baltzell's sedge, sandhill sedge, pinesap, and large-leaved jointweed are rare plants documented at this site. • Fire would be catastrophic at this site. • Encompasses ~540 acres.
East Bay Savannahs	Wet Prairie/Wet Flatwoods/ Domeswamp/Hydric/mesic flatwoods/Floodplain swamps	• Curtiss' sandgrass, Chapman's butterwort, and white-top pitcher plants are most numerous species. • Also, sweet pitcher plant, spoon-leaved sundew, West's flax, Florida cowlily. • Encompasses ~1,040 acres.

3.3 ANTHROPOGENIC RESOURCES

Anthropogenic resources include archeological or historical sites, collectively discussed as cultural resources, human-related issues including environmental concerns such as urban pollution, UXO from previous military activities, socioeconomic and demographic information such as population and land use, and commercial and recreational activities. Population and conservation lands are presented in Figures 3-17 through 3-19. Figures 3-20 through 3-22 illustrate surrounding land use, UXO, and other human-related issues and resources.

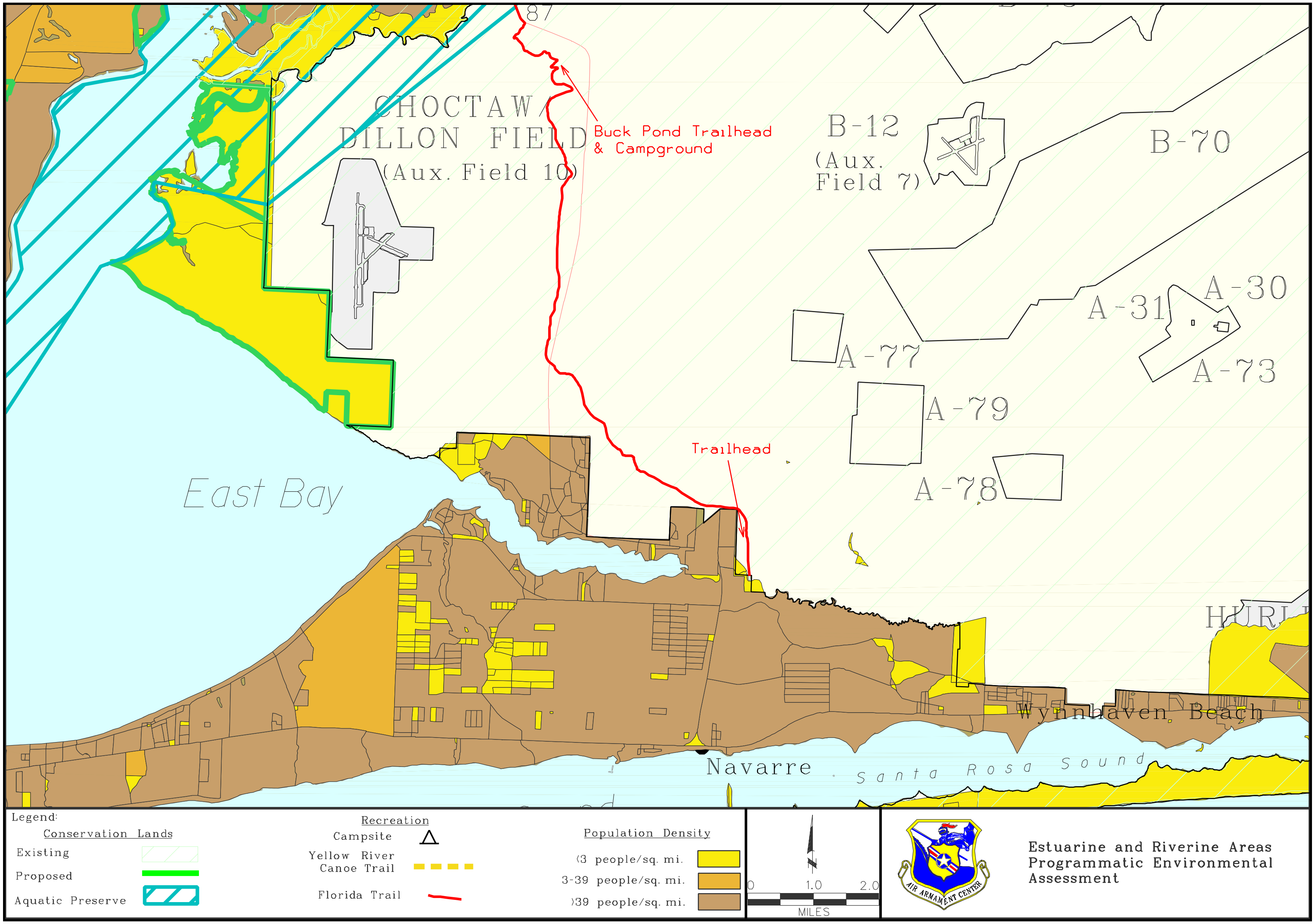

Figure 3-17. Population and Existing Conservation Land Near East Bay and East Bay River

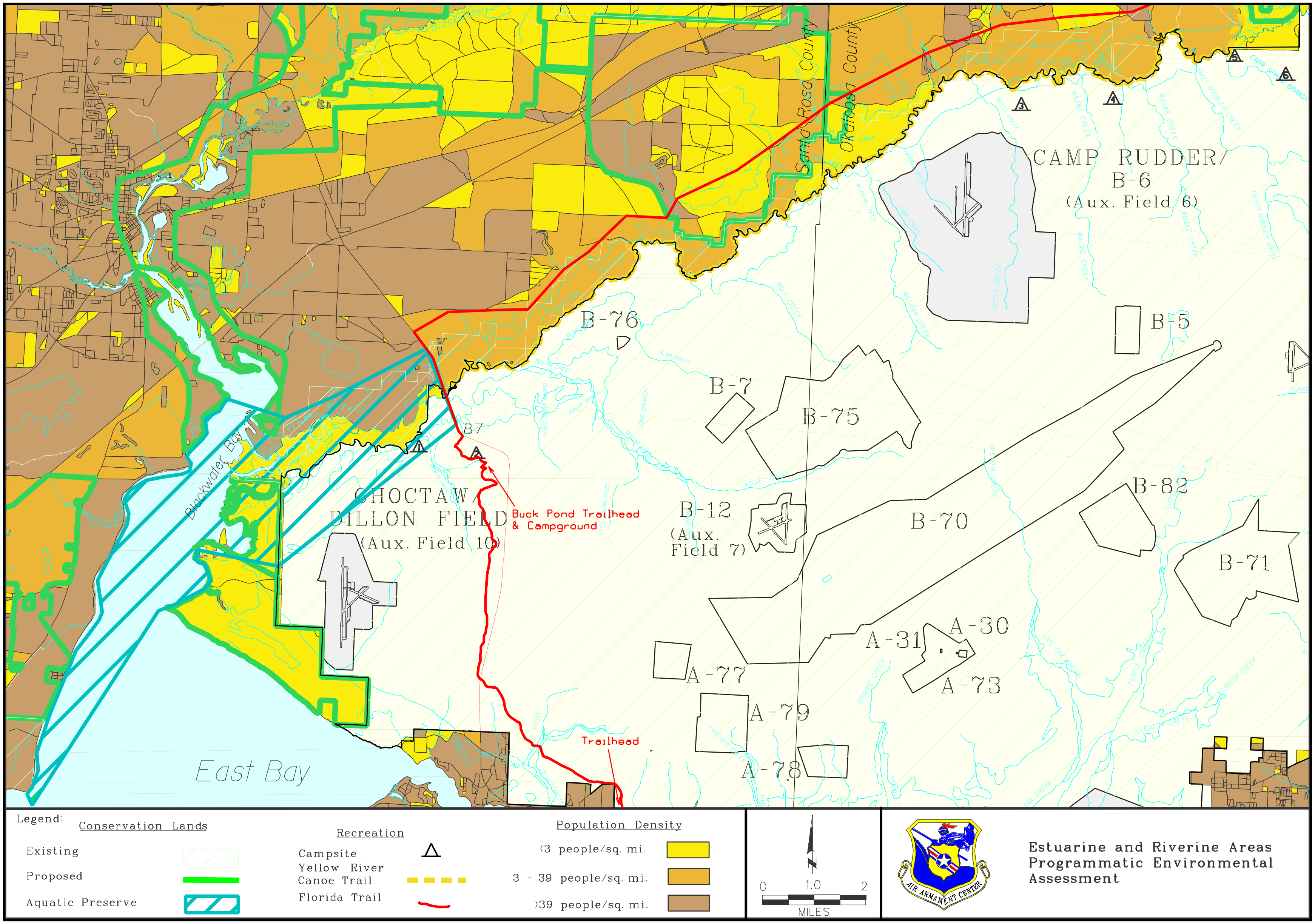

Figure 3-18. Population and Existing Conservation Land Near the Yellow River

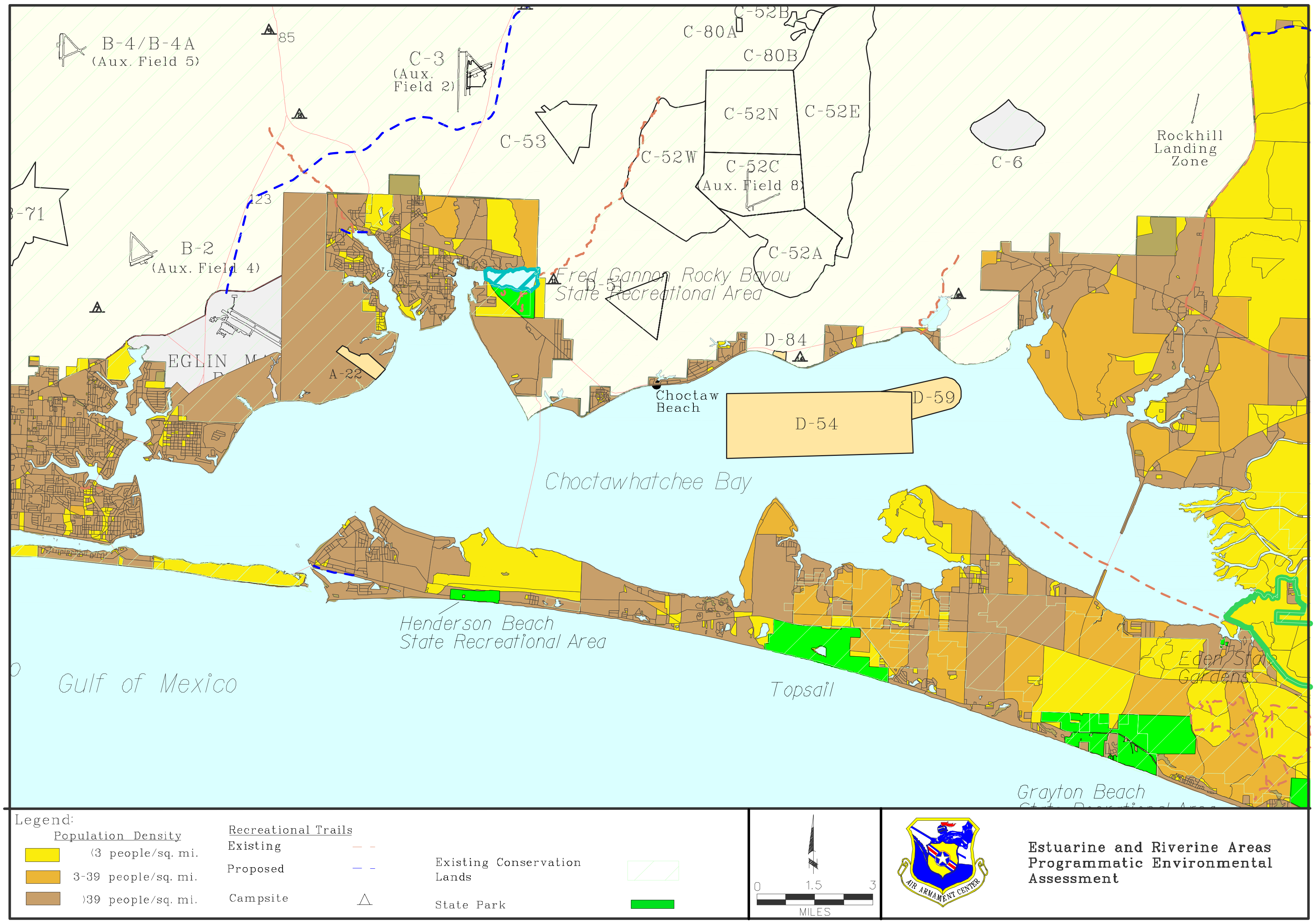

Figure 3-19. Population and Existing Conservation Land Near Choctawhatchee Bay

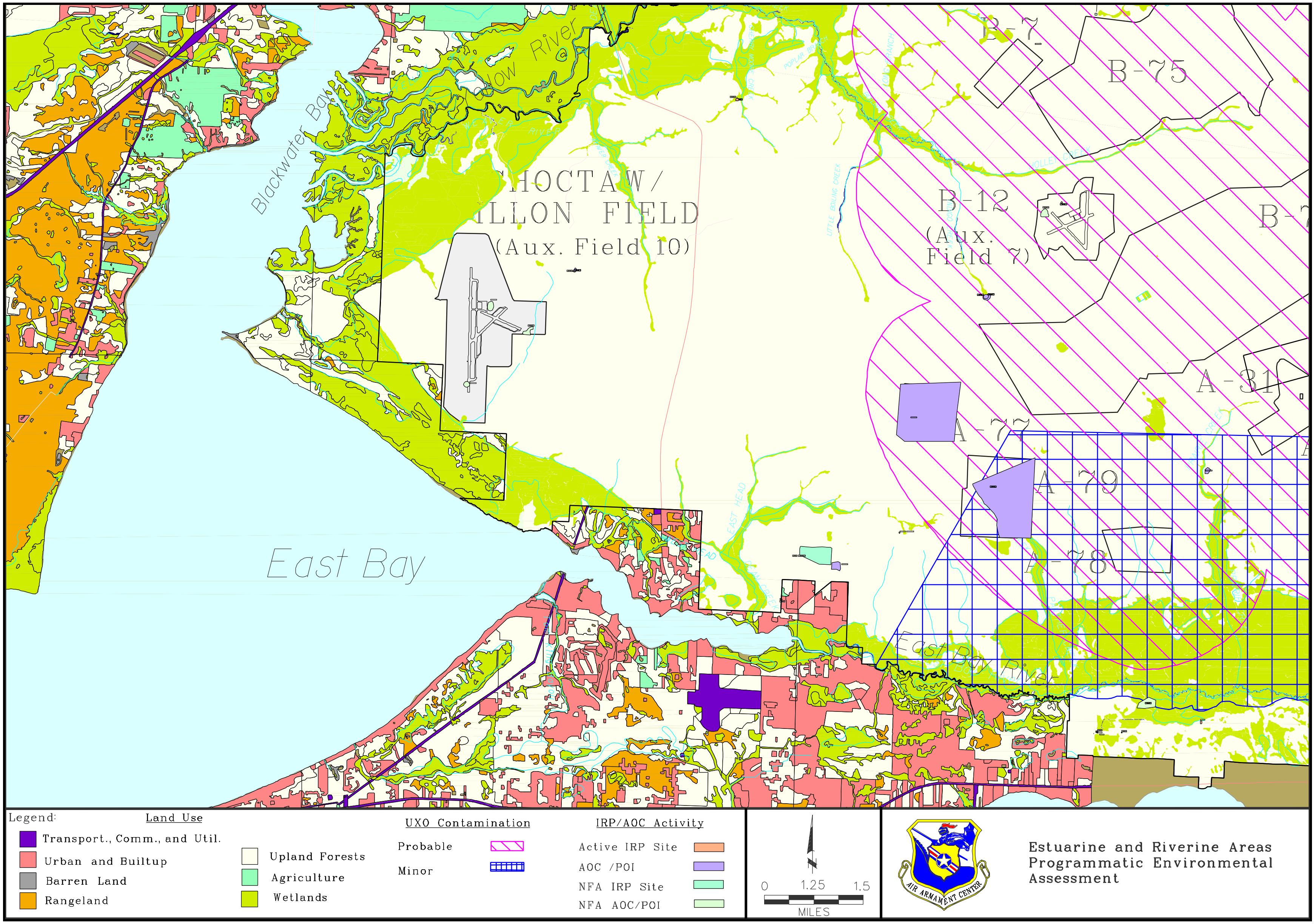

Figure 3-20. Land Use Adjacent to East Bay and East Bay River

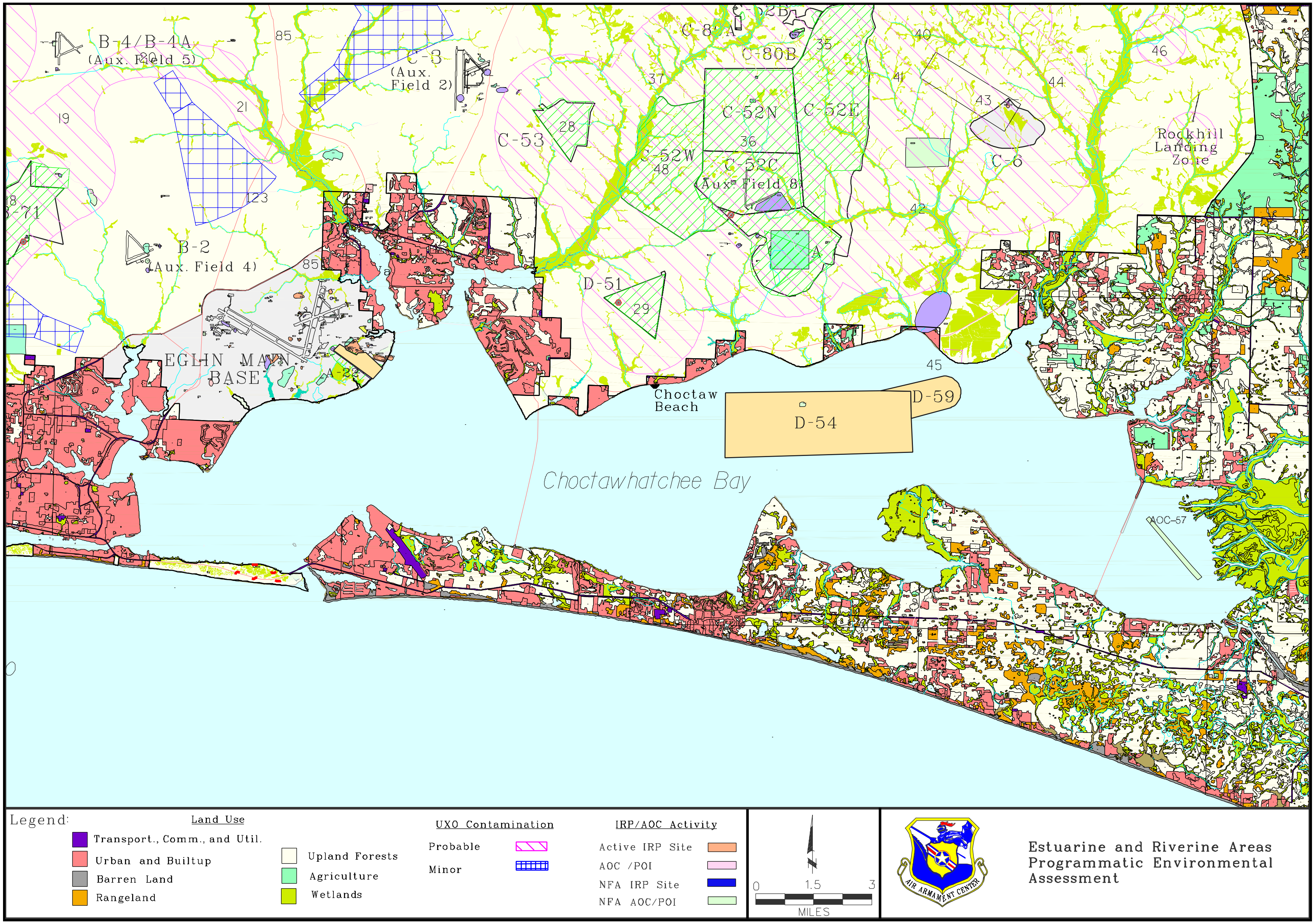

Figure 3-21. Land Use Adjacent to Choctawhatchee Bay

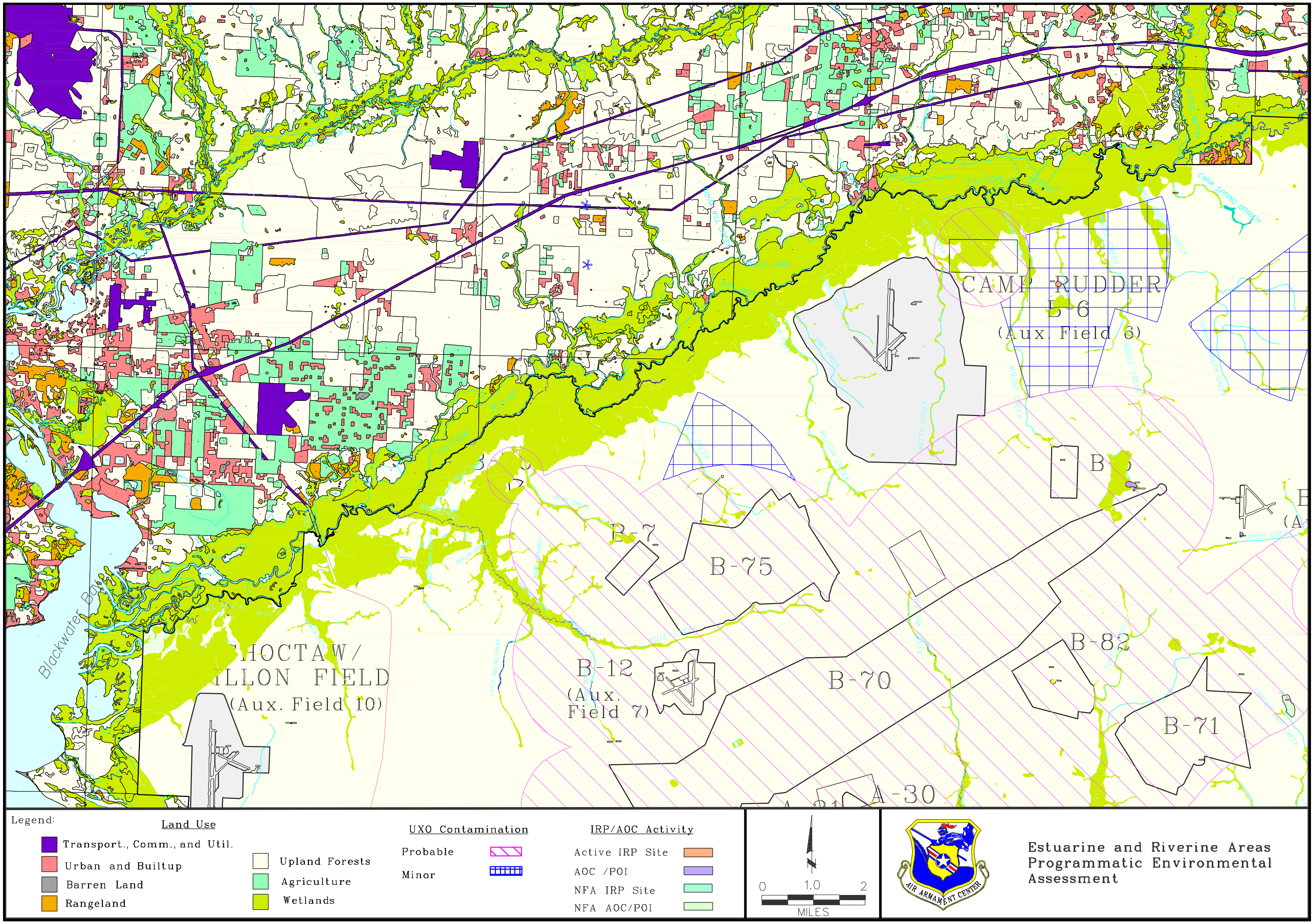

Figure 3-22. Land Use Adjacent to the Yellow River

Population

Since 1920, the population in the entire Choctawhatchee River-Bay drainage has nearly doubled from 191,951 to 370,765 persons. The most noticeable change occurred in Okaloosa County, whose population increased 15 fold from 9,360 to 143,776 persons from 1920 to 1990. Resource quality issues (Livingston, 1986) of the study area include decrease in seagrass habitat (20 percent losses), decrease in marshgrass habitat, apparent decrease of commercial species, and degradation of sediment communities in some areas.

The following are water- and sediment- quality issues cited (Paulic and Hand, 1994; Livingston, 1986) for the Bay: point source pollution (e.g., wastewater treatment plants, industry), nonpoint source pollution (e.g., urban and agricultural runoff, septic tanks), human usage (e.g., boating, fishing), hydrological modifications (e.g., bridges, causeways, dredging), and vertical stratification of salinity (e.g., leads to low oxygenation).

3.3.1 Socioeconomic – Commercial and Recreation Activities

Choctawhatchee Bay/Santa Rosa Sound

As of 1994, 14,741 registered commercial and recreational vessels were operating in Okaloosa County and 2,576 registered vessels were operating in Walton County; an estimated 10 to 15 percent of the vessels were personal watercraft, such as jet skis and waverunners (Joyner, 1995). In 2000, there were 15,516, 3,803, and 11,185 registered vessels in Okaloosa, Walton, and Santa Rosa Counties, respectively. Okaloosa County ranked 6th in the state for number and severity of boating accidents out of 67 counties. Walton and Santa Rosa Counties were 37th and 33rd. Okaloosa County ranked 4th in the state in 2000 for accidents involving personal watercraft.

Reported revenues from Choctawhatchee Bay commercial fishing totaled $2.7 million for 1990 through 1994, accounting for nearly 14 percent of all commercial fishing revenue in Okaloosa and Walton Counties. Gulf of Mexico catch totaled $17 million (86 percent of revenues) over the same five-year span (FDEP, 1995). Bay landings and revenues decreased by 40 percent from 1990 to 1994, while trips decreased by only 13 percent. Dollar values and landings per trip decreased by 32 to 35 percent (FDEP, 1995).

Problems associated with fishing and boating include depletion of stocks, destruction of habitat, and degradation of water and sediment quality. Marina construction was cited as a contributor to bayou metal contamination. Lead, copper, tin, petroleum, and raw or partially treated sewage may also originate from boat usage (Barnett and Teehan, 1989).

Yellow River, East Bay, and East Bay River

Recreational use of the Yellow River, East Bay, and East Bay River include fishing, crabbing, boating and canoeing, camping, and swimming. Species fished include largemouth bass, spotted bass, shadow bass, warmouth, bluegill, redear sunfish (shellcracker), longear sunfish, spotted sunfish (stumpknocker), chain pickerel, channel catfish, and striped bass.

Two commercial fish camps are located near the end of Highway 89 and provide access to the Yellow River; a public landing is located at the south end of the Highway 87 Bridge. Fishing has generally suffered from drought conditions over the last two years. According to the FWC, a year or more of normal rainfall may be necessary to restore the quality of fishing on the Yellow River (FWC, 2001). Long stretches of the river are undeveloped and provide good wildlife viewing opportunities. The current averages 2 to 3 mph on the lower section and increases to over 3 mph on the upper sections where the grade is steeper. Motorboats are more numerous on the lower sections where the fishing is better. The Yellow River Canoe Trail, which begins north of the reservation, extends 31 of its 56 miles along the reservation boundary. The canoe trail may be accessed at the State Road 2 Bridge at Oak Grove, the U.S. 90 Bridge west of Crestview, a boat ramp on State Road 189, and the State Road 87 Bridge. The trail has a moderate level of difficulty requiring intermediate canoeing skills (FDEP, 2001a). Figure 3-17 and 3-18 show recreation and conservation areas associated with the Yellow River, East Bay, and East Bay River. Figure 3-19 shows population and conservation lands around Choctawhatchee Bay.

Commercial Shipping

The Gulf Intracoastal Waterway crosses through several northern Gulf inland water bodies and is the primary shipping route through Choctawhatchee Bay and Santa Rosa Sound for vessels transporting oil, coal, chemical products, and other bulk items. The USACE maintains data of the number of vessels using the waterway, as well as the amount of items shipped. From 1990 to 1999, vessels (tankers, tugs, and barges) averaged 8,400 trips over the Intracoastal Waterway through Choctawhatchee Bay, averaging 115 million tons per year. A ten-year chart of total tons shipped is presented in Figure 3-23. Trips for other years were estimated based on 1998 average tons per trip. Barge boat-miles traveled through the Bay would approximate 250,000 miles per year based on length of Bay (30 miles) times number of trips (8,400).

3.3.2 Unexploded Ordnance

Military Activities and Unexploded Ordnance

Historical water ranges and safety fans of land ranges that extend out over the water have been identified as areas that may potentially contain UXO. A description of historical ranges is provided in Appendix C

Compared to historical use, few missions are currently conducted in Choctawhatchee Bay. As previously discussed in Chapter 2, evidence of historical water ranges still exists, most noticeably at TA D-55 where an arrangement of utility poles is still located near the mouth of the Choctawhatchee River.

According to Eglin Geographic Information System (GIS) files, areas near East Bay River fall within a zone designated as having “minor” contamination, while all areas west of Hwy 87 are uncontaminated. Areas adjacent to the Yellow River are uncontaminated; the closest “probable contamination” zone is related to an inactive test area east of Camp Rudder.

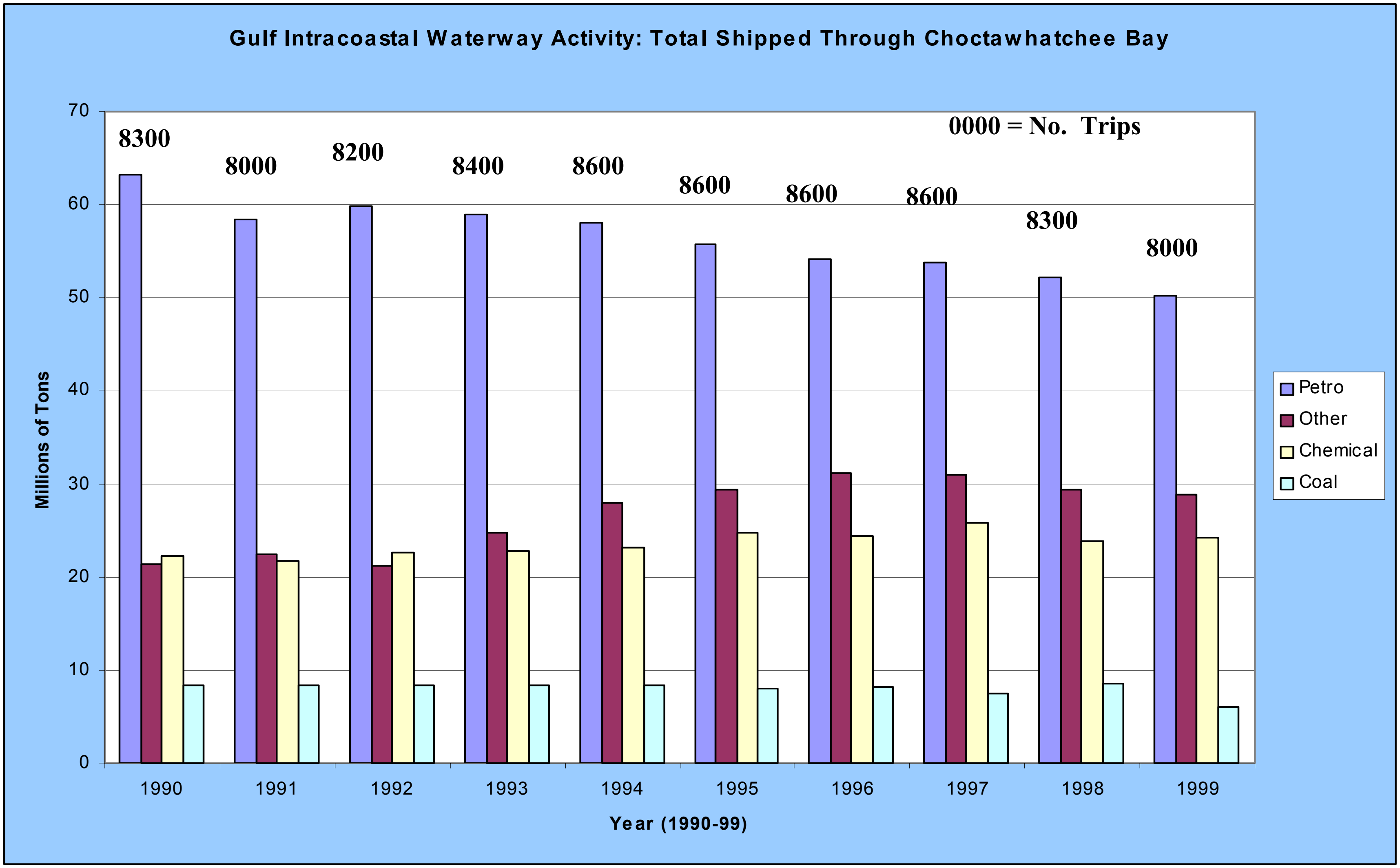

Figure 3-23. Commercial Shipping Activity in Choctawhatchee Bay

3.3.3 Dredging

Dredging activities have occurred in Choctawhatchee Bay in the past. Radcliff Company, Mobile, Alabama, removed eight million cubic yards of oyster shell and sediment from 1946 to 1970. Currently, the USACE does not dredge in the Bay, but maintains the intracoastal passage entering the eastern end of the Bay and East Pass, and Santa Rosa Sound (USACE, 1995). Extensive dredging was necessary to restore clear passage to East Pass after Hurricane Opal.

3.3.4 Damming the Yellow River

At the recommendation of the "Citizens for Water Conservation," Okaloosa County Commissioners have funded a study analyzing damming the Yellow River north of Crestview, Florida, to create a reservoir for water use and recreation, and to possibly generate hydroelectric power from the dam (Florida Wildlife Federation, 2001). Environmental issues related to the construction of a dam on the Yellow River include decreased water flow, introduction of invasive and exotic water weeds (a common problem in reservoirs), and potential impacts to the habitat of sensitive species. Damming of the Yellow River would impact designated critical habitat for the Gulf sturgeon. Impacts to military missions would also potentially occur if water levels to the Yellow River and adjoining tributaries were sufficiently lowered as to prevent the access of special operations training boats.

3.3.5 Deadheading

Deadheading occurs in the Yellow River and refers to the practice of removing sunken logs from the bottoms of rivers, lakes, and bays. The logs are left over from historical logging operations, when a common means of transporting logs out of the forest was to float them down the nearest water body. Some of the logs soaked up water and sank and were preserved in the low oxygen mud. The logs are removed from the bottom by winch and sold for profit. Environmental issues arising from this activity deal with the increased sedimentation and disturbance of habitat of sensitive species on the Yellow River, such as the Gulf sturgeon.

3.3.6 Pollution

The CWA (33 USC 1362[6]) defines pollutants to include "dredged soil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste."

Pollutants originate from two main sources, point sources and non-point sources. The CWA defines a point source as "any discernible, confined, and discrete conveyance" (33 USC 1362 [14]; 40 *CFR* 122.2), and includes such things as pipes, ditches, tunnels, wells, and vehicles, including aircraft. Point source pollution is often associated with wastewater treatment plant (WWTP) outfalls, power plant outfalls, and industrial or chemical plant effluents. Non-point sources are areas from which runoff occurs and include golf courses, lawns, construction sites, paved areas, and agricultural and forestry activities.

Point Source Pollution

Ten WWTPs are located in the Choctawhatchee Bay area but none discharge directly into Bay waters. Effluent disposal from all ten WWTPs is through spray field irrigation, but several tributary systems within the basin still have problems (i.e., nutrients, nuisance algae growth) associated with domestic or industrial discharge. Alligator, Holmes, and Camp Branch Creeks receive discharge from Chipley, Graceville, and Bonifay WWTPs, respectively. West Sandy Creek receives discharge from DeFuniak Springs' WWTP. There are WWTPs on the Yellow River.

Non-point Source Pollution

Non-point source contaminants are carried to water bodies through direct runoff or from percolation through soil to groundwater (Hand et al., 1994). Possible non-point pollution sources in the study area include WWTP spray field runoff, urban and agricultural runoff, septic tank leachate, landfill leachate, silviculture operations (logging), hydrologic modifications (bridges, causeways), golf courses, and marinas. Areas affected by non-point sources are Sandestin Harbor; Horseshoe, Alaqua, LaGrange, Boggy, Cinco, and Garnier Bayous; and eastern riverine sections (Livingston et al., 1988; Livingston, 1986; Hand et al., 1994). Septic tanks along the Yellow River, Santa Rosa Sound, East Bay, and Choctawhatchee Bay may be leaching contaminants as well.

Urban and Agricultural Runoff

Runoff enters the Bay waters through bayous, creeks, and ditches primarily during storm events either directly or as overland sheet flow. Urban and agricultural runoff are sources of fecal and total coliform and fecal streptococcus bacteria. Septic tank leachate and domestic animals are the primary bacterial contributors (Barnett and Teehan, 1989). Increased upland freshwater usage presents problems of decreased freshwater flow and return of nutrient- and contaminant-laden water through runoff (USDA SCS, 1993; Rozengurt and Haydock, 1991). Sprayfield runoff from WWTPs (Livingston et al., 1988), septic tank seepage, and marina construction has all been associated with habitat degradation (Livingston, 1986).

The Choctawhatchee River has been described as moderately impacted from agricultural runoff, including increased turbidity, nutrients, and pesticides (Hand et al., 1994). Coastal eutrophication (a condition of excess nutrients and low oxygen) is indicated by algal blooms, high chlorophyll a concentrations in the water column, and subsequent increased turbidity; these effects reduce available light and have been implicated in seagrass bed dieoffs (Turner and Rabalias, 1991). High chlorophyll a concentrations near the river mouth and in East Pass possibly indicate agricultural and development impacts, respectively. Deposition of nitrogen from the atmosphere in amounts equal to river runoff as a result of wind erosion, where dust from agricultural fields is carried airborne and deposited through precipitation, has also been documented. Increases in nitrogen and decreases in silicon have been documented as causing decreases in favorable diatom (a class of algae) populations and increases in harmful blooms of dinoflagellates (another class of algae) that can cause red tides and other problems (Short et al., 1991). Reduction of available light resulting from eutrophication and increased suspended sediments is believed to be the most serious threat to seagrass population health (Short et al., 1991; Livingston, 1986).

IRP/AOC

As a result of past resource and waste management practices, some areas of Eglin AFB were contaminated by various chemical compounds (U.S. Air Force, 2000b). In response, environmental restoration programs have been initiated at the base. Ongoing efforts to comply with applicable laws and regulations ensure that present resource and waste management practices are carried out in a manner that protects human health and the environment. IRP and AOC sites are identified for Eglin AFB in Figures 3-20 through 3-22.

AOC-03/FT-92 is the site of an inactive skeet range, located at the end of the range road on Eglin Main Base on the shoreline of Choctawhatchee Bay. It was initially investigated as an area of concern and further investigated as IRP Site No. FT-92. The AOC file is now closed. This facility was in use for ~30 years. Painted clay target fragments, assumed destroyed with lead shot, were observed during a 1995 site investigation, but were not found to contain lead. Sediment analysis indicated the presence of a few metals below levels of concern. No further action (NFA) has been recommended and approved for this site (U.S. Air Force, 2000b).

AOC-12 is a target vessel located in Test Area D-54 in Choctawhatchee Bay. The vessel, historically used for aircraft munitions testing, was identified as a potential source of environmental contamination from metals and unexploded ordnance (U.S. Air Force, 2000b).

AOC-57 is a grid of creosote pilings in east Choctawhatchee Bay that constitutes the now inactive Test Area D-55 initially constructed in 1959. It was identified in 1991 as a potential source of contamination due to the creosote in the pilings. An environmental assessment focusing on the pilings was conducted in February 1994. Removing the pilings was deemed cost-prohibitive and potentially more environmentally impactive than leaving them in place (U.S. Air Force, 2000b).

AOC-68 is the Eglin Main Base Gunnery Butt at Test Area A-22, a currently active test area on the western end of Choctawhatchee Bay. The analysis of this site was also included in a separate base-wide radiological survey. The Gunnery Butt is ~500 feet wide and 1 mile long, with an impact area extending 3 miles into Choctawhatchee Bay. This facility has been used for the testing of aircraft guns with ammunition up to 40 millimeters in size and other associated hardware. This facility also has been used to test small arms and flares. Various metal-bearing projectiles (including lead) have been tested on site for >50 years. Prior to 1972, activities at this site were not extensively documented. The facility consists of four concrete target butts, placed at 200, 400, 600, and 1,000 yards downrange. These targets are 12 feet high and have an earthen berm on the impact side. The earth is periodically replaced and the spent projectiles recycled; however, unexploded projectiles could remain in the subsurface of the site. Depleted uranium projectiles were tested only once at this range, and all fragments were collected and removed (U.S. Air Force, 2000b).

Point of Interest (POI) 303 is located West of Hurlburt Field approximately 800 feet from the East Bay River. Investigations determined that POI-303, initially thought to be a former Chemical Waste Treatment Plant site, did not exist as the plant was planned but never constructed. The POI file for this site is closed (U.S. Air Force, 2000b).

POI-335 is the site of a round disposal area for the now inactive Main Base Skeet Range. Metal debris and spent munitions were suspected to occur along the shore of this site but their presence could not be confirmed during a 1997 site visit. POI No. 335 lies within Eglin's Test Range A-22, which is currently active.

POI-345 is a former munitions storage site located approximately 1,300 feet south of the Yellow River on Carr Spring Branch, northeast of Auxiliary Field No. 6. In addition to 30- and 50-mm munitions, five storage bunkers, two abandoned trucks, and two mock tank targets were also observed at the site. EOD personnel removed the munitions from this site in September 1995. The USEPA approved a No Further Action (NFA) status in 1999 and the POI file was closed (U.S. Air Force, 2000b).

AOC-417 is a C-141 crash site located in the western portion of the Eglin reservation in the East Bay Swamp approximately four miles north of Hurlburt Field. The crash occurred on February 20, 1989. Two 150-pound depleted uranium counterweights were located in the wings of the aircraft and are now assumed to be buried underneath several feet of water and mud. The U.S. Air Force Radioisotope Committee recommended that the counterweights be left in place after a determination that in their present state they posed no threat to the public. No further action was recommended for this site.

Site SS-01 is a petroleum- and chlorinated- solvent contamination site located at TA-20 approximately 4,000 feet from the East Bay River. The site consists of a radar operations building, a pump house, an electrical generator building, and a sewage treatment plant. In 1984 fuel odor was detected in a lift-station manhole. An environmental investigation confirmed that leaks or spills in the storage tank area entered the groundwater and migrated in a north-northeast direction. The site is being remediated and a groundwater treatment system is presently in operation. In addition, a malfunctioning electrical transformer on the northern side of the generator building caused PCBs to seep into the soil. The PCB-contaminated soil was excavated in November and December of 1996. Further assessment of the soil and groundwater has been contracted to completely characterize the extent of any remaining petroleum, solvent, or PCB contamination. Due to the distance (>3,000 feet) of the nearest domestic well from the site, risks to people from contaminated groundwater are expected to be low. The expected site closeout date is July 2002 (U.S. Air Force, 2000b).

Site SS-02 is a Radar Facility Diesel Fuel Leak site located about five miles west of Hurlburt Field and about one mile north of the East Bay River on Range Road 668. The site is known as the TA-21 radar facility and consists of the main radar building, two radar towers, a pumphouse and base drinking water well, and a paved parking area. The site is approximately one acre in size, is fenced, and contains a 1,000-gallon aboveground diesel fuel tank that leaked an unknown amount of fuel over a period of time. Volatile organic compounds (VOCs) and the metals antimony and molybdenum were detected in initial groundwater samples collected from the site. The groundwater is approximately five feet below ground surface (bgs) and generally flows north toward East Bay. Surface water runoff is believed to be toward East Bay Swamp. In 1995, the USEPA concurred with the NFA recommendation because sampling indicated that the site was no longer issuing contaminants into the groundwater (U.S. Air Force, 2000b).

POI-500 is a former Eglin waste site located adjacent to the Santa Rosa County Holley Landfill approximately one mile from the East Bay River. An assessment is ongoing to determine whether or not the site is contributing to contamination observed in landfill monitoring wells (U.S. Air Force, 2000b).

Site LF-95 is the Holley Sanitary Landfill, which operated from 1977 until 1992, located approximately one mile from the East Bay River on State Road 87. During its operation, residential, agricultural, municipal, and commercial waste materials were delivered to the site. Contaminants detected in wells and water samples include VOCs, benzene and vinyl chloride, high levels of iron, as well as low pHs. The total area of the site encompasses approximately 160 acres. A remedial system is in place with an anticipated closeout date of 2006 (U.S. Air Force, 2000b).

3.3.7 Conservation Lands

Existing Conservation Lands

Existing conservation lands (Figures 3-17 through 3-19) include the Eglin reservation, once known as the Choctawhatchee National Forest, the Blackwater State Forest, the Yellow River Aquatic and Buffer Preserve, the Yellow River Water Management Area, and the Yellow River, an OFW.

Proposed Conservation Lands

The Escribano Point Acquisition (Figure 3-17) is located between the Eglin AFB and the Blackwater Bay and East Bay. Approximately 4,830 acres of relatively undisturbed land have been targeted for acquisition by the state of Florida to help protect the local bay systems and downstream areas of the Blackwater and Yellow Rivers from environmental effects primarily related to development (USF, 2001). Grassy Point (a portion of Escribano Point) has been purchased by the Northwest Florida Water Management District, but the other portion (the actual point) is still being pursued. The acquisition would essentially serve to connect existing conservation areas of Garcon Point, the Yellow River Marsh Aquatic Preserve, and Eglin AFB into one large corridor with a variety of wildlife habitats (USF, 2001).

The consolidation would help preserve natural hydrologic conditions presently susceptible to development, maintain wet prairie, bay swamp, and tidal marsh areas important as nutrient sources or nurseries for many of the bay system animal species, and provide a buffer for military training operations.

3.3.8 Cultural Resources

Of the 463,000 acres comprising the Eglin Military Complex, 100,000 acres have been surveyed and over 1,300 cultural sites identified. As a federal agency, Eglin is required by law to consider the effects of its actions on historic properties. Mandating regulations include the Antiquities Act of 1906, Historic Sites Act of 1935, National Environmental Policy Act of 1969, National Historic Preservation Act (NHPA) of 1966 as amended, 36 CFR Part 800, Archaeological and Historical Preservation Act of 1974 (AHPA), Archaeological Resources Protection Act of 1979 (ARPA), Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), American Indian Religious Freedom Act (AIRFA), and Air Force Instruction 32-7065. The most consequential among these in terms of cultural resources responsibilities is the NHPA, which details the Section 106 compliance process.

Section 106 of the National Historic Preservation Act requires that federal agencies analyze the impacts of federal activities on historic properties. The Section 106 review begins with the identification of an area of potential effect and an assessment of information needs. In this step, all available information on historic properties is examined to determine the proper course of action. The assessment of information needs could lead to a determination that no action is required. Alternatively, the assessment may result in the need for cultural resources investigations (e.g., historical research, field survey, architectural survey, among others).

Section 106 review is initiated during Eglin's environmental impact analysis process (EIAP) when AAC/EMH determines if a project qualifies as an "undertaking" (as defined in 36 CFR Part 800). If it is determined the action is an undertaking, the process proceeds in consultation with the State Historic Preservation Officer (SHPO) and any other identified consulting parties. An undertaking will have an adverse effect on a property if any part of the undertaking, directly or indirectly, might alter the characteristics that qualify the property for inclusion in the National Register of Historic Places. If adverse effects are determined, mitigation plans are developed in consultation with the SHPO. Section 106 Compliance is achieved upon completion of a memorandum of agreement (MOA) between the agency (Eglin) and the SHPO.

AAC/EMH is currently integrating their maps into a GIS to better describe definitive areas of cultural resource concern. A map of all of the areas of cultural resource concern on Eglin is in production and upon completion will be placed in the GIS viewer and on the Eglin internal website. More specific information is sensitive and AAC/EMH should be consulted on a need-to-know basis. Until a complete survey of the areas of concern has been accomplished, the danger of direct physical impact to unknown cultural resources is a possibility.

Several sites exist along the Eglin property of East Bay and user groups are aware of which areas to avoid (U.S. Air Force, 2001d). Most, if not all, sites along the Yellow River have been surveyed, particularly at the landing areas used by ground operations training groups (U.S. Air Force, 2001d).

AAC/EMH has surveyed many of the areas along the Bay, concluding that many are potential cultural resource concerns. Important cultural resource sites are present near Alaqua Bayou on Choctawhatchee Bay, and a site exists near Wynnhaven Beach, an important troop crossover area. The site near Wynnhaven Beach is currently undergoing Section 106 mitigation.

3.3.9 Wildfires

Wildfires are usually detected by Eglin Natural Resources Branch personnel, Civil Air Patrol aircraft, military aircraft, Florida State Division of Forestry (DOF) fire towers, mission control personnel, or the public. Four fire towers that Eglin uses only under severe fire hazard conditions are Jackson Guard, Okaloosa, Ramer, and Metts Towers. Two other towers are owned by the Florida DOF: the Crestview Tower (Okaloosa County) and the Coldwater Tower (Santa Rosa County).

Some causes of wildfire include mission activities, arson, carelessness of children and hunters/campers, lightning, and downed power lines. Most wildfires on Eglin occur around test areas (historically 75 percent) from mission activities such as explosions and air-to-ground gunnery. There are two primary dry seasons on Eglin when fire hazards increase (April through May and mid-September through November); however, the fire season is year-round (U.S. Air Force, 2002b). The high-intensity storms that frequent this area not only deliver significant amounts of rain, they also create frequent lightning strikes, which can easily start wildfires.

These lightning events and associated fires were historically instrumental in sustaining fire-dependent plant communities such as the Longleaf Pine-Wiregrass association. However, recent events have shown that wildfires can still have widespread, devastating effects on the landscape. Table 3-11 presents causes of wildfire data from 1990 through 2002 for Eglin.

Table 3-11. Eglin AFB Wildfires for 1990 through 2002

Cause	Metric	Year									
		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Air Force Mission	*Number of Fires*	64	51	45	38	40	42	27	36	46	48
	Acres Burned	4322	4295	9554	9640	2614	11917	4500	2933	9599	10408
	Average Size (ac)	68	84	212	254	65	283	166	81	209	217
Army Mission	*Number of Fires*	19	11	11	10	20	18	20	18	14	12
	Acres Burned	726	314	2627	1245	755	6140	860	1975	637	216
	Average Size (ac)	38	29	239	125	38	341	43	110	45	18
Arson	*Number of Fires*	5	3	6	22	1	5	4	2	1	3
	Acres Burned	6	56	2696	2418	6	60	203	2.6	14	13
	Average Size (ac)	1	19	449	110	6	12	51	1.3	14	4
Children	*Number of Fires*	2	5	2	3	5	3	2	1	1	4
	Acres Burned	0	10	251	101	24	0.2	0.5	3	14	181
	Average Size (ac)	0	2	126	34	5	0.07	0.25	3	14	45
Hunters	*Number of Fires*	0	0	0	1	0	1	2	0	0	2
	Acres Burned	0	0	0	10	0	0.25	9	0	0	117
	Average Size (ac)	0	0	0	10	0	0.25	4.5	0	0	58
Lightning	*Number of Fires*	7	1	4	2	3	6	5	24	7	7
	Acres Burned	225	50	221	1	18	174	32	875	110	2348
	Average Size (ac)	32	50	55	0	6	29	6.4	36	16	335
Miscellaneous	*Number of Fires*	4	9	9	9	9	9	6	7	2	1
	Acres Burned	35	986	546	12	346	543	438	3029	372	378
	Average Size (ac)	9	110	61	1	38	60	73	433	186	378
Powerline	*Number of Fires*	4	1	1	2	0	2	0	2	4	1
	Acres Burned	14	0	2	1	0	1.2	0	25	58	18
	Average Size (ac)	4	0	2	1	0	0.6	0	13	14.5	18
Unknown	*Number of Fires*	11	5	9	10	5	11	3	19	8	30
	Acres Burned	241	3	1286	44	94	1580	200	911	180	919
	Average Size (ac)	22	1	143	4	19	143	67	48	22	31

ac = acre Source: U.S. Air Force, 2001j

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4. ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter analyzes the potential environmental impacts of the alternatives described in Chapter 2 on the affected environment described in Chapter 3. The paragraphs below explain the process used to accomplish the EIAP. Mission activities are referred to as ***effector***s while components of the affected environment are referred to as ***receptors.*** The riverine and estuarine study areas are depicted in Figure 4-1.

An environmental consequence ***issue*** is a general category of common effector products, by-products, and/or emissions (pollutants) that may be collectively analyzed for potential impacts to the affected environment receptors. Six broad categories of potential environmental consequence issues have been identified for the study areas and are titles of the subheadings of this chapter:

- Noise (Section 4.2)
- Restricted Access (Section 4.3)
- Chemical Materials (Section 4.4)
- Debris (Section 4.5)
- Direct Physical Impacts (Section 4.6)
- Habitat Alteration (Section 4.7)

Similarly, the Affected Environment (Chapter 3) resources have also been divided into three general resource categories for impact analyses:

- Physical Resources
- Biological Resources
- Anthropogenic Resources

Military activities within the estuarine and riverine areas include primarily special operations types of missions and infrequent testing and technology demonstrations characterized by air-to-water and water-to-land transitions of troops, vessels and equipment. Alternatives 4 and 5 are characterized by live-fire operations primarily in areas not previously used for that purpose.

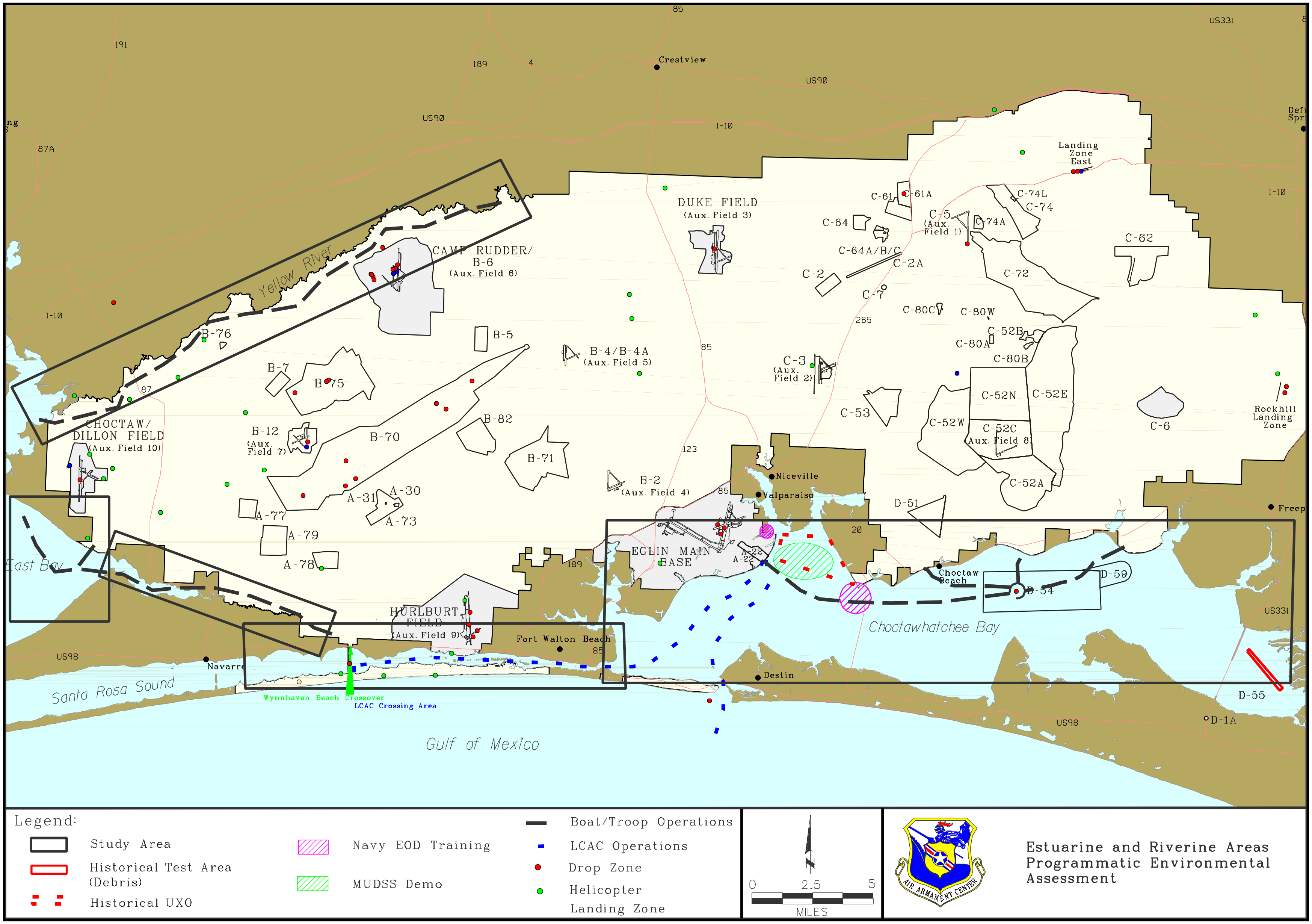

Figure 4-1. Estuarine and Riverine Study Areas

Mission activity categories are described as they pertain to environmental issues. Data from the baseline years (FY95 to 99), plus selected historical activities, are used for environmental analysis. The baseline data indicates the location of the activity and the mission expendables (e.g., smokes).

Impacts to receptors were measured based on a comparison to available criteria. If criteria were not available, then impact analysis was based on available literature. Measurements were frequently derived from maps of the affected environment overlain with quantifiable aspects of mission activities. Environmental issues related to riverine and estuarine ground operations activities and the potential impacts to receptors are presented in Table 4-1.

Table 4-1. Environmental Issues and Potential Impacts to Receptors

Receptor Categories	ENVIRONMENTAL CONSEQUENCE ISSUES					
	Noise	**Restricted Access**	**Chemical Materials**	**Habitat Alteration**	**Debris**	**Direct Physical Impact**
Physical Resources *Air* *Water* *Soils/Sediments*	–	–	o	–	–	o
Biological Resources *Wildlife* *T&Es* *Sensitive Habitats*	o	–	o	o	o	o
Anthropogenic Resources *Cultural Resources* *Public/Populated Areas* *Commercial Interests* *Recreational Users* *Military Mission*	o	o	–	o	o	o

o = potential impact
– = no potential impact
T&E = Threatened and Endangered [Species]

Potential environmental issues arising from the alternatives are summarized in Table 4-2 and are discussed in the appropriate sections to follow. The specific resources (receptors) affected are listed in the table for each alternative and their associated issues. A major issue is one that potentially does not meet the requirements of a federal, Air Force, or state regulation; represents an impact to the military mission; or requires management to offset potential impacts. A minor issue is one with minimal or negligible effects on resources. Minor issues are already being managed by existing management practices or can be managed through existing management practices.

Table 4-2. Potential Environmental Issues by Alternative

Alternative	ENVIRONMENTAL ISSUES					
	Noise	**Restricted Access**	**Chemical Materials**	**Debris**	**Direct Physical Impact**	**Habitat Alteration**
Alt. 1: FY (fiscal year) 95-99 Baseline	Public (Annoyance)	Recreation	Wildlife/T&E	Wildlife/T&E	Mission Impact: erosion	Shoreline erosion
	Wildlife/T&E	Commercial	Air Quality	Public (Safety)	Cultural Resources	Sensitive Habitats
			Water Quality			Public (Safety-wildfire)
Alt. 2: Authorization of Baseline	Public (Annoyance)	Recreation	Wildlife/T&E	Wildlife/T&E	Mission Impact: erosion	Shoreline erosion
	Wildlife/T&E	Commercial	Air Quality	Public (Safety)	Cultural Resources	Sensitive Habitats
			Water Quality			Public (Safety-wildfire)
Alt. 3: 100% Increase of Alt 1.	Public (Annoyance)	Recreation	Wildlife/T&E	Wildlife/T&E	Mission Impact: erosion	Shoreline erosion
	Wildlife/T&E	Commercial	Air Quality	Public (Safety)	Cultural Resources	Sensitive Habitats
			Water Quality			Public (Safety-wildfire)
Alt. 4: Alt. 3 + Live-Fire Estuarine Range	Public (Annoyance)	Recreation	Wildlife/T&E	Wildlife/T&E	Wildlife/T&E	Wildlife/T&E
	Wildlife/T&E	Commercial	Air Quality	Public (Safety)	Sensitive Habitats	Sensitive Habitats
	Mission Impact: Range Safety Policy		Water Quality	Mission Impact: Range Debris	Public (Safety)	Public (Safety-wildfire)
					Cultural Resources	
Alt. 5: Alt. 4 + Live-Fire Riverine Range	Public (Annoyance)	Recreation	Wildlife/T&E	Wildlife/T&E	Wildlife/T&E	Wildlife/T&E
	Wildlife/T&E	Mission Impact: Safety Footprints	Air Quality	Public (Safety)	Sensitive Habitats	Sensitive Habitats
	Mission Impact: Range Safety Policy		Water Quality	Mission Impact: Range Debris	Public (Safety)	Public (Safety-wildfire)
				Water Quality/ Wetlands	Cultural Resources	Shoreline erosion

Key:

Minor Issue: Low Potential for Effects	Major Issue: BMPs Required

4.2 NOISE

Noise is one of the most common environmental issues associated with human activities, especially military training. Concerns regarding noise relate to potential impacts such as hearing loss, nonauditory health effects, annoyance, speech interference, sleep interference, and effects on domestic animals, wildlife, structures, terrain, and historic and archaeological sites. Certain estuarine and marine species, such as dolphins, may be susceptible to injury or harassment from loud underwater noise.

Methodology

Noise associated with aircraft operations, operations involving the LCAC, sensor testing, and ordnance use associated with the alternatives was considered and compared with current conditions to assess impacts. Data developed during this process is also used to support analyses in other resource areas.

Based on numerous sociological surveys and recommendations of federal interagency councils, the most common benchmark referred to is a Day-Night Average Sound Level of 65 dBA for A-weighted noise and 62 dBC for C-weighted noise. These thresholds are often used to determine residential land use compatibility and risk of human annoyance. Other noise levels are also useful in assessing environmental impacts to people:

- A Day-Night Average Noise Level of 55 dBA was identified by the U.S. Environmental Protection Agency (USEPA) as a level ". . . requisite to protect the public health and welfare with an adequate margin of safety" (USEPA, 1974). Noise may be heard, but there is no risk to public health or welfare.
- A Day-Night Average Noise Level of 75 dBA is a threshold above which effects other than annoyance may occur. It is 10 to 15 dBA below levels at which hearing damage is a known risk (OSHA, 1983). However, it is also a level above which some adverse health effects can not be categorically discounted.
- A Sound Pressure Level (SPL) of 140 dBP (unweighted peak sound pressure level in decibels) has been identified by the U.S. Department of Labor, OSHA, as a maximum recommended unprotected exposure level necessary to prevent physiological damage to the human ear drum (29 CFR Ch. XVII § 1926.52[e]).
- An SPL less than 115 dBP has been shown to cause minimal public annoyance resulting from the noise (Russell, 2001).
- Florida Statute 327.60(1) addresses noise exposure to humans from passing boats. The statute states that in order to prevent potential annoyance impacts to people from a single noise event, no vessel may exceed a sound level of 90 A-weighted decibels over a 1-second duration, also referred to as A-weighted Sound Exposure Level (ASEL) at a distance of 50 feet from the vessel.
- The Eglin Noise Study suggested a voluntary noise exposure limit of 95 ASEL for low-flying aircraft. This threshold would be applicable for helicopter drop zones over the water.

Public annoyance is often the most common impact associated with exposure to elevated noise levels. When subjected to Day-Night Average Sound Levels of 65 dBA, approximately 12 percent of persons so exposed will be "highly annoyed" by the noise. At levels below 55 dBA, the percentage of annoyance is correspondingly lower (less than three percent). The percentage of people annoyed by noise never drops to zero (some people are always annoyed), but at levels below 55 dBA it is reduced enough to be essentially negligible. When subjected to Day-Night Average Sound Levels of 62 dBC, approximately 15 percent of persons so exposed will be "highly annoyed" by the noise (CHABA, 1981).

The U.S. Army and U.S. Air Force have adopted a set of annoyance criteria using mathematical equations that integrate land-use guidelines with predictions of percentages of the population that would be "highly annoyed" when exposed to given day-night average sound levels. These sound levels have been categorized into "noise zones," and are shown in Table 4-3. It is desirable that Noise Zone I criteria not be exceeded.

Table 4-3. Noise Zones

Noise Zone	NOISE TYPE/CRITERIA		Percent Population "Highly Annoyed"
	Transportation A DNL (L_{dn})	Impulsive C DNL (L_{Cdn})	
I	<65 dBA	<62 dBC	<15
II	65 – 75 dBA	62-70 dBC	15-39
III	>75 dBA	>70 dBC	>39

Source: U.S. Army, 1994; Finegold et al., 1994
DNL = Day-Night Level

4.2.1 Alternative 1

Alternative 1, the No-Action Alternative, is based on the current level of activity for a baseline period between Fiscal Year (FY) 1995-99. This alternative is defined as continuing the current practice of analyzing each estuarine/riverine action on an individual basis.

Currently, the major groups utilizing the estuarine and riverine areas include the U.S. Army's 6th Ranger Training Battalion (6 RTB), the U.S. Air Force Special Operations Command's (AFSOC) HAVE ACE, 23rd Special Tactics Squadron, the 16SOS/DOO, 720th Special Tactics Group, Navy EOD, 46 OG/OGMT and 46 TS/OGEX. The specific missions and training operations performed by each of these organizations are described in Section 2.2.1, and are not repeated here.

The scope and intensity of military training conducted by these units varied over the five-year period under consideration. To analyze the potential environmental effects associated with these major activities, a typical annual level of training events was developed and quantified in terms of persons involved, equipment used, and expendables consumed. These events are described in Table 2-1. The major noise-producing events associated with these activities include the use of aircraft, use of the Landing Craft Air Cushion (LCAC), and live-fire exercises using a 30-mm GPU-5 mounted on an LCAC. Resultant noise levels are assessed below.

Since there are always uncertainties associated with scheduling, it is important to note that all of the assessments below are based on day-equivalent events. As previously discussed, penalties are assessed for noise events that occur between the hours of 10:00 p.m. and 7:00 a.m. Thus, one night event would be equal to 10 day events. Also, since specific locations of many exercises are difficult to predict in advance, assessments either consider identified locations where an estimated number of operations may occur, or assess both a single operation and all of the predicted annual operations as though they occur in one location. If these conservative assessment techniques indicate little or no noise impact, then it is reasonable to assume that as events actually occur at semi-random, geographically dispersed locations, effects would be less.

Aircraft Noise

The primary sources of aircraft noise are helicopters used for exercises in which troops and equipment are inserted into or extracted from an area. To assess this noise, a representative training "area" was defined. This area was large enough to allow some measure of random flight during collective operations, but still confined enough to represent the spatial scope of training areas currently used. Then, using flight times and flight profiles representative of specific operations, the Air Force's MR_NMAP model was used to calculate the uniformly distributed noise in the area (Lucas and Calamia, 1996). Specific noise data associated with these missions are shown in Table 4-4 and are output by the model as monthly day-night A-weighted noise, or L_{dnmr}. The L_{dnmr} model output is essentially a day-night average with a penalty assigned for the startle effects, related to the onset rate of some aircraft. For helicopters, the model assigns an onset rate of zero since the perception of helicopter sound is gradual in nature; thus no startle effects are factored into the outputs below.

Table 4-4. Alternative 1, Aircraft Noise

Location	Number of Annual Operations	Noise Level (in L_{dnmr})	Maximum Operations for 55 L_{dnmr}	Maximum Operations for 60 L_{dnmr}
Estuarine	45	49.3	166	525
Riverine	10	42.8	166	525

Source: Lucas and Calamia, 1996

As shown, noise associated with these operations is minimal. All operations could expand more than 10-fold and still remain well below an average noise level of 65 L_{dn}.

Low-Level Single Event Helicopter Noise

Helicopter noise would be most noticeable to persons on shore during personnel and equipment drops and hoisting maneuvers. During these operations, helicopters would be stationary over the Santa Rosa Sound drop zone (Figure 4-2) at altitudes of 10 to 100 feet. The sound exposure levels in Table 4-5 for an HH-53 represent typical noise that would be produced at the drop zones and landing zones out to several distances. It should be noted that during hot weather, helicopters require more energy to stay aloft, and produce more noise as a result, but humidity may have a dampening effect on sound. Cold weather may cause sound to travel farther than it would during warm weather.

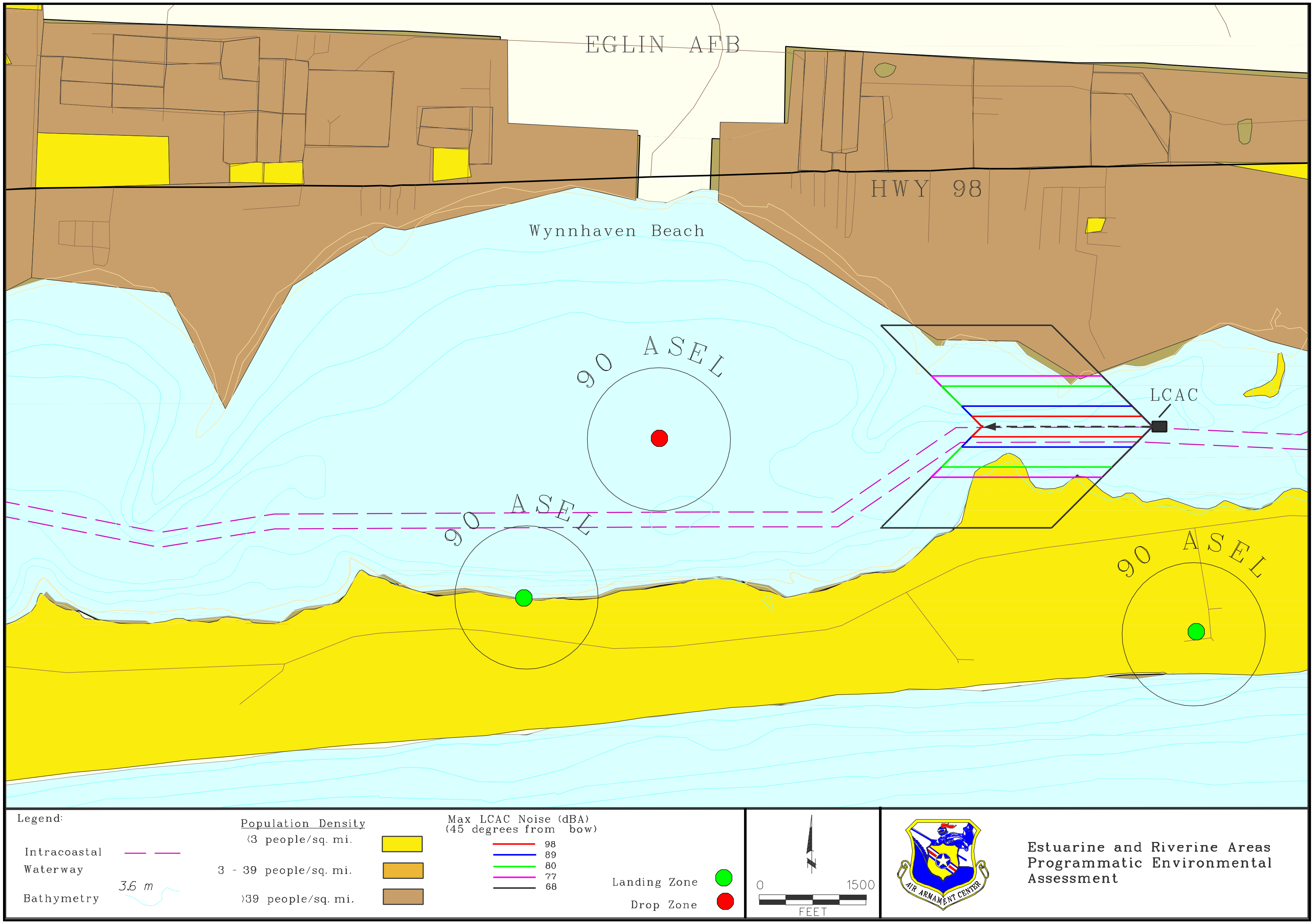

Figure 4-2. Alternative 1 Single Event Noise in the Sound

Table 4-5. HH-53 Sound Exposure Levels

Distance (feet)	Sound Exposure Level*
200	**101.4**
250	99.9
315	98.4
400	96.8
500 Threshold	**95.2** Threshold
630	93.6
800	91.9
1,000	90.2
1,250	88.4
1,600	86.6
2,000	84.7
2,500	82.8
3,150	80.7
4,000	78.6
5,000	76.4
6,300	74
8,000	71.5
10,000	68.8
12,500	66
16,000	63
20,000	59.9
25,000	56.4

*dBA based on 100 percent RPM, at 59 °F, 70 percent relative humidity
Source: U.S. Air Force, 1996b

Potential Noise Impacts to the Public

At a distance of 500 feet, noise would not exceed 95 ASEL. No single noise exposure from low-level helicopter operations in the Sound should result in annoyance to the public, given that the distance between the drop zone and the shoreline exceeds 1,000 feet. The public would not be exposed to noise greater than 95 ASEL from helicopters at landing zones. People on Hurlburt Air Field would be exposed to potentially annoying levels of noise. Highway 98 is the closest major road and falls outside of the 95 ASEL noise contour. Other vessels should not be exposed to noise of 95 ASEL since training is not conducted until the drop zone and surrounding areas are clear of nonparticipating vessels and aircraft.

LCAC Noise

Noise resulting from LCAC operations was considered under two modes of operation: 1) the transit of the craft through Choctawhatchee Bay or Santa Rosa Sound, and 2) maneuvering of the craft during other specific missions and during live-fire exercises.

There are no detailed noise curve data available for LCAC operations. However, based on the Air Force's Acoustic Effects Branch (AL/OBEN) Excess Sound Attenuation Model for the LCAC's engines under ground runup conditions, some sound data are available. Data estimate that the maximum noise level (98 dBA) results at a point 45 degrees from the bow of the craft at a distance of 200 feet (Figure 4-3). Maximum noise levels fall below 90 dBA at a point less than 400 feet from the craft (Table 4-6) (U.S. Air Force, 1999).

Table 4-6. Summary of Estimated LCAC Noise Impacts at Distance

Distance from LCAC (feet)	Noise Level (dBA)*
200	98
400	89
800	80
1,000	77
2,000	68

*Measures represent estimates during LCAC operation.

To estimate noise exposure from the LCAC in transit, it was considered as a noise source moving laterally in front of a receptor positioned at 300 feet perpendicular to the track of the craft. The craft was estimated to be traveling at a speed of 40 knots along this track. Considering available noise level data, the Sound Exposure Level (SEL) at the receptor was calculated for the total noise event, which was estimated to last approximately 16 seconds. This single day-equivalent event was estimated to result in a 24-hour equivalent sound level ($L_{eq(24)}$) of approximately 52 dBA at that specific receptor.

It should be noted that at greater distances, sound levels are significantly less. Furthermore, tracks would be somewhat random through these bodies of water, and the probability of successive exposures at short ranges is low.

Use of the LCAC in direct support of a specific mission indicated the need to constrain the craft into a specific maneuver area. Then, the random distribution of noise throughout this area was considered. For LCAC operations, the maneuver area considered was approximately one square mile.

The first step in the analysis was to calculate the total acoustic energy that would be generated in the training area. Next, the LCAC's operation was spatially distributed throughout the area considering "most likely" areas of operation. This yielded a spatially-weighted contribution to total area acoustic energy at different points. With this spatial distribution scaled on axes bisecting the area, it was then possible to calculate a mean and standard deviation for the distribution of noise along each axis.

These data were then used to calculate a standard normal distribution and "allocate" acoustic energy to points along each axis. Finally, the normally distributed energy from multiple source points throughout the site was aggregated at specific points at given distances from the site edges. These edges were identified as the "leading edge" and the "lateral edge." The leading edge represents the "front" of the area, or the general direction in which the craft is moving. The edges of the rectangle to the left and right of the leading edge are the lateral edges. The aggregated noise levels at the receptor points represent the distributed noise that had emanated off-site.

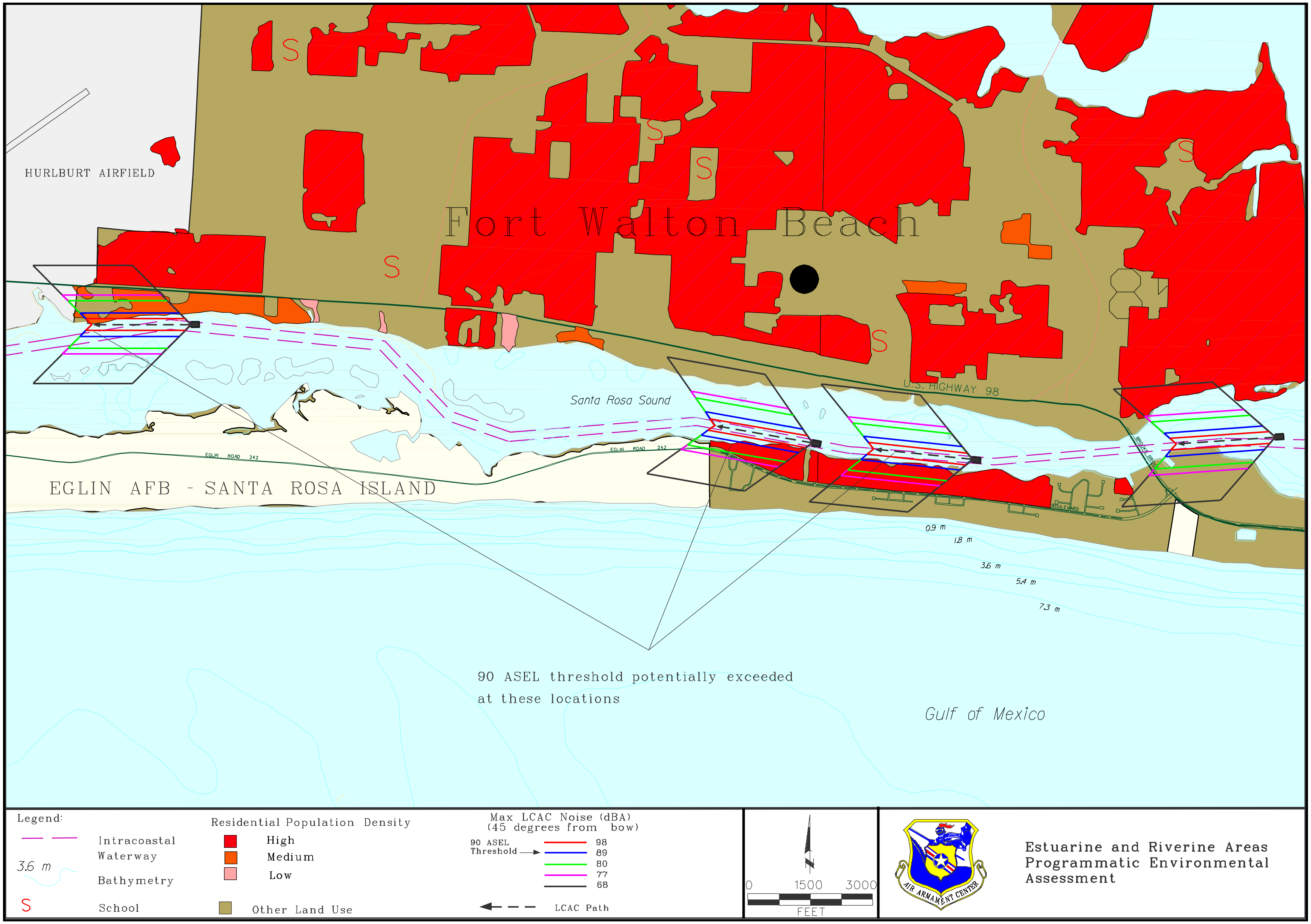

Figure 4-3. Areas Where LCAC Noise May Exceed Single Event Thresholds

Table 4-7 reflects aggregated noise levels at a range of distances from the indicated edges of the maneuver area. Shown are the equivalent noise levels resulting from one operation in a 24-hour period ($L_{eq(24)}$) and the annual day-night average noise level resulting from 25 day-equivalent operations. This is a conservative estimate since it assumes that all exercises occur in the same maneuver area.

Table 4-7. Alternative 1, LCAC Maneuver Noise Levels

Distance From Edge of Maneuver Area (feet)	Noise Levels: 1 Operation [$L_{eq(24)}$]		Noise Levels: 25 Annual Operations (L_{dn})	
	Leading Edge	**Lateral Edge**	**Leading Edge**	**Lateral Edge**
500	53.7	52.9	43.5	42.7
1,000	49.5	49.0	39.3	38.8
1,500	46.8	46.6	36.6	36.4
2,000	44.8	44.6	34.6	34.4
2,500	43.1	43.0	32.9	32.8

Single Event Noise from LCAC Operations

LCAC operations would produce noise of approximately 90 ASEL just under a distance of 400 feet. Within that distance, people would be exposed to a level of noise identified by the state of Florida as “annoying.” The actual wording of the statute states that no vessel shall exceed a sound level of 90 dBA at a distance 50 feet away from the vessel. Clearly, this statute is addressing recreational vessels with typical inboard or outboard engines. The LCAC is equipped with four AVCO-Lycoming aircraft-type engines, which do not comply with the Florida boat noise statute due to their sizeable horsepower. Noise limits of the statute can be complied with through activation of the restricted and prohibited areas such that other vessels would not be exposed to noise and maintaining a distance from shore of at least 400 feet such that residential areas would not be exposed.

Potential Noise Impacts to the Public

Figure 4-4 identifies the areas along the LCAC maneuver route down the Intracoastal Waterway that would potentially expose the public to noise greater than 90 ASEL. It is recommended that at these areas where the Intracoastal Waterway is located close to shore, the LCAC should move a sufficient distance into the Sound to minimize potential noise exposure to the public. It is recommended that for the LCAC, a minimum distance of 400 feet be maintained to prevent exposure of residential areas to noise of 90 dBA. For missions with potential noise impacts, advance notification of the operation should be provided to the public when possible. Overall, the frequency of exposure to the public from annoying levels of LCAC noise is low due to the low number of missions. Therefore, temporary, intermittent noise from LCACs is not significant.

Noise from 30-mm Live Fire

During the baseline, impulsive noise from ordnance use was limited to 30-mm ammunition. These rounds create approximately 155 dBP SPL at one meter from the source and require auditory protection for persons in close proximity to the weapon. However, noise levels attenuate rapidly as distance increases between the weapon and the receptor. Since live-fire procedures establish safety zones and require evacuation of all persons not directly involved in the operation, and the mission occurred within the restricted/prohibited area of Santa Rosa Sound, no nonparticipant was exposed to potentially harmful noise levels.

Noise assessment of 30-mm live-fire from the LCAC was accomplished using the same basic procedure as that described above for the LCAC maneuver operations. However, the firing area for the weapon within the overall one square mile operation area was limited to a more centralized zone. The assessment considered the firing of 900 rounds during the range period. Since people are somewhat more sensitive to impulsive noise, the live-fire assessment considered both a 24-hour equivalent noise level and the more traditional annual day-night average for the single exercise conducted. These sound levels are shown in Table 4-8.

Table 4-8. Alternative 1, 30-mm Live-Fire

Distance From Edge of Maneuver Area (in feet)	Noise Levels: 1 Operation [$L_{eq(24)}$] C-Weighted		Noise Levels: 1 Annual Operation (L_{Cdn})	
	Leading Edge	Lateral Edge	Leading Edge	Lateral Edge
500	53.9	50.0	29.8	25.9
1,000	51.6	48.4	27.5	24.3
1,500	49.8	47.1	25.7	23.0
2,000	48.3	46.0	24.2	21.9
2,500	47.1	45.0	23.0	20.9

Source: Author created.

Potential Noise Impacts to the Public

Neither average nor single-event noise thresholds would be exceeded from 30-mm live fire. The closure of the area to nonparticipants would provide safe distances to the public from noise exposure. Personnel aboard the LCAC would have to wear ear protection.

Sensor Testing

In 1998, the 46OG/OGP supported CSS for a demonstration of MUDSS in which several types of underwater sensors were used to detect underwater debris and buried unexploded ordnance (UXO). The surveyed area was a square 1.4 nautical miles wide located near the mouths of Rocky and Boggy Bayous in waters 15 to 30 feet deep. The demonstration lasted six days and involved towed laser line scan electro-optical, passive magnetic, trace chemical, and three sonar sensors. The sonar sensors included a high frequency (180-kilohertz [kHz]) and a low frequency (20 kHz) synthetic aperture sonar (SAS), and a SeaBat forward looking sonar with an operating frequency of 455 kHz (Carroll et al., 2000). Source levels at one meter from the high-frequency and low-frequency sonars were 214 and 212 dB re 1 microPascal respectively. A safety feature shut off the laser if the roll of the boat exceeded 40 degrees to ensure that the sensor was always directed downward.

Noise Impacts to Protected Marine Species

Protected marine species that occur in Choctawhatchee Bay include marine mammals such as Atlantic bottlenose dolphins, protected under the Marine Mammal Protection Act (MMPA); the Florida manatee, protected under the MMPA and the Endangered Species Act; and sea turtles, protected under the Endangered Species Act. Both marine mammals and sea turtles may be affected by underwater noise. Potential effects to marine mammals from a given noise source are frequency and energy dependent and differ between species. Dolphins, which rely on their sense of hearing to find food and to communicate, are particularly sensitive to underwater noise and may experience a temporary loss in hearing sensitivity from loud noise, a condition known as temporary threshold shift (TTS). Manatees are a rare occurrence in Choctawhatchee Bay and are not known to have sensitive hearing. In environmental impact statements for the U.S. Navy, TTS effects on dolphins and sea turtles were anticipated to occur beginning at 182 dB re 1 microPascal (U.S. Navy, 2001). For nearly any action with the potential to emit harmful levels of noise, marine mammal surveys are required before, during, and after the action.

For the MUDSS test, a safety boat accompanied the towboat to observe for other craft and watch for marine mammals (i.e., bottlenose dolphins) within the MUDSS hazard area (approximately 330 feet from the vessel), which could be potentially affected by the low-frequency sonar. The high-frequency sonar and the SeaBat sonar operate beyond the hearing sensitivity range of bottlenose dolphins. The activity was CATEXed with the stipulation that a marine mammal observer is present and that the demonstration occurs during daylight hours. In September 2000, a similar test was conducted in St. Andrews Bay, a north Florida estuary east of Choctawhatchee Bay. The Navy determined the impact area for potential effects to bottlenose dolphins, defined by the region exposed to sound of 180 dB referenced to 1 microPascal (re 1 μPa), which varied according to sonar type. Through informal consultation, the National Marine Fisheries concurred with the Navy that the tests would not be likely to adversely affect any listed species as long as certain mitigations were adhered to. The Finding of No Significant Impact for the Navy sensor tests included a table of mitigations for several sensor types along with anticipated impacts, including those for the MUDSS sensor tests. Table 4-9, a modification of the mitigation table listed for the Navy sensor tests in St. Andrews Bay, lists the sensor types applicable to the MUDSS test conducted in Choctawhatchee Bay. The species groups applicable to Choctawhatchee Bay or other estuarine areas adjacent to Eglin AFB are odontocetes, which are toothed whales (e.g., bottlenose dolphins), sirenians (i.e., manatees), and sea turtles.

Like the MUDSS demonstration, observers for the Navy sensor tests in St. Andrews Bay watched for marine mammals within a 330 foot hazard area and, in addition, for night tests used spotlights in conjunction with a SeaBat sonar to aid in detecting turtles or marine mammals. The 455 kHz emitting frequency of the SeaBat is not audible to marine mammals or sea turtles and thus poses no threat.

MUDSS type sensor tests would not likely adversely affect listed species as long as the mitigative procedures in Table 4-9 are followed. In order to conduct new types of sensor tests in the estuarine areas adjacent to Eglin AFB, consultation (either formal or informal) with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service would be required.

Table 4-9. Potential Impacts and Mitigative Measures for MUDSS Sensor Tests

		Radius and Area of 180 dB re 1µ Pa Sound		Species Groups Possibly Affected			Mitigation Measures
Sensor Type	**Frequency (kHz)**	**Radius (m)**	**Area (km^2)**	**Odontocetes (toothed whales)**	**Sirenians (manatees)**	**Sea Turtles**	
Low SAS	20	32	0.0032	Possible effect	Low effect	Low effect	Using two observers, monitor for sea turtles and marine mammals within 330 feet of vessel for daytime tests. For nighttime, monitor 330 feet from vessel aided by spotlights and use SeaBat sonar to detect a "biological presence" within 330 feet of vessel. Operations will cease if listed species are seen or detected by SeaBat sonar within 330 feet of the vessel, and systems will be turned off until the area is clear. If winds exceed 11 to 16 knots and seas are choppy with frequent white caps (Beaufort Scale 4), operations will cease (visual surveys impaired during rough seas).
High SAS	180	28	0.0025	Possible effect	Low/no effect	Low effect	20 kHz and 180 kHz operate concurrently and the mitigations for low-frequency SAS are more restrictive than those of the high-frequency SAS due to greater absorption occurring at higher frequencies.
SeaBat	455	14	0.0006	No effect	Low/no effect	Low effect	No mitigation is required because 455 kHz would not be audible to marine mammals or sea turtles.

Source: U.S. Navy, 2000

Under Alternative 1, average noise criteria would not be exceeded for any vessel or aircraft operation. Single event noise thresholds for preventing annoyance to the public may result with LCAC operations along some areas of the Sound where the Intracoastal Waterway is close to the shore. Historically, the LCAC has followed this route, but it is recommended that the LCAC stay at least 400 feet from public shorelines in order to prevent noise exposure to residential and commercial areas. Riverine and estuarine boat noise from special operations training missions constitutes a fraction of all vessels in the Yellow River, East Bay, East Bay River, Choctawhatchee Bay, and Santa Rosa Sound. Under Alternative 1, no significant noise impacts would result from any estuarine and riverine activities, including boat, aircraft, LCAC and 30-mm fire. In keeping with the precedent established by the Navy, sensor tests would require observance of the previously mentioned mitigations in Table 4-9 (e.g., pre- and post-test surveys) and case-by-case coordination and/or consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries.

30-mm Live-Fire Noise Impacts to Piping Plover

Live fire occurring near A-13B would have no effect on piping plover within the critical habitat located near A-17. Piping plover may potentially occur near A-13B but have not been sighted in this area. Noise from LCACs and 30-mm artillery would likely cause birds to flush and leave the area. The low frequency of this event would not result in significant effects to piping plover on SRI.

Noise Impacts to Bald Eagles

A bald eagle nest occurs near TA A-22 on Eglin's main base. In accordance with the *Habitat Management Guidelines for the Bald Eagle in the Southeast Region*, LCACs would remain at least 1,500 from the shoreline when passing the eagle's nest (USFWS, 1987). As a result, LCAC noise would have no effect on bald eagles associated with Eglin AFB.

4.2.2 Alternative 2

Under Alternative 2, the levels of activity and number of exercises defined as representative for the baseline year would be authorized. The major aspects of those activities that could contribute to increased noise levels were assessed above under Alternative 1. Authorizing activities at the levels described in Section 4.2.1 will have little, if any, impact on the regional acoustic environment.

4.2.3 Alternative 3

Under this Alternative, the number of training activities and missions would double, and the conduct of a few operations would be modified. As an overview, a doubling in the number of events producing noise would represent a doubling in the amount of acoustic energy produced. A doubling of acoustic energy is represented mathematically as an increase in noise levels of 3 dB. Details for the specific activities and operations associated with this alternative are presented below.

Aircraft Noise

Under this alternative, the numbers of annual helicopter operations associated with each of the two estuarine operation zones would increase from 45 to 105 in each zone. Operations in the riverine area would double. Noise levels and thresholds associated with these activities are shown in Table 4-10.

Table 4-10. Alternative 3, Aircraft Noise

Location	Number of Annual Operations	Noise Level (in L_{dnmr})	Maximum Operations for 55 L_{dnmr}	Maximum Operations for 60 L_{dnmr}
Estuarine	105	53.0	166	525
Riverine	20	45.8	166	525

Source: Lucas and Calamia, 1996

LCAC Noise

LCAC operations would also double. Overall, annual LCAC operations would not exceed 50 mission days; live-fire exercises would increase to two missions. Noise resulting from LCAC transit would continue to be dispersed and somewhat random. Thus, although transits would double, the general assessment of this noise source remains as described in Section 4.2.1. Table 4-11 reflects noise resulting from LCAC maneuver operations.

Table 4-11. Alternative 3, LCAC Maneuver Noise Levels

Distance From Edge of Maneuver Area (feet)	Noise Levels: 1 Operation [$L_{eq(24)}$]		Noise Levels: 50 Annual Operations (L_{dn})	
	Leading Edge	Lateral Edge	Leading Edge	Lateral Edge
500	53.7	52.9	46.5	45.7
1,000	49.5	49.0	42.3	41.8
1,500	46.8	46.6	39.6	39.4
2,000	44.8	44.6	37.6	37.4
2,500	43.1	43.0	35.9	35.8

Source: U.S. Air Force, 1998; Author created.

Live-Fire Impulsive Noise

Operations involving live-fire of 30-mm rounds from the GPU-5 mounted on an LCAC would increase from one operation per year to two. Impulsive noise resulting from this increase is shown in Table 4-12.

Table 4-12. Alternative 3, 30-mm Live Fire

Distance From Edge of Maneuver Area (feet)	Noise Levels: 1 Operation ($L_{eq(24)}$) C-Weighted		Noise Levels: 2 Annual Operations (L_{Cdn})	
	Leading Edge	Lateral Edge	Leading Edge	Lateral Edge
500	53.9	50.0	32.8	28.9
1,000	51.6	48.4	30.5	27.3
1,500	49.8	47.1	28.7	26.0
2,000	48.3	46.0	27.2	24.9
2,500	47.1	45.0	26.0	20.9

Source: SAIC, 2002

As with previously described alternatives, although persons on the live-fire range directly participating in the exercise would require ear protection, nonparticipants off-range would not be exposed to hazardous noise levels.

As indicated by the above analyses, activities associated with Alternative 3 would be expected to create minimal or no noise impacts.

Sensor Tests

A 100 percent increase in the number of sensor tests would not adversely affect listed species as long as the mitigative measures described under Alternative 1 are followed. Any new types of sensor tests not previously conducted in the estuarine areas would require consultation with NMFS and USFWS on some level.

4.2.4 Alternative 4

Under this Alternative, all increased levels of activities associated with Alternative 3 would continue to be accomplished. Noise associated with aircraft, LCAC operations, and 30-mm live-fire exercises would remain as assessed in Section 4.2.3. However, under this alternative, small-arms, live-fire, and estuarine/marine beach ranges would be developed. Single-event noise impacts for Alternative 4 are shown in Figures 4-4 through 4-6.

As with the 30-mm live-fire exercise, impulsive sound levels associated with the varied-caliber small-arms ranges are such that persons on the range participating in the exercise would require ear protection. However, due to range safety criteria, nonparticipants would be sufficiently separated from the noise and would not be exposed to any adverse health or safety risks.

The noise assessment for this element of the alternative was conducted using the same methodology as that applied to the assessment of the 30-mm live-fire exercise. However, for these small-arms exercises, it was assumed that the "range" area would be more constrained, measuring 1,000 feet by 1,000 feet. For each exercise, it was assumed that approximately 1,000 rounds of varied-caliber ammunition would be expended. Sound levels associated with use of these arms at their firing location vary from approximately 142 dBP to 160 dBP (AFOSH, 1994). Although the proposal proposes developing two ranges, it is uncertain what the use would be for each range. Therefore, to conduct a conservative assessment, all proposed annual activities were assessed for a single "range." It is reasonable to assume that if the collective impacts from all annual activities are minimal, then geographically dispersing them will further lessen their effect.

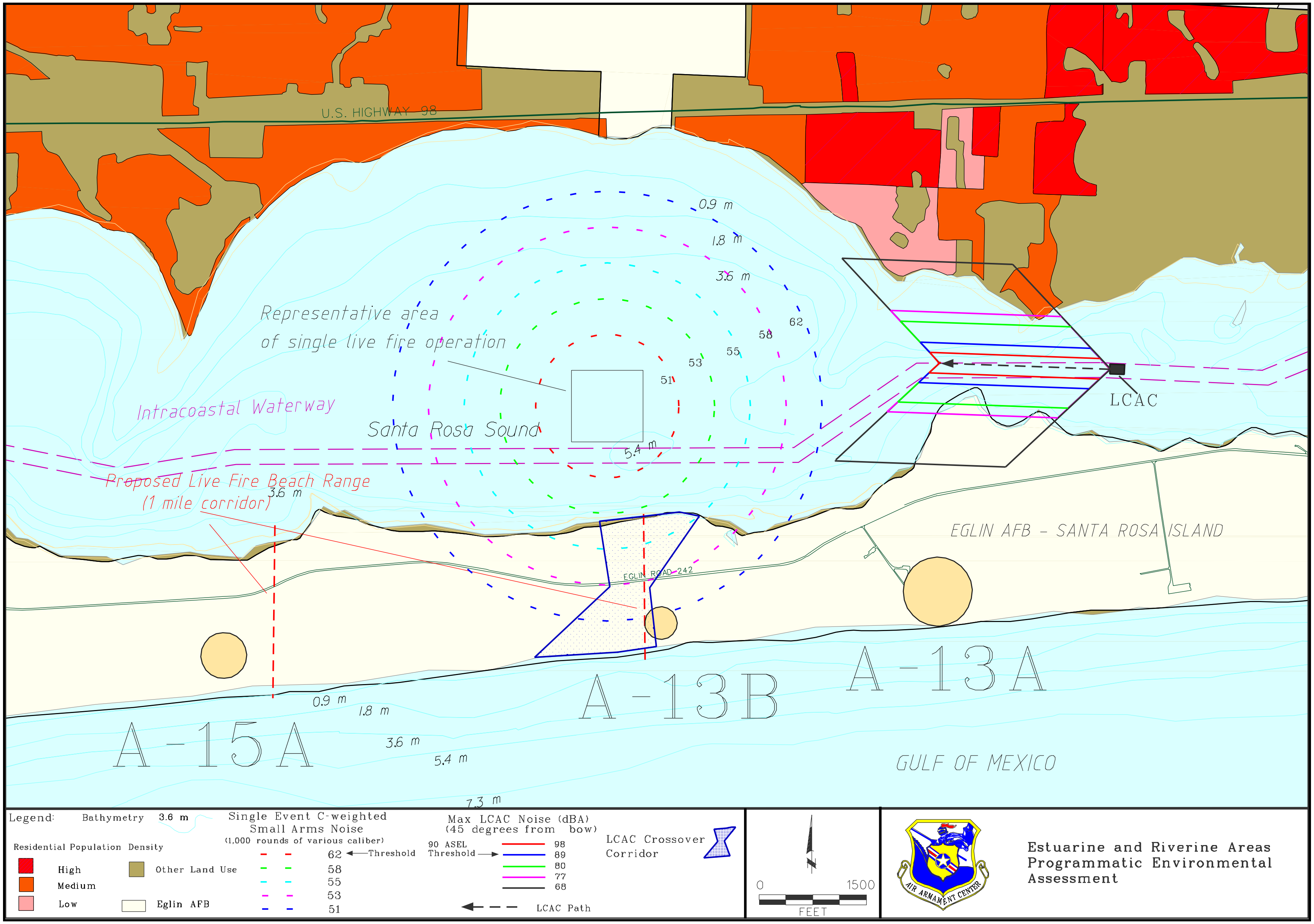

Figure 4-4. Alternative 4 Single Event Noise Impacts – Santa Rosa Sound

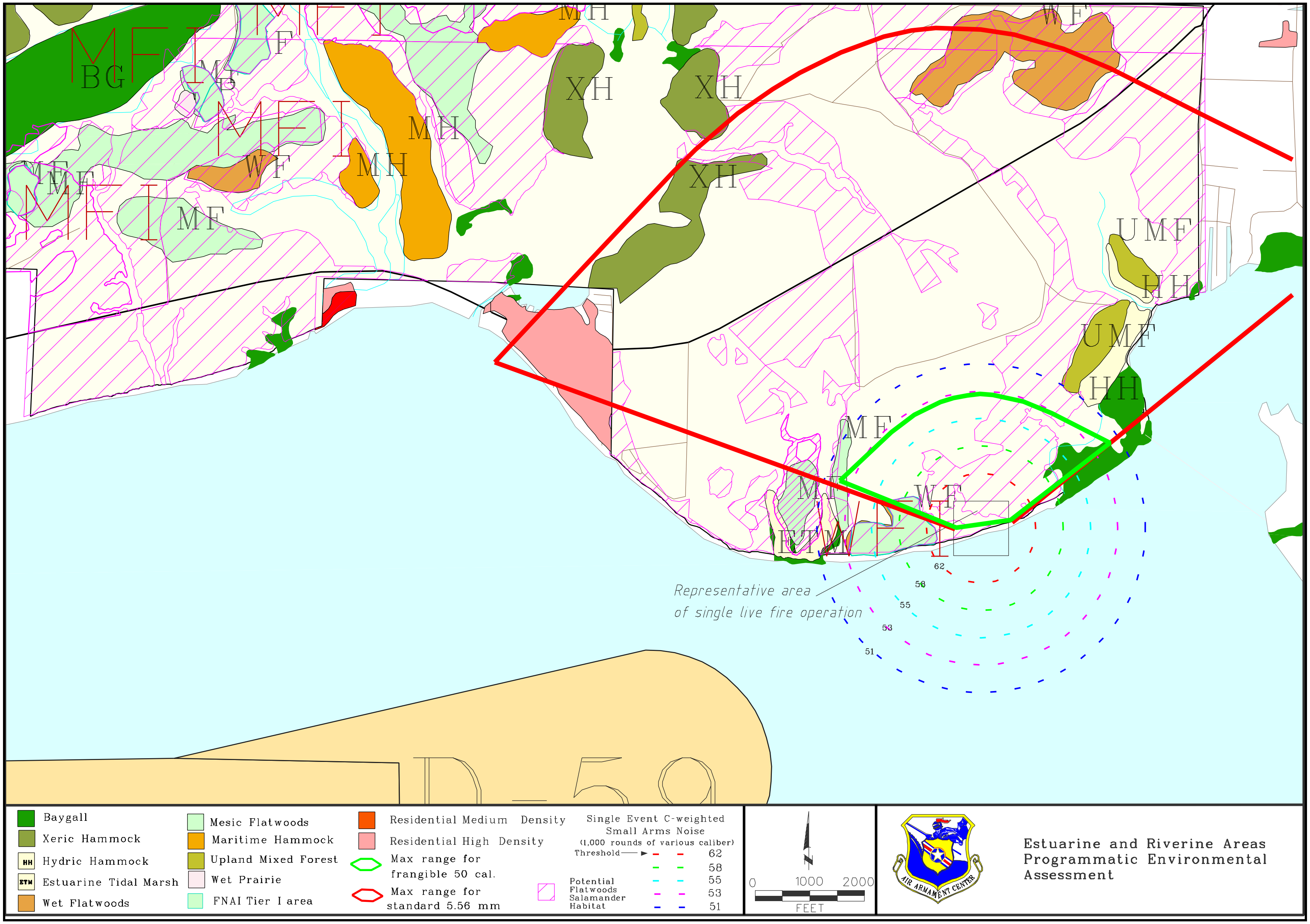

Figure 4-5. Alternative 4 Single Event Noise Impacts – Alaqua Point

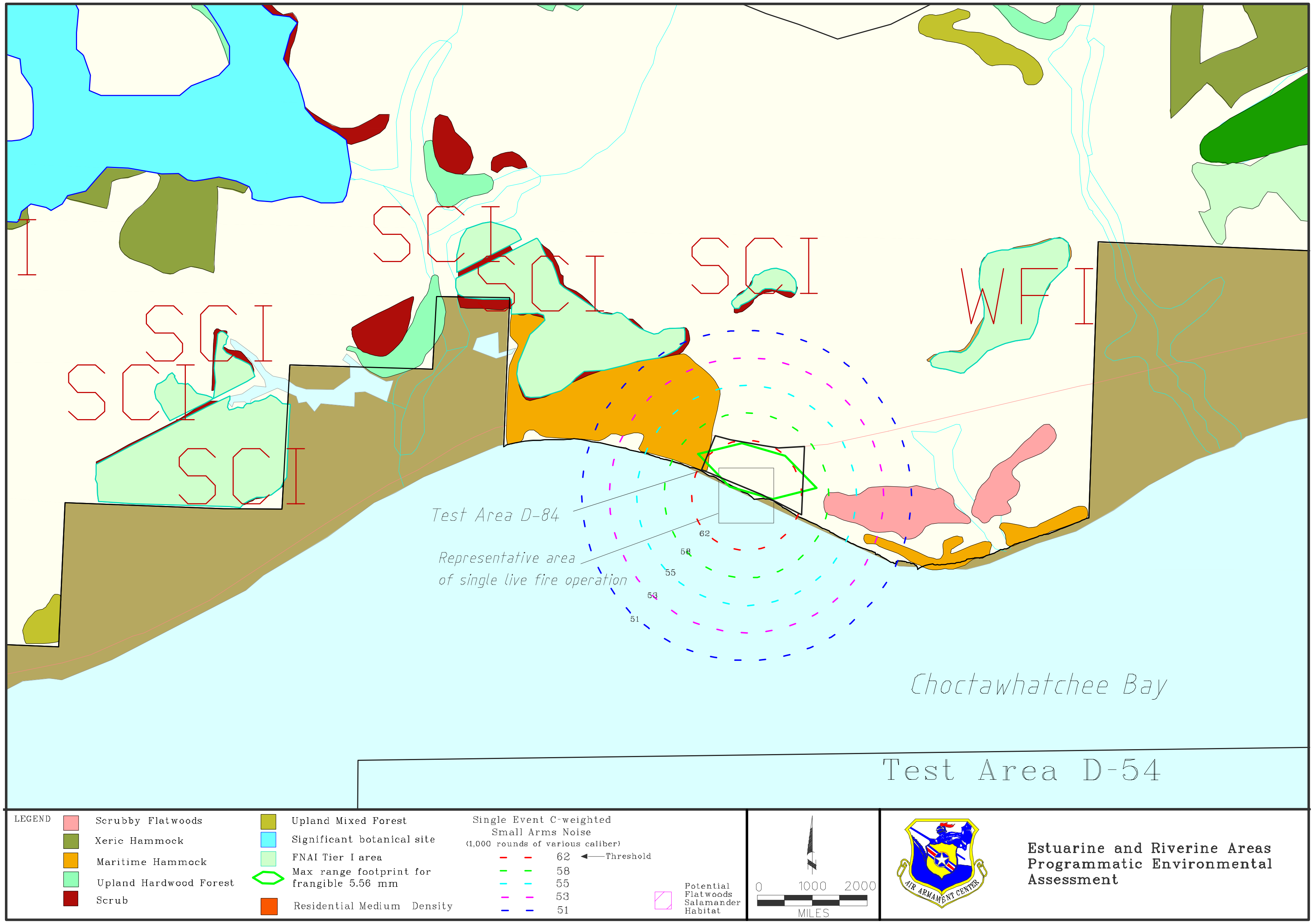

Figure 4-6. Alternative 4 Single Event Noise Impacts – D-84

Table 4-13 provides data on sound levels resulting from a single operation in a 24-hour period and the day-night average noise level resulting from an estimated 34 annual operations.

Table 4-13. Alternative 4, Estuarine Small-Arms Live-Fire Range

Distance From Edge of Maneuver Area (feet)	Noise Levels: Single Operation ($L_{eq(24)}$) C-Weighted		Noise Levels: 34 Annual Operations (L_{Cdn})	
	Leading Edge	**Lateral Edge**	**Leading Edge**	**Lateral Edge**
500	61.6	61.3	52.8	52.5
1,000	57.6	57.5	48.8	48.7
1,500	54.9	54.9	46.1	46.1
2,000	52.9	52.9	44.1	44.1
2,500	51.3	51.3	42.5	42.5

Source: AFOSH, 1994; SAIC, 2002

As indicated by the above analyses, activities associated with Alternative 4 would be expected to create minimal or no noise impacts.

4.2.5 Alternative 5

Alternative 5 retains all of the operations and activities proposed for Alternative 4. Therefore, noise from aircraft, LCAC, 30-mm, and small-arms live-fire in the estuarine area would remain as assessed above. However, under this alternative, a riverine small-arms live-fire capability would be developed for a one-mile segment of Boiling Creek. In operation, this live-fire range would be similar to an estuarine range. Assessment of the noise associated with the use of this range is similar to that performed for the estuarine range. However, the riverine range would support slightly more use. Applicable sound levels resulting from the use of the riverine range are shown in Table 4-14.

Table 4-14. Alternative 5, Riverine Small-Arms Live-Fire Range

Distance From Edge of Maneuver Area (feet)	Noise Levels: 1 Operation ($L_{eq(24)}$) C-Weighted		Noise Levels: 36 Annual Operations (L_{Cdn})	
	Leading Edge	**Lateral Edge**	**Leading Edge**	**Lateral Edge**
500	61.6	61.3	53.0	52.7
1,000	57.6	57.5	49.0	48.9
1,500	54.9	54.9	46.3	46.3
2,000	52.9	52.9	44.3	44.3
2,500	51.3	51.3	42.7	42.7

Source: AFOSH, 1994; SAIC, 2002

As indicated by the above analyses, activities associated with Alternative 5 would be expected to create minimal or no noise impacts.

Single event noise analysis indicates that no thresholds would be exceeded off the Eglin Military Complex. In Figure 4-7, noise contours for a single live-fire training event are illustrated. Two sets of noise contours were created for placement at either end of the proposed one-mile segment to identify the limits of noise produced from anywhere on that segment.

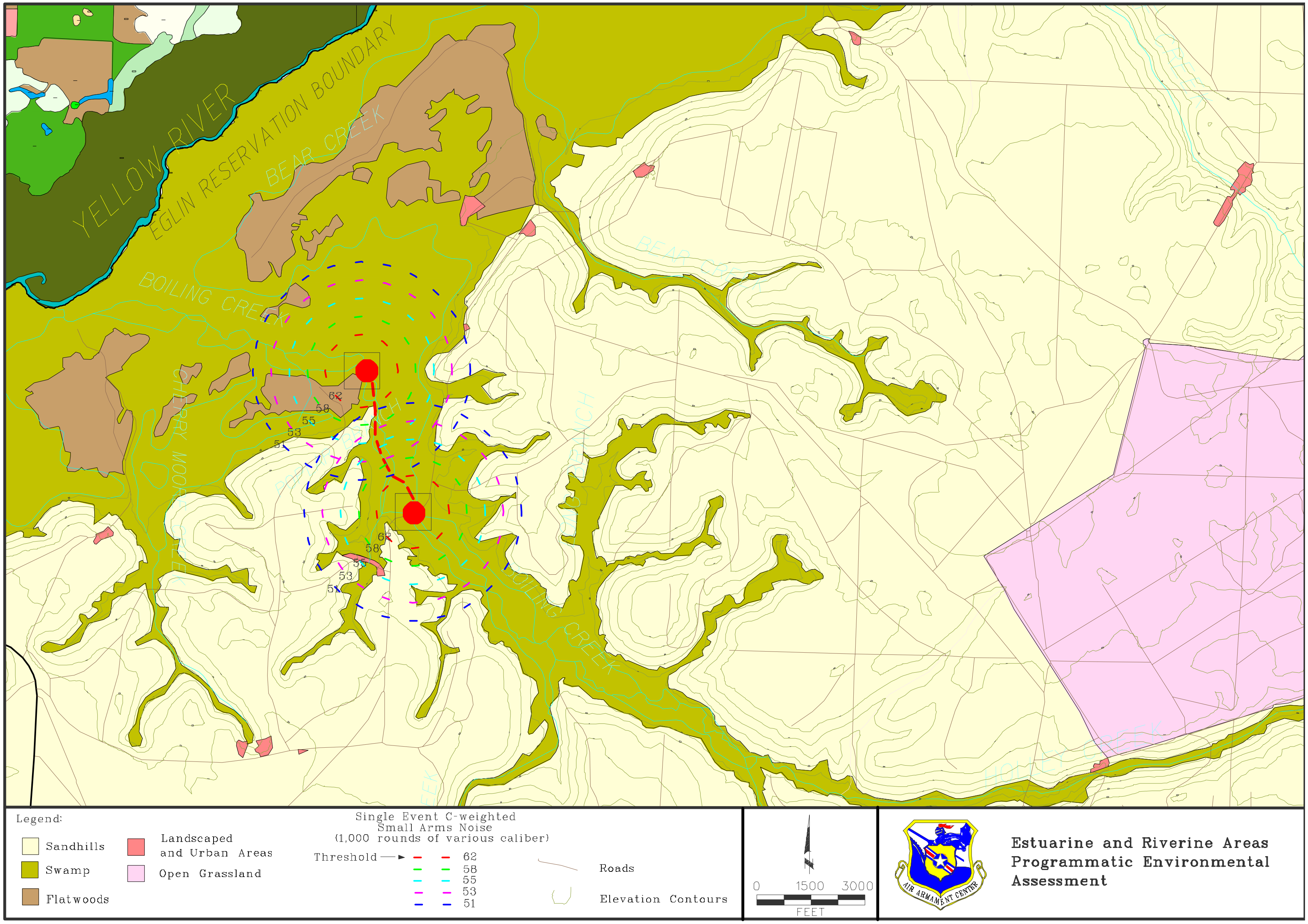

Figure 4-7. Alternative 5 Single Event Noise – Boiling Creek

4.3 RESTRICTED ACCESS

Access would be restricted by temporarily limiting the availability of water or land areas (e.g., roads) to the public at times when missions are in progress. The purpose of restricting access to the public during these times is to ensure their safety while maintaining mission integrity. Currently, restricted areas, prohibited areas, and danger zones in Choctawhatchee Bay and Santa Rosa Sound are outlined on nautical charts and are described in the U.S. Coast Pilot, Vol. 5 (U.S. Department of Commerce, 2003). Controlled firing areas (CFAs) allow for hazardous activities within an airspace but are not charted since they do not result in course changes by nonparticipating aircraft.

Definitions as they appear in the *U.S. Coast Pilot* are:

> ***Danger Zone*** *– A defined water area (or areas) used for target practice, bombing or rocket firing, or other especially hazardous operations, normally for the armed forces. The danger zones may be closed to the public on a full-time or intermittent basis as stated in the regulations.*
>
> ***Restricted Area*** *– A defined water area for the purpose of prohibiting or limiting public access to the area. Restricted areas generally provide security for Government property and/or protection to the public from the risks of damage or injury arising from the Government's use of that area.*
>
> *"Danger zones and restricted areas are to provide for public access to the area to the maximum extent practicable" and "the authority to prescribe danger zone and restricted area regulations must be exercised so as not to unreasonably interfere with or restrict the food fishing industry. Whenever the proposed establishment of a danger zone or restricted area may affect fishing operations, U.S. CEC District Engineer will consult with the Regional Director, U.S. Fish and Wildlife Service, Department of the Interior and the Regional Director, National Marine Fisheries Service, National Oceanic and Atmospheric Administration."*
>
> ***Controlled Firing Area*** *– A defined airspace block that contains activities that would be potentially hazardous to nonparticipating aircraft. Activities are immediately suspended if spotter aircraft, radar, or ground lookouts identify an aircraft approaching the area.*

CFAs must be renewed by the Federal Aviation Administration (FAA) every two years (U.S. Air Force, 2001e).

Environmental Analysis

Analysis of restricted access must first examine the overlap of use of state recreational and navigable water areas between the military and the public to determine whether training significantly prevents the use of these areas by the public. Peak recreational public use of the area waters occurs during the summer months with highest use during the middle of the day. Commercial transportation through the Gulf Intracoastal Waterway in Choctawhatchee Bay is relatively steady throughout the year while commercial fishing interests are usually located in areas not used for military training. Much of the training occurs at night, when public recreational usage is lowest. Generally, the goal of many of the estuarine and riverine missions is to get in and out of an area without being detected; thus, some of the missions are conducted at night and in nearshore swamps where people would not likely be found.

Measuring Restricted Access

Number and duration of closures is an appropriate metric because specific guidelines have been published in the *U.S. Coast Pilot* for activating restricted and prohibited areas in Santa Rosa Sound.

Criteria

The criteria would be not to exceed the number of allowed closures as set forth in the *U.S. Coast Pilot*. The restricted areas may not be activated more than twice weekly and for no longer than one hour at time.

4.3.1 Alternative 1

Testing and training on the water ranges (TA D-54) and in Santa Rosa Sound (drop zones, controlled firing areas) requires control of the airspace, water, and land that are part of the mission scenario. The Eglin Range Safety Office develops safety footprints for missions that contain potentially harmful aspects (e.g., live munitions) and determines the extent of the closure or if a closure is warranted at all. Coordination with the Range Safety Office (ACC/SEU) is necessary. In accordance with Eglin AFB's current method of operation, AAC/SEU determines the risk from unexploded ordnance (UXO) and employs control measures based on an informal analysis of the action and the risk factors.

Usually, riverine and estuarine missions allow for visual clearing of an area through real-time observation; once an area (e.g., a drop zone) has been determined to be clear of nonparticipants, the exercise would proceed. Other water areas are restricted or prohibited to the public according to legal descriptions in the *U.S. Coast Pilot* (U.S. Department of Commerce, 2003). Areas within the Santa Rosa Sound and Choctawhatchee Bay bearing these designations are illustrated in Figure 4-8. A one nautical mile radius restricted zone and a five nautical mile radius prohibited zone are located in Santa Rosa Sound (Figure 4-8). These zones allow the U.S. Air Force to restrict or prohibit altogether the entry of vessels into these zones especially during times of testing operations. Stipulations for frequency of closure of the restricted area are identified as not more than twice weekly for one hour at a time. At any time, vessels are to proceed through the prohibited area along the Gulf Intracoastal Waterway without stopping. The restricted area is activated during test operations, though typically not for the type of missions (i.e., special operations) analyzed in this document; however, vessels may not enter this area during this time.

The base commander is authorized to enforce the regulations of the *U.S. Coast Pilot* pertaining to the restricted and prohibited areas of Choctawhatchee Bay and Santa Rosa Sound (U.S. Department of Commerce, 2003). Typically, military personnel in boats warn away other traffic from the restricted areas to prevent interference with a testing or training exercise.

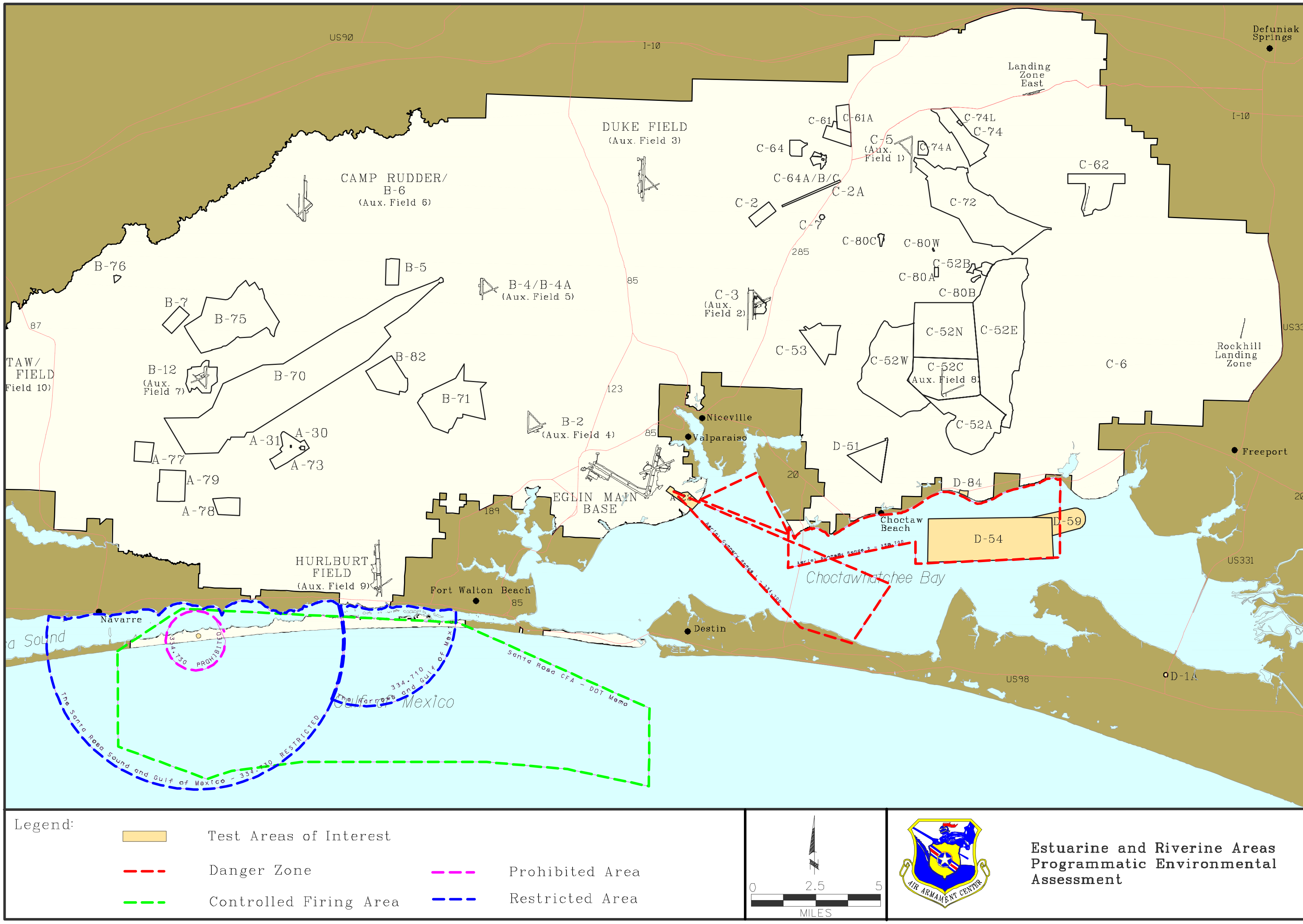

Figure 4-8. Areas of Potential Restricted Access Within the Study Area

According to the Eglin Safety Office, activating the prohibited area in Choctawhatchee Bay and, thereby, closing TA D-54 would require a Notice to Mariners (NOTMAR). Enforcing the closure of TA D-54 has not been necessary since there have historically been no conflicts with military and public users (U.S. Air Force, 2001f). Further, if nonmilitary personnel were to enter into, or near, the drop zone, training activity would simply cease until the area was cleared (U.S. Air Force, 2001f).

Activities on the Yellow River do not require closure nor can closure be accomplished since the U.S. Air Force does not control both banks of the river. Activities on the Yellow River are benign with respect to the use of munitions: no blank fire, pyrotechnics, or live munitions are currently used.

No significant impacts with respect to restricted access would occur under Alternative 1. In Choctawhatchee Bay, the A-22 safety fan was activated once over the last year but did not impact any recreational users. LCAC tests, including transits from Choctawhatchee Bay and into the Sound, and 30 mm firing over SRI would require activation of the restricted areas, but these exercises have not been conducted at a frequency (from 0 to 4 times a year) that would exceed *U.S. Coast Pilot* stipulations.

Impacts to Commercial Fishing

Commercial fishing interests would not be affected as long as operational guidelines that specify the frequency of closure are followed. Potential impacts to the fishing industry would have been considered, by law, prior to the establishment of the danger zones and restricted areas as specified in the *U.S. Coast Pilot* (U.S. Department of Commerce, 2003). If an issue existed with the establishment of the restricted areas, then the USACE would have consulted with the USFWS and the NMFS (U.S. Department of Commerce, 2003).

Impacts to Local Road Traffic

Highway 98 is generally not closed when military personnel cross over it into Wynnhaven Beach and onto the Eglin reservation. Even so, there is no set limitation on the number of times this can occur. Requests for closing Highway 98 are submitted to the Okaloosa County Sheriff's Department. Usually crossovers occur without closing the highway.

Impacts to Commercial Shipping

Closures would not exceed the number specified in the *U.S. Coast Pilot*. Special operations user groups scout for nonparticipants on a real-time basis and do not routinely activate the restricted or prohibited areas. The restricted area in Santa Rosa Sound is not activated during special operations missions because these missions do not involve munitions. LCAC live-fire tests would require activation of the restricted areas in Santa Rosa Sound about once a year for less than 30 minutes. Barge traffic may be affected, but advance notification through NOTMARS would allow adjustment to a brief closure. A rocket test (not part of this PEA) on SRI did result in barge stoppage for several miles along the Sound. Given that the duration of actual firing is on the order of minutes, allowing flexibility to the closure of restricted and prohibited areas in the Sound, no stoppage of traffic is anticipated for the Alternative 1 level of missions.

Impacts to Recreational Users and Public Safety

Impacts to recreational users would be minimal. On Eglin, areas normally open to outdoor recreation are not closed as a result the level of estuarine and riverine training under Alternative 1. These activities generally take place in areas not heavily used by the recreating public, such as swamps and wetland areas. Public access to the wetland and swamp areas near the Yellow River and East Bay River is limited. However, use of the Yellow and East Bay Rivers by the public and military can coincide. The Yellow River is part of a canoe trail and the East Bay River is adjacent to a section of the Florida Scenic Trail. Preliminary reconnaissance of these areas before the commencement of training would eliminate potential mission impacts and public safety concerns. Nonparticipants would be politely asked to leave an area where a training exercise is scheduled to occur.

On Eglin recreational lands, outdoor recreation permit holders are notified at the time of application that closures of open lands may occur as part of the normal routine. Closures of water bodies during peak recreational public usage periods would be avoided. Peak use of area waters occurs during the summer months and on weekends, with the highest use during the middle of the day. Mission planning for activities that require closures of the Bay, Sound, or Gulf would consider the occurrence of recreational events such as fishing tournaments, sailboat races, etc. NOTMARs stating the location and duration of the proposed operations in public waterways would be required for certain missions.

In Santa Rosa Sound, LCAC live-fire testing required activation of the restricted area, temporarily restricting passage of boaters through the area for approximately one hour. Normally, passage through the restricted and prohibited areas is allowed; however, recreation within these areas is not allowed according to the *U.S. Coast Pilot*. In Choctawhatchee Bay, no impacts to recreational users resulted from missions at D-54 since no closures were necessary. Increasing development of the east end of Choctawhatchee Bay will likely lead to more recreational boating in that area, and possible future closures may be necessary to ensure mission integrity.

4.3.2 Alternative 2

Potential impacts of this alternative would be the same as those discussed for Alternative 1.

4.3.3 Alternative 3

A 100 percent increase in activity under Alternative 3 would increase the number of Santa Rosa Sound closures to two. The increase in military activity combined with future growth may result in more situations where closure of D-54 in Choctawhatchee Bay is necessary. Increased activity on the Yellow River, East Bay, and East Bay River may result in a slightly higher incidence of interaction with nonparticipants. Increased development around Eglin AFB will cumulatively add to the potential for increased impacts to recreational users as more people use the estuarine and riverine resources. The completion of the Florida Scenic Trail near the East

Bay River will allow access of more recreational users to that area. Closures of this area as a result of training missions would therefore potentially affect a greater number of people.

4.3.4 Alternative 4

Under Alternative 4, SRI Site A-13B, Alaqua Point, and D-84 would be used for live-fire training missions. The firing fans of the munitions to be used in these activities are shown in Table 4-15 and are an important factor in determining the extent of closure of land and or water areas required to ensure safe training operations. Effective and maximum ranges of each munition are shown (Table 4-15). The effective range is the furthest distance the munition would travel and still maintain accuracy and efficiency. Targets would be located within the effective range. Safety footprints discussed in this section are derived from the maximum ranges of the munition, which is the farthest distance that the munition would travel.

Table 4-15. Firing Fans: Maximum and Effective Ranges (meters)

	Standard Munitions		Frangible Munitions	
Caliber	**Effective Range**	**Maximum Range**	**Effective Range**	**Maximum Range**
5.56 mm	550	3,100	25	250
5.56 mm SAW	1,000	3,600	N/A	N/A
7.62 mm	460	4,800	100	600
.50 cal	2,000	6,700	150	700

SAW- squad automatic weapon; N/A - not applicable, no known frangible version

Environmental Analysis

Under this alternative, live-fire activities can cause restricted access issues around the alternative sites. Public access, traffic flows, commercial transport activities, residential communities, and recreation activities would potentially be affected.

Santa Rosa Island Site A-13B

The SRI live-fire training range would be located near Site A-13B, the same area previously used for LCAC live-fire testing of 30-mm guns. This area is encompassed within an established CFA that allows for control of airspace and underlying water and land areas. Both the prohibited area and CFA would potentially be activated up to 28 times a year, but fewer since this total number of events would likely be distributed over three estuarine locations. For biweekly training use as projected for an established live-fire beach range, small caliber weapons between 5.56 mm and .50 caliber are desired and would be fired in a seaward direction only. If available, soldiers would use frangible munitions that have shorter ranges and/or are composed of non-lead materials to reduce or eliminate potential environmental and safety concerns. Tungsten munitions with similar ballistic characteristics may be available. The safety footprint of weaponry basically entails the distance of the maximum range of the munition 360 degrees from the point of fire. Given that the maximum range of the .50 cal is 6,700 meters, standard ammunition could not be fired from SRI; frangible versions of the .50 cal would be one option. Thirty millimeter munitions would potentially be used on an intermittent basis, either mounted on an LCAC or Mk-5 vessel. Safety footprints of the standard 30 mm would not extend onto public property, but would be within the waters of the Sound and Eglin property on SRI.

The firing fan of standard 5.56-mm munitions would extend 2,800 meters into the Gulf. Thus a 2,800 meter (approximately 1.75 miles) arc into the Gulf from A-13B would need to be closed to outside users. Commercial and recreational boat and air traffic would be temporarily prohibited from entering the live-fire area, which is within an existing controlled firing area (CFA). NOTAMs and NOTMARs would be issued prior to each mission. As specified in the *U.S. Coast Pilot*, the frequency of closure is not to exceed twice weekly, with a maximum closure duration of one hour. Under this alternative, the maximum number of live-fire estuarine missions per year would not exceed 28.

Impacts to Commercial Fishing

Commercial fishing interests in Santa Rosa Sound and the Gulf of Mexico would not be affected as long as operational guidelines that specify the frequency of closure are followed. Potential impacts to the fishing industry would have, by law, been considered prior to the establishment of the danger zones and restricted areas in Choctawhatchee Bay and Santa Rosa Sound, as specified in the *U.S. Coast Pilot* (U.S. Department of Commerce, 2003). If an issue existed with the establishment of the restricted areas, then the USACE would have consulted with the USFWS and the NMFS (U.S. Department of Commerce, 2003). Alternative 4 activities would not restrict commercial fishing areas in the Gulf of Mexico.

Impacts to Commercial Shipping

Biweekly use of the SRI live-fire range would involve closures of Santa Rosa Sound a few minutes in duration with minor impacts expected. Given the brief duration of closure, it is conceivable that mission flexibility would allow for real-time management of safety concerns (i.e., shipping, recreational users) such that no closures would result, similar to the approach currently used today for paradrop and paratroop missions in Choctawhatchee Bay. The *U.S. Coast Pilot* allows for twice weekly closures of Santa Rosa Sound for durations of one hour. These stipulations would not be exceeded under Alternative 4.

Impacts to Recreational Users

Impacts to recreational users would be minimal overall, with a slight potential increase for impacts during the spring and summer when recreational use is highest. Recreational water use fluctuates during special events such as fishing tournaments. Cobia fishing tournaments may be held in late March and April, and an annual billfishing tournament is held in October.

In 2000, there were 35,000 participants in the October billfishing tournament over the month-long period. Billfish are caught in offshore waters; thus, other than travel through the waters offshore of SRI to and from the deepwater, only minor impacts would be expected, even during the month of October. The SRI live-fire area would be located approximately 16 miles west of East Pass, the closest outlet for fishing vessels entering the Gulf of Mexico. Only a small percentage of fishing vessels would be expected to travel near the Alternative 4 Live-Fire area since few artificial reefs are located in this area and deepwater is more readily accessed by traveling due south from East Pass. Based on the number of participants on a given day during the annual billfish tournament (35,000/31 days), and assuming an average of six persons per vessel, less than 200 boats participate per day. A fraction of those might be briefly restricted from entering a safety footprint for a live-fire exercise on two days out of that month (live fire would occur twice a month).

Cobia are fished from wrecks and artificial reefs beginning in late March. These fish are predominantly fished by cruising the inshore waters and spotting from towers mounted on boats. A tournament would increase the number of boats in the nearshore waters during that time. Some artificial reefs are located within the controlled firing area, but well east of the proposed Live-Fire Beach Range. Thus, it is possible fishing would not be affected at these reefs. Throughout the year, charter boats would be notified of closures through NOTMAR announcements.

D-84

At D-84, ammunition would be 5.56 mm and targets would be of wood or cardboard construction erected in front of earthen berms, which would serve as ammunition stops. Since safety footprints of standard 5.56-mm munitions would extend past the Eglin boundary at D-84 and into nearby residential areas, frangible munitions or blanks are the only reasonable option for conducting live fire at the D-84 area. The standard 5.56-mm munition has a maximum range of 2,800 meters (1.75 miles) with a safety footprint of the standard 5.56 mm that would overlap the residential Choctaw Beach area.

Impacts to Public Safety

The use of standard munitions at this location entails significant safety concerns and represents a potential significant impact at this area given that the safety footprint would extend into residential areas. If frangible and/or blank munitions were used at this site, the safety footprint would be greatly reduced down to 250 meters, and would be wholly contained on Eglin property.

Impacts to Road Transportation

The frangible 5.56-mm footprint appears to extend up to Highway 20 and, depending on target placement and the precise firing point that would be used, could overlap this road, which would require closure during live-fire exercises. In Figure 4-6 (Section 4.2, Noise), the frangible 5.56-mm maximum range safety footprint is shown to occupy most of the D-84 area. If closed, Highway 20 traffic flows would be impeded up to twice monthly for a few minutes during each of the training missions. Since live-fire training entails a total of 28 annual events distributed over three locations, less than two closures per month are probable. The restricted access impacts would be minimal. Blank munitions would have no access impacts on bordering residential areas or traffic.

Impacts to Commercial Shipping

Impacts to commercial shipping would not occur. Safety footprints would not extend into the Gulf Intracoastal Waterway.

Alaqua Point

At Alaqua Point, the training mission scenarios would be the same as those at D-84, however, there is no provision for blank fire to be used in lieu of live munitions. The standard 5.56-mm munition has a maximum range of 2,800 meters (1.75 miles), a distance that would extend the safety footprint beyond the Eglin reservation boundary. Since this is unacceptable from a safety standpoint, frangible munitions would have to be employed at this location. Frangible munitions would greatly reduce safety and restricted access considerations. Figure 4-5 (Section 4.2, Noise) illustrates the maximum range for the standard 5.56 mm, which extends beyond the reservation boundary, and the maximum range for the frangible .50 cal, which is contained within the Eglin property of Alaqua Point.

Impacts to Public Safety

The use of standard munitions at Alaqua Point would significantly affect adjacent residential communities east of Choctaw Beach, south of Basin Bayou, and southwest of Portland due to the overlap of standard munition safety footprints on these areas. Therefore, the use of standard munitions at Alaqua Point is not a viable option. Blanks or frangible munitions would have no effect on restricted access. To protect the public, control of the Alaqua Point site would have to be improved. Even though Alaqua Point is closed to the public, no fence is erected around the property to ensure that the public does not enter. Thus, to ensure safety to the public during live-fire events, a thorough reconnaissance of the wooded areas of Alaqua Point would be required for live or blank fire of any type.

Impacts to Road Traffic

The use of standard munitions would require closure of Highway 20, impeding regular traffic flows through the area during the training missions.

If blank munitions are used at this site, these significant impacts to bordering residential communities and highway traffic flows could be effectively managed. No road closures would be required from frangible munition use up to and including .50 cal.

Impacts to Commercial Shipping

There would be no impacts to commercial shipping in Choctawhatchee Bay since exercises would not be conducted until the water areas were clear of nonparticipating vessels. In addition, the Gulf Intracoastal Waterway is almost two miles away from the Alaqua Point live-fire site and over a mile from the D-84 site and would be well outside of safety footprints for frangible munitions used at those sites.

4.3.5 Alternative 5

Boiling Creek was selected from six candidate sites as a potential live-fire riverine training site. A site analysis, presented in Appendix G, details the process used to examine the candidate sites for riverine live-fire training. During construction of a live-fire range, the Air Force Engineering Letter 01-13: Small Arms Range Design and Construction must be consulted.

Under this alternative, the river trip would take about three hours in a rigid-hull inflatable or zodiac with outboard motor. The live-fire engagement scenario would last less than 30 minutes with actual firing time on the order of a couple of minutes. Census 2000 data indicate that populated census blocks exist north of the Eglin reservation boundary within the maximum range of the SAW-fired 5.56 mm. Thus, safety restrictions would limit the firing of this weapon to southeasterly or southwesterly directions (i.e toward the interior of Eglin).

Resources Potentially Affected

The use of frangible, limited-range munitions up to .50 caliber could be used with no restricted access impacts to users of the Yellow River, since the maximum range for this munition would be wholly contained on the Eglin Military Complex. Range roads and portions of Boiling Creek would be closed briefly during live-fire training. Appendix G provides a detailed analysis of munition ranges and associated impacts for several munitions and sites along the Yellow River and adjoining tributaries.

Impacts to Road Traffic

Live-fire activity under this alternative would require closures of unimproved roads north and south of Range Road 211 and possibly some river access roads on the north boundary of the Yellow River.

Impacts to Recreational Users

Implementation of this alternative would potentially require temporary closure of some portions of the Florida Scenic Trail as well as portions of Boiling Creek. All forms of recreation would be briefly affected. Some areas normally open to hunting would also be temporarily closed.

Canoe clubs and indivduals paddle Boiling Creek monthly. The 1-mile length of the proposed live-fire range is part of the Boiling Creek Canoe/Kayak Trail, which totals 3 miles in length and extends from the bridge at RR211 to the Yellow River. A local canoe club numbers about 20 canoes six times per year for organized events, and about 40 canoes on an annual New Years Day Paddle. Approximately 16 individuals from the club paddle Boiling Creek monthly (Szymoniak, 2004). Out-of-town canoe clubs from Wisconsin, Illinois, Louisiana and Central Florida have paddled Boiling Creek in 2003–2004, totaling approximately 60 participants over five events (Szymoniak, 2004). Primarily, canoeists use the area from RR211 bridge to the Highway 87 bridge, which is within the proposed live-fire riverine range. Saturday and Sunday are the most often used days for canoe club events (West Florida Canoe Club, 2004).

Closures of Boiling Creek to recreational usage would last approximately one hour; thus any restrictions would be temporary. Mission use would primarily occur on the weekdays, affecting the least amount of recreational users.

4.4 CHEMICAL MATERIALS

Chemical materials as they pertain to the analysis in this document are components introduced into the environment from the expenditure of flares, smokes, or munitions, or leaks, spills, or exhaust from equipment, vehicles, or vessels. These materials may degrade the quality of air, soil, or water that are currently below federal or state standards or may be toxic to plants, wildlife, or people.

4.4.1 Alternative 1

Under Alternative 1, chemical materials were introduced into the environment through smoke grenades, flares, and boat and helicopter engine emissions. Smoke grenades are associated with training primarily in Choctawhatchee Bay. The M-18 smoke grenade, which emits dye-colored smoke, is the most commonly expended item in the estuarine areas and adjacent land areas. No pyrotechnics are used on the Yellow River or in the adjacent wetland areas. Other emission sources include vehicle and vessel use. Aircraft or ground transportation needed to deliver ground troops to their destination, plus escort boats and trucks needed to ensure the safety of troops during training, are used in or near the estuarine/riverine areas.

During air-to-water transitions (i.e., paradrops/paratroops deployments), illumination smokes and flares are deployed. These burn out after about 30 to 45 seconds, temporarily illuminating the operation area. Table 4-16 lists the boat and helicopter use and expendable items for the maximum yearly missions of the FY95-99 baseline.

Table 4-16. Alternative 1, Boat and Helicopter Use and Expendables

Location	Use Category	Activity	Boat-Miles/ year	Helo paradrop/ Mission	Helo drops/ year	Hover-Hours	Expendables /year
Estuarine	Special Ops	Training, testing	1,600	<1	90	90	315 M-18 100 flares
	Navy EOD Training[1]	Classes	340	0	0	0	20 recall devices
		Misc.	360	0	0	0	0
	Testing Support	Sensor/ technology, LCAC	4,200	0	0	0	10 M-18s
	Live Fire	LCAC, A-22	150	0	0	0	<1,000 30 mm TP rounds
Riverine	Special Ops	Training, testing	8,000	<1	10	10	30 lightsticks

M-18 Smoke Grenades

M-18 smoke grenades are typically deployed during paradrops or to signal/communicate with aircrews. The M-18 smoke grenade may give off yellow, green, red, or violet colored smoke and burn for 50 to 90 seconds (Table 4-17). The M-18 is self-contained and is filled with a solid-fuel smoke producing agent. It is 2.5 inches in diameter, 4.5 inches long, and weighs 1.07 pounds.

Table 4-17. Average Amount of Dye in Grams Expended Per Mission* Over Test Area D-54

Solvent Yellow 33	186.9
Solvent Red 1	110.5
Disperse Red 9	38.9
Disperse Red 11	22.0
Solvent Green 3	98.2

*Based on an average of 1.43 smoke grenades per mission (315 grenades/200 missions)

Emissions from Boats and Aircraft

Although the majority of activities within the estuarine and riverine areas involve movement on foot, motorized escort boats and helicopters are sometimes used. The 6RTB uses up to four motorized boats for riverine missions and up to five motorized boats to support troop crossings in Santa Rosa Sound. Other units employ boat motors from 25 to 200 horsepower for outboards, and inboard diesel engines are used on 26-foot aluminum craft for some missions. A conservative approximation of total estuarine and riverine boat mileage attributable to motorized vessels is 20 percent. A helicopter is used to retrieve troops after crossing the Sound and from Test Area D-54 in Choctawhatchee Bay.

Environmental Analysis

The DoD sponsored a review of smoke and obscurant toxicity data by the National Research Council (NRC, 2000) in order to establish exposure guidelines for personnel in training or the general public. Insufficient data existed to establish exposure limits with respect to M-18 colored smoke grenades, and the NRC review concluded that additional studies should be conducted with animals to determine acute and subchronic effects of the combusted-dye products to people. Other important facts about the different M-18 smoke dyes condensed from the NRC report are provided in Appendix F, Toxicity of M-18 Smoke Grenades.

An appropriate metric is the amount of smoke-grenade dye released expressed in grams or milligrams per unit volume (mg/m^3) for air, water, and sediment exposure and grams per weight (mg/kg) for biological exposure.

Resources Potentially Affected

Smoke grenade dye material would potentially affect air, water, and sediment quality and biological resources.

Impacts to Air Quality

Impacts to air quality would be temporary and localized. This issue was analyzed by estimating the potential temporary concentration within a given air space and comparing it with an acceptable level based on available toxicity data with old smoke grenade formulations. The analysis is discussed as follows.

A certain air space is required for smoke material, upon the dissemination of a signal smoke, to reach a level above 1,000 mg/m^3, which is a no-effect level for a single inhalation. Above this level, it is assumed that a single exposure, and certainly repeated exposures, would begin to have adverse effects on air quality. Dissemination of 136 grams of smoke material, the amount in one grenade to an air concentration of >1,000 mg/m^3 would require the smoke cloud to expand to a space of 136 cubic meters (m^3), which is about the size of a cube 5 meters (16.4 feet) on a side. This small but potentially toxic area would exist for a short time period due to rapid dissipation of smoke particles. Less than 26 square meters (m^2) (0.006 acres) of ground or water surface area would be exposed to these concentrations for a brief period after the smoke is released. The rate of dissipation of the smoke is not known, so that the time that the smoke is confined to a 136 m^3 area cannot be calculated. Typical expenditure levels of smoke grenades are approximately 1.4 per mission in the estuarine areas, primarily Test Area D-54. The amount of dye in 1.4 smoke grenades is 190 grams, which would reach a no-effect concentration of 1,000 g/m^3 upon expansion to an area 190 m^3 or a cube almost 6 meters (about 17 feet) to a side. Due to the low number of smoke grenades expended, the dispersion of the smoke, and the small area potentially affected, there would be no significant affects on air quality.

The risk to personnel involved in training missions utilizing colored smokes should be minimal if use is in accordance with standard procedures and current mitigations and with conversion of smoke material to less toxic smokes. Air Force procedures call for use of smoke grenades by qualified instructors only, and for the throwing of smoke grenades in a direction in which the wind would dissipate the vapor away from personnel.

Boat exhaust from motorized escorts would have short-term localized effects on air quality but would not be significant. The USEPA has published emission factors for air pollutants produced by several types of two-stroke and four-stroke outboard engines. The most conservative emission factors (i.e., the worst polluting type of engine) for two-stroke outboard engines of various horsepowers are presented in Table 4-18. Particle size for emissions from gasoline-burning, two-stroke engines was assumed by the USEPA to be smaller than 2.5 microns ($PM_{2.5}$) (USEPA, 1999).

Table 4-18. Emission Factors for Two-Stroke Engines

Power Range (horsepower)	Total Hydrocarbons (g/hp-hr)	Nitrogen Oxides (g/hp-hr)	Carbon Monoxide (g/hp-hr)
25-50	116.4	1.12	422.2
50-100	102	1.83	276
100-175	115.6	8.2	289.4
>175	115.6	8.2	289.4

g/hp-hr = grams per horsepower-hour
Source: USEPA, 1999

Annual total boat miles traveled was estimated to be 6,650 miles for estuarine missions and 8,000 miles for riverine missions. Motorized boat mileage accounts for approximately 20 percent of estuarine and riverine boat miles, since the majority of boats used in these missions are man-powered. Therefore, the total estimated motorized boat miles traveled would be 1,330 miles for estuarine missions and 1,600 miles for riverine missions. The average boat speed was estimated at 15 miles per hour, which was used to calculate annual hours of motorized boat operations. Total hours of motorized operation for estuarine areas were approximately 90; total riverine boat operations were approximately 110 hours. Boat emissions were then calculated using the emission factors for a 25- to 50-horsepower engine (upper range), first converted to pounds (grams/454), in Table 4-19. The results for each criteria pollutant, presented in Table 4-19, were derived by the following equation:

$$\textbf{Outboard Emissions (lb)} = \frac{\textbf{Hours} \times \textbf{Emission Factor (g/hp-hr)} \times \textbf{No. of Horsepower}}{\textbf{454}}$$

Table 4-19. Alternative 1, Boat Emissions

	Total Hydrocarbons	Nitrogen Oxides	Carbon Monoxide
Emission Factors for 50 hp outboard (g/hp-hr)	116.4	1.12	422.2
Estuarine Boat Emissions – 90 hours (lb/year)	1,153	11.1	4,185
Riverine Boat Emissions – 110 hours (lb/year)	1,410	13.6	5,115
Total Estuarine and Riverine Boat Emissions	2,533	24.7	9,300

Impacts to air quality are measured at the county level and consider air pollution from all mobile and stationary sources. The region of influence is in attainment for USEPA air quality standards; thus the baseline level of emissions is not having a significant effect on air quality at the county level. Military riverine and estuarine vessels constitute a fraction of mobile sources in the counties in which these missions occur. For example, there are over 14,000 registered commercial and recreational vessels (e.g., commercial and recreational boats) in Okaloosa County alone. Thus, the emissions produced by riverine and estuarine missions constitute a minor amount of total boat emissions for the region of influence.

Fuel flow rates and air emission factors for the MH-53J Pave Low helicopter were obtained from the *Air Force Air Emissions Inventory Guidance Document for Mobile Sources* (O'Brien and Wade, 2002) and were based on the T64-GE-100 engine. The MH-53J Pave Low has two engines and an auxiliary power unit. Pounds of emissions per hour for the MH-53 are given in Table 4-20. Emissions for the auxiliary power unit, which is used primarily when the aircraft is on the ground, were not considered. For the calculations in Table 4-20, normal power engine emissions were selected to represent expected emission during helicopter drops and retrievals in the estuarine and riverine areas.

In Table 4-20, the total annual helicopter emissions for estuarine and riverine missions was derived by the following equation:

$$\textbf{Total Helo Emissions (lb)} = \frac{\textbf{Hover hours x Normal Fuel Flow Rate}}{\textbf{1000 lb}} \times \textbf{Emission Factor (lb/1000b)} \times \textbf{No. of Engines}$$

Table 4-20. Engine Fuel Flow Rates and Emission Factors for the MH-53

Aircraft Engine	Power Setting	Fuel Flow rate (lb/hr)	Emission Factors in lb pollutant per 1,000 lb fuel burned (lb/1,000 lb)			
			NOx	CO	VOC	PM_{10}
T64-GE-100	Idle	284	1.62	75.46	27.97	2.36
	75% Normal	1,217	5.49	4.97	0.20	1.97
	Normal	1,714	7.45	1.85	0.06	1.61
	Military	1,882	8.01	2.97	0.29	0.92

Source: U.S. Air Force, 2002c

Multiplying 90 hours (the Alternative 1 level of activity) by the normal fuel flow rate of 1,714 pounds per hour, then dividing by 1,000 and multiplying by the corresponding emission factor times two engines yields the total annual helicopter emissions presented in Table 4-21.

Table 4-21. Helicopter Air Emissions for Alternative 1

Aircraft	Total Suspended Particulates (PM_{10})[a]	Sulfur Oxides[b]	Nitrogen Oxides	Carbon Monoxide	Volatile Organic Compounds
MH-53/60 emission factors[c] (lb/1,000 lb)	1.61	2.9	7.45	1.85	0.06
Total Annual Estuarine Helo emissions (lb - based on 90 hover hours/year) [d]	497	522	2,298	570	18.6
Total annual emissions for Eglin AFB (lb)[e]	25,800	14,400	503,200	1,882,000	230,400

[a]Particulate matter 10 microns or smaller in diameter
[b]From U.S. Air Force, 1994
[c]For normal power setting; emission rates from O'Brien and Wade, 2002 except for SO_x
[d]Emissions for two engines; emission factors for all pollutants obtained from O'Brien and Wade, except for SO_x
[e]1999 mobile sources for entire Air Force Base (U.S. Air Force, 2001g)

In summary, air quality would be temporarily affected by smoke from M-18 smoke grenades and aircraft and boat engine exhaust. By-products of M-18 combustion primarily consist of the unaltered dye. The extent of effects from these sources would be temporary and localized, and would have minimal impact on air quality.

Except for Pensacola, the area from Mobile, Alabama, to Panama City, Florida, is designated by the USEPA as in "attainment" or "unclassifiable/attainment" with National Ambient Air Quality Standards for all pollutants. From Table 4-21 above it can be seen that emissions from estuarine and riverine missions constitute a minor fraction of all Eglin mobile source emissions. Within the air quality region of Okaloosa, Santa Rosa, and Walton counties, Eglin emissions account for less than one percent of the total for each criteria pollutant except nitrogen oxides, for which the base accounts for less than two percent (U.S. Air Force, 2001g). Thus, emissions from estuarine and riverine missions would have no significant impact on air quality.

Impacts to Water Quality

Boat operations, equipment drops, smoke grenade use, and signal illumination use would temporarily affect water quality but would have no lasting or significant effects due to quick dispersal of materials in the water column.

Dyes used in smoke grenades have limited solubility, which means that only a small amount of the dye will dissolve in water and the rest will remain as solid particles. The solubility of Solvent Yellow 33 ranges from 0.089 mg/L (89 parts per billion) at a temperature of 12 °C to 0.18 mg/L (180 parts per billion) at 22 °C, a range of concentrations that is not lethal to aquatic organisms. However, algal growth was significantly affected at solubility limits of .20 mg/L. The low solubility of the dyes means that residence in the water column would be short, with the dyes ending up in the sediments.

The average number of Solvent Yellow M-18 grenades deployed per mission is 1.4, based on 151 missions from 1996 to 1999. The amount of Solvent Yellow Dye introduced into the environment each mission would then be very minor at 186.85 grams or about 60 kilograms (132 pounds) per year.

Impacts to Sediment Quality

Given that missions utilizing smoke grenades occur monthly, some smoke dye, especially Solvent Yellow 33, should be present in the soil/sediment environment at all times, though it is unlikely that the same area is continuously affected due to variability in wind and wave conditions and changes in release locations.

As previously mentioned, smoke grenade dyes would not stay in the air or water but would be bound to soil and sediments. Once in the sediments, the extent of the effect of the dyes on sediment quality and on animals that live in the sediments has to do with the concentration of the dyes in the sediments, the availability of the dye to organisms, and the feeding and respiration mechanisms of organisms that live in the sediments. Chemical properties of the dyes, such as the solubilities and partition coefficients, indicate that once dyes are input into the environment, they will be absorbed or adhere to soil or sediments. Because they would be tightly bound to sediments, they would not be readily available to animals that live and feed in the water column. The degree to which the dyes move through the environment depends on how the sediments to which they are attached migrate.

Impacts to Biological Resources

Biological resources include estuarine plants and animals. Ingestion, inhalation, and direct contact are potential exposure mechanisms. An indirect means of exposure is bioconcentration. Bioconcentration is the increasing of a substance in the tissues of animals beyond the concentrations that exist in the animals' immediate surroundings, possibly due to repeated inhalation or ingestion or the consumption of other plant or animals species that have ingested or incorporated the substance. Smoke grenade dyes possess certain properties that enable them to be bioconcentrated. Disperse Red 11, Disperse Red 9, and Solvent Yellow 33 have the potential to bioconcentrate approximately 1,000 times (NRC, 2000). Solvent Red 1 and Solvent Green 3 have potential bioconcentration factors of 10^5 and $10^{7,}$ but also have large molecules that make accumulation take longer (Garrison et al., 1992). Filter feeding animals such as oysters are known to bioconcentrate up to 100 times substances in the water column. Even though the potential exists for marine organisms to bioconcentrate dyes, such an occurrence is rare (Appendix F).

Potential Impacts on Wildlife

Wildlife would be potentially exposed to dye-colored smoke through inhalation, ingestion, direct contact, and bioconcentration. The most likely opportunity for such exposure would be immediately after the smoke has been dispelled, but since wildlife would most likely leave the area during training exercises, direct exposure to toxic levels of emissions is not anticipated. Once released, smoke grenade dyes could persist in the environment for a time, eventually settling out on water or land. Ingestion or inhalation of particles in sufficient amounts to cause harm is unlikely due to the wind driven distribution of smoke particles. However, since dye compounds do persist in the environment, bioconcentration of dye particles in the tissues of animals is a possibility.

Potential Impacts to Threatened and Endangered Species

Because smoke grenades are not used on the Yellow River, sturgeon in those areas would not be affected. There is a potential for sturgeon in Choctawhatchee Bay to be exposed to dyes that have been incorporated into the sediments. Impacts would only occur if the dyes have been bioconcentrated in the prey organisms of sturgeon to potentially toxic levels. Sturgeon in Choctawhatchee Bay typically feed over sandy sediments, as opposed to muddy bottoms typical of the area under TA D-54. USFWS scientists have determined that sturgeon that spawn in the Choctawhatchee River spend their winters in Choctawhatchee Bay (rather than migrate out into the Gulf of Mexico) with increased numbers in Alaqua, Hogtown, and LaGrange Bayous. Sturgeon prey on insects, crustaceans (crabs, shrimp), molluscs (clams, snails), worms, and small fish. The potential for impacts from bioconcentrated dyes is expected to be low due to the wide geographic area in which these animals feed and their preference for prey organisms not generally found in the muddy sediments of TA D-54. Protected marine mammals (e.g., dolphins) should not be exposed for sufficient duration to experience negative effects from estuarine and riverine emissions.

Potential Impacts to the Public

Military personnel are trained in the handling of smoke grenades and observe procedures to reduce or eliminate the potential hazards of inhaling dye smoke. Air Force procedures state that smoke grenades are to be thrown in a direction that allows the wind to carry the smoke plume away from personnel. When released, new National Resource Council findings and recommendations regarding smoke grenade toxicity and risks to military personnel will be consulted. The public would not be exposed due to safety procedures that either stop the training activity or prevent public access to areas under use by military testing or training groups. Smoke would dissipate before reaching populated or areas used by civilians.

Handling of Hazardous Materials and Wastewater

The storage, transport, and handling of hazardous material will be coordinated with AAC/EMCE, and these materials would be disposed of appropriately according to AAC Plan 32-5, Hazardous Waste Management Plan. Immediate response is required for petroleum, oil, and lubricant (POL) spills. Appropriate containment and spill response actions, including on-base reporting requirements and disposal are required. POL products cannot be directed to sewer systems or impervious surfaces (such as grass).

All spills and accidental discharges of petroleum, oils, lubricants, chemicals, hazardous waste or hazardous materials, regardless of the quantity, will be reported. A Spill Discharge Report must be filled out, and the responsible party must hand-carry or fax (882-3761) this Spill Report to AAC/EMC or 16 SOW CES/CEV, within four duty hours of the spill occurrence. Any spill that poses a threat to life, health, environment, or has the potential to cause a fire, will be reported to 96 CEG/CEF via 96 SFS by dialing 911. If the Fire Department declares an emergency condition, they may take control of the situation, including the tasking of the organization's response detail. Spills over 25 gallons are required to be reported to the Florida Department of Environmental Protection (through AAC/EMC). Off-base notification of spills will be reported to Eglin Public Affairs Office (AAC/PA) at (850) 882-3931. The Proponent will comply with AAC Plan 32-9 Hazardous Materials Management.

Wastewater from field kitchens must be captured and disposed of property (i.e., base wastewater plants or off base wastewater plants). Coordination with Mr. Martin, 96 CEG (850-882-6852) is required. Portable latrines may be needed in sensitive areas and near water bodies.

4.4.2 Alternative 2

Potential effects of this alternative would not differ from those of Alternative 1.

4.4.3 Alternative 3

Chemical materials inputs would double under this alternative. Emissions from boats, aircraft, smoke grenade, and flare use would increase with the number of missions (Table 4-22).

Table 4-22. Alternative 3, Boat and Helicopter Use and Expendables

Location	Use Category	Activity	Boat-Miles /Year	Helo/ Paradrop/ Mission	Helo Drops/ Year	Hover-Hours	Expendables/ Year
Estuarine	Special Ops	Training, testing	3,200	<1	180	180	630 M-18 200 flares
	Navy EOD Training	Classes	450	0	0	0	30 recall devices
		Misc.	360	0	0	0	0
		Para/boat ops training	120	1	30	30	0
	Testing Support	Sensor/ technology, LCAC	4,200	0	0	0	20 M-18s
	Live Fire	LCAC, TA A-22	300	0	0	0	<2,000 30 mm TP rounds
Riverine	Special Ops	Training, testing	8,000	<1	10	10	60 lightsticks

Using the same methodology described in Alternative 1, air emissions from boat and helicopter emissions in the estuarine and riverine areas were estimated (Table 4-23).

Table 4-23. Air Emissions for Alternative 3

Aircraft	Total Suspended Particulates (PM_{10})[a]	Sulfur Oxides	Nitrogen Oxides	Carbon Monoxide	Volatile Organic Compounds
MH-53/60 emission rates[b] (lb/1,000 lb)	1.61	2.9	7.45	1.85	0.06
Total annual estuarine helo emissions (lb - based on 180 hover hours/yr)[c]	993	1,044	4,596	1,140	37
Emission rates for 25-50 hp outboard (g/hp-hr)	N/A	N/A	116.4	1.12	422.2
Estuarine boat emissions – 180 hours (lb/year)	N/A	N/A	2,306	22.2	8,370
Riverine boat emissions – 220 hours (lb/year)	N/A	N/A	2,820	27.2	10,230
Total Alternative 3 vessel/aircraft emissions	993	1,044	9,722	1,189.4	18,637
Total annual emissions for Eglin AFB (lb)[d]	25,800	14,400	503,200	1,882,000	230,400

[a]Particulate matter 10 microns or smaller in diameter
[b]For normal power setting; emission rates from O'Brien and Wade, 2002, except for SO_x
[c]Emissions for two engines; emission factors for all pollutants obtained from O'Brien and Wade, 2002,except for SO_x
[d]1999 mobile sources for entire Air Force Base (U.S. Air Force, 2001g)
N/A = Not applicable or information not available from USEPA

Alternative 3 would not appreciably increase emissions from boat, aircraft and smoke grenades relative to the total Eglin mobile source emissions (Table 4-23). Regional air quality, water quality, and biological resource impacts would be similar as those in Alternative 1. The increase would not cause an increase in potential impacts due to the extremely low percent contribution to overall emission inputs for the base and for the region.

4.4.4 Alternative 4

Chemical materials inputs under Alternative 4 would increase over the previous alternatives, primarily due to the increased emissions from motorized boat operations and live munitions use along shoreline areas of D-84, SRI, and Alaqua Point. The increase in motorized boat mileage under this alternative is an estimated 1,080 miles from biweekly special operations missions and quarterly Navy Mk-5 boat training. Approximately 30,000 to 40,000 rounds of mostly small-caliber ammunition would be distributed among the three estuarine live-fire locations.

There are three types of ammunition analyzed in this section: lead projectile munitions, frangible munitions, and "green" munitions with nonlead projectiles. Frangible munitions are of nonlead composition and of limited range, whereas green munitions have the same performance characteristics as standard lead ammunition.

Special operations units desiring to conduct live-fire operations in the estuarine areas have expressed a willingness to use frangible and green munitions, which are in various stages of development. Frangible munitions are relatively less toxic than standard lead-based projectile munitions and are primarily composed of tungsten-tin and held together with a nylon binder.

Analysis of standard munitions (lead alloy projectile) is provided in this section as well, though military live-fire ranges across the nation are under scrutiny for lead contamination in soil and groundwater. Tungsten-based green munitions with similar ballistic properties as standard lead ammunition would offer a less environmentally impactive option.

The repeated use of copper and lead projectiles in the estuarine areas could, over time, lead to potentially significant impacts on soil quality, plants, and animals as indicated by soil modeling, discussed later in this section ("Impacts to Soil Quality"). Best management practices (BMPs) that essentially contain the lead and restrict its transport, would minimize the potential for environmental impacts. BMPs for live-fire ranges are discussed in Appendix B.

Frangible munitions were developed to break apart when hitting hard surfaces, thereby preventing the incidence of ricochets during close-quarter combat. Frangible bullets are not made from a lead projectile covered with a copper jacket but rather are composites of hybrid materials pressed together with adhesives. Although the fragments from the bullets may corrode faster in the environment, potentially becoming more readily available to aquatic organisms than larger-fragment projectiles, the constituents are not as hazardous as lead.

Oak Ridge National Laboratory (ORNL) developed a nontoxic, all-metal replacement for lead in bullets. The frangible bullets are fabricated from mixtures of tungsten-tin. ORNL's Industrial Hygiene Department determined that the metals and alloys in the projectile material for the bullets are environmentally safe (ORNL, 2003). Still, modeling indicates that tin levels in soil could increase near target areas to levels identified by USEPA as screening levels, requiring further analysis and monitoring.

Lead-free "green" bullets have been developed to replace copper-jacketed bullets. The bullets are produced with tungsten-tin or tungsten-nylon cores instead of lead. Depending on the composition, shape, size and amount of heat treatment, the bullets may be frangible, as described above, or penetrating. Tungsten and tin do not have any known toxic characteristics when used as green bullets (Bogard, 1999). Tungsten, a nontoxic metal more dense than lead, and tin, used extensively in food and beverage containers, are now used in the projectile slugs, resulting in ballistic performance equivalent to that of lead slugs but without the environmental impacts. Additionally, tungsten and tin are specified by federal law, 50 CFR, 1997, as nontoxic for use in shot for hunting migratory waterfowl. Also, these metals are not designated by USEPA as hazardous waste constituents and have no applicable federal land disposal restrictions (Bogard, 1999).

Compositions for standard 7.62-mm munitions and nonlead frangible 5.56-mm munitions were available and analyzed for potential effects to the environment. During live fire, the projectile, bullet cartridge, or casing and propellant would be introduced into air and water areas of the estuarine live-fire sites. The chemical materials of concern are the by-products of the bullets' propellant explosion and, for standard 7.62-mm rounds, the lead projectile. Since there are several variations of the 7.62-mm round, the M80 ball munition frequently used in automatic weapons was selected for analysis. The 25.35 gram, 7.62-mm M80 round consists of four major components: the propellant charge (3 grams), the cartridge case (12.3 grams), the bullet projectile (9.7 gram), and the primer or cap (0.35 grams). Table 4-24 lists the components of the

M80 WC846 propellant. Propellant combustion converts 99 percent of the original material primarily to carbon dioxide (CO_2), water (H_2O), and nitrogen gas (N_2), with small amounts of carbon monoxide (CO), nitric oxide (NO), and nitrogen dioxide (NO_2) emitted into the atmosphere (U.S. Air Force, 1997a).

Table 4-24. 7.62-mm Munition Propellant Composition

Material	Percent Composition
Graphite	0.40
Sodium sulfate	0.50
Calcium carbonate	0.25
Nitroglycerin	9.50
Diphenylamine	1.13
Dibutylphthalate	5.25
Nitrocellulose	82.97

The estimated air emissions generated by M80 7.62-mm round expenditures is provided in Table 4-25. Less than 15 pounds of USEPA criteria pollutants would be generated over the course of a year.

Table 4-25. Estimated Air Emissions Generated by the Expenditure of Standard M80 7.62-mm Ammunition Under Alternative 4

Criteria Pollutant	Emission Factor[a]	TOTAL EMISSION BY-PRODUCT (POUNDS)	
		Per Mission	Annual Total[b] (40,000 rounds)
Carbon monoxide (CO)	0.038	0.33	10
Nitrogen oxides (NO_x)	N/A	N/A	N/A
Hydrogen sulfide (H_2S)	0.01	0.088	2.6
Lead (Pb)	0.0006	0.005	0.16

[a]USEPA, 1996
[b]Based on approximately 30 missions, with 1,000 – 1,500 rounds expended per mission.

Brass shell casings and possibly lead-alloy projectiles would also be expended, some of which would not be retrievable. The brass (70 percent copper and 30 percent zinc) cartridge case encapsulates the propellant charge and supports the bullet projectile. Projectile cartridge types include ball bullets, tracers, and incendiary bullets. The bullet projectile consists of two parts, a copper alloy clad steel metal jacket and a lead alloy core. The core of the ball is composed of a short forward section of steel and a larger rear section of lead/antimony. The metal jacket around the core is normally composed of brass (copper and zinc) or a ductile grade of malleable steel covered with a thin coating of copper (U.S. Air Force, 1997a). Annual live-fire training would result in about 1,000 pounds of brass from shell casings. The lead alloy projectile of the 7.62 mm weighs 9.7 grams or .021 pounds. The annual total weight of lead projectiles expended would potentially be 855 pounds at the three estuarine live-fire sites.

An estimated 60 percent of the brass casings would be retrievable. Greater detail is given to the distribution and retrieval of brass in Section 4.5, Debris, since brass casings would primarily be a debris issue. The chemical input from corroding brass should be insignificant, because brass undergoes slow corrosion, even in salty environments. A slow release of copper and zinc ions would result from brass corrosion.

Impacts to Personnel

Indoor hazard analysis has been conducted for a frangible version of the 5.56-mm munition in response to range personnel reports of eye and nasopharyngeal irritation not previously experienced with lead-based ammunition (U.S. Air Force, 2001h). The indoor range is an enclosed space, and the reported irritating effects of the frangible munition components were attributed to inadequate ventilation of combustion products. The by-products of the frangible 5.56-mm munition include ammonia, copper, tungsten, zinc, and traces of lead and hydrogen cyanide (U.S. Air Force, 2001h). Outdoor use is unlikely to present any inhalation hazard to personnel.

Impacts to Soil Quality

Soil modeling was conducted to estimate the amount of metals that would result from the use of frangible and standard munitions over time. The Seasonal Soil Compartment Model (SESOIL) was used for this analysis; the model is a one-dimensional, vertical transport integrated screening-level soil compartment tool. The model utilizes site-specific soil, chemical, and meteorological values as input to obtain chemical concentrations. SESOIL can estimate the rate of migration of chemicals through soils and the concentration of the chemical in soil layers following chemical loading that is instantaneous or continuous.

The criteria used to determine potential impacts as indicated by modeling results were contaminant thresholds or benchmarks identified by the federal government for screening or identifying areas where the potential for contamination exists.

More specifically, USEPA uses these ecological screening benchmarks to identify chemical concentrations in environmental media that are associated with a low probability of unacceptable risk to ecological receptors. The ORNL Environmental Sciences Division developed a comprehensive assembly of screening values, which are presented together with values developed by regulatory agencies for constituents of concern in Table 4-26. The benchmarks are based on conservative endpoints and sensitive ecological effects data and represent a preliminary screening of site contaminant levels to determine if there is a need to conduct further investigations at sites and are not meant to be used as cleanup levels. Exceedances of the ecological screening values may indicate the need for further evaluation of the potential ecological risks posed in the area. USEPA Region III risk-based concentrations are values used to show the potential risk to human health of residential inhabitants from exposure to levels above criteria. Table 4-26 also lists concentrations of copper, lead, and zinc that are naturally occurring in soil.

Table 4-26. Ecological Benchmark Values and Soil Screening Criteria for Munitions Constituents

	Naturally Occurring in Area Soils[a]	**USEPA Region IV Ecological Soil Screening Benchmark**[b]	**USEPA Region III Risk Based Concentration (Residential)**[c]	**ORNL Soil Microbe Benchmarks**[b]	**ORNL Soil Invertebrate Benchmarks**[b]	**ORNL Soil Plant Benchmarks**[b]
	mg/kg					
Copper	7.3	40	3,100	100	50	100
Lead	14.7-18.7	50	400	900	500	50
Tin	ND	53	4,700	2,000	ND	50
Tungsten	ND	400	ND	400	ND	ND
Zinc	26	50	23,000	100	100	50

[a]Boerngen and Shacklette, 1981
[b]ORNL, 2003
[c]USEPA Region III Risk Based Concentration Table, 4/25/2003. http://www.epa.gov/reg3hwmd/risk.
ND = No Data

SESOIL runs were made for the constituents found in both frangible and nonfrangible munitions, based on input of 855 pounds (no projectile collection from target areas) and 133 pounds (87 percent projectile collection). Modeling of contaminant loading was for 1 year and 5 years of munitions use in areas of 1 acre, 5 acres, and 20 acres, since the actual target distribution of the live-fire ranges have not yet been defined. Assuming this alternative is selected and the actual target arrangement is defined, additional modeling may be required to refine the analysis. The assumption used for SESOIL modeling was that the constituents in the rounds were immediately available (i.e., free to move through the environment) once expended. In reality, some time would pass before constituents would be available, but this scenario presents a useful concentration to compare to established screening criteria in lieu of actual site-specific sampling data. Results of SESOIL modeling are presented in Table 4-27. Exceedances are denoted in bold.

Table 4-27. SESOIL Modeling Results of Munitions Composition Constituents in Soil

	SURFACE AREA (acres)											
Constituent[a]	1				5				20			
	MUNITIONS USE (years of loading)											
	1		5		1		5		1		5	
	CONSTITUENT LOADING (pounds)*											
	133	855	133	855	133	855	133	855	133	855	133	855
	Maximum concentration in soil (mg/kg)											
Copper	8.02	51.7[b]	67.1	432	1.62	10.4	13.5	86.6	0.0004	0.0026	0.0032	0.0216
Lead	9.63	62.1	80.7	520	1.94	12.4	16.3	104	0.0005	0.0031	0.0039	0.0260
Tin	4.43	60.8	79.0	509	1.90	12.2	15.9	102	0.0005	0.0030	0.0038	0.0255
Tungsten	10.8	69.7	89.6	586	2.18	14.0	18.3	116	0.0005	0.0035	0.0043	0.0289
Zinc	8.68	55.9	72.7	468	1.75	11.2	14.7	93.7	0.0004	0.0028	0.0035	0.0234

[a]Assumes metals from ammunition are immediately dispersed and available for transport.
[b]Boldface indicates exceedance.

Potential impacts from 855 and 133 pounds of rounds expended in a 20-acre area did not exceed either background or soil screening levels (SSLs). Nor were exceedances noted for modeled concentrations in a 5-acre area with 1 year of loading and at 5 years and 133 pounds. However, SSLs were exceeded in a 5-acre area with 855 pounds of annual loading for 5 years. According to the SESOIL model, the greatest exceedances occur within a 1-acre area receiving 133 pounds over 5 years and 855 pounds of rounds annually for 1 to 5 years. All metals, with the exception of tungsten, would exceed one or more benchmarks listed in Table 4-26. Only lead exceeded the RBC for residential exposure from the 5-year, 855-pound modeled concentration, but exceedances for tin, copper, and zinc were also predicted by the model. If lead bullets are expended within 5 acres over a 5-year period, or in a 1-acre area from 1 to 5 years, 87 percent bullet containment is recommended. Depending on the type of munition actually used (i.e., frangible versus. lead), periodic soil monitoring for copper, lead, tin, and/or zinc would be required. Similarly, should frangible munitions be expended within 1 acre annually for 5 years, BMPs outlined in Appendix H would be necessary to negate potential ecological impacts from munitions residue in soil. As long as BMPs are implemented, the chemical materials impacts would not be significant.

Potential Impacts to Air Quality

Under Alternative 4, emissions from small-caliber munitions would create temporary, localized effects on air quality but would neither exceed USEPA NAAQS criteria nor have any lasting effect on regional air quality. Personnel engaged in firing activities of frangible munitions may experience some irritation as described above, but since the firing platform (a boat) is mobile, exposure to emissions would be brief.

Potential Impacts to Water Quality

Approximately 400 pounds of brass casings would be expended into the water column from live-fire operations, distributed between the D-84, Alaqua, and SRI live-fire areas. Cartridge brass by composition is 70 percent copper and 30 percent zinc, and corrosion of the elements, though slow, would occur over time. The primary interaction between the brass alloy and the environment would occur at the sediment water interface, potentially affecting those organisms that live in the sediments. Due to water volume and the movement of water, concentrations of copper and zinc would not become elevated in the water column and impacts to water quality would not be significant.

Potential Impacts to Wildlife

Terrestrial wildlife can be exposed to contaminants through multiple pathways; they may drink or swim in contaminated water, ingest contaminated soil and food, and breathe contaminated air. Animals may move between habitats incurring contamination from several spatially discrete sources.

Soil ingestion by wildlife could function as a major pathway for the uptake of metals. Cattle, sheep, and swine studies identified soil as the main sources of exposure to contaminants, including lead.

Soil may be ingested intentionally or incidentally. Wildlife may intentionally feed on soil and grit to supplement mineral deficiencies and/or to assist in food digestion. Surface soil contains minerals such as sodium, calcium, iron, magnesium, manganese, phosphorus, zinc, and other trace minerals that are required to sustain life processes. Typically, these constituents are derived in adequate quantities from the consumption of plants or animal foods. However, because of seasonal fluctuations or deficiencies in food source mineral content, species may consume mineral-laden soils. Increased demand for calcium or sodium may cause some animals to ingest soil directly. Seed-eating birds ingest soil as a digestion aid. Box turtles, tortoises, and other reptiles are known to intentionally consume soil, possibly for its mineral content (Arthur and Alldredge, 1979). Animals can incidentally ingest soil while grooming, digging, grazing, and feeding on soil-covered roots or food sources such as mollusks that contain sediment. Some birds gather mud in their beaks for nest building. Wood ducks can ingest high rates of sediment while feeding (USEPA, 1993). Animals that feed extensively on earthworms may have an increased exposure potential because worms ingest soil directly. Earthworms are typically 20 to 30 percent soil. Estimated soil ingestion rates for several species is presented in Table 4-28.

Table 4-28. Estimated Soil and Sediment in Terrestrial Species Diets

Species	Percent Soil in Diet (dry weight)	Rate of Soil Consumption/Food Consumption (kg/d)
BIRDS		
Wild turkey	9.3	0.0162/0.174
Wood duck	11.0	ND
Shorebirds	10–60	
Feral hog	2.3	
MAMMALS		
White-tailed deer	<2.0	0.0348
Red fox	2.8	0.0126/0.45
White-footed mouse	<2.0	0.000068/0.0034
Eastern cottontail	6.3	0.015/0.237
REPTILES		
Eastern painted turtle	5.9	ND
Box turtle	4.5	

Sources: USEPA, 1993; Sample and Suter, 1994
ND = no data

Live firing of standard or frangible munitions poses a risk of exposure from various metal alloys to certain species of wildlife, particularly those that feed in close contact with the soil and sediments such as some insects, birds, and wild hogs. Shorebirds, based on their rate of soil ingestion of up to 60 percent, could potentially be affected from metals deposited in their feeding areas. Thus, for SRI live-fire areas, it is important to either locate targets in areas where shorebirds do not feed and/or implement measures to retrieve 87 percent or greater of projectiles spent. Additionally, brass cartridges should be collected to the degree possible. Where possible, deposition of casings and other materials into sensitive species habitats, such as the flatwood salamander and bog frog, should be avoided. BMPs presented in Appendix B will be implemented to minimize potential environmental impacts.

4.4.5 Alternative 5

Chemical materials inputs from this alternative include those from the previous alternative plus emissions and projectiles from an additional 36,000 rounds of small-caliber ammunition that would potentially be introduced into Boiling Creek and/or adjacent land areas.

Potential Impacts to Soil Quality

The number of projectiles and types of rounds discussed in Alternative 4 are applicable to Alternative 5. The overall increase of ammunition by-products into the environment would potentially double, given the addition of a live-fire riverine range, but soil concentrations at the any one live-fire target location would not increase over the amounts discussed in Section 4.4.4 and listed in Table 4-27. Based on the SESOIL modeling results discussed in Section 4.4.4, 87 percent or greater containment/retrieval of projectiles is required to prevent concentrations of metals (lead, copper, and zinc from lead-based munitions and tin from frangible munitions) from exceeding USEPA screening levels. As mentioned, exceedances of screening levels do not necessarily indicate significant impacts but identify situations that may require additional analysis or preventive measures.

Potential Impacts to Air Quality

Using 7.62 mm as a representative caliber, emissions were calculated using USEPA emission factors for small arms (USEPA, 1996). The amounts presented in Table 4-29 are negligible with regard to air quality. As previously mentioned in the Alternative 4 discussion, some have reported irritation from inhaling emissions from frangible arms fire. Military personnel directly involved in the training activities would be at greatest risk for inhalation of live-fire emissions, but the exposure should be brief given that firing occurs from moving platforms (i.e., boats).

Table 4-29. Estimated Air Emissions Generated by the Expenditure of Standard M80 7.62-mm Ammunition Under Alternative 5

Criteria Pollutant	Emission Factor[a]	Total Emission By-product (lb)	
		Per Mission	Annual Total[b] (36,000 rounds)
Carbon monoxide (CO)	0.038	0.297	9
Nitrogen oxides (NO_x)	N/A	N/A	N/A
Hydrogen sulfide (H_2S)	0.01	0.08	2.3
Lead (Pb)	.0006	0.0045	0.14

[a]USEPA, 1996
[b]Based on approximately 30 missions, with 1,000 – 1,500 rounds expended per mission.

Potential Impacts to Water Quality

Based on estimates derived from the debris analysis (Section 4.5), about 260 pounds of brass ammunition shell casings would be deposited into Boiling Creek. Though considered irretrievable from the water areas in the analysis, some method for retrieval could be explored to recycle this metal.

Potential Impacts to Wildlife

Metallic components of both frangible and lead munitions can be toxic to wildlife. The exposure pathway most likely to occur would be regular ingestion of plants or soil invertebrates growing or living near target areas.

The environmental stability, mobility, and biological uptake of tungsten from bullets made of tungsten-nylon and tungsten-tin were studied by ORNL. Concentrations of tungsten in leachate from experiments using sand showed the greatest mobility of tungsten. Outdoor exposures and accelerated aging tests studied the stability of materials. Data showed that tungsten powder oxidizes to form a tungsten oxide, which is insoluble in water and fairly stable in the environment. Biological uptake revealed that earthworms were not adversely affected by exposure to soil contaminated with the tungsten-containing bullets; the uptake of tungsten by the earthworms was minimal to zero (Lowden et al., 2003).

Bioaccumulation factors (BAFs) and ecological benchmarks are tools used to assess environmental impacts from contaminants. The fish bioaccumulation factor is often used as a threshold for screening purposes in aquatic systems. When a BAF is above 1,000, bioaccumulation should be considered. None of the chemical constituents of ammunition have a fish BAF greater than 1,000. Table 4-30 lists BAFs for heavy metals associated with both frangible and nonfrangible standard ammunition.

Table 4-30. Fish Bioaccumulation Factors for Metals in Ammunition

Chemical	Fish BAF (L/kg)
Copper	3.2
Iron	3.2
Lead	3.2
Tin	100
Tungsten	3.2
Zinc	3.2

Source: ORNL, 2003

The adverse environmental impacts of lead in shooting rounds are well documented. Although lead-replacement metals such as tungsten and tin are considered to be less environmentally impactive than lead (Bogard, 2002), studies on the chemical fate and transport of all frangible munitions composite materials (i.e., copper, zinc) are lacking. Of concern is the predisposition of frangible munitions to break apart into tiny fragments, which may become more readily bioavailable to terrestrial and aquatic biota. Table H-2 in Appendix H provides additional information on potential fate and transport and an ecological toxicity assessment of metals used in frangible and standard training rounds.

Since BMPs would be employed and the majority of the projectile components removed, minimal exposure of fish and wildlife to metals is expected. However, as a conservative measure, sensitive species habitats would be avoided.

4.5 DEBRIS

Debris may include items from present-day missions, such as lightsticks, smoke grenade canisters, flare chutes and structures, and items left over from historical missions such as test targets and munitions. Historical documents indicate that the majority of leftover munitions are dummy or practice bombs, which are still considered UXO because they may contain a small amount of explosive known as a spotting charge. High explosive munitions were historically used and may be present as well. UXO is buried in the sediments of Choctawhatchee Bay in an area between Rocky and Boggy Bayous, and the area is marked on NOAA nautical charts. Other areas of Choctawhatchee Bay were historically used for gunnery and bombing, and the potential for UXO exists at these areas as well. An example of historical target debris still visible is the utility poles that comprise TA D-55. More information on historical usage of estuarine and riverine areas is presented in Appendix C.

4.5.1 Alternative 1

Many missions in the estuarine and riverine areas may potentially involve some sort of disposable or portable item that at some time during the mission may be expended and left behind in the environment. Because many units operate under a policy of picking up debris (e.g. spent casings) after missions, debris that is left behind is likely done so unintentionally, accidentally, or because the item is simply irretrievable or lost. Nonenforcement of debris policing rules, particularly for visiting units, may account for other instances where debris is not picked up. The type of debris related to current mission activities is essentially litter.

Expended items from estuarine and riverine missions that are not picked up are classified as debris. These may include, but are not limited to, smoke canisters, parachutes from flares, and lightsticks. Policies for retrieval are in place for some user groups, and limitations on where certain items can be expended (e.g., no pyrotechnics in wetlands) are a range-wide policy. A debris survey has not been conducted, but it is commonly reported that casings, flare chutes, and other items are noticeable within the interstitial areas and TAs and on SRI. Some groups interviewed have stated their units operate on a “take what you bring in” policy. It is unlikely that all user groups conduct post-mission sweeps of the training area for debris, though certainly some do. Also, some debris may be left over from missions of previous years when debris policing rules were not enforced.

Plastics and other debris are a well-documented hazard in the marine environment as well, and are of particular concern with regards to sea turtles and dolphins, which are protected under the ESA and MMPA, respectively.

Given the range debris policing policies in place and the higher percentage of recreational and public users to the military, debris from military missions likely constitutes a minor percentage of total debris deposited in the estuarine and riverine areas.

Environmental Analysis

Measuring Debris

Debris can be measured in terms of number of items deposited over time, volume, or weight per unit area (i.e., pounds per acre), surface area covered (i.e., square feet), or potentially hazardous or obstructive areas displaced for other uses. Some types of debris, such as plastic, may present specific hazards to certain types of animals. Aesthetic impacts (i.e., visually unattractive) for nonhazardous debris are relative according to the uses of the area affected and may differ from person to person. For example, debris may be more visually impactive to some people when encountered on a hiking trail or along a beach than on a TA. For estuarine and riverine missions, debris is most noticeable in and around the areas used as mission objectives. These areas are located more inland.

Criteria for Analyzing Potential Effects of Debris

Debris criteria do not exist in terms of the number of items or weight allowed or prevented by law. As evidenced by the amount of trash illegally deposited on the reservation, people vary in their opinions as to the amounts of debris they are willing to tolerate in the areas they use for recreation. There are laws that specify "no dumping" on recreational areas of the Eglin reservation and laws that prohibit throwing trash on the highways that are directed at the general population. But for federal actions there are federal laws that may be relevant to the deposition of items in state waters and lands and on DoD lands from estuarine and riverine missions. These laws could be applied to address the secondary impacts of debris, such as what limits it might place on other users (i.e., the public) and the act itself of depositing debris (i.e., a permit may be needed if within state waters), such that meeting debris criteria in this document would be defined as meeting the requirements of applicable environmental laws. The laws and regulations potentially pertinent to this issue are:

- The Coastal Zone Management Act (CZMP) – states that federal actions must be compliant with the state's Coastal Zone Management Plan, which in Florida, stresses public access to beaches and waters of the state. A federal CZMP consistency determination is included as Appendix H.
- The National Pollutant Discharge Elimination System (NPDES) – may require a permit for items expended into state waters, which could include smoke, flare, and other debris.
- The DoD Range Rule – while most applicable to the cleanup of ranges associated with base closures, the Range Rule could apply to inactive TAs (i.e., TA D-55) and the danger zone in Choctawhatchee Bay.
- Air Force Instruction 13-212 (U.S. Air Force, 2001i). Volume 2 of AFI 13-212 states "Inhabited areas of the range should be scheduled for periodic 'policing' to remove unwanted debris and general clearing or mowing of excess vegetation. Debris should be collected and properly disposed of in accordance with local procedures."

Analysis of Potential Effects of Debris

Deposition and abandonment of debris items may potentially conflict with the Coastal Zone Management Act, the NPDES, and the DoD Range Rule. Periodic policing of debris on ranges is required according to AFI 13-212. Leftover debris in Choctawhatchee Bay has led to the establishment of a danger area, which potentially limits the uses of the resources contained within, and a potential navigation hazard near the mouth of the Choctawhatchee River in the leftover utility poles that constitute TA D-55.

TA D-55 consists of 2,040 utility pilings distributed over an area 2 miles long and 660 feet wide, or an area of 160 acres. The danger zone is located in the northwest section of the Bay near Rocky and Boggy Bayous and covers an area of approximately 2,120 acres. It contains UXO primarily in the form of 250- and 500-pound World War II practice bombs. While this UXO has resulted in a restricted-use designation on nautical charts, this area is nonetheless used today by the public. The danger zone designation was created to notify the public of the potential hazards within the sediments and not on the surface waters.

Miscellaneous flare and smoke grenade items are deposited in or near TA D-54 and are composed of plastic, paper, and metal of nonhazardous constituents. Flare chutes are composed of plastic and have been known to attract animals due to the salts from expelled flare smoke that coat them.

Resources Potentially Affected

Public Resources

In 1998, a Navy-sensor demonstration in Choctawhatchee Bay employing acoustic, magnetic, and electro-optical devices located 157 potential UXO “targets” within the danger zone but were unable to confirm any as UXO, largely due to limitations in the sensor devices’ abilities to provide details of deeply buried items (Carroll et al., 2000). The sensors are most efficient when detecting UXO on the sediment surface. The majority of the signatures indicated that the items were buried in at least one foot of sediment. The UXO trapped in the sediments and delineated by NOAA danger zone boundaries is likely not an imminent threat to the public using the surface waters within the zone, because UXO is buried in the sediments and most of the bombs (i.e., practice bombs) contain only a spotting charge. (A spotting charge is a small amount of explosive used to make hits on a bombing target more visible for scoring purposes, and would not result in a large-scale explosion.)

While people have been accidentally injured or killed when handling practice bombs, one would have to first be retrieved from the sediments to pose an immediate hazard. Commercial fishing operations (i.e., nets, trawls) and dredging operations have the greatest potential for accidentally retrieving UXO due to the gear used and contact of the gear with the sediments, but likely avoid the area because of the danger zone status and the potential for underwater objects to snag fishing gear. Commercial fishermen and shrimpers in Choctawhatchee Bay maintain a record of bottom areas where they have previously lost nets and other gear to submerged objects in order to avoid those areas in the future, even though it is unlikely that UXO contributes to a significant number of gear "hangs" because most of it is buried.

During the 1998 demonstration, Navy sensors also detected a variety of other objects within the danger zone such as a sunken trawler, a propane tank, a boat, and other non-UXO items that could present substantial obstacles to fishing and shrimping. In the event a storm surge or other weather phenomenon were to dislodge an item from the bottom and move it to shallower waters or the shore, then a potential safety hazard would exist for the general population, depending on the size and type of munition.

The utility poles on TA D-55 occupy approximately 160 acres near the mouth of the Choctawhatchee River that could be used for boating and other recreational pursuits. The logs may potentially break off over time and present floating navigational hazards and also may increase the difficulty of night navigation in that area. An environmental assessment found that removal of the poles by shearing them at the sediment interface level would have no significant impacts on water quality, sediment quality, or sensitive species but would be cost-prohibitive (U.S. Air Force, 1994).

Potential Effects on Wildlife and Listed Species

Natural resources personnel have reported at least one instance of a deer ingesting an illumination flare parachute; the deer was attracted to the smoke by-products (i.e., salts) coating the chute, and the chute became stuck in the animal's throat. The maximum baseline amount of flares expended for Alternative 1 is 100, but they are not equipped with parachutes. Flares used during the baseline were primarily marine marker signal illumination smokes. These devices are tossed into the water and burn for approximately 40 minutes.

Plastic debris in the marine environment has been identified as a cause of death in some species of sea turtles due to the similarity of the debris to the turtles' food prey. A 1998 study focused on debris and stranding deaths of sea turtles in inshore and offshore areas near south Texas (Shaver and Plotkin, 1998). Of the 473 strandings that occurred from 1983 to 1995, .001 percent of deaths were attributable to plastic debris such as bags, sheets, and straps, but 42 percent of all turtles stranded offshore had ingested some plastic debris. The incidence of debris in inshore strandings was significantly lower than for offshore turtle strandings.

Some researchers have suggested that sea turtles may be attracted to lightsticks on commercial fishing long lines. The turtles can then become entangled in the line or caught on the long line hooks. Though light sticks, used by some special operations groups, may accidentally be introduced into the estuarine environment, they have not by themselves (i.e., not part of fishing gear) been identified as particularly hazardous items to sea turtles. Plastic flare chutes deposited into the waters should be retrieved in order to prevent accidental ingestion by sea turtles. Overall, debris effects from estuarine and riverine missions are expected to be minimal and not likely to adversely affect listed species.

4.5.2 Alternative 2

Potential environmental effects of debris under Alternative 2 are the same as those under Alternative 1.

4.5.3 Alternative 3

The amount of debris items would potentially double under this alternative.

4.5.4 Alternative 4

To quantify debris and assess impact potentials, it is necessary to estimate the general deposition tendencies of shell casings during mission events; that is, are they deposited within a boat or on the land surface, or ejected into the water during firing. Shell casings deposited within the confines of a boat or on the soil surface are easily retrieved following training events, whereas casings ejected into the water are less likely to be retrieved. Debris includes retrievable as well as nonretrievable shell casings, with the differentiation being that retrieved shell casings are not a debris issue.

Expended ammunition shell casings most likely to end up in the water are small arms that are carried by troops and fired from a variety of positions versus guns that are used on large boats and may be in a fixed position. Debris analysis, based on assumptions and proposed mission performance attributes, is outlined in the following conservative mission event scenario:

- The proposed Special Operations Forces (SOF) live-fire training would be conducted at SRI live-fire range, D-84 live-fire area, and Alaqua Point. All live-fire training operations would occur within designated areas.
- During a typical year, 34,000 rounds of 5.56 mm to 40 mm would be expended. Of the small arms and gun ammunition utilized, shell casings from small arms (5.56 mm, 7.62 mm, and .50 caliber) would most likely be deposited on soil or water surfaces. Guns (20 mm to 40 mm) are normally fixed in position during firing and used on larger boats that tend to capture expended shell casings.
- Of the 34,000 rounds expended, 95 percent (32,300) would be 5.56 mm, 7.62 mm, and .50 caliber small arms ammunition; the remaining 1,700 rounds would include gun ammunition. Yearly small arms ammunition expenditures would be allocated equally among the three proposed sites (10,767 rounds/site) and wade/on-beach and boat/beach firing scenarios. Where more than one type of small arms ammunition is utilized, the allocation would be equally distributed among the types of small arms ammunition.
- SOF training scenarios would include two principal phases: deployment of troops from helicopters into boats or directly into the water and movement of troops toward the beach. Live fire toward the beach would occur from boats, while wading ashore, and from positions on the beach.
- Small arms firing during wading would result in 100 percent deposition of shell casings in the water. Firing from boats would result in deposition of 50 percent of 5.56 mm and 7.62-mm shell casings in the water and 50 percent deposition within the boat.

Ninety-five percent of .50 caliber shell casings would be deposited within the boat and 5 percent would be ejected outside the boat. It is assumed that all land deposited shell casing debris would be collected following mission events.

- Shell casings deposited in water are considered nonretrievable, whereas casings deposited on land or within boats are considered retrievable. Shell casings that are retrieved are not considered a debris issue component.

A summary of estimated Alternative 4 debris metrics is presented in Table 4-31.

Table 4-31. Alternative 4, Live-Fire Debris Metrics

Live-Fire Location	AMMUNITION SPECIFICATIONS*			SHELL CASING DEPOSITION/YEAR (pounds)			
				Wade/On-Beach Firing		Boat/On-Beach Firing Event	
	Type	Weight (pounds)	Length (inches)	Casing Retrievable	Casing Not Retrievable	Casing Retrievable	Casing Not Retrievable
Alaqua Point	5.56 mm	0.0133	1.81	17.90	17.90	26.85	8.95
	7.62 mm	0.0266	2.23	35.80	35.80	53.71	17.90
D-84	5.56 mm	0.0133	1.81	71.60	71.60	53.70	17.90
	Alaqua/D-84 Total			**125.3**	**125.3**	**134.26**	**44.75**
SRI	5.56 mm	0.0133	1.81	11.94	11.94	17.92	5.97
	7.62 mm	0.0266	2.23	23.89	23.89	35.83	11.94
	.50 cal	0.1218	4.29	109.38	109.38	164.06	54.69
	SRI Total			**145.21**	**145.21**	**217.81**	**72.60**
Shell Casing Deposition Category Totals				**270.51**	**270.51**	**352.07**	**117.35**
Shell Casing Deposition Grand Total				**1,010.44**			

* Midas Database, 2003

Impact Potentials

Based on the Alternative 4 mission scenario presented in Table 4-31, approximately 1,010.44 pounds of small arms ammunition shell casings could be generated annually by small arms live fire at the proposed SRI live-fire range, D-84 live-fire area, and Alaqua Point. Of the total amount of shell casing debris, it is estimated that 62 percent (622.58 pounds) could be retrieved and 38 percent (387.86 pounds) could not be readily retrieved. No ammunition shell casings debris thresholds were available for quantifying potential impacts of water-deposited shell casings on sensitive habitats or species.

Water-deposited shell casings would come to rest on the sandy or muddy bottoms of the sound. Casings that come to rest on the muddy sediments of the sound would tend to be incorporated into the sediment layer or be buried by sediment influx. Casings could be exposed and relocated by nearshore wave action and the high-energy sediment relocation events associated with hurricanes and storm surge. It is estimated that tides would have minimal effect on casing deposition.

4.5.5 Alternative 5

This alternative proposes the introduction of SOF live-fire and riverine maneuvers along a portion of Boiling Creek. The range of operations would extend inward toward TA B-76.

Alternative 5 debris analysis, based on assumptions and proposed mission performance attributes, is outlined in the following conservative mission event scenario:

- The proposed SOF live-fire operation would occur along a one mile segment of a tributary of the Yellow River, Boiling Creek.
- Over a period of one year, 24 one-day live-fire and river maneuver missions would be conducted using five boats and two trainees/boat.
- Trainees would fire 5.56-mm (Figure 4-9) and/or 7.62-mm (Figure 4-10) ammunition at a rate of 750 rounds/minute for a total of two minutes, expending approximately 1,500 rounds at riverbank targets (total of 1,500 rounds/mission event). Other potential weapons used include the .50 caliber machine gun and 40-mm gun.

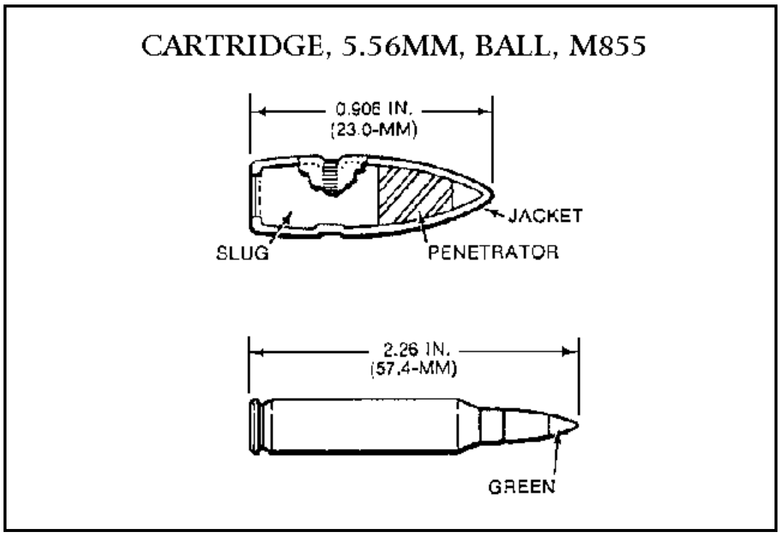

Figure 4-9. Specifications for 5.56-mm Cartridge

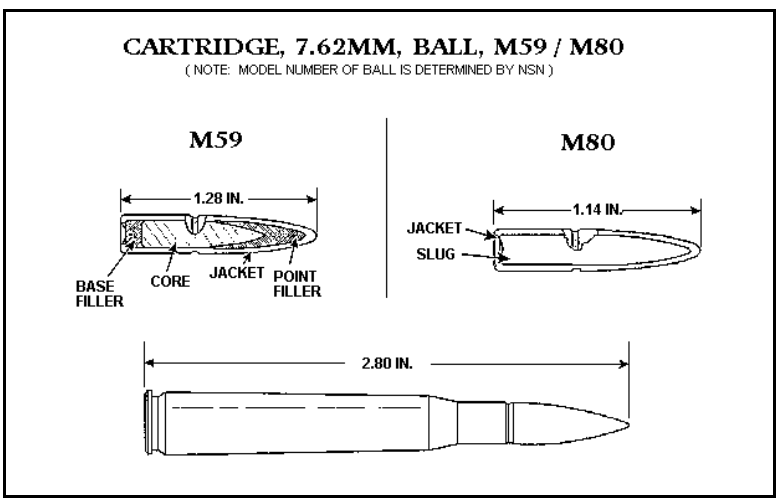

Figure 4-10. Specifications for 7.62-mm Cartridge

During a typical mission event, trainees would travel up Boiling Creek and fire 1,500 rounds of live ammunition at shoreline targets, then proceed to B-76.

During small arms firing from boats, 50 percent of 5.56-mm and 7.62-mm shell casings would be ejected into the river and 50 percent would remain in the boat. Firing of the .50 caliber machine gun would result in the deposition of 95 percent of the shell casings within the boat and 5 percent of the casings would be ejected outside the boat. It is assumed that all shell casings deposited in the boat could be retrieved, and river deposited casings would not be retrieved.

A summary of estimated Alternative 5 debris metrics is presented in Table 4-32.

Table 4-32. Alternative 5, Live-Fire Debris Metrics

Ammunition Specifications[a]			**Shell Casing/Mission Event[b] (pounds)**	
Type	**Weight (pounds)**	**Length (inches)**	**Retrievable from Boat**	**Not Retrievable from Water**
5.56 mm	0.0133	1.81	4.66	4.66
7.62 mm	0.0266	2.23	13.03	5.59
.50 Caliber	0.1218	4.29	11.57	0.61
Mission Event Totals			29.26	10.86
Annual Totals			**702.24**	**260.64**

[a]Midas Database, 2003
[b]Total rounds fired/mission event: 5.56 mm = 700, 7.62 mm = 700, .50 caliber = 100

Potential Impacts to Physical Resources

Based on the mission event scenario described in Table 4-32, it is estimated that for the 24 missions conducted during a year, about 260 pounds of 5.56 mm, 7.62 mm, and .50 caliber ammunition shell casing debris would be deposited in the Boiling Creek and approximately 700 pounds of shell casing debris would be deposited in the bottom of boats. Casings deposited in the boat could be retrieved, whereas casings ejected into the water during firing would not be retrievable. Shell casing deposition points could be distributed at undesignated points along the one-mile training area during the live-fire exercise. Because of the variability in firing scenarios, potential shell casing deposition points, and river channel flow regimes, it is unlikely that there will be measurable accumulations of shell casings at a single location. The casings could move through several cycles of being buried and exposed to downstream channel transport or deposition in floodplain sediments. No adverse alterations of floodplain wetland or river channel aquatic habitats or aesthetic values are anticipated.

Potential Impacts to Sensitive Species

A potential summer refuge site for Gulf sturgeon exists below Boiling Creek on the Yellow River. There is the potential for fish such as the Gulf sturgeon to ingest shell casings during feeding. In clear water conditions, the shiny metallic surface of the casing and its movement with the river currents may trigger a food source reaction in fish or other species. Once ingested, the casing could become lodged in the digestive system of the fish, which could interfere with food consumption and digestion. However the potential for such an occurrence is considered remote, and impacts to sturgeon breeding and population viability are not anticipated.

4.6 DIRECT PHYSICAL IMPACT (DPI)

Continuous foot or boat traffic, frequent boat landings, or direct contact with boats, vehicles, or vessels could potentially affect cultural resources, sensitive vegetation, and sensitive animal species. The potential for directly disturbing cultural resource sites near the Yellow River and Santa Rosa Sound (i.e., Wynnhaven Beach) is high. Eligible sites exist in both areas, and Section 106 compliance is necessary by means of archaeological evaluation, mitigation, and/or protection.

Boat operations can directly damage submerged aquatic vegetation if the hull or propeller of the boat comes in direct contact with seagrass beds. Oyster reefs in shallow water would also be susceptible to damage from vessels. Boats may directly collide with animals in the water, causing death or injury. In south and central Florida, boats striking manatees are a leading reason for human-caused manatee mortality.

Erosion could potentially occur at boat-landing sites from repeated use.

4.6.1 Alternative 1

Mission activity includes foot and boat traffic in the estuarine and riverine areas. Areas frequently used for water-to-land transitions include the Yellow River, Santa Rosa Sound, and Choctawhatchee Bay. The East Bay and East Bay River are not used that frequently.

Environmental Analysis

Measuring Direct Physical Impacts

DPI can be measured in terms of the area of boat landings, acres or length of shoreline habitat affected by landings, acres of seagrass or Tier I habitat directly impacted, and tons of sediment eroded.

Criteria

Boats should avoid contact with grassbeds at all times, but some situations may arise where this is not possible. In addition, in public areas, effects from recreational vessels and military vessels would be difficult to separate. Impacts to emergent vegetation should be avoided as well. Near boat landings, if care is taken, no impacts should occur outside of the area required to land the boat. The criteria for erosion would therefore be nonuse of an established landing area (i.e., impacts to mission) and loss of habitat beyond the dimensions of the boat landing area as a result of erosion caused by mission activities.

As with all actions, no sensitive species should be harmed from DPI. If harm to a sensitive species is likely to happen from estuarine and riverine activities, then consultation with the appropriate regulatory agency would be required in order to comply with the Endangered Species Act, or in the case of a marine mammal, the Marine Mammal Protection Act. The degradation of plant communities and habitats from ground training missions has been previously addressed in the Interstitial PEA. The analysis supported a FONSI, as long as training routes through wetlands and woods avoided sensitive (i.e., rare) plant communities.

Analysis

Analysis examines the potential for habitats and species to be directly impacted using GIS to determine the location of these areas and visually correlating them to the locations used for estuarine and riverine missions.

Resources Potentially Affected

Submerged Vegetation

The boats used in conjunction with estuarine and riverine missions are primarily rubber-hulled with no propeller. Some propeller-driven boats are used but would not impact submerged vegetation in Santa Rosa Sound because the area of operations (i.e., drop zone, landing area, crossing routes) is at least 3,000 feet from the nearest grassbed. In shallow waters, boat operators would avoid areas with submerged vegetation. In the Yellow River, submerged freshwater grasses are plentiful at the mouth, but the shallow draft vessels used by training units should not impact these areas. Navy EOD activities at White Point in Choctawhatchee Bay take place in muddy areas, though grassbeds are nearby. Aerial photographs of White Point show no apparent propeller scarring (Section 4.7). Affecting submerged and emergent vegetation is primarily a Habitat Alteration issue; thus, additional discussion is provided in Section 4.7.

Potential Impacts to Threatened and Endangered Species

Units transitioning from the water onto land and moving to target objectives within the interstitial areas and on TAs frequently pass through habitat for the flatwoods salamander, a protected species. According to a study conducted for the U.S. Army, mechanized-vehicle traffic would potentially impact this species; however, foot traffic would pose little concern. In addition, fire suppression or lack of fire in the flatwoods salamander habitat is a leading cause of the disappearance of this species' habitat. Given that wildfires sometimes result from ground training missions, estuarine and riverine activities that transition onto land might have a potentially beneficial impact on flatwoods salamander habitat; however, prescribed burning under more controlled and monitored conditions is preferred by Eglin Natural Resources (AAC/EMSN) for habitat maintenance. If wildfire suppression is necessary, control methods such as plowlines and firebreaks can negatively impact salamander habitat. Potential and confirmed flatwoods salamander habitat occurs near the East Bay River, Yellow River, and northern shore of Choctawhatchee Bay near Alaqua Bayou.

The potential for boats in Santa Rosa Sound or Choctawhatchee Bay to physically strike a sensitive species (e.g., Gulf sturgeon, manatee, or dolphin) is low, and the potential for injury from such a strike would be even lower because most of the boats used are rubber-hulled and man-powered and move relatively slowly, allowing the animal time to move away.

Potential Impacts to Sensitive Plant Communities

Tier I plant communities are located near all water bodies of the region of influence (Chapter 3, Figures 3-7 through 3-10). Repeated traffic through a given location could eventually degrade a sensitive plant community. Since the completion of the Interstitial PEA (U.S. Air Force, 1998), some communities on the Yellow River are being avoided as a mitigative measure. Thus, there should be no impacts to sensitive plant communities near the Yellow River as long as units follow these mitigations.

Potential Impacts from Erosion

Erosion is occurring at nearly every boat-landing site on the Yellow River due to the absence of stabilizing vegetation at those sites and continued use by special operations training missions (U.S. Air Force, 2001). In order to preserve the integrity of the landing sites and to ensure their continued use for military training, some repairs and erosion control measures (e.g., rock placement) have been implemented, but additional measures are required to prevent loss of mission facilities. At present, riverine missions are continuing but are threatened due to significant erosion at several boat ramps. A reconnaissance and analysis of Pine Bluff Landing is provided in Appendix E to illustrate the extent of the erosion. Boat landing dimensions should be maintained at a width and slope necessary to serve training units and should not be allowed to expand as a result of erosion. Shoreline restoration and stabilization measures are needed at the boat ramps to prevent further loss of this mission element.

Erosion is also occurring in several areas of Choctawhatchee Bay, primarily along the north shore. The erosion appears to be unrelated to military missions since many areas of the north shore of the Bay are eroding due to greater wave action. Stabilization of the shoreline is being attempted at some sites on military property. As shown in Figure 4-11, rocks have been placed along the shore north of TA D-54 in an attempt to stop the erosion.

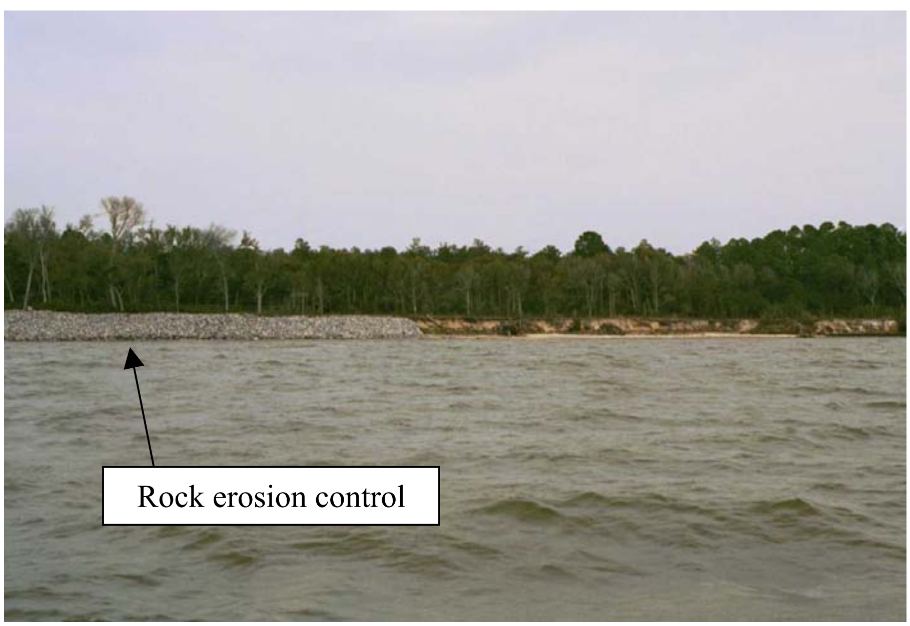

Figure 4-11. Erosion Control Measures North of Test Area D-54

Prevention of erosion in heavily used shoreline areas can be accomplished through restoration/stabilization, rotational use, and avoidance of contact with emergent vegetation along banks and shorelines and should be implemented. Road improvements near water bodies must adhere to the Eglin Air Force Base Range Road Maintenance Handbook. During site improvements near water bodies, erosion-control BMPs must be employed, and coordination with AAC/EMSN and AAC/EMC is necessary. Observation of off-road restrictions near water bodies will also minimize erosion potential. Digging in floodplains, wetlands, and near water bodies should be avoided.

Potential Impact to Cultural Resources

Coordination between special operations groups and the Eglin Cultural Resources Division would prevent the potential for impact to buried cultural resources. Foot traffic and disturbance along transition routes from the water onto the land have the greatest potential to affect cultural resources. AAC/EMH is in the process of conducting Section 106 compliance at Wynnhaven and East Bay. Within the estuarine and riverine areas, digging (e.g., for foxholes) does not occur under the present alternative. In order to prevent disturbance of cultural resources, AAC/EMH should be notified prior to changes in training routes or if ground disturbing activities are desired.

Archaeological sites will be avoided where possible by constructing barriers such as fences or marking sites in the field and on maps. When avoidance of archaeological sites is not feasible, mitigation strategies will be developed in consultation with the SHPO. Troops will be instructed to avoid high-probability zones for cultural resources during ground movements. Where high-probability zones for cultural resources must be utilized, steep slopes near streams, eroded banks, soft sands, or other vulnerable areas would be avoided. Areas where artifacts can be seen on the ground would be avoided. Artifacts include any man-made object, including glass, nails, bricks, ceramics, arrowheads, metal, and structures such as fence posts and bridge remnants. Troops would be instructed to not collect, damage, or move artifacts from their original location.

4.6.2 Alternative 2

Potential effects under Alternative 2 are the same as those under Alternative 1.

4.6.3 Alternative 3

Erosion

Direct physical impacts would increase under this alternative. Erosion at sites previously mentioned in Alternative 1 would accelerate unless preventive and restorative measures are implemented. The increased loss of soils and vegetation at the boat ramps would reduce the utility of the boat ramps for special operations training missions.

Potential Impact to Cultural Resources

Sites in some of these locations encompass significant resource areas that are unavoidable, especially if activity levels are doubled. Impacts would likely occur if activities take place in areas with significant resources and would require mitigation or consultation.

4.6.4 Alternative 4

Alternative 4 would introduce new effector mechanisms and expand the current estuarine missions into new areas from the establishment of live-fire estuarine ranges. New effectors would be live-fire munitions and increased numbers of trainees transitioning to shore areas not previously or heavily used. Alaqua Point and D-84 are proposed for use as live-fire ranges under this alternative, in addition to SRI, Test Site A-13B, which has historically been used (once) for this purpose. The possibility for impacts to listed species, sensitive habitats, and cultural resources under this alternative would be potentially high, depending on the specific areas used for targets.

Potential Impacts to Cultural Resources

Cultural resource mitigations would be required at Alaqua Point and possibly D-84, depending on the designated activity area. Consultation with the SHPO would be required.

Potential Impacts to Sensitive Species

According to the Eglin GIS, Alaqua Point contains potential habitat for flatwoods salamanders, a federally listed threatened species. Impacts to this species would potentially result from target preparation activities and live fire. Vegetation would be destroyed by live munitions or from clearing training and target areas; thus these areas would have to be surveyed for rare and endangered plants. In Figure 3-10, a Tier I Wet Flatwoods plant community can be seen along the shore at the center of the point. Loss of habitat from clearing out target areas could lead to shoreline erosion since trees and plants along the shore are a stabilizing factor.

Live-fire operations at the SRI live-fire site could affect wildlife, including listed bird species. Target areas should be determined clear of birds and other animals before firing. A consultation with the USFWS would be required to determine potential impacts to piping plover, least terns, and other listed species that could potentially occur near the proposed Test Site A-13B live-fire corridor. A federally protected plant species, the perforate reindeer lichen, generally occurs on the east end of SRI and should not be affected by Alternative 4 activities. A reconnaissance of the area should be conducted to ensure that this species has not spread to the Alternative 4 site.

Resources potentially subject to direct physical impacts from live fire on SRI are illustrated in Figure 4-12. Less than 25 acres of shrub and brush land within the effective range of the SAW-fired 5.56 mm would potentially be destroyed; other caliber weapons, such as the 30 mm, would affect a greater area of the island, while frangible munitions would affect a much smaller area. An area identified as being used for communications is located within the effective range of the SAW-fired 5.56 mm (and larger calibers) and would potentially be affected. Adjustments in firing direction and/or specific target placement would be necessary to avoid impacting this area. Public resources (e.g., boats) would not be affected since the area would be closed to the public during live-fire operations.

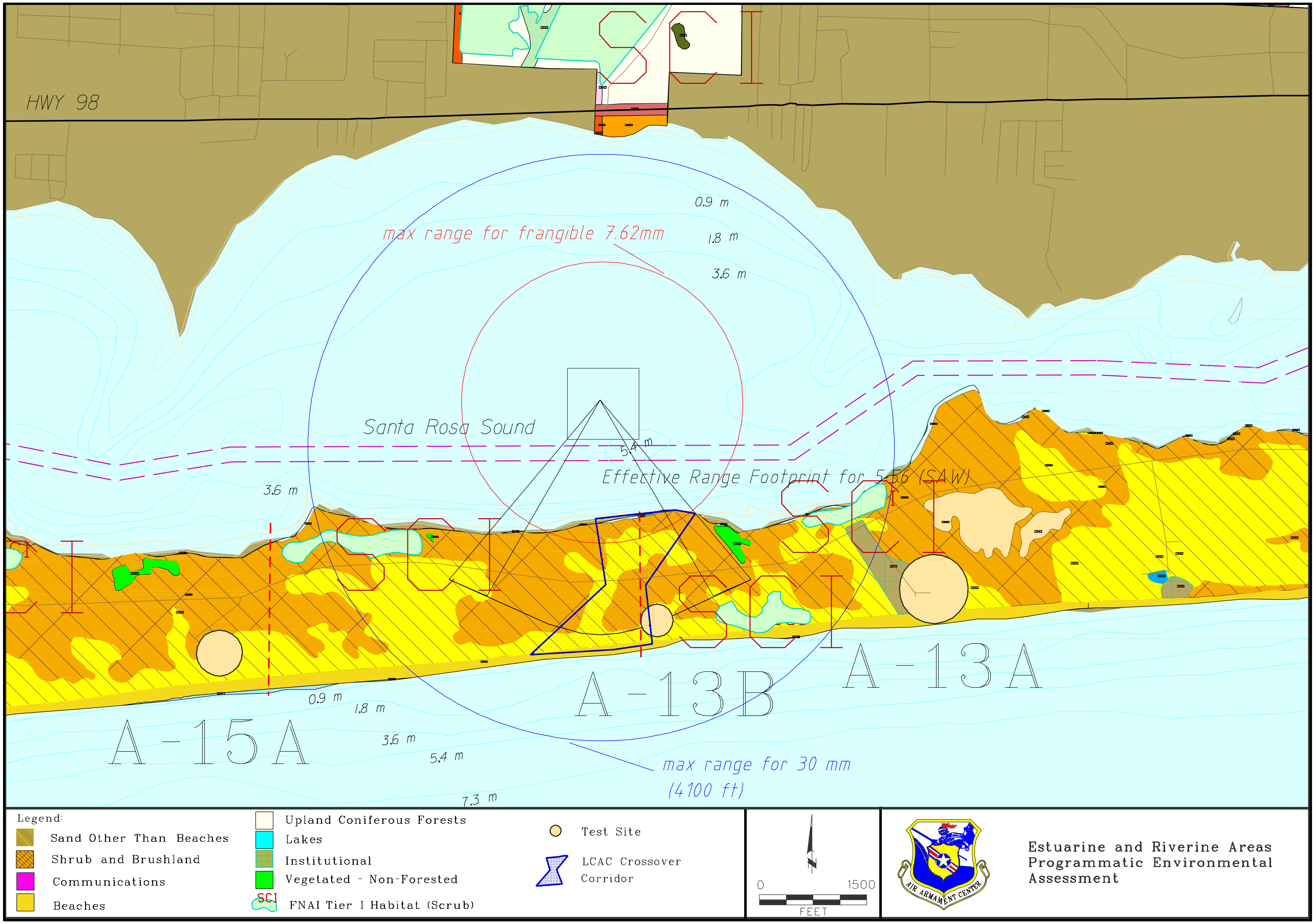

Figure 4-12. Alternative 4 Direct Physical Impacts – Santa Rosa Sound

4.6.5 Alternative 5

Alternative 5, which carries over Alternative 4 and establishes a live-fire range at the Boiling Creek site off of the Yellow River would have potential direct physical impacts. An analysis of candidate site locations along the Yellow River is presented in Appendix G. As with Alternative 4, the introduction of live fire into areas not previously used for that purpose would result in marked changes to the terrain and vegetation either from munitions impacts or from target siting and preparation. In addition, the disturbance to the terrain could potentially affect undiscovered cultural resources and protected animal and plant species. The removal of vegetation along the shore could lead to potentially significant erosion impacts similar to that observed at Pine Bluff and other currently used landings along the Yellow River. Coordination with AAC/EMSN and AAC/EMH would be required before activities take place.

Live-fire operations have the potential to directly affect sensitive animal species. Target areas should be determined to be clear of wildlife before commencing firing.

Direct Physical Impacts to Habitats

This alternative could result in direct effects to vegetation and sensitive species at the Boiling Creek site. Approximately .44 acres of FNAI Tier 2 habitat would be affected by the munition with the smallest effective range, the frangible 5.56 mm. The next largest buffer, for the frangible 7.62 mm, overlies (i.e., potentially affects) 4.4 acres of FNAI Tier 2 habitat. The frangible .50 cal buffer overlies approximately 10 acres of Tier 2 habitat. Tier 1 habitat would not be affected until the largest munition, the standard .50 cal was used; the SAW-fired 5.56 munition would not affect Tier 1 habitat, but would affect up to approximately 500 acres of Tier 2. For the standard .50 cal, approximately 128 acres of Tier 1 habitat are located within the effective range of that munition, and would be adversely affected. Thus, for this candidate site, minimal environmental impacts would occur to high quality natural vegetative habitats through use of the frangible .50 cal and smaller munitions.

Direct Physical Impacts to Sensitive Species and Their Habitat

Approximately 1.2 acres of potential flatwoods salamander habitat would be affected by the frangible 7.62 mm, but none would be affected from the use of the frangible 5.56 mm, which has the smallest effective range of all munitions. Impacts to potential flatwoods salamander habitat would include soil disturbance from the impact of munitions hitting the ground, which can create mounds that the salamander cannot crawl over, and can change hydrology. Impacts to flatwoods salamander habitat could be avoided entirely for all munitions if firing were oriented in a southeasterly direction. There is no risk to known locations of bog frogs from any of the munitions considered. No active red-cockaded woodpecker (RCW) cavity trees occur within the effective range of any of the munitions considered. Inactive cavity trees occur within effective range of the standard 5.56 mm and higher calibers. Consultation with the USFWS may be required for potential impacts to the flatwoods salamander.

4.7 HABITAT ALTERATION

Habitat alteration can occur from indirect or direct actions that lead to modification of terrain, decrease in available habitat, changes to the quality of habitat, changes to biodiversity, changes in lighting regime, and effects on sensitive species. Wildfires are another type of habitat alteration. Some documented causes of habitat alteration in the literature include invasive or exotic plant species proliferating and displacing native species, changes to floodplain elevations through ditching or damming, fragmentation of habitat through road or corridor placement, and accidental fires negatively or positively affecting natural habitats. Bryant (1999) states that invasive and introduced species are a major contributor to native species extinctions and depletions, second only to direct habitat loss. Though some introductions occur naturally as species move into other geographic regions, people have introduced the majority either purposefully, often with good intentions, or accidentally. In water bodies, invasive species may be introduced through boats that are trailered from one location to another.

Boat and troop movements through rivers and estuaries could erode areas of the shore, degrade emergent vegetation from repeated landings at a particular location, damage seagrass beds with boat propellers and anchors in shallow water, and start wildfires from pyrotechnic, smokes, and blank ammunition use. Propeller scarring is more prevalent in areas throughout the state that experience a high degree of recreational use and have a greater area of seagrass beds, particularly south Florida (Sargent et al., 1995). Repeated use of shallow areas could eliminate important seagrass habitat or affect water clarity such that growth of seagrass would be diminished.

4.7.1 Alternative 1

All total, the various user groups make an estimated 1,500 boat landings at up to 10 sites per year. The majority of the landings occur at designated boat-landing sites along the Yellow River, while a few landing sites vary with each mission. Approximately 100 Navy EOD trainees use the White Point area and Postl Point Marina annually for underwater mine detection training. No live ordnance is used.

The Wynnhaven Beach drop zone is situated in approximately 16 feet of water, approximately 3,000 feet from the nearest sensitive habitat, a seagrass bed located to the east of Wynnhaven Beach. According to resource maps from the State of Florida that reside with Eglin AFB GIS, no sensitive habitats would be encountered from air drops at Wynnhaven Beach and movement through Santa Rosa Sound. Thus, wetland habitat is not likely to be adversely impacted by the air drops at Wynnhaven Beach. A helicopter landing zone on the north shore of SRI is used to retrieve troops previously dropped into the Sound at the Wynnhaven Beach drop zone.

Environmental Analysis

In shallow regions, boat operations can resuspend bottom sediment, increase turbidity, and release bound-up contaminants from the sediments. Turbidity, a measure of water clarity that indicates the amount of suspended particulates in the water, affects the photosynthetic activity (i.e., how plants convert light to food) of algae and submerged aquatic vegetation. Shallower areas would be more susceptible to sediment disturbance. Boat propellers may damage shallow water grassbeds, a condition known as scarring (Sargent et al., 1995).

Wildfires though beneficial to some habitats are a major concern when they occur near the Eglin reservation boundary and the public land interface. Wildfires could potentially occur as a result of smoke and pyrotechnic use during ground training operations after transitioning onto land.

Measuring Habitat Alteration

Useful metrics include length or acres of shoreline habitat affected, acres of seagrass or other important habitat affected, introduction of invasive or exotic species, changes in natural light regime, and acres of human/reservation interface potentially at risk of wildfire.

Criteria

Using the above metrics, the following criteria are suggested:

- No net loss to vegetation coverage beyond an established width of boat landing (i.e., no permanent impacts should occur outside of the area required to land the boats)
- No permanent impacts to submerged vegetation (i.e., seagrass and freshwater grassbeds)
- No introduction or transport of exotic or invasive species
- No increase in the natural erosion rate as a result of missions or mission support
- Minimization of wildfires near the public-reservation interface

Meeting the above criteria would ensure no significant environmental impacts, but would allow the continued use of the riverine and estuarine areas for missions, particularly on the Yellow River, where issues like erosion can lead to loss of boat landings and shallower operating areas.

Some of the criteria are already being met or are addressed through current procedures. The transport of exotic or invasive species, particularly aquatic weeds, should be prevented by thoroughly rinsing boats after use. Wildfire prevention is addressed through monitoring of a wildfire index that evaluates the potential for such an event to occur. Fire control personnel are on hand for missions with a potential for starting wildfires. Other measures such as increased erosion prevention or restoration need to be implemented. Erosion prevention at landing sites reduces sedimentation and vegetation impacts while allowing sustained use of the facilities.

Analysis

To analyze habitat alteration, the authors consulted available literature and maps on submerged vegetation and other habitats within the region of influence and communicated directly with parties knowledgeable about resources and potential impacts in the region of influence. Potential shoreline or acreage of habitat affected was estimated using GIS files of Eglin resources.

Resources Potentially Affected

In general, most of the activities associated with estuarine and riverine missions take place in the water or on shoreline habitats. Missions frequently involve travel through wetland habitats.

Impacts to Submerged Aquatic Vegetation

Submerged aquatic vegetation occurs at the mouth of the Yellow River, in Santa Rosa Sound, in Choctawhatchee Bay, and, to a small degree, in East Bay. Submerged vegetation has generally been decreasing in all of these areas throughout the latter half of this century for various reasons, such as loss of water clarity, increased sedimentation, or changes in temperature. Submerged aquatic vegetation provides habitat for fish, shellfish, and waterfowl and plays an important role in maintaining water quality through assimilating nutrients. It also reduces wave energy, protecting shorelines and bottom habitats from erosion. Replacing submerged aquatic vegetation, once it has been uprooted or eliminated from an area, is difficult, and the science of replacing it artificially is not well-developed. It is, therefore, important to protect existing grassbeds.

Except for Navy EOD training at White Point in Choctawhatchee Bay, the locations of grassbeds and mission areas generally do not coincide such that no impacts to this type of habitat would occur from estuarine and riverine missions. Drop zones and transition points in the Sound and Bay do not occur over seagrass beds according to state maps. The Florida Marine Research Institute in Sargent et al (1995) identified areas in the state where grassbed scarring was occurring. Sargent et al (1995) shows seagrass scarring primarily occurring outside of the region of influence or in areas that are not used by the military; instead these areas are heavily used by the public as in the western Santa Rosa Sound near Pensacola Beach and at the mouth of East Pass in Choctawhatchee Bay. The damage is related to boat propellers coming into contact with the grass beds, and because special operations groups use motorized boats on a very limited basis and away from mapped grassbeds, impacts would not occur. A GIS map of the Wynnhaven Beach drop zone indicates seagrass beds are located approximately 3,000 feet away. In Santa Rosa County, seagrass scarring occurs west of areas used by special operations. In Okaloosa County, scarring occurs near the mouth of East Pass and would not be attributable to estuarine military operations. In Walton County, where TA D-54 is located, no grass occurs in the north part of the Bay (Sargent et al., 1995).

Approximately 100 students train each year at White Point as part of the Navy EOD school. Aerial photos (Figure 4-13) indicate seagrass occurs 100 feet off the west shore of White Point and about 220 feet of the east shore of White Point. Beginning at the tip of White Point and extending into the deeper parts of the Bay, there is an area 300 feet wide in which no seagrass occurs. EOD training takes place within this area over muddy bottoms. During training, boat props do not come into contact with the bottom. Mine placement, detection, and retrieval exercises are conducted during which mines that have been thrown overboard are raised to the surface with lift balloons and brought to shore. Occasional foot traffic would not result in a decrease in grassbed coverage.

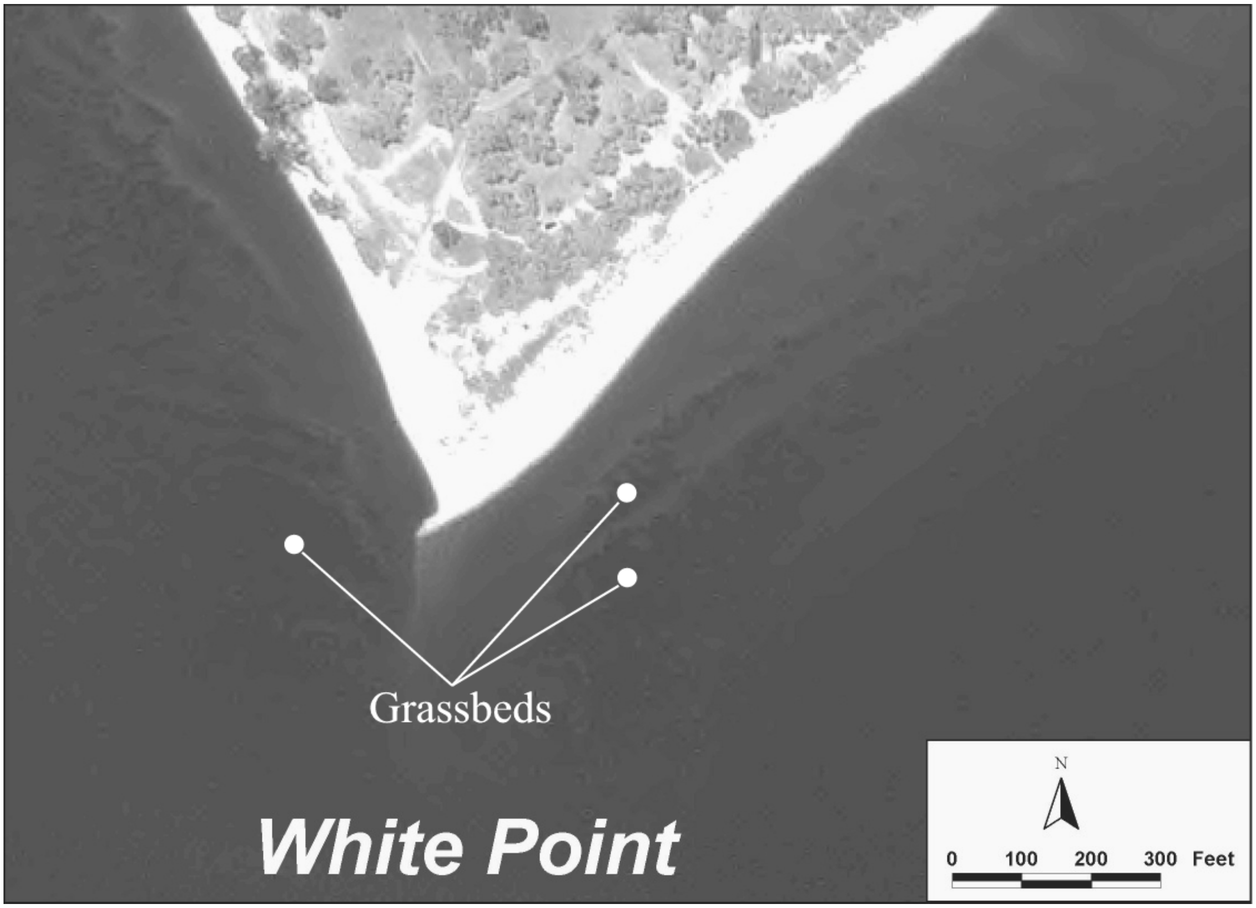

Figure 4-13. White Point Grass Beds

Impacts to Wetlands

Mission activities require mission personnel to travel through some wetland areas. The potential exists for impacts to wetland areas; however, management requirements, such as routing personnel around sensitive wetland areas, can minimize impacts. No significant impact to wetland habitats is anticipated by occasional foot traffic. Under the Clean Water Act, modifications to wetlands require a Section 404 permit from the U.S. Army Corps of Engineers. None of the activities currently being conducted constitute modification of a wetland; thus a Section 404 permit would not be required for Alternative 1.

Impacts from Shorelines from Erosion

Erosion is occurring at boat landings on the Yellow River that are used by the military and the public. In addition, sedimentation from a reservation access road near the Weaver River is suspected of having an effect on water level at that location. According to the Yellow River Marsh Aquatic Preserve Office, the depth of the water has decreased at that location due to the volume of sediment that has eroded into it. This type of erosion is potentially significant from an environmental point of view, but equally so from a mission impact point of view, because the decreased depth could prevent the continued use of this area for riverine training. Some erosion control measures (i.e., gravel placement) have been implemented at Carr Landing, Pine Bluff

Landing, and Sweet Gum Landing on the Yellow River and may need to be continued or increased (U.S. Air Force, 2001).

Pine Bluff Landing is undergoing erosion significant enough that future use of this area is in question. The primary user group, the Army Rangers, relies upon this area for small boat training and course instruction. For this reason, Pine Bluff Landing was selected for additional analysis, which will also provide a general understanding of processes that may be occurring at other landings and cleared areas along the Yellow River. Appendix E analyzes in detail the status of Pine Bluff Landing and proposes steps for restoration. In short, the erosion may be currently related to a variety of natural and man-made factors. Fluctuations in water level related to extreme rain events bring rapid increases in water height and flow, increasing the rate of erosion along river banks. The lack of shoreline vegetation, which was removed when the landing was first constructed several years ago, destabilizes the riverbank.

Erosion from boat landings is not widespread or significant enough to affect threatened or endangered species through habitat alteration. The Yellow River was designated as critical habitat for the Gulf sturgeon in March of 2003. The area of the Yellow River from Boiling Creek to Highway 87 appears to be an important summer habitat for the sturgeon (Craft et al., 2001). Military activities along the shore of this area that could cause erosion (e.g., construction of boat ramp, shoreline clearing) would have to consider potential impacts to sturgeon habitat and consult with the U.S. Fish and Wildlife Service.

Habitat Impacts from Invasive Species

Executive Order 13112 and Florida Statute 62C-52.011 prohibit the collection or transportation of nuisance aquatic plants, including Eurasian watermilfoil, water hyacinth, and *Hydrilla*. These species foul waterways and clog boat propellers in many areas throughout north Florida. The transport of invasive species would not likely occur from estuarine and riverine missions, primarily because local units rinse boats and other equipment after use and boats and equipment are only used in local waters. The potential exists for out-of-town units to transport invasive species into local waters if boats are not rinsed after each use, but a relatively greater risk exists from nonmilitary users of the river that may not follow a set maintenance and care schedule for their equipment. In order to prevent the introduction of nonnative species from other aquatic environments into pristine areas such as the Yellow River, out-of-town units must be verified as clean before using their watercraft in local waters.

Habitat Impacts from Artificial Lighting

Changes in lighting at night associated with some types of missions have historically been considered in other environmental assessments. Signal illumination flares are a source of light that would have no significant impacts on the lighting regime of surrounding areas due to a brief burn time and the location of use away from sensitive species that rely on light-based cues for survival, such as hatching sea turtles. Illumination flares might temporarily attract fish but this would not have detrimental effects. Chemical lightsticks are employed for some estuarine and riverine missions and would not emit enough light to effect any changes to water or wetland habitats. However, they are sometimes left behind as debris (Section 4.5).

Habitat Impacts to Sensitive Plant Communities

Tier I plant communities are located adjacent to riverine and estuarine areas and units may travel through them on their way to interior objectives on the reservation, such as TAs. In the Interstitial PEA (U.S. Air Force, 1998), recommendations were made to avoid Tier I plant communities if alternative areas were available. Specifically, Hick's Creek Prairie and Whitmier Island on the Yellow River were identified as plant communities that might be susceptible to repeated foot traffic due to the hydric nature of plants and soil at the site. An assessment of Whitmier Island by Chafin and Schotz (1995) stated that the community was in very good condition despite use by the military and that damage was minimal.

Sensitive plant communities also occur on the shores of Choctawhatchee Bay near White Point, Alaqua Point, and Rocky Bayou. In addition, they can be found in East Bay, near the mouth of the East Bay River, and just north of the river.

Impacts to Essential Fish Habitat

Essential fish habitat (EFH) in the study area includes seagrasses and oyster reefs. The primary impact would be potential contact between vessels and submerged vegetation/bottom substrates. Contact could impact habitat quality either directly by physical disruption or indirectly by siltation. Zodiac boats are not considered to have impacts to EFH because of these boats have a shallow draft and are powered by a water intake and propulsion system rather than a propeller. Activities that may potentially result in impacts are those that involve the use of motorized boats with propellers in very shallow waters such that contact with the bottom is possible. In Santa Rosa Sound and Choctawhatchee Bay boat landing sites do not near seagrass beds. Navy EOD activities at White Point occur near seagrass beds but most of the activities take place on muddy bottoms. Similarly oyster reefs are typically deep enough such that no contact would occur. Also these areas can be noted on maps and avoided. No significant impacts to Essential Fish Habitat are anticipated from estuarine or riverine activities.

Impacts to Flatwoods Salamander Habitat

Palis (1997) cited illegal trash-dumping, off-road vehicles, and plowlines (i.e., firebreaks) as threatening the integrity of some breeding sites on Eglin AFB, but these activities were not associated with estuarine and riverine missions. Fire suppression or lack of fire near the breeding sites has caused some sites at Eglin to become overgrown with Chapman's St. John's wort, which affects the growth of other herbaceous species in the wetlands where the salamanders hide (Palis, 1997). Military training may introduce fire through the use of live fire and incendiary devices, which could potentially benefit the area by eliminating the St. John's wort (Palis, 1997). Alternately, wildfires may also have negative effects on salamander habitat if suppression is necessary. Plowlines and firebreaks can alter the hydrology of salamander ponds.

Flatwoods salamanders breed in temporary ponds and spend other parts of their lifecycle partially buried near the ponds or in transit to and from the ponds. Salamanders move to and from their breeding ponds between October and December. Jackson Guard has identified primary buffer areas around the ponds that are potentially used by the flatwood salamander.

Avoidance and minimization procedures that would minimize impacts to the flatwoods salamander include restricting activities in isolated wetlands and within good condition primary buffers, confining impacts to poor buffer habitat in situations where it is impossible to avoid flatwoods salamander habitat, and following Eglin Wildfire Specific Action Guide Restrictions for pyrotechnics use. Under Alternative 1, no effect on the flatwoods salamander due to estuarine and riverine missions is anticipated. More information on the flatwoods salamander is available in Appendix D.

Habitat Impacts from Wildfires

Wildfires can be both beneficial and harmful to natural communities, depending on the severity and necessity for suppression activities. It is unknown whether the wildfires potentially associated with riverine and estuarine missions have a net positive or negative effect on sensitive communities and species. Adjacent to the Yellow River, about 900 acres were burned during the baseline years (Figure 4-14). Adjacent to East Bay where the reservation is closest (southeast corner) to shore, about 1,035 acres were burned. Next to, and north of, East Bay River wildfires appear to be related to TAs A-77 and A-78. The fires that spread south to the East Bay River encountered potential salamander habitat and burned a total of 7,100 acres, including areas not part of the region of influence (Figure 4-15). Near Choctawhatchee Bay, 1,670 acres were burned in three separate fires; two occurred 9,000 feet west of Choctaw Beach and one due north of TA D-54. These fires may or may not have been related to estuarine operations (Figure 4-16). Relatively speaking, the acreage of areas burned was small in comparison to other areas of the reservation that were burned, and many of the habitats, such as the flatwoods salamander habitat, may have benefited from the burn.

One significant botanical site, Piney Creek, located north of Choctaw Beach on Choctawhatchee Bay, would be negatively impacted by fire. This habitat consists of upland hardwood forests and xeric hammocks/baygall of approximately 540 acres. This area is presently not used for transition movements from water to land during estuarine missions. If troop were to move through this site, then no pyrotechnics, flares, or smoke grenades should be employed. One of the fires west of Choctaw Beach occurred adjacent to public land but appears to have been contained within the reservation boundary. None occurred next to Santa Rosa Sound. Impacts to habitats from wildfires were not significant and may have been positive with respect to sensitive species habitats. However, there is the potential for damage to sensitive habitats from wildfire suppression methods, such as plowlines and firebreaks. Operations are to continue to observe the Eglin Fire Control Index and have on hand a sufficient number of fire control personnel when conducting live fire or when using pyrotechnics such as flares, smoke grenades, or ground-burst simulators.

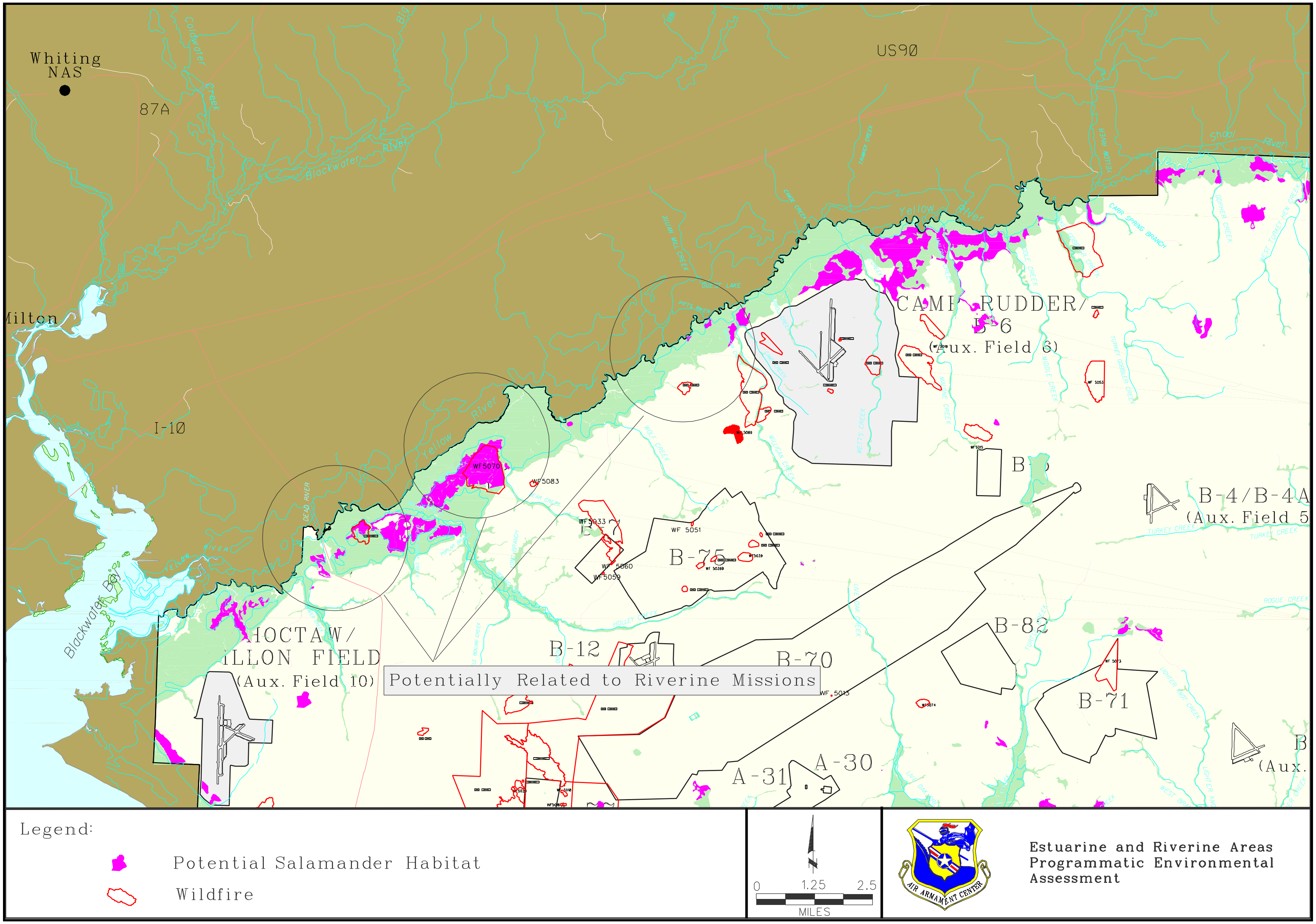

Figure 4-14. Potential Mission Related Wildfire Near the Yellow River

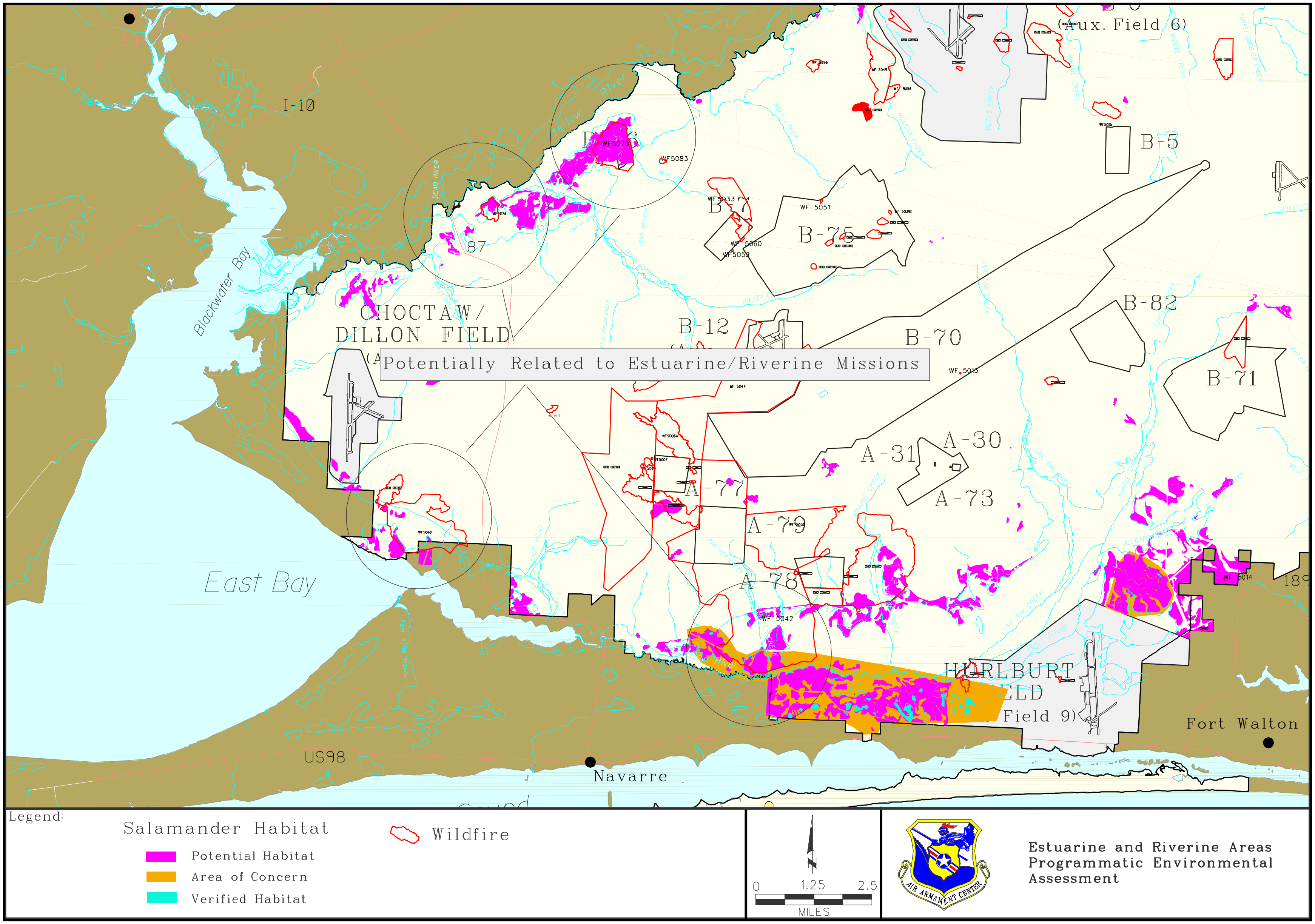

Figure 4-15. Potential Mission Related Wildfire Near the East Bay River

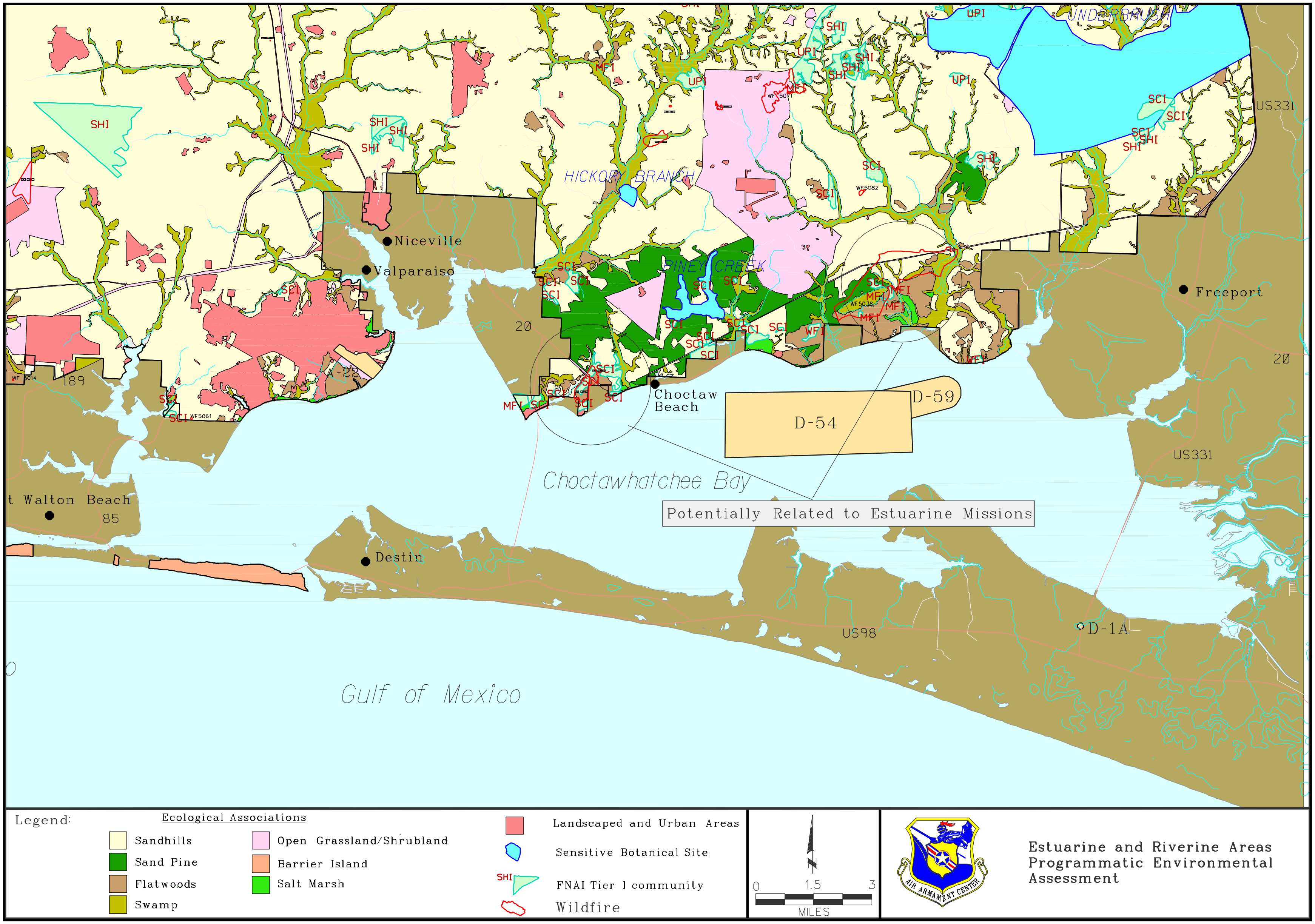

Figure 4-16. Potential Mission Related Wildfire Near Choctawhatchee Bay

4.7.2 Alternative 2

Potential effects to habitats would be the same under Alternative 2 as under Alternative 1.

4.7.3 Alternative 3

The potential for habitat alteration would increase under Alternative 3 since wildfire events and erosion would logically increase with an increased number of missions. Erosion at boat landings on the Yellow River is presently a major issue due to the loss of shoreline and the impacts to certain user groups. This alternative would exacerbate an existing problem unless restoration of eroding areas was initiated.

Potential Effects to Grassbeds

Grassbeds are not currently being affected due to their location away from training areas; thus, increasing the number of Navy EOD classes or number of estuarine missions would have no effect on grassbeds. In many estuarine missions, boats are primarily rubber inflatables without propellers, and at White Point operations occur in the muddy areas off of the point. No boat propellers come into contact with the bottom. Under Alternative 3, no potential effects are occurring or are expected to occur with respect to this resource.

Potential Effects to Public Resources from Wildfire

The risk of wildfire caused by ground training missions that originate in the estuarine or riverine areas would increase under this alternative. Currently observed fire control procedures and monitoring of the fire index and weather conditions would take on increased importance in order to prevent public resources from being affected. It is possible that the number of acceptable days in which to conduct operations could be the limiting factor, as opposed to the number of missions. Because procedures are in place and are currently being observed, the increase in the number of missions is not expected to significantly increase the risk to the public or to habitats from wildfires as long as sufficient resources (i.e., fire management personnel and equipment) are available to respond to fire emergencies.

4.7.4 Alternative 4

Under this alternative, live fire would potentially affect habitats either through the direct action of firing live munitions or through target preparation and range clearing activities. The Air Force provides clear guidance with regard to habitat alteration from target construction. AFI 13-212 Volume 2, Section 1.7, states:

> Target construction should avoid federally listed threatened and endangered species and their habitats, historic and archeological sites and wetlands. If during target construction archeological sites or artifacts are discovered, construction activities should be halted and the base environmental management flight should be contacted.

An analysis of resources surrounding the estuarine live-fire sites was conducted using available resource maps in the Eglin GIS. These maps were overlain with the various munitions footprints to determine potential habitat impacts. Each munition has an effective range and a maximum range. The greatest potential for habitat impacts is assumed to occur within the effective range. Trees and vegetation would potentially be damaged or destroyed within the munitions effective range. Eventually the habitat within the effective range would consist of shrubs and low vegetation, as larger (i.e., taller) trees are killed as a result of the live fire.

Alaqua Point

Consultation with the U.S. Fish and Wildlife Service for possible impacts to flatwoods salamanders and their potential habitat may be necessary for live-fire activities at Alaqua Point. A rare plant survey of habitats within the effective range of the munition would be necessary to identify threatened or endangered plants that would potentially be affected from target clearing or live fire. A Tier 1 area occurs at the tip of Alaqua Point, and extensive ground-disturbing activities should be minimized in this area if possible.

Santa Rosa Island

A proposed 500-foot LCAC corridor would occupy about 20 acres of beach dune habitat at the A-13B site. The LCAC could maneuver to avoid vegetation and would not contact the surface since it is supported on a cushion of air. Thus, LCAC travel over SRI would have minimal impact on habitats. During the baseline years, a LCAC mission involved live fire at a target in the Gulf of Mexico. The LCAC fired 30-mm rounds over SRI into the Gulf without directly affecting dunes or habitat on the Island, and then proceeded over the Island into the Gulf. Under Alternative 4, other scenarios are possible.

4.7.5 Alternative 5

Appendix G presents a detailed analysis of candidate sites for this alternative. One site, Boiling Creek, was selected that would accommodate mission requirements while having low potential environmental effects. Figure 4-17 illustrates the effective range of all munitions considered. The smallest and largest munition footprints, the frangible 5.56 mm and the standard .50 cal, are labeled.

Potential Impacts to Wetlands and Sensitive Habitats

No construction or clearing activities would occur along Boiling Creek, and a Section 404 Permit would not be required from the U.S. Army Corps of Engineers.

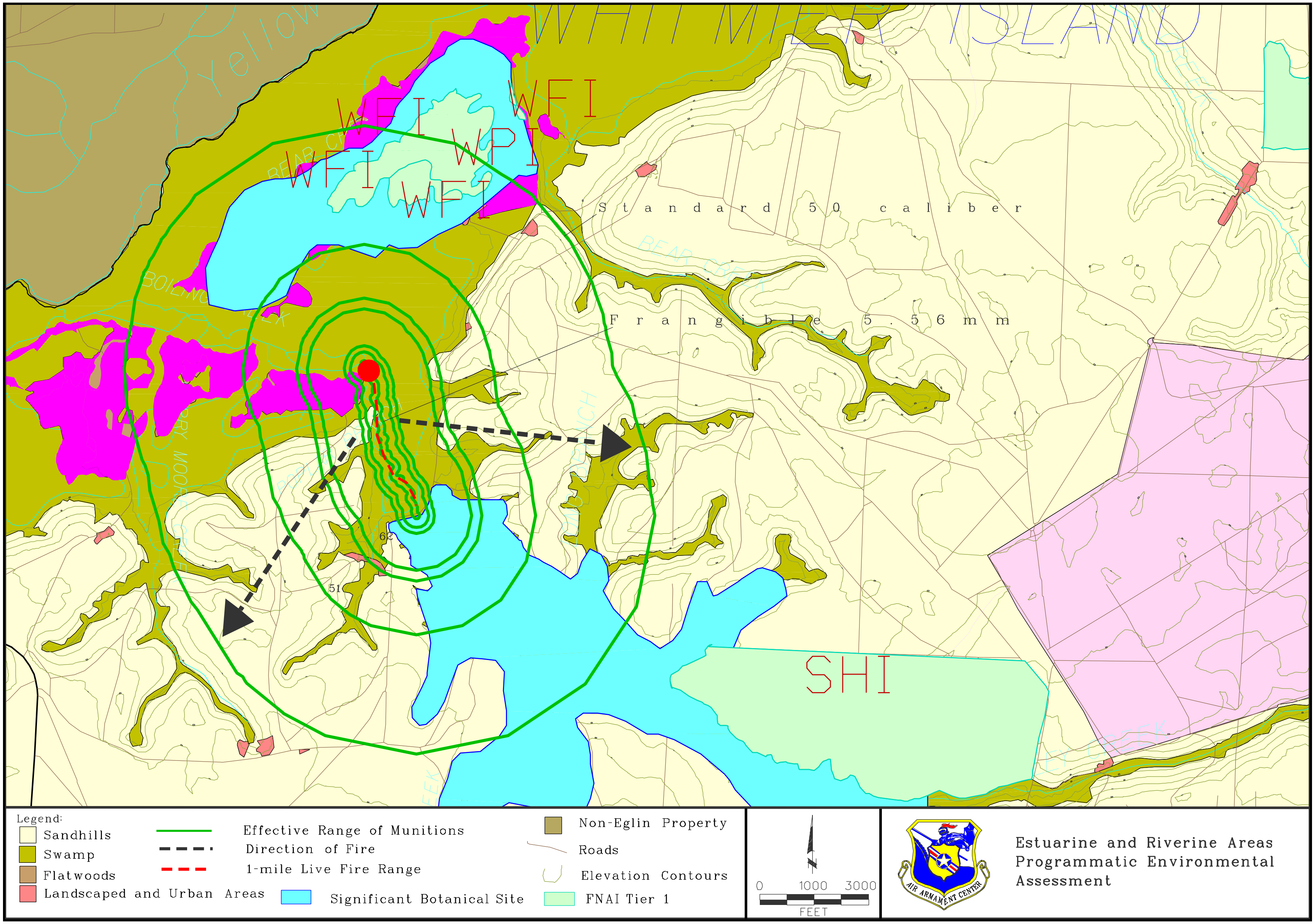

Figure 4-17. Alternative 5 Habitat Alteration from Live Fire at Boiling Creek

Potential Impacts to Habitats

Approximately .44 acres of FNAI Tier 2 habitat would fall within the range of the frangible 5.56 mm, the munition with the smallest effective range. The largest munition, the standard .50 cal, would overlap approximately 128 acres of Tier 1 habitat and could potentially degrade some of this habitat. The range of the SAW-fired 5.56 munition would overlap approximately 500 acres of Tier 2 habitat. Use of the frangible .50 cal and smaller munitions would result in minimal degradation to high-quality natural vegetative habitats.

Potential Impacts to Sensitive Species

Under Alternative 5, potential impacts to habitats of several species were considered. Because the weapons footprints of the various munitions may extend for some distance, consideration was given to more inland species such as the red-cockaded woodpecker (RCW) in addition to species found closer to or in the river, such as the flatwoods salamander, bog frog, and Gulf sturgeon. This alternative would require a Section 7 Consultation with the U.S. Fish and Wildlife Service for potential impacts to federally listed species.

Appendix G presents an analysis of candidate locations for live-fire riverine sites. This analysis indicates that a site on Boiling Creek, two miles from the Yellow River, would have minimal impacts to flatwoods salamanders, bog frogs, and RCWs. Erosion from clearing of any of the potential sites discussed in Appendix G has the potential to affect the Gulf sturgeon, because all of the sites drain into the Yellow River system, which is known Gulf sturgeon habitat; however, erosion-control measures can minimize any runoff. Because of the presence of potential flatwoods salamander habitat and because specific target placements are unknown, a consultation with the U.S. Fish and Wildlife Service would still be required for this alternative.

Approximately 1.2 acres of potential flatwoods salamander habitat would be affected by the frangible 7.62 mm, but none would be affected from the use of the frangible 5.56 mm, which has the smallest effective range of all munitions. Impacts to flatwoods salamander habitat may be avoided entirely for all munitions if firing is oriented in a southeasterly direction.

Indigo snakes occur throughout Eglin and thus may occur within the footprint of the proposed live-fire riverine range. Since vegetative clearing would be kept to a minimum and targets would be hand placed, indigo snakes would not be adversely affected.

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APPENDIX A

RELEVANT AND PERTINENT LAWS, REGULATIONS, AND POLICIES

RELEVANT AND PERTINENT LAWS, REGULATIONS, AND POLICIES

The Estuarine and Riverine Areas Programmatic Environmental Assessment was prepared with consideration and compliance of relevant and pertinent environmental laws, regulations, and policies. This section includes federal executive orders and laws; Department of Defense (DoD) directives and instructions; U.S. Air Force Instructions (AFI) and policy directives; and Florida state statutes and administrative codes. This list has been compiled and limited to include the most relevant laws, regulations, and policies that are pertinent to the specific mission activities defined in this document. It is further recognized that additional laws and regulations may exist and will be included with subsequent updates.

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

AFI 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 U.S. Air Force environmental laws and regulations.

AFI 32-7061; 24-Jan-95; The Environmental Impact Analysis Process; This Instruction provides a framework for how the U.S. Air Force is to comply with NEPA and the Council on Environmental Quality regulations.

AFI 32-7062; 1-Apr-94; Air Force Comprehensive Planning; Implements AFPD 32-70 by establishing U.S. Air Force Comprehensive Planning Program for development of U.S. 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 *Code of Federal Regulations (CFR)* Parts 50 & 51; 1996; Clean Air Act (CAA), National Ambient Air Quality Standards (NAAQS); Emission sources must comply with air quality standards and regulations established by federal, state, and local regulatory agencies.

AFPD 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 CAA.

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

Florida Statute (FS) Ch. 403, Part I; 1996; Florida Air and Water Pollution Control Act; Regulates air pollution within the state.

Florida Administration Code (FAC) Chap. 62-204; 1996; Florida State Implementation Plan, with Ambient Air Quality Standards and Prevention of Significant Deterioration (PSD) Program; Establishes state air quality standards and requirements for maintaining compliance with NAAQS.

FAC Chap. 62-213; 1996; Operation Permits for Major Sources of Air Pollution; Adopted 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-Supp; 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; FAR No. 53; Defines and prescribes requirements for special use airspace.

14 *CFR* Part 91; 1997; FAR; Governs the operation of aircraft within the United States, including the waters within three nautical miles of the U.S. coast. In addition, certain rules apply to persons operating in airspace between three and 12 nautical miles from the U.S. coast.

Land Resources

16 USC 670a to 670o; 1997-Supp; Sikes Act, Conservation Programs on Military Reservations; DoD, in a cooperative plan with U.S. Department of the Interior and State, opens U.S. Air Force 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. The U.S. Air Force is to manage the natural resources of its reservations to provide for sustained multipurpose use and public use.

16 USC 1451 to 1465; 1997-Supp; Coastal Zone Management Act of 1972; 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-Supp; Federal Land Policy and Management Act of 1976; Provides that the Secretary of Interior shall develop land use plans for public lands within Bureau of land Management 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-Supp; Coastal Barrier Resources Act (CBRA); Limits federal expenditure for activities on areas within the CBRA System. An exception is for military activities essential to national security, after the federal agency consults with the Secretary of the Interior.

Executive Order 11988, Floodplain Management; Requires examination of actions involving construction (i.e., roads, buildings) within a floodplain for the potential to impact drainage patterns within the floodplain or for the potential for people or structures to be impacted by flooding in order to minimize or prevent loss of life and property.

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

AFI 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 U.S. Air Force operational capability from the effects of land use which are incompatible with aircraft operations.

AFI 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; 1997-Supp; Noise Control Act of 1972; 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-Supp; Controlling Aircraft Noise and Sonic Boom; Provides that the FAA will issue regulations in consultation with the U.S. Environmental Protection Agency (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.

FS 327.60(1); This statute states that in order to prevent potential annoyance to people from passing boats, the single event exposure level of noise from a boat should not exceed 90 dBA at a distance of 50 feet from the vessel.

AFI 32-7063; 1-Mar-94; AICUZ; The AICUZ study defines and maps noise contours. Update when noise exposure in U.S. Air Force operations results in a change of Day-Night Average Sound Level of two decibels (dBs) or more as compared to the noise contour map in the most recent AICUZ study.

Range Construction

Engineering Technical Letter (ETL) 01-13; 31 December 2001; Small Arms Range Design and Construction. This ETL provides guidance for design and construction of Air Force Small Arms Ranges, and applies to both new construction and major renovations. It replaces Chapter 3 of AFMAN 36-2227v1, Combat Arms Training And Maintenance (CATM) Training Management and Range Operations.

Water Resources

33 USC 426, 577, 577a, 595a; 1997-Supp; River and Harbor Act of 1970; Keeps navigable waterways open, authorizing the U.S. Army Corps of Engineers (USACE) to investigate and control beach erosion and to undertake river and harbor improvements.

33 USC 1251 et seq.; 1997-Supp; Clean Water Act (CWA) (Federal Water Pollution Prevention and Control Act, FWPCA); In addition to regulating navigable water quality, the CWA establishes National Pollutant Discharge Elimination System permit program for discharge into surface waters and storm water control; USACE permit and state certification for wetlands disturbance; regulates ocean discharge; sewage wastes control; and oil pollution prevention.

33 USC 1344-Section 404; 1997-Supp; CWA and FWPCA, Dredged or Fill Permit Program; Regulates development in streams and wetlands by requiring a permit from the USACE 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-Supp; Safe Drinking Water Act (SDWA); Requires the promulgation of drinking water standards, or maximum concentration levels, 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; RCRA; Establishes standards for management of hazardous waste so that water resources are not contaminated: RCRA Corrective Action Program requires cleanup of groundwater 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 groundwater resources contaminated with hazardous substances.

Executive Order 12114, 44 FR, No. 62; 04-Jan-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 environmental impact statement shall be prepared for major federal actions having significant environmental effects within the global commons (i.e., Antarctica, oceans).

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

AFPD 32-70; 20-Jul-94; Environmental Quality; Develops and implements the U.S. Air Force Environmental Quality Program composed of cleanup, compliance, conservation, and pollution prevention. Implements CWA, SDWA, and Water Quality Act of 1987.

AFI 32-7006 29-Apr-94; Environmental Program in Foreign Countries; Implements DoD Directive 6050.7.

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

AFI 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.

FS Chaps. 253, 258; 1996; Florida Aquatic Preserves Act; Establishes state aquatic preserves.

FS Chap. 403, Part I; FWPCA; Establishes the regulatory system for water resources in Florida.

FAC Chap. 62-302; 1995; Surface Water Quality Standards; Classifies Florida surface waters by use. Identifies Outstanding Florida Waters.

FAC Chap. 62-312; 1995; Florida Dredge and Fill Activities; Requires a state permit for dredging and filling conducted in, on, or over the surface waters of the state.

FAC Chap. 62-621; 2003; Generic Permit for Stormwater Discharge from Large and Small Construction Activities. Requires state permits for disturbances of 1 to 5 acres of land, and greater than 5 acres of land.

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-Supp; Migratory Bird Treaty Act; Makes it illegal to take, kill, or possess migratory birds unless done so in accordance with regulations. An exemption may be obtained from the Department of the Interior for taking a listed migratory bird.

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

AFI 32-7064; 22-Jul-94; INRMP; Explains how to manage natural resources on U.S. Air Force property, and to comply with federal, state, and local standards for resource management.

Threatened and Endangered Species

16 USC 668 to 668d; 1995; BGEPA; Makes it illegal to take, possess, sell, purchase, barter, transport, export, or import, at any time in any manner, any bald or golden eagle, unless done in accordance with regulations or permit conditions.

16 USC 1361 et seq. Public Law 92-574; 1997-Supp; MMPA; Makes it illegal for a person to "take" a marine mammal, which includes significantly disturbing the habitat, unless done in accordance with regulations or a permit.

16 USC 1531 to 1544-16 USC 1536(a); 1997-Supp; 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; 1996; ESA - Interagency Cooperation; These rules prescribe how a federal agency is to interact with either the U.S. Fish and Wildlife Service or the NMFS in implementing conservation measures or agency activities.

50 *CFR* Part 450; 1996; 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.

AFPD 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 ESA.

AFI 32-7064; 22-Jul-94; INRMP; 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; 1996; Occupational Safety and Health Act, Chemical Hazard Communication Program; Requires that chemical hazard identification, information, and training be available to employees using hazardous materials and institutes material safety data sheets, which provide this information.

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

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

AFI 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.

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

AFI 32-7063; 1-Mar-94; 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.

AFI 91-301; 1-Jun-96; U.S. Air Force Occupational and Environmental Safety, Fire Protection and Health Program; Identifies occupational safety, fire prevention, and health regulations governing U.S. 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.

AFPD 32-70; 20-Jul-94; Environmental Quality; Develops and implements the U.S. 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-Supp; Federal Insecticide, Fungicide, and Rodenticide Act Insecticide and Environmental Pesticide Control; Establishes requirements for use of pesticides that may be relevant to activities at Eglin Air Force Base (AFB).

42 USC Sect. 2011 - Sect. 2259; 1997-Supp; Atomic Energy Act of 1954; Assures the proper management of source, special nuclear, and byproduct radioactive materials.

42 USC 6901 et seq.; 1980; RCRA and Solid Waste Disposal Act of 1980; 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-Supp; 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; 1995; 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; 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.

AFPD 32-70; 20-Jul-94; Environmental Quality; Provides for developing and implementing an U.S. Air Force Environmental Quality Program composed of four pillars: cleanup, compliance, conservation, and pollution prevention. Implements RCRA, CERCLA, EPCRA, 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.

AFI 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.

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

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

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

AAC Plan 32-7; *Integrated Solid Waste Management Plan, AAC PLAN 32-7*, Headquarters, AAC, Eglin AFB, Florida, February 2003. Establishes procedures for managing solid waste and debris.

Cultural Resources

10 USC 2701 note, Public Law 103-139; 1997-Supp; Legacy Resource Management Program; 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, which has the jurisdiction over those lands.

16 USC 461 to 467; 1997-Supp; Historic Sites, Buildings and Antiquities Act; 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-Supp; Archaeological and Historic Preservation Act of 1974; Directs federal agencies to give notice to the Secretary 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 Secretary may undertake preservation.

16 USC 470aa-470mm, Public Law 96-95; 1997-Supp; Archaeological Resources Protection Act of 1979; 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-Supp; National Historic Preservation Act; 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-Supp; Native American Graves Protection and Repatriation Act of 1991; 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; 1994; American Indian Religious Freedom Act; 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; 1996; 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; 1996; 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; 1995; Protection of Historic and Cultural Properties; Sets out the Section 106 process for complying with Sections 106 and 110: 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; Establishes policy requirements for archaeological and cultural resource protection and management for all military lands and reservations.

AFPD 32-70; 20-Jul-94; Environmental Quality; Develops and implements the U.S. 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.

AFI 32-7065; 13-Jun-94; Cultural Resource Management; Directs Air Force bases to prepare cultural resources management plans 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 U.S. Air Force policy to comply with historic preservation and other federal environmental laws and directive.

APPENDIX B

MANAGEMENT PRACTICES

MANAGEMENT PRACTICES

Management practices that would reduce the potential for impact are listed below. Some have been implemented for prior mission activities. Some are ongoing and are routine procedures.

1. NOISE

- For the LCAC, maintain an operating distance from shore of at least 400 feet to prevent exposure of residential areas to noise of 90 dBA.
- For underwater sensor testing, use SEABAT sonar and lookouts to ensure that no marine mammals enter the sensor hazard areas. For night tests, use spotlights to assist in visual surveys (**past practice**).
- LCAC will maintain a distance of 1,500 feet from eagle nest at A-22 during transit.
- For missions with potential noise impacts, provide advance notification to the public when appropriate.

2. RESTRICTED ACCESS

- Avoid closures of water bodies during peak recreational public usage periods. Peak use of area waters occurs during the summer months and on weekends with highest use during the middle of the day.
- Consider the occurrence of recreational events such as fishing tournaments, sailboat races, etc., in mission planning for activities that require closures of the Bay, Sound or Gulf.
- NOTMARs stating the location and duration of the proposed operations in public waterways, including Santa Rosa Sound, East Bay, and Choctawhatchee Bay, will be required for certain missions.
- Safety footprints will be required for all live munitions use (ongoing practice).
- Coordination with Eglin's Safety Office (AAC/SEU) will be conducted.
- In accordance with Eglin AFB's current method of operation, AAC/SEU will determine the risk from UXO and employ control measures based on an informal analysis of the action and the risk factors.

3. CHEMICAL MATERIALS

- When released, consult new National Resource Council (NRC) findings and recommendations regarding smoke grenade toxicity and risks to military personnel.
- Continue to observe current procedures for allowing smoke grenade use by qualified instructors. Air Force procedures state smoke grenades should be thrown in a direction that allows the wind to carry the smoke plume away from personnel **(ongoing practice)**.
- Where possible, use munitions composed of non-lead alloys.
- Where possible, recover munition casings from streams, wetland areas, and interior objectives.
- Avoid deposition of casings and other materials into sensitive species habitats.
- The storage, transport, and handling of hazardous materials will be coordinated with AAC/EMCE, and these materials would be disposed of appropriately according to AAC Plan 32-5, Hazardous Waste Management Plan.
- Immediate response is required for petroleum, oil, and lubricant (POL) spills. Appropriate containment and spill response actions, including on-base reporting requirements and disposal, are required. POL products cannot be directed to sewer systems or impervious surfaces (such as grass).
- All spills and accidental discharges of petroleum, oils, lubricants, chemicals, hazardous waste or hazardous materials, regardless of the quantity, will be reported. A spill discharge report must be filled out, and the responsible party must hand-carry or fax (882-3761) this spill report to AAC/EMC or 16 SOW CES/CEV within 4 duty hours of the spill occurrence. Any spill that poses a threat to life, health, or the environment or that has the potential to cause a fire will be reported to 96 CEG/CEF via 96 SFS by dialing 911. If the Fire Department declares an emergency condition, they may take control of the situation, including the tasking of the organization's response detail. Spills over 25 gallons are required to be reported to the Florida Department of Environmental Protection (through AAC/EMC).
- Off-base notification of spills will be reported to Eglin Public Affairs Office (AAC/PA) at (850) 882-3931.
- The Proponent will comply with AAC Plan 32-9 Hazardous Materials Management.

4. DEBRIS

- Continue to police objective areas for mission debris items **(ongoing practice).** Enforce range debris retrieval and recycling policies (i.e., AF13-212, AAC Plan 32-7), especially for out-of-town units.
- Where possible, retrieve shell casings from sediments and beach/bank areas.
- Troops will pack out debris and refuse packed in or properly dispose of litter (FAC 62-701).

- Troops will remove and properly dispose of solid debris from blanks, chaff, smokes, and flares in accordance with Eglin operating procedures.

5. DIRECT PHYSICAL IMPACT

- Prevent erosion of heavily used shoreline areas through restoration/stabilization, rotational use, and avoiding contact with emergent vegetation along banks and shorelines.
- Avoid sensitive plant communities as identified by Eglin Natural Resources **(past practice)**. Ensure that communities previously identified in the Interstitial PEA are presently being avoided as agreed to in that document.
- Road improvements will adhere to the Eglin Air Force Base Range Road Maintenance Handbook.
- During site improvements, erosion-control best management practices (BMPs) must be employed, and coordination with AAC/EMSN and AAC/EMC is necessary.
- Observe off-road restrictions.
- Avoid digging in floodplains, wetlands, and near waterbodies.
- Archaeological sites will be avoided where possible by constructing barriers such as fences or marking sites in the field and on maps.
- When avoidance of archaeological sites is not feasible, mitigation strategies will be developed in consultation with the SHPO.
- Troops will be instructed to avoid high-probability zones for cultural resources during ground movements.
- Where high-probability zones for cultural resources must be utilized, steep slopes near streams, eroded banks, soft sands, or other vulnerable areas will be avoided.
- Areas where artifacts can be seen on the ground will be avoided. Artifacts include any man-made object, including glass, nails, bricks, ceramics, arrowheads, metal, and structures such as fence posts and bridge remnants.
- Troops will be instructed to not collect, damage, or move artifacts from their original location.

6. HABITAT ALTERATION

- Continue to observe the Eglin Fire Control Index and have on hand a sufficient number of fire control personnel when conducting live fire or using pyrotechnics such as flares, smoke grenades, or ground burst simulators **(ongoing practice)**.
- Avoid contact of boat propellers with submerged vegetation (i.e., seagrass beds) **(ongoing practice)**.

- Keep boats clean to prevent introduction of invasive or nonnative species from other aquatic environments into pristine areas such as the Yellow River **(ongoing practice)**. Out-of-town units must be verified clean before using them in local rivers, creeks and estuaries.
- Maneuver around wetlands whenever possible for all activities on foot and by vehicle.
- Vehicles should remain on existing roads when crossing water bodies whenever possible.
- Wastewater from field kitchens must be captured and disposed of properly (i.e., base wastewater plants or off-base wastewater plants). Coordination with Mr. Martin, 96 CEG ((850) 882-6852) is required.
- Portable latrines would be placed at designated locations.

Procedures that will be employed to minimize impacts to the flatwoods salamander include the following:

- Activities will be restricted in isolated wetlands to foot traffic.
- When it is impossible to avoid flatwoods salamander habitat, impacts will be confined to lesser-quality habitat versus higher-quality habitat (as identified by AAC/EMSN).
- Pyrotechnics use will follow Eglin's Wildfire Specific Action Guide Restrictions.

7. BMPS FOR OUTDOOR LIVE-FIRE RANGES

Bullet Containment. The most effective BMP for managing lead or other heavy metal contamination on outdoor shooting ranges is bullet containment (USEPA, 2001). All containment systems are site-specific and dependent upon installation and maintenance costs. A variety of containment devices can be used, include the following:

- Earthen Berms and Backstops. A common system used at shooting ranges, which uses earthen material such as sand and soil located directly behind the target. The backstop is usually 15 to 20 feet high with a steep slope. Reclamation is required to remove lead from soils, as continuous use increases the risk of bullet ricochet and fragmentation (USEPA, 2001).
- Sand Traps. Sand traps are a variation of the earthen backstop with mounds of sand or soil located directly behind bullet targets. The 15- to 20-foot mounds serve as a backstop that employs a system that contains, collects, and controls lead and contact water. Sand traps may be located over an impermeable liner to prevent lead from contacting the soil underlying the trap. As with the earthen backstop, traps must be sifted when saturated with bullets. The bullets can then be recycled (USEPA, 2001).
- Steel Traps. Steel traps vary in design and complexity. The Escalator Trap contains an upward sloping deflection plate that directs bullets into a spiral containment area. The Vertical Swirl Trap is a modular, freestanding trap that funnels the bullets into a vertical aperture in which they spin, decelerate, and then become trapped in a collector container. The Passive Bullet Trap has steel deflection plates that slope upward and downward.

Bullets follow their path of deceleration in a round chamber for collection and recycling. Reclamation of lead is easier using steel traps in comparison to sand traps and earthen berms; however, an increase in lead dust and fragmentation should be considered and managed (USEPA, 2001).

- Lamella or Rubber Granule Traps. The Lamella Trap consists of tightly hanging, vertical strips of rubber with steel backing located behind targets that stops bullets. The bullets are then removed from the rubber. Rubber Granule Traps increase safety by reducing the incidence of back splatter and eliminating lead dust dispersion to the air and soil. Considerations include required additional maintenance; fire threat due to heat from friction created by bullets impacting rubber at high volumes; inability to withstand long-term weather elements; difficult reclamation due to bullets rubber particles melting to lead bullets (USEPA, 2001).
- Shock-Absorbing Concrete (SACON) Bullet Traps. The SACON is a low-density, fiber-reinforced, foamed concrete bullet trap. Studies at ranges revealed that at 25 meters, the trap contained 87 percent of the bullets. A large portion of the bullet fragments and debris formed a pile in the front of the trap. Exposure of the bullet debris to SACON material resulted in insoluble lead corrosion products. Toxicity Characteristic Leaching Procedure (TCLP) levels were below 5 mg/L, and the weathered material was classified as nonhazardous and disposed of as a solid waste (ESTCP, 1999).

Lead-Based Projectiles Management

<u>Lime Addition</u>. Soils with the acidic conditions (as those shown on Eglin) should be of particular concern because of the increased breakdown and mobility of lead, copper, and zinc. One BMP to control metal migration is to spread lime around earthen backstops, sand traps, and shotfall zones. Spreading of the lime neutralizes the acidic soils, thus reducing the degradation potential. The recommended soil pH for ranges as proposed by the National Sports Foundation is 6.5 to 8.5. Generally, adding 50-pound (sandy soils) or 100-pound (clay soils) bags of granulized or palletized lime per 1,000 square feet of range will raise the soil pH approximately one pH unit for a period of 1 to 4 years (USEPA, 2001), but each live-fire target site should first be analyzed for soil pH to determine the amount of lime needed. The market price of lime is ~$2 to $4 per 50-pound bag. Soil pH should be monitored annually, as the effectiveness of the lime decreases over time and routine applications will be necessary.

<u>Clay Addition</u>. Areas where adverse impacts to groundwater have the potential to occur can be effectively treated with clay applications. A clay layer is placed between the area where spent lead accumulates and the groundwater. The clay not only works to prevent vertical migration of the lead, but it also is effective in removing lead from water. Two limitations should be realized when using clay applications. First, clay may increase runoff from the surface, and second, the growth of vegetation that can prevent erosion may be impaired (FDEP, 2003).

<u>Phosphate Addition</u>. Phosphate spreading is recommended where lead is widely dispersed in range soils or there is an increased potential for vertical lead migration to groundwater (such as low soil pH and shallow water table). Unlike lime addition, the goal of phosphate treatment is not to change soil pH but to bind lead particles. This process decreases the migration potential

off-site or into the subsurface. Phosphate can be purchased as phosphate rock (pure form) or as a lawn fertilizer. The average fertilizer contains 25 percent phosphate. Twenty pounds of phosphate should be spread per 1,000 square feet of area. The average cost of lawn fertilizer is approximately $7 per 40-pound bag. It is not recommended to use fertilizers near water bodies as it can increase algal blooms. Rock phosphate should be used if surface water is nearby.

Control of Runoff. BMPs for controlling soil erosion and surface water runoff can control or prevent migration of range contaminants. Factors that influence the amount of contaminants carried to surface waters and off-site are the amount of residues on ranges and the velocity of the runoff. Runoff velocity can be controlled using the following BMPs (USEPA, 2001):

- Vegetative Ground Cover. The use of vegetative ground cover (such as grass) can minimize contaminant runoff from land surface during heavy rainfall. Ground cover absorbs rainwater, which can reduce the contaminant-water contact time. Grasses yield the most control where impact areas are sloped and water runoff and soil erosion is more likely. Bahia or Bermuda grass are suitable species for this region.
- Mulches and Compost. Mulches and compost contain acids that naturally sorb lead out of solution and reduce its mobility. Mulches and compost can also reduce the amount of water that comes into contact with munitions residues. It is recommended that the material be spread at least 2 inches thick and maintained periodically to maintain effectiveness. Most compost and mulch is acidic so when adding it to ranges with low pH values, an increase in the application of lime may be needed to control pH.
- Surface Covers. Removable surface covers may be used at outdoor ranges. Impermeable materials such as plastic liners are placed over the shotfall zone when not in use to protect the area from erosion during rainfall and to keep the shot from coming into contact with rainwater. Permanent surface covers may be used in pistol ranges, impact backstops, and target areas. The permanent roofed covers prevent rainwater from contacting berms. However, this control is costly due to roof installation, and design plans must adhere to safety issues. Some ranges may utilize synthetic liners (asphalt, rubber, Astroturf®) under shotfall zones to prevent rainwater or runoff from filtering through contaminated soils. Synthetic liners will generate more runoff that must be controlled. Liners must be chosen on a site-specific basis considering soil type, pH, rainfall, organic content of soil, and surface water drainage patterns (USEPA, 2001).
- Engineered Runoff Controls. Runoff controls should be of the greatest concern on a range such as Eglin that receives heavy annual rainfall due to the increase in migration of contaminants. The impact of rainfall is increased in areas that are rolling or have slopped terrain. Examples of runoff controls include filter beds, detention or retention ponds/containment traps, dikes/dams, and ground contouring.

Lead Removal and Recycling. Lead reclamation has been identified by the FDEP (2003) as the most important way to manage the amount of lead in the environment. A variety of methods may be employed, and it is essential to determine the length of time between reclamation activities based on the precipitation and soil characteristics. The necessity exists to develop a plan for periodic lead removals and ensure that the lead removal is completed as scheduled. The typical methods used by range managers and personnel include hand raking, sifting, and screening. Raking and sifting requires little technology and finances (FDEP, 2003). Other technologies include soil washing, soil flushing, wet screening, gravity separation, pneumatic separation, phytoremediation, and vacuuming. Reclamation may be self-performed or contracted out to a professional company (FDEP, 2003).

Stormwater Management. Live-fire range operations will comply with FAC 62-621, and if necessary, obtain a generic permit for stormwater discharge for land disturbances that exceed one acre.

Practices for Wildlife Management on Ranges

Mow, cut, burn, trim, or apply herbicides to manage the amount of vegetation available as food for species. Use vegetative sources that are less edible for animals and reduce coverage of weedy coverage to control the abundance and distribution of wildlife on the range.

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APPENDIX C

ESTUARINE AND RIVERINE HISTORICAL MISSION USE

ESTUARINE AND RIVERINE HISTORICAL MISSION USE

1. CHOCTAWHATCHEE BAY

Range A-21

This range was located on Eglin Main Base and encompassed 620 acres. It was historically used for demonstrating all types of gunnery and bombing including various types of inert bombs, rockets, and static firing of airborne guns and boresighting of guns and cameras. Ground gunnery consisted of firing 100 to 200 rounds at a stationary target on Range A-21. Targets were placed either on land or in Choctawhatchee Bay. The firing area extended 10 miles out into the Bay, though available maps show the firing area and impact areas to be less than 5 miles in length. The impact area for Range 21 changed during the 1950s and 1960s as illustrated in Figures C-1 and C-2. Small arms ammunition was used from 1940 to 1957; practice bombs with spotting charges, high explosive bombs, practice rockets, and pyrotechnics were used after 1957. A chemical munitions demonstration was presented to visiting personnel in 1948. This range was combined with Test Area (TA) A-22 in 1976. The U.S. Army Corps of Engineers (USACE) has determined that the highest concentration of unexploded ordnance (UXO) remaining from usage of this range is likely along the southeast length of the test area, and into Choctawhatchee Bay (USACE, 2000).

Test Area A-22

TA A-22 (Figures C-1 and C-2), formerly Range 22, is a land TA located on Eglin Main south of the McKinley Climatic Laboratory, with an impact area that extends into Choctawhatchee Bay. According to the Air Force Development Test Center Technical Facilities Manual, this test area currently has a firing range 6,000 feet in length with an authorized impact area into the Bay of three miles (U.S. Air Force, 1996). Historical use of this test area from 1940 to 1990 includes all types of small arms gunnery ammunition, ammunition up to 40 mm, practice rockets, practice bombs with spotting charges, ground pyrotechnics, flares, ballistic analysis of air-gun launched submunitions, fuel-air explosives bombs testing, testing of dummy bombs, air delivery of high explosive bombs up to 500 pounds on the northern side (formerly Range A-21), and napalm bombs with igniter/burst hazard. The southeast portion of the range likely contains the highest concentration of UXO. During the 1950s, the firing area of this TA was listed as extending 10 miles out into the Bay (USACE, 2000).

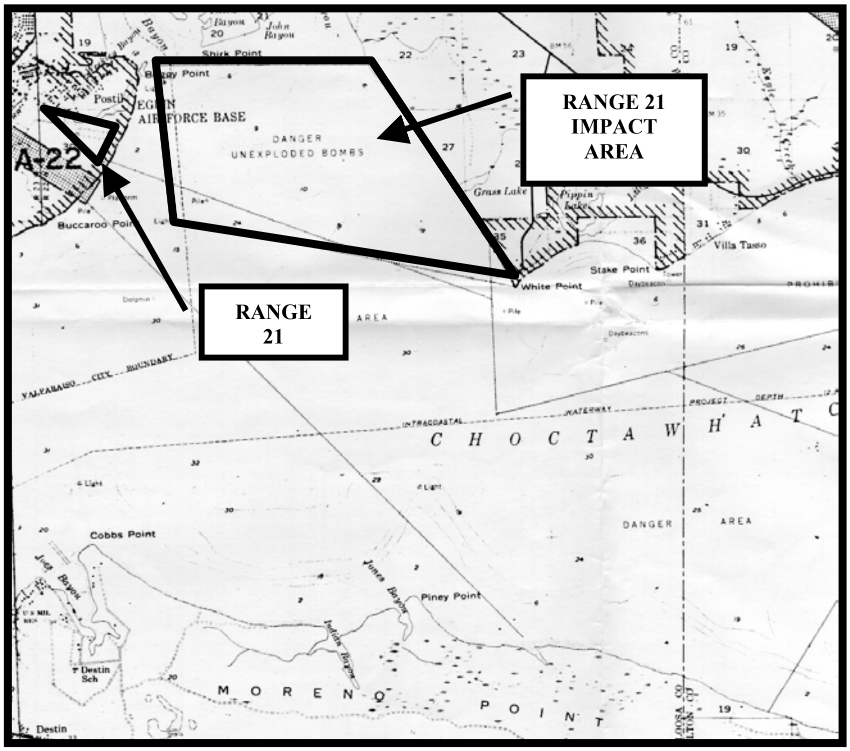

Figure C-1. Range 21 And UXO Area, 1968

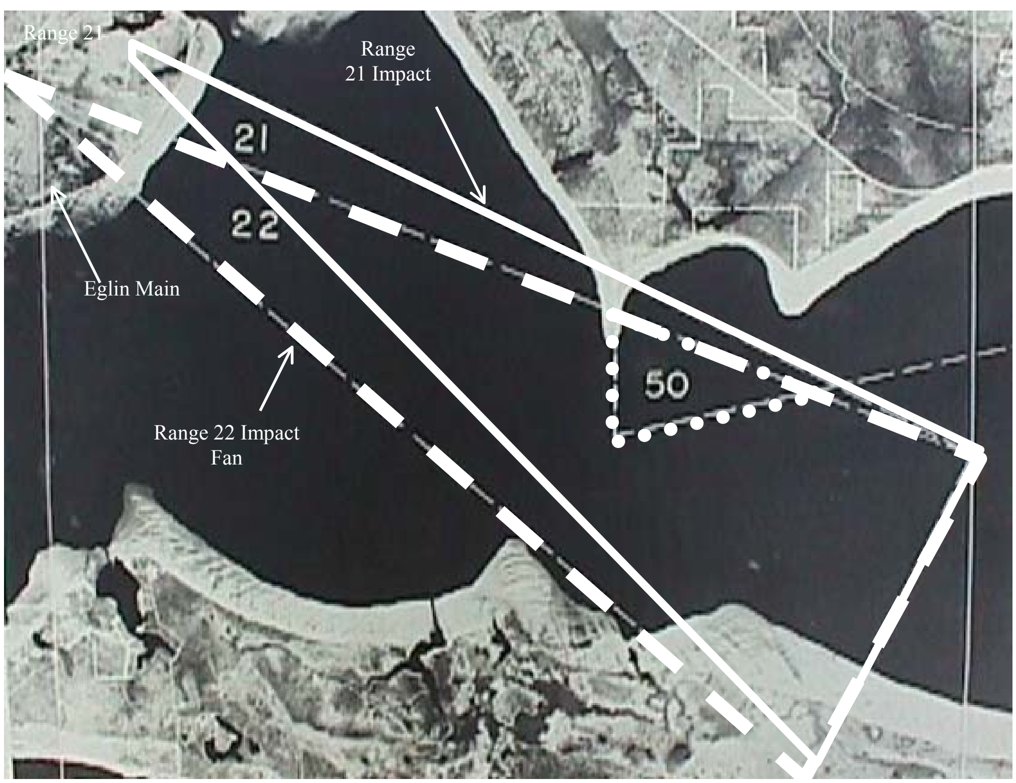

Figure C-2. 1947 Map of Range 21 (solid line), Range 22 (dashed line) and Range 50 (dotted)

Buccaroo Point Gunnery Range

Buccaroo Point Gunnery Range was established approximately 2,000 feet south of TA A-22 in 1936 and existed until around 1950. During that time, National Guardsmen from various states conducted ground-based machine gun practice on water and aerial targets. The targets were assembled on the ground and then placed on piers in the water. Thirty- and .50-caliber ammunition was primarily used (USACE, 2000). Aerial targets were sometimes located over East Pass and Destin. The safety fan is unknown.

Water Range 50 Air-To-Water Bombing Range

Water Range 50, also known as the White Point Water Bombing Range and as Bombing Range No. 1, was located in Choctawhatchee Bay at White Point (Figure C-2). Low-level gunnery, inert bombing, and rocketry were practiced on this range particularly for tests requiring targets on a water surface or where aircraft over-flight required a water surface. Targets included a wooden pyramidal shape on a piling, a ship silhouette constructed of wooden pilings, 116 feet long and 97 feet high, a radar reflector mounted on a piling, and various other targets constructed as needed. Precision bombing was practiced on the wooden pyramid with bomb burst locations triangulated from three towers to determine the accuracy of the hit. The ship silhouette simulated the center engine section of a tanker (USACE, 2000).

Test Area D-54

TA D-54 (Figure C-3) was historically known as Water Range 54, generally located off Hammock Point in Choctawhatchee Bay, approximately 12 miles east of Eglin Main. This range was established in 1944 and was available for use for high explosive and practice munitions used for dive-bombing, skip-bombing, gunnery, rocketry, toss-bombing, and napalm up until 1987, though it has been inactive for these purposes since 1979. In the 1940s, a silhouette of a ship built from pilings and a railroad trestle extending 1,000 feet into the Bay were used as targets for bombing and gunnery. The ship silhouette target was 311 feet long with a 56-foot stack and a 97 foot high mast, built on piles and covered with target tow cloth. In the early 1950s, a sunken freighter located 4,200 feet offshore was used as a target for visual or radar bombing (USACE, 2000).

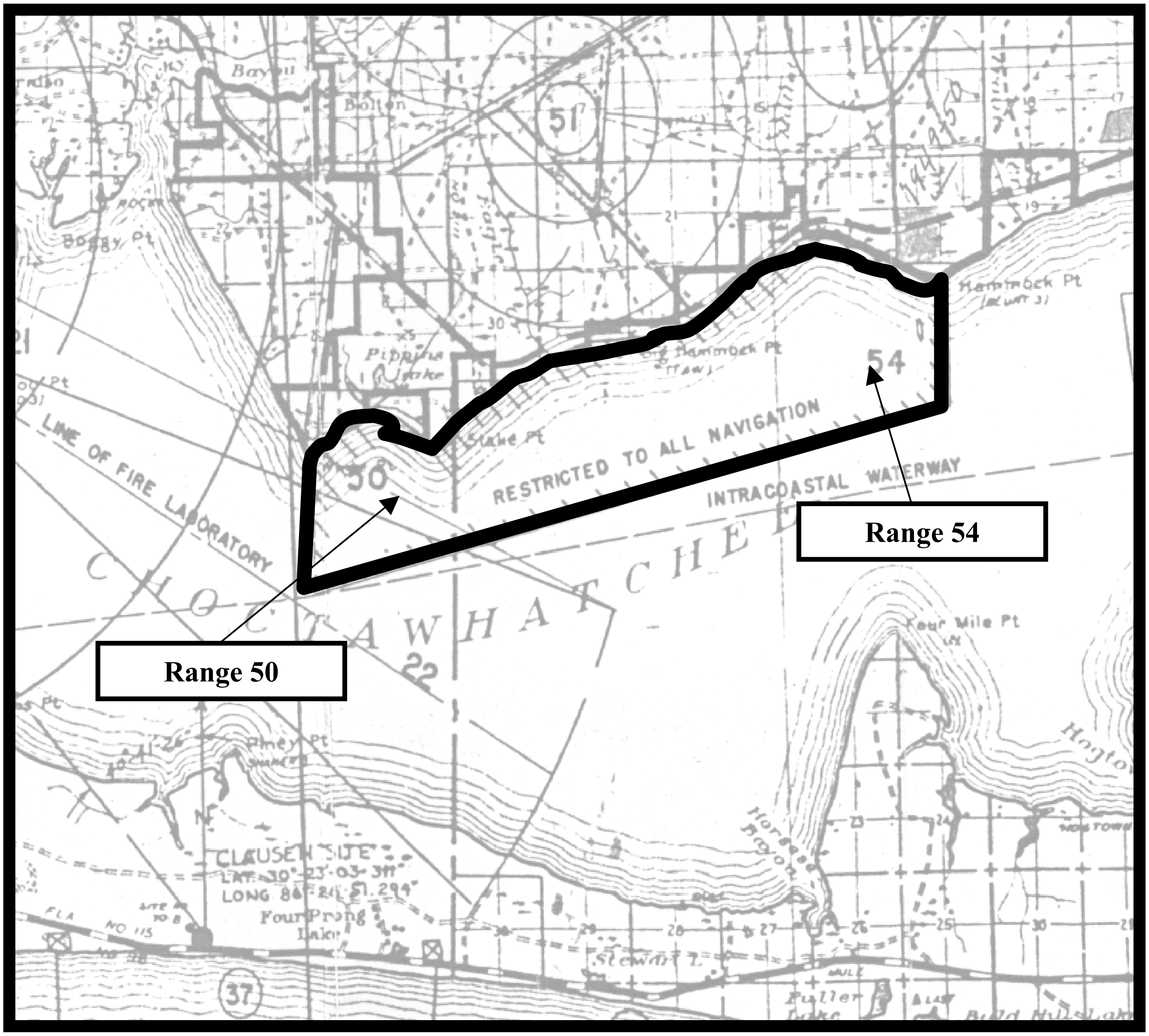

Figure C-3. 1953 Map of Water Ranges 50 and 54 (Now Test Area D-54)

Test Area D-55

This TA is located on the eastern end of Choctawhatchee Bay near the mouth of the Choctawhatchee River, approximately 25 miles east of Eglin Main. In the mid-1950s, TA D-55, historically Water Range 55, was established as an air-to-water synthetic target consisting of 11,000 modified radar corner reflectors mounted on utility poles distributed over an area of 7,500 feet by 6,900 feet. Modifications to this range were apparently made as a 1969 map (Figure C-4) depicts the area of Range 55 as more elongated with an approximate length of 10,000 feet, clearly different from a 1955 configuration (not shown). No munitions were expended on this TA (USACE, 2000). Many of the utility poles are still standing minus the radar reflectors (Figure C-5).

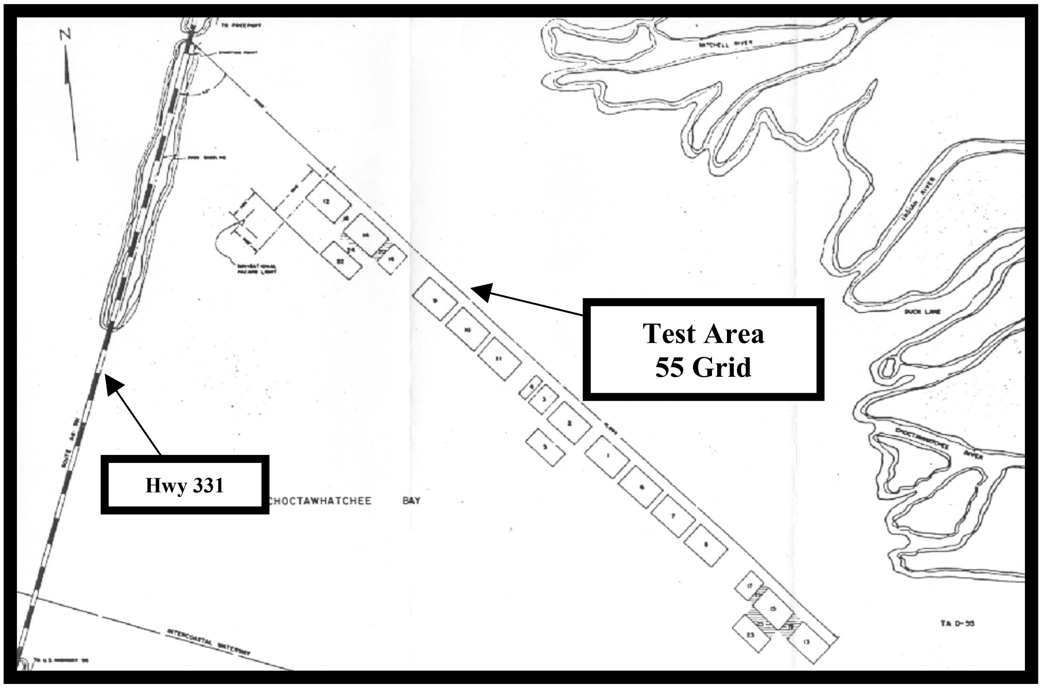

Figure C-4. 1969 Map of Test Area D-55 Radar Reflector Grid

Figure C-5. Test Area D-55 Utility Poles

Test Area D-59

In 1944, TA D-59 at Alaqua Point (Figure C-6) was initially an air-to-water sonic range, which utilized hydrophones to record sounds from air-to-ground bombing, and later in 1947 was used to test projectiles against surface water targets, and for aircraft calibration. In the 1950s, a pyramid-type radar target consisting of one corner radar reflector was erected for low- and medium-altitude inert bombing. In 1957, Water Range 59 was listed as an inactive range with an air-to-ground bombing capability including low- and medium-altitude inert visual bombing. By 1974, no targets were visible as indicated by aerial photographs (USACE, 2000).

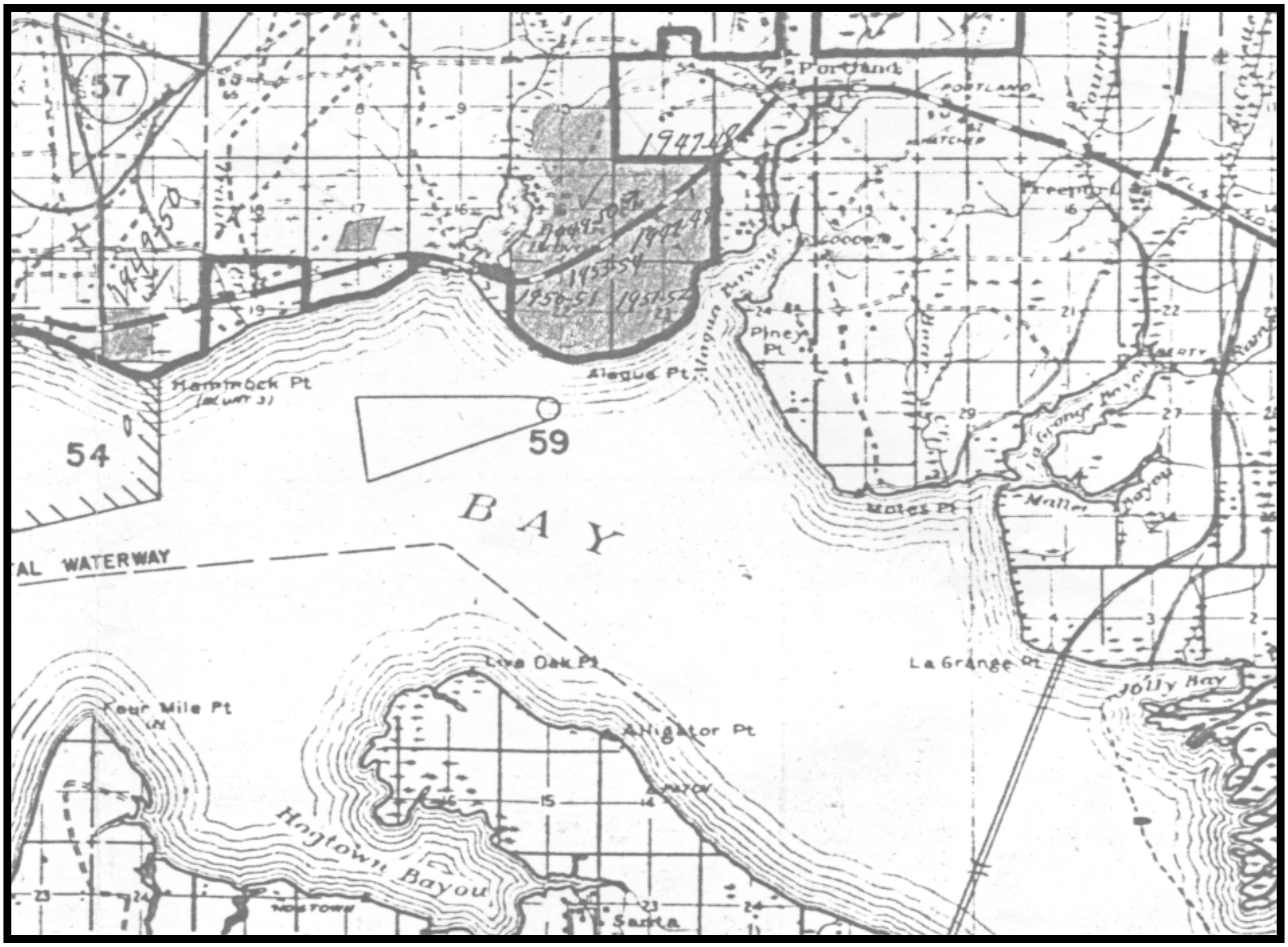

Figure C-6. 1953 Map of Water Range 59

Water Range 60

In 1944, this range was an air-to-water gunnery range located off Black Point in Choctawhatchee Bay about 5 air miles southwest of Eglin Field (Figure C-7). One of the targets consisted of a ship silhouette 116 feet long with a 56-foot stack and a 97-foot mast intended to simulate a Japanese tanker. The target was built on wood pilings. Water Range 60 was active from approximately 1944 to 1951, utilized for aircraft calibration and for the testing of high explosive and practice projectiles and munitions against surface water targets (USACE, 2000).

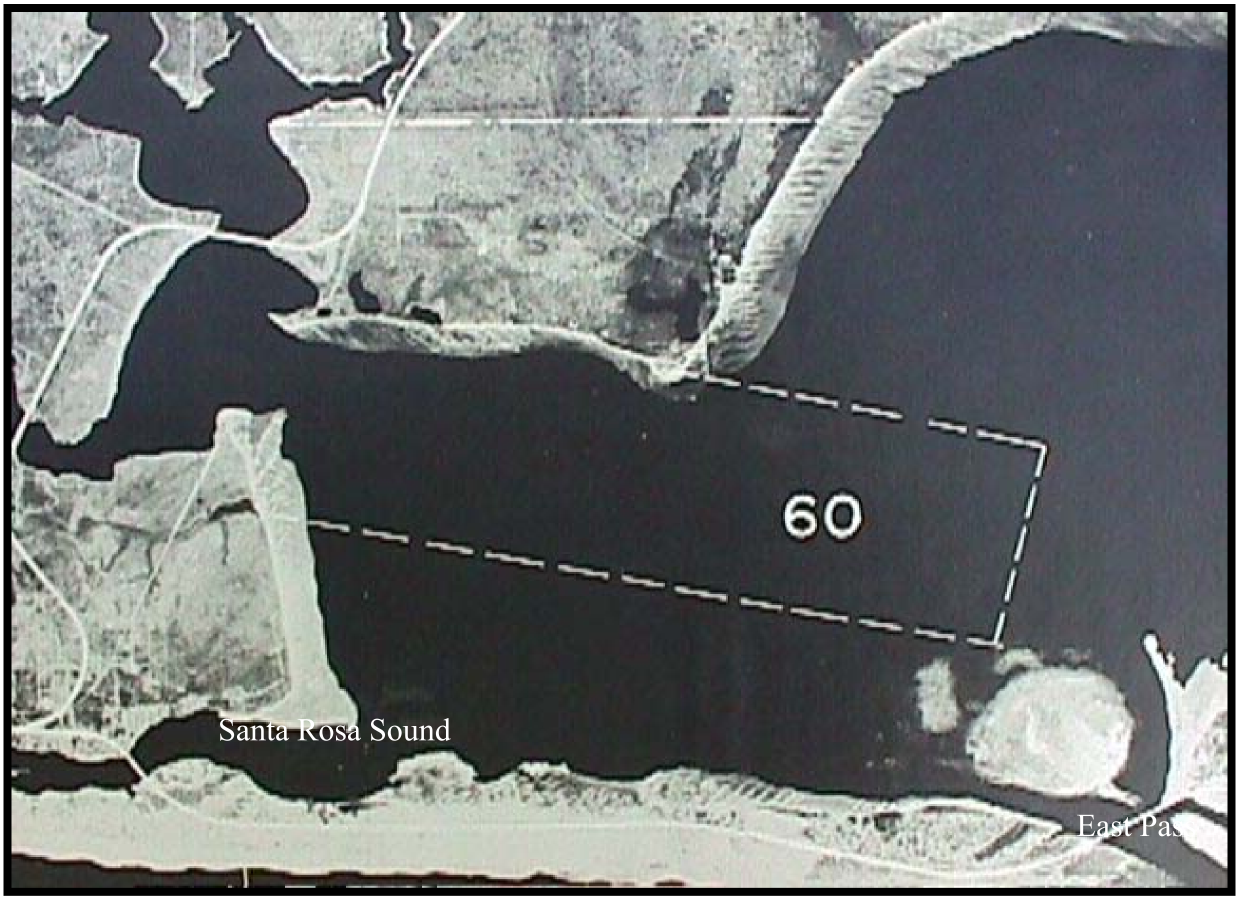

Figure C-7. 1947 Map of Water Range 60

Water Range 61

Water Range 61 was an air-to-water gunnery range adjacent to Water Range 60 (Figure C-8). There were no permanent targets on this range, but targets from the Range Boat Section were towed out to the area as needed. Range 60 and 61 were designed to test projectiles used against surface water targets and for aircraft calibration. Projectiles of various types were used at Range 61 until 1951, when the range was declared inactive (USACE, 2000).

Skeet Range

The skeet range was located on the western shoreline of the Bay north of TA A-22. The area has since been cleared and all buildings have been removed. It was used for training as well as for leisure time activities. Shotgun ammunition and casings manufactured from 1940 to 1960 and fragments of clay targets are present at the site. Chemical demolition training may have been conducted on the skeet range in the 1950s, but no evidence has been found to support this (USACE, 2000).

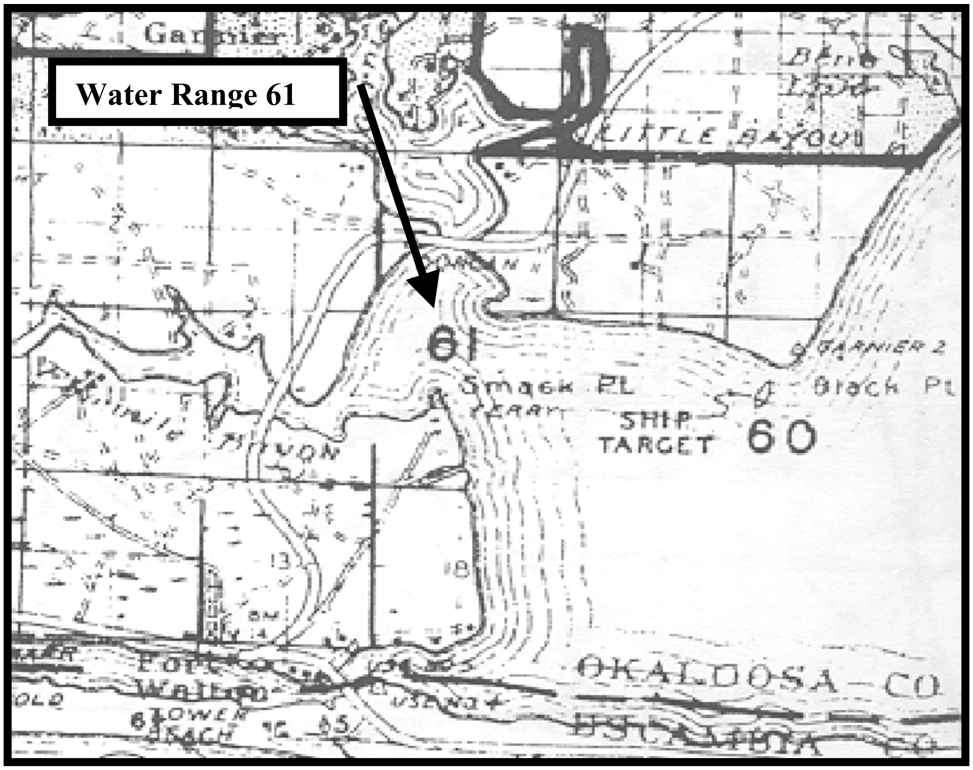

Figure C-8. 1944 Map of Water Range 61

2. SANTA ROSA SOUND HISTORICAL USE

Santa Rosa Sound has been used in the past for large-scale joint exercise operations involving fuel transfer and other logistical aspects (Joint Logistics Over The Shore (JLOTS) operations), surface training, and personnel and equipment drops. There are no historical TAs, but restricted and prohibited areas initially created for activation during rocket testing on SRI are still in place today (see Chapter 4).

3. YELLOW RIVER HISTORICAL USE

Safety fans of historical ranges 28 and 3a overlap the Yellow River (Figure C-9). Range 28 was an airspace range used by aircraft for gunnery training. Cloth banners towed behind other aircraft were the primary targets. All types of small ammunition in use from 1940 through 1950 were expended over this range. Range 3a was an air-to-ground range used in the 1940s and 1950s for low-altitude bombing and air-to-ground gunnery and rocketry. Munitions expended were 1940- through 1950-style small arms aircraft gunnery ammunition of all types, particularly .30 cal, .50 cal, and 20 mm.

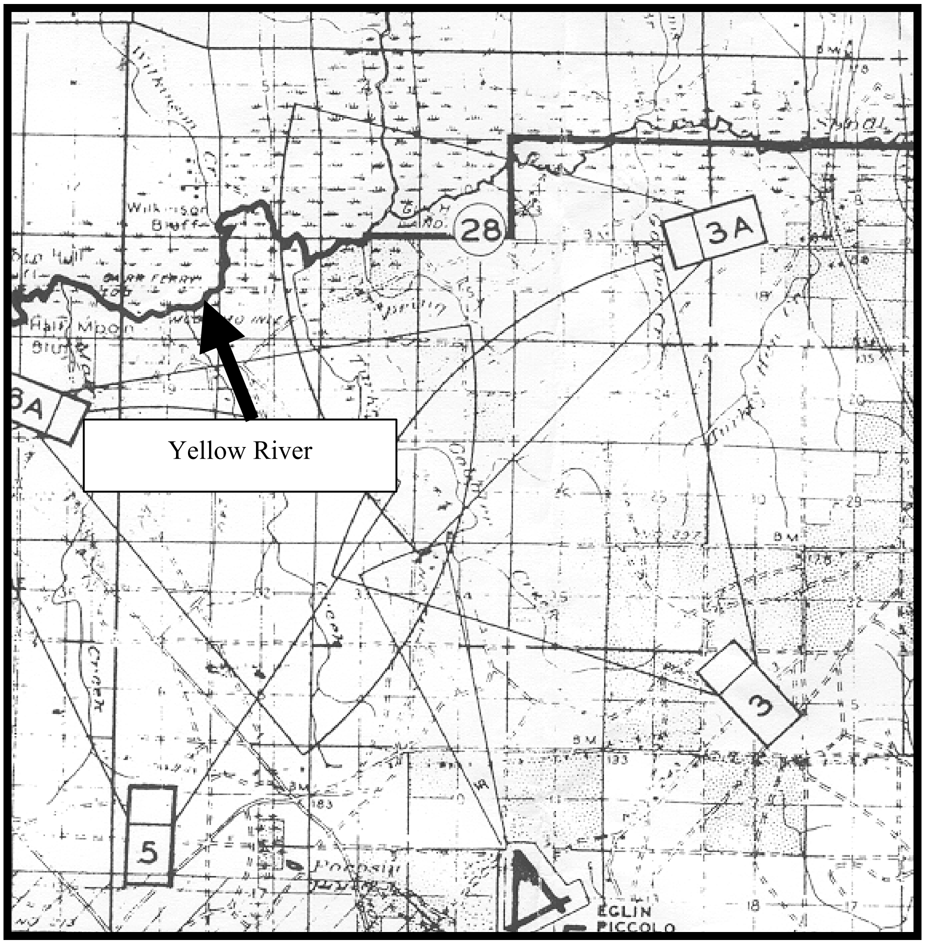

Figure C-9. Test Area 3A Historical Safety Fan Overlapping the Yellow River

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APPENDIX D

THREATENED, ENDANGERED, AND SPECIAL STATUS SPECIES

THREATENED, ENDANGERED, AND SPECIAL STATUS SPECIES

Lists of threatened, endangered, and special status species are presented in Tables D-1 and D-2. A species is listed as threatened and endangered by the federal Endangered Species Act or by a state government. Special status species may be those awaiting review for placement on a federal- or state-threatened or endangered list such as a species of special concern, or those that may have protection under another law, such as marine mammals, which are protected under the Marine Mammal Protection Act (MMPA). Following the tables is a description of the protected species found within the region of influence.

Table D-1. Protected Species with the Potential to Occur In or Near Choctawhatchee Bay and Santa Rosa Sound

Species	Status	Natural Communities and Notes on Occurrence
PLANTS		
Godfrey's golden aster Chrysopsis godfreyi	SE	Beach dunes, coastal grasslands
Cruise's golden aster *Chrysopsis gossypina cruiseana*	SE	Coastal dunes, coastal strand, openings and blowouts
Perforate reindeer lichen *Cladonia perforata*	FE, SE	Coastal strand, rosemary scrub, full sun; known occurrences on Eglin property of SRI
BIRDS		
Southeastern snowy plover *Charadrius alexandrinus tenuirostris*	ST, C	Estuarine and marine unconsolidated sediments, coastal dunes, sandy beaches, inlets
Piping plover Charadrius melodus	ST, FT	Estuarine and marine unconsolidated sediments, coastal dunes, sandy beaches, inlets
Marian's marsh wren Cistothorus palustris marianae	SSC	Estuarine and marine tidal marsh
Little blue heron Egretta caerulea	SSC	Estuarine marshes, shoreline; lake and river floodplains and shorelines
Snowy egret Egretta thula	SSC	Estuarine marshes and tidal swamps, shoreline; lake edges, river shorelines
Tricolored heron Egretta tricolor	SSC	Estuarine marshes and tidal swamps, shoreline; lake edges, river shorelines
Arctic peregrine falcon Falco peregrinus tundrius	SE, FE	Winters along coasts
Southeastern kestrel *Falco sparverius paulus*	ST	Various estuarine, lake, and open terrestrial habitats
American oystercatcher *Haematopus palliates*	SSC	Exposed estuarine sediments, exposed oyster reef, beaches
Bald eagle *Haliaeetus leucocephalus*	ST, FT	Estuarine marsh edges, tidal swamps, lakes and riverine floodplains, forests
Least tern *Sterna antillarum*	ST	Various estuarine, lake and river habitats; beach dunes
Brown pelican Pelecanus occidentalis	SSC	Open estuarine and marine waters; nests on estuarine islands

Table D-1. Protected Species with the Potential to Occur In or Near Choctawhatchee Bay and Santa Rosa Sound Cont'd

Species	Status	Natural Communities and Notes on Occurrence
FISH		
Okaloosa darter *Etheostomae okaloosae*	SE, FE	Seepage streams
Gulf sturgeon *Acipenser oyrinchus desotoi*	FT, SSC	Lives predominately in the northeastern Gulf of Mexico; may venture out to 20 miles. Moves inland to spawn. Within the region of influence, spawning takes place in the Choctawhatchee River to the east of Eglin AFB and the Apalachicola River to the east of Tyndall AFB during April through June
Saltmarsh topminnow *Fundulus jenkinsi*	SSC	Estuarine tidal marsh
REPTILES		
American alligator *Alligator mississippiensis*	FT(s/a), SSC	Estuarine marshes and other habitats, lakes, and rivers
Eastern indigo snake *Drymarchon corais couperi*	FT, ST	Estuarine tidal swamp, hydric hammock, wet flatwoods, mesic flatwoods, upland pine forests, and others
Alligator snapping turtle *Macroclemys temminckii*,	SSC	Estuarine tidal marsh, lakes, and streams
Atlantic Green sea turtle *Chelonia mydas*	FE, SE	Inhabits open marine waters; may potentially enter Choctawhatchee Bay or Santa Rosa Sound
Hawksbill sea turtle *Eretmochelys imbricata*	FE	Inhabits open marine waters; may potentially enter Choctawhatchee Bay or Santa Rosa Sound
Kemp's Ridley sea turtle *Lepidochelys kempi*	FE, SE	Inhabits open marine waters; may potentially enter Choctawhatchee Bay or Santa Rosa Sound
Leatherback sea turtle *Dermochelys coriacea*	FE, SE	Inhabits open marine waters; may potentially enter Choctawhatchee Bay or Santa Rosa Sound
Atlantic loggerhead sea turtle *Caretta caretta*	FT, ST	Inhabits open marine waters; may potentially enter Choctawhatchee Bay or Santa Rosa Sound
MAMMALS		
West Indian manatee *Trichechus manatus latirostris*	FE, SE	Herbivorous aquatic mammals; diet consists mainly of water hyacinth, hydrilla, turtle grass, manatee grass, and shoal grass; usually occurs south of Suwannee River, but has been sighted in northwest Florida
Atlantic bottlenose dolphin *Tursiops truncatus*	MMPA	Resident population in Choctawhatchee Bay

FE = federal endangered, FT = federal threatened, C = federal candidate, SSC = state species of special concern, SE = state endangered, ST = state threatened, MMPA = Marine Mammal Protection Act, s/a = listing due to similarity in appearance to another listed species

Table D-2. Federal- and State-Listed and Special Status Species Potentially Associated with Yellow River, East Bay, and East Bay River

Common Name	Status	Natural Communities and Notes on Occurrence
FISH		
Gulf sturgeon *Acipenser oxyrinchus desotoi*	FT, SSC	Various estuarine and marine habitats; spawns in alluvial and blackwater rivers and streams
Blackmouth shiner *Notropis melanostomus*	SE	Blackwater streams
Bluenose shiner *Pteronotropis welaka*	SSC	Blackwater, alluvial, and spring-run streams
AMPHIBIANS AND REPTILES		
American alligator *Alligator mississippiensis*	FT(s/a), SSC	Open water, swamps, floodplains, marshes, shorelines
Flatwoods salamander *Ambystoma cingulatum*	FT, SSCC	Wet flatwoods, dome swamp, basin swamps; reproduces in ephemeral wetlands within mesic flatwoods community
Eastern indigo snake *Drymarchon corais couperi*	FT, ST	Mesic flatwoods, upland pine forest, sandhills, scrub, scrubby flatwoods, rockland hammock, tidal swamp, hydric hammock, wet flatwoods
Gopher tortoise *Gopherus polyphemus*	SSC	Sandhills, scrub, scrubby flatwoods, xeric hammocks, coastal strand
Pine barrens treefrog *Hyla andersonii*	SSC	Seepage slope, baygall, seepage stream
Alligator snapping turtle *Macroclemys temminckii*	SSC	Tidal marsh, river floodplain lake, swamp lake, alluvial and blackwater stream
Florida bog frog *Rana okaloosae*	SSC	Seepage slope and stream, baygall
BIRDS		
Little blue heron *Egretta caerulea*	SSC	Marshes, shorelines, floodplains, and swamps
Snowy egret *Egretta thula*	SSC	Marshes, tidal swamps, shoreline, floodplains
Tricolored heron *Egretta tricolor*	SSC	Marshes, tidal swamps, shoreline, floodplains
Arctic peregrine falcon *Falco peregrinus tundrius*	FE(s/a), SE	Winters along coasts, various palustrine (nontidal wetlands) habitats
Osprey *Pandion Haliaetus*	SSC	Lakes, rivers, estuaries, and terrestrial habitats
Southeastern kestrel *Falco sparverius paulus*	C, ST	Various estuarine and palustrine habitats, open pine forests, clearings
Brown pelican *Pelecanus occidentalis*	SSC	Nests on estuarine islands, estuarine and marine open water
Bald eagle *Haliaeetus leucocephalus*	FT, ST	Marsh edges, tidal swamp, open water, swamp lakes, edges and floodplains, pine and hardwood forests, clearings
Red-cockaded woodpecker *Picoides borealis*	FE, ST	Mature longleaf, slash, and loblolly pine forests
Marian's marsh wren *Cistothorus palustris marianae*	SSC	Estuarine and marine tidal marshes
Least tern *Sterna antillarum*	ST	Various estuarine, riverine and lacustrine (wetlands and deepwater habitats), beach dunes

Table D-2. Federal- and State-Listed and Special Status Species Potentially Associated with Yellow River, East Bay, and East Bay River Cont'd

Common Name	Status	Natural Communities and Notes on Occurrence
MAMMALS		
Florida black bear *Ursus americanus floridanus*	C, ST	Titi swamps, floodplains, pine and hardwood forests
West Indian manatee *Trichechus manatus latirostris*	FE, SE	Estuarine and marine open waters, submerged vegetation, alluvial, blackwater, and spring-run streams
Atlantic bottlenose dolphin *Tursiops truncatus*	MMPA	Occurs in East Bay
PLANTS		
Curtiss' sandgrass *Calamovilfa curtissii*	ST	Mesic and wet flatwoods, wet prairie, depression marsh
Baltzell's sedge *Carex baltzellii*	ST	Slope forest, moist sandy loam
Spoon-leaved sundew *Drosera intermedia*	ST	Sinkhole lake edges, seepage slopes, wet flatwoods, depression marsh, seepage stream banks, drainage ditches
Bog-button *Lachnocaulon digynum*	ST	Seepage slope, wet flatwoods, bog exposed sands
Panhandle lily *Lilium iridollae*	SE	Baygall, dome swamp edges, mucky soil, seepage slope, edges of titi bogs, blackwater stream banks
Ashe's magnolia *Magnolia ashei*	SE	Slope and upland hardwood forest, ravines
Naked-stemmed panic grass *Panicum nudicaule*	ST	Seepage slope, bog, wet flatwoods, dome swamp
Chapman's butterwort *Pinguicula planifolia*	ST	Wet flatwoods, seepage slopes, bog, dome swamp, ditches, water
Orange azalea *Rhododendron austrinum*	SE	Bottomland forest, seepage stream bank, slope forest, upland mixed forest
Hairy-peduncled beak-rush *Rhynchospora crinipes*	SE	Blackwater stream-shelving, sandy banks
White-top pitcher plant *Sarracenia leucophylla*	SE	Wet prairie, seepage slope, baygall edges, ditches
Red-flowered pitcher plant *Sarracenia rubra*	ST	Bog, wet prairie, seepage slope, wet flatwoods, seepage stream banks
Pineland hoary-pea *Tephrosia mohrii*	ST	Sandhill

Source*:* U.S. Fish and Wildlife Service, 2000

FE = federal endangered, FT = federal threatened, C = federal candidate, SSC = state species of special concern, SSCC = state species of special concern candidate, SE = state endangered, ST = state threatened, MMPA = Marine Mammal Protection Act, s/a = listing due to similarity in appearance to another listed species.

Gulf Sturgeon

The Gulf sturgeon (*Acipenser oxyrhynchus desotoi)* (Figure D-1) occurs predominately in the northeastern Gulf of Mexico, inhabiting offshore areas and inland bays during the winter months and moving into freshwater rivers, such as the Yellow River and the Choctawhatchee River during the spring (U.S. Fish and Wildlife Service [USFWS] and Gulf States Marine Fisheries Service (GSMFS), 1995). Fish that travel from saltwater to freshwater to spawn are termed anadromous. Migration into freshwater occurs from February to April, while migration into saltwater occurs from October through November. USFWS scientists have learned that approximately 95 percent of the Gulf sturgeon that spawn in Choctawhatchee River spend the entire winter in Choctawhatchee Bay, without moving out into the Gulf. Due to the low number of sturgeon observed in East Bay during the winter, Craft et al. (2001) theorize that the majority of sturgeon in that region migrate to the Gulf of Mexico during the winter months. Distribution and area/habitat preference in Choctawhatchee Bay may be related to sturgeon age. Sub-adult sturgeon are located frequently in LaGrange and Alaqua Bayous, while adults seem to prefer Hogtown Bayou. Areas east of the Highway 331 Bridge are generally not used as winter habitat (USFWS, 2001). Sturgeon have been found on both sides of the Mid-Bay Bridge, but decrease in occurrence as one moves west to Fort Walton Beach.

Gulf sturgeon feed on insects, crustaceans, molluscs, worms, and small fish (U.S. Coast Guard, 1996; Page and Burr, 1991). Bottom disturbing activities and underwater detonations during times of the year and known areas of occurrence would be activities that could significantly impact the Gulf sturgeon (USFWS, 2001).

Figure D-1. Gulf Sturgeon
Photo Credit: USFWS Panama City Field Office, Florida

Scientists are presently studying the movements of the Gulf sturgeon in the Yellow River using tags and implanted chips. The information will provide researchers with a better understanding about the sturgeons' preferred spawning locations (USFWS, 2001). Tracked Gulf sturgeon were found to be distributed nonrandomly within Choctawhatchee Bay in nearshore areas 2 to 4 meters deep, with a home range usually no more than one square kilometer. Occasionally, the sturgeon would travel further distances but generally remained in areas of sandy bottom sediments that contained an abundance of amphipod crustaceans and polychaete worms (Fox et al., 2000).

Research on Gulf sturgeon in the Yellow River, supported in part by Eglin AFB, suggests that certain areas of the Yellow River may be potential summer refuge areas for sturgeon (Craft et al., 2001). Adult sturgeon have been found to congregate in relatively high numbers in these summer refuge areas, though their distribution is spread over the entire length of the Yellow River. Due to the sensitive nature of this information, the specific locations are not disclosed here. Generally, the summer refuge areas are located in the southern part of the Yellow River adjacent to Eglin property. Heavy sediment loads and low water volume from drought conditions were identified as factors potentially affecting sturgeon migration in the Yellow River.

Critical Habitat

The final rule for Gulf sturgeon critical habitat was published in the Federal Register on March 19, 2003. "Critical habitat" is defined by the ESA as specific areas within or outside the geographical area occupied by the species that contain physical or biological features essential to the species' conservation and that may require special management considerations or protection. As pertains to this PEA, critical habitat units for the Gulf sturgeon include the Yellow River, Pensacola Bay, Santa Rosa Sound, and Choctawhatchee Bay.

The lower Yellow River runs along Eglin for much of its northern border. On the Yellow River, summer resting areas are located along Eglin's border. The portion of the Yellow River bordering Eglin is considered a migratory pathway to possible spawning sites located upriver. The Yellow River empties into Blackwater Bay, which is part of the Pensacola Bay system. Blackwater Bay and East Bay within Pensacola Bay both border Eglin and are included as critical habitat for winter feeding and migration for Gulf sturgeon. Within the bays, movement is generally along the shoreline, and sturgeon have shown a preference for the mouth of the Yellow River and Escribano Point, near Catfish Basin, which is close to Eglin AFB (USFWS, 1998; Craft et al., 2001). Santa Rosa Sound has also been designated as critical habitat because it is believed to be a migratory pathway between Pensacola Bay, Choctawhatchee Bay, and the Gulf of Mexico for genetic exchange and feeding. Within the sound, Gulf sturgeon have been documented in shoreline areas 6.6 to 17.1 feet deep and midchannel. Choctawhatchee Bay (including Hogtown Bayou, Jolly Bay, Bunker Cove, and Grassy Cove) critical habitat serves as a winter feeding area for subadult and adult Gulf sturgeon. Subadults have shown a preference for shoreline habitats with sandy substrates, low salinity, and water depths less than 10 feet, while most adults were found in shallow water (6.6 to 13.1 feet) with sandy substrate.

Okaloosa Darter

The Okaloosa darter is found in six small Choctawhatchee Bay Basin tributaries located in the Sandhills ecological association. Erosion can increase siltation and can imperil the darter's habitat. Its range has been reduced by habitat modification and replacement by the brown darter. In order to protect the Okaloosa darter, the quantity and quality of water in the streams must be protected.

Flatwoods Salamander

Adult salamanders are approximately five inches long, blackish brown with a gray cross-banded pattern across the back and a plain gray to black belly with lighter colored spots (Figure D-2). Flatwoods salamander larvae are long and slender with white bellies and striped sides of various colors: gray, black, tan, pale yellow, and blue-black. A dark brown stripe passes through the eye from the nostril to the gills (CFR, 1999).

Flatwoods salamanders breed in isolated wetland areas, including pine flatwood depressions, cypress or blackgum swamps, roadside ditches, and borrow pits. Adults move to breeding sites from October to December during rainy weather associated with cold fronts. Breeding sites typically lack large predatory fish, but have a diverse assemblage of macroinvertebrates (e.g., insects, crustaceans, worms) and a burrowing crayfish fauna. Female flatwoods salamanders lay eggs when breeding sites are dry underneath leaf litter, at crayfish burrow entrances, among grassy vegetation, or under logs. The eggs develop to hatching size after three weeks but only hatch after being inundated (Palis, 1997). Breeding sites are not connected to any other water body and are dominated by slash pine, pond cypress, and blackgum. Trees, shrubs, grasses, and sedges grow in and around the ponds. Adult and post-larval salamanders prefer moderately moist (mesic) woodlands of longleaf/slash pine (*Pinus palustris/P. elliottii*) flatwoods, a habitat that needs to be maintained by frequent burning. An open canopy is needed for the grasses and sedges to flourish and must be maintained by periodic burning. The depressions are relatively small, shallow, and cyclically dry with a mean size in Florida of 3.68 acres and a mean depth of less than 15.4 inches. Adults feed on a variety of terrestrial invertebrates (e.g., earthworms), and young are presumed to feed on aquatic invertebrates (Palis, 1997).

Flatwoods salamanders have been documented to travel as far as 1.1 miles from a breeding site, with a probable activity range of approximately .4 acres (Palis 1997). Therefore, salamanders at breeding pond sites within two miles of each other may belong to a single population, termed a metapopulation. Some biologists have encouraged establishing a 1.2-mile radius buffer zone around breeding sites, within which little or no ground disturbance activities should occur (CFR, 1999).

Figure D-2. Adult Flatwoods Salamander
Source: Palis, 1997

Adults and sub-adults construct burrows or modify existing crayfish burrows. Sexual maturity is reached at one year (males) and two years (females). Lifespan is unknown, though one individual has been maintained in captivity for four years.

To successfully reproduce, flatwoods salamanders need fall rains to move to breeding ponds and winter rains to sustain water levels in the ponds so that larvae may develop, hatch, and metamorphose (CFR, 1999). Too much rainfall in the summer can have a definite negative impact by preventing water levels from dropping below the grassy pond edge where the salamanders will deposit their eggs. This dependence on rainfall cycles and amounts, which can vary greatly from year to year, leads to unpredictable breeding events and decreases the likelihood that recruitment of individuals from one pond to another will occur every year (CFR, 1999). Additionally, it explains why modifications to the landscape that affect the natural hydrology of the flatwoods salamander habitat can be so detrimental to the continued existence of this species.

Concerns

The wetland breeding sites of flatwoods salamanders are often temporary ponds in a stage of eventual transformation to a drier type of habitat. Due to this ecological succession, Semlitsch (1998, cited in CFR, 1999) states that "there will be inevitable extinctions of local populations."

Species Management

Management recommendations presented by Palis (1997), U.S. Army Corps of Engineers (USACE), include establishing a 1.2-mile buffer around breeding sites, harvesting timber within the buffer only during dry periods, limiting clear-cutting of the buffer to 25 percent of the area during each harvest, avoiding soil disturbance by restricting mechanical site preparation, and restricting herbicide use to times when fire cannot be used. An inner buffer zone of approximately 540 feet would exclude clear-cutting altogether. Observing the 540-foot buffer zone would protect an estimated 95 percent of the population at a breeding site. Most, if not all, of the management recommendations presented by Palis (1997) and the USFWS (1999) are designed to limit the effects of the more environmentally impactive timber industry around salamander habitat; the effects of military ground training activities are inherently less noticeable than that of logging operations.

In addition, Palis (1997) recommended that a mosaic of ponds with varying hydrologies should be maintained, and terrestrial habitats linking those ponds should be maintained to serve as colonization corridors. A variety of ponds will allow for breeding during different climate regimes, and habitat corridors would allow salamanders to move to new breeding sites.

Palis (1997), in a document prepared for the USACE Waterway Experiment Station, stated that military training can be either detrimental or beneficial to salamander habitats. If habitats become fragmented as a result of training (for example, through the establishment of roads or trenches through flatwoods, soil compaction from tank maneuvering, or clearing of grasses in bivouac areas), then fuel sources (i.e., dry vegetation) could become fragmented so that fire would not spread over large areas. Native grasses are essential for allowing large areas to burn, thus maintaining the natural condition of sensitive habitats. Military activities can have a particularly beneficial effect on native communities by reintroducing fire through live ammunition activities and the use of incendiary devices; the frequency and patterns of burning observed at some installations where this takes place has been compared to a natural fire regime.

As shown in Figures 3-15 and 3-16, flatwoods salamander habitat is abundant south of the East Bay River and Yellow River. Areas verified (in red) to contain flatwoods salamanders within 1 mile of the East Bay River total 136 acres, not including habitat within Hurlburt Air Field. The verified salamander habitat falls within the more general area of concern, which encompasses over 4,000 acres around the East Bay River. Potential areas (shown in purple) are even more extensive along the Yellow River and East Bay River. Figure 3-14 depicts potential flatwoods salamander habitats along the shores of Alaqua Bayou and areas north of Alaqua Bayou of Choctawhatchee Bay.

Bog Frog

The Florida bog frog (*Rana okaloosae*), is a small, yellow-green frog, which makes a distinct call composed of a series of chucks. It was first discovered in 1982 and is listed by the state as a Species of Special Concern. The entire global distribution of this species lies within Walton, Okaloosa, and Santa Rosa Counties, with several locations near the Yellow River (Figure 3-16). The species' restricted distribution may be due to characteristics of the area's streams and soil. All known locations are small tributary streams to the Yellow, Shoal, or East Bay Rivers.

Sea Turtles

Five species of sea turtles inhabit the waters in, or near, the eastern Gulf. The smallest species is the Kemp's ridley (75 to 100 pounds), and the largest is the leatherback (up to 2,000 pounds and eight feet long). Sea turtles spend their lives at sea and only come ashore to nest. It is theorized that young turtles, between the time they enter the sea as hatchlings and their appearance as sub-adults, spend their time drifting in ocean currents among seaweed and marine debris (Carr, 1986a, 1986b, 1987). The population numbers of sea turtles were gravely reduced during the twentieth century due to illegal domestic harvest of eggs and turtles in the United States and its territories, as well as other important nesting areas around the world. Sea turtles feed on seagrass and, thus, may be found in the Sound, East Bay, and Choctawhatchee Bay.

Manatees

Manatees are herbivorous aquatic mammals; their diet consists mainly of water hyacinth, hydrilla, turtle grass (*Thalassic testidinum*), manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*) (USFWS 1991; U.S. Coast Guard, 1996). They live in coastal regions including bays, rivers, salt marshes, seagrass meadows, and mangroves (USFWS, 1990). Although they usually occur in tropical waters, they have been sighted in northwest Florida. West Indian manatees rarely venture into deeper waters, but have been spotted as far offshore as the Dry Tortugas Islands (U.S. Coast Guard, 1996). For most of the year, they are found throughout south and central Florida, often in conjunction with sea grasses and vascular freshwater aquatic vegetation (MMS, 1990). The distributional range of the majority of West Indian manatees extends from the Suwannee River south to the Chassahowitzka River during summer and winter migrations (Rathburn et al., 1990). Incidental sightings outside of their normal range (north of the Suwannee River) and as far south as Sanibel Island have been documented (Rathburn et al., 1990). Seasonal movements result from the West Indian manatee's intolerance to cold. They usually move into areas where there are warm-water refuges such as artesian springs and power-plant discharges during cold fronts. During the summer, their habitats are less defined as they have more freedom to move around in warmer waters and search for food (U.S. Coast Guard, 1996). Studies on ear structure indicate that manatees hear within a narrow, low-frequency range and have difficulty distinguishing the location of a sound (Ketten et al., 1992).

Manatees are a federal- and state-listed endangered species, also having protection under the MMPA. They are one of the most endangered coastal species in Florida with mortality rates between 1988 and 1992 averaging 170 (USFWS, 1993). Natural mortality is predominantly related to cold stress, while boat collisions are the most frequent man-made cause of mortality. Red-tide, parasitism, net entanglement, debris ingestion, and poaching are other known causes of mortality. Manatees occur infrequently in the north Florida panhandle with occasional sightings documented in the news media. In December 1999, a manatee was sighted in the Blackwater River and a month later a manatee carcass, presumably of the previously sighted animal was found in Blackwater Bay (Figure 3-16) (Naples Daily News, 2000). A total of three cold-related deaths, one each in Escambia, Santa Rosa, and Okaloosa counties, occurred from 1974 to 2001 (FMRI, 2002). Cold temperatures usually limit the occurrence of manatees in the Florida panhandle to the summertime. Manatees prefer to feed in shallow grass beds near the mouths of coastal rivers and sloughs on a wide variety of submerged, floating, and emergent vegetation (USFWS, 1993).

Atlantic Bottlenose Dolphin

Density and population estimates of the bottlenose dolphin (*Tursiops truncatus)* in Gulf of Mexico coastal bays, sounds, and estuaries were reported in Waring et al. (1999) and derived from aerial surveys conducted from September to October 1993. Aerial and shipboard visual surveys are typical methods used by the National Marine Fisheries Service (NMFS) to monitor coastal dolphin populations. Aerial surveys are flown over line transects generally perpendicular to the mainland at fixed altitudes. Optimal sighting conditions for aerial surveys are clear skies and low winds (<20 km/hour) between 1,000 and 1,500 hours (Mullin et al., 1990). Density may be expressed as number of individuals or herds (if occurring in groups) per square kilometer.

The surveys were conducted by the NMFS and determined the density and population estimates of the Atlantic bottlenose dolphin in Gulf of Mexico coastal bays, sounds, and estuaries in fulfillment of MMPA requirements for assessing stocks of cetacean populations (Blaylock et al., 1995).

The MMPA makes it illegal for anyone to "take" a marine mammal species. Take is defined as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal" (NMFS, 1997). The MMPA, as amended, was enacted to protect all marine mammals in state and federal waters with a goal toward maintaining optimal sustainable populations of all marine mammal species. Although the taking of marine mammals is prohibited, regulations implementing the MMPA provide a mechanism for allowing the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity within a specified geographical region. The definition of "U.S. citizen" includes any department or instrumentality of the federal government. Under the MMPA, the NMFS is responsible for the conservation and management of pinnipeds (excluding walruses) and cetaceans, while the USFWS is responsible for walruses, sea and marine otters, polar bears, manatees, and dugongs (NOAA, 2002). A request for a letter of authorization to permit "small take authorizations" or "incidental harassment authorizations" initiates the NMFS rule-making and public review process (West Publishing Co., 1993). Harassment is further categorized by severity. Level A harassment is defined as an act of torment or annoyance with the potential to cause injury.

Level B harassment is any act of pursuit, torment, or annoyance, which could disturb, through disruption of migration patterns, feeding, nursing, breathing, breeding, or sheltering (NMFS, 1997).

The NMFS is required to estimate abundance, provide a minimum population estimate (MPE) and calculate the potential for biological removal (PBR) for each stock. The PBR is the number of human-caused mortality events that a population could withstand and not be in jeopardy. NMFS estimated bottlenose dolphin abundance in Choctawhatchee Bay to be between 188 and 242 bay-wide or approximately .58 to .74 dolphins per square kilometer. The MPE and PBR for the Choctawhatchee Bay stock is 188 and 1.9, respectively. No aerial surveys have been conducted over Choctawhatchee Bay since 1993; bottlenose dolphin abundance estimates as reported in the 1999 U.S Atlantic and Gulf of Mexico Marine Mammal Stock Assessments (Waring et al., 1999) were unchanged from the 1993 estimates.

Bottlenose dolphins in East Bay belong to the Pensacola Bay community, assumed to be a geographically, socially, and genetically distinct stock or group of dolphins. The MMPA requires that all distinct, genetic cetacean stocks be maintained as such, and studies of dolphin populations at other Gulf estuaries suggest that due to the long-term structure and stability of dolphin communities, they do form a distinct stock, even though they interbreed with other communities. The NMFS is required to estimate abundance, provide an MPE, and calculate the PBR for each stock. The abundance, MPE, and PBR of the Pensacola Bay stock is 33, 18, and .2, respectively (Waring et al., 1999).

The diet of Atlantic bottlenose dolphins consists mainly of fish, crabs, squid, and shrimp (Caldwell and Caldwell, 1983).

Bottlenose dolphins are able to hear sounds between 75 and 125 Hertz (Hz), though their best hearing range is 10 kHz (kilohertz) to 90 kHz. Their hearing threshold is in the range of 40 to 60 dB re 1 µPa. In the absence of noise, the bottlenose dolphin are able to detect a signal of about 41 to 42 dB at various frequencies between 10 kHz and 100 kHz (Johnson, 1967, 1968). Spectrum of explosive signal implies odontocetes are not affected by sound energy below 2500 Hz and are not vulnerable to explosive sound with total energy on the order of 200 dB. The effective hearing band of odontocetes, as stated in the Navy's Distant Thunder EA, is the band above 2,500 Hz.

Piping Plover

The piping plover is state and federally listed as endangered. Piping plovers are found in wintering habitats as early as mid-July and leave by early March (USFWS, 2001). This bird's primary winter range is along the Atlantic and Gulf coasts from North Carolina to Mexico and into the Bahamas and West Indies (USFWS, 1996). Piping plovers are commonly documented during winter in the Florida panhandle, with highest numbers of birds occurring in Franklin, Gulf, and Bay counties. Even though Florida has not been considered a primary wintering area for piping plover, diminishing habitat along other Gulf coast areas may be affording the piping plover new wintering grounds in Florida. These wintering grounds are still considered less suitable, thus forcing the piping plover to utilize isolated patches. As a result, critical habitat has been designated for piping plovers along the Gulf coast of Florida.

Critical Habitat

Wintering critical habitat for the piping plover was designated on July 10, 2001 (66 *Federal Register* 36038). *Critical habitat* refers to specific geographic areas that contain the essential habitat features necessary for the conservation of threatened and/or endangered species. Although only a small area near Test Site A-18 on the north side of SRI has been designated as critical habitat, piping plovers may be found any place that affords proper foraging and sheltering resources. 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. All of these habitat types can be found on Eglin's portion of Santa Rosa Island (SRI). Although it is possible that piping plovers could use any one of these habitat types at any time during the wintering season, studies have shown that wintering plovers spend 76 percent of their time foraging for invertebrates found just below the surface of wet sand (Johnson and Baldassarre, 1988).

Eglin AFB Natural Resources Branch and volunteer personnel have periodically conducted shorebird surveys on SRI during the wintering season. These surveys included participation in the International Piping Plover Census in January of 1991, 1996, and 2001. Piping plovers were not sighted on Eglin's property during any of these official surveys. During the 2001 survey, the closest sighting occurred at Navarre Beach State Park and Big Sabine Point (Ferland and Haig, 2001). Volunteers from the Choctawhatchee Audubon Society have conducted periodic shorebird surveys on SRI, during which six piping plovers were documented foraging within the designated critical habitat. Two shorebird surveys were conducted on SRI during January and February of 2003, during which no piping plovers were sighted (Fenimore, 2003).

Least Tern

The least tern *(Sterna antillarum)* is the smallest of the North American tern species. It is currently state-listed as threatened, with only interior U.S. populations federally listed as endangered. On Eglin AFB, nesting colonies have been documented on open, flat areas on SRI and several gravel rooftops on Eglin Main. Successful nesting on SRI is rare, primarily due to heavy predation from feral cats. While most colonies have been documented on the easternmost portion of Eglin's SRI property, another colony was recently documented near Test Site A-17 (Miller, 2003).

Southeastern Snowy Plovers

The southeastern snowy plover (*Charadrius alexandrinus*) is state-listed as a threatened species and is one of several shorebird species found on Eglin barrier island property. During the breeding season, these birds may be found foraging anywhere along the SRI beachfront. Nests are typically laid in the wrack line near vegetated areas and will be abandoned if disturbed. Vehicular and foot traffic, storms, and predation by feral cats are considered the primary causes of nest failure. Eglin beach property contains the highest densities of snowy plovers (37 percent of Florida's breeding pairs) ,making it one of the most productive nesting areas in the state (U.S. Air Force, 2002c).

Bald Eagle

Bald eagles feed primarily on fish, but may also feed on other species of birds, small mammals, and turtles. Adults average approximately three feet from head to tail, weigh approximately 10 to 12 pounds, and have a wingspread that can reach seven feet. Generally, female bald eagles are somewhat larger than the males (USFWS, 2000a).

Breeding pairs of bald eagles mate for life. In the south, breeding season begins in the winter. Nests are generally constructed of sticks, pine needles, and grass, measuring up to six feet across and weighing hundreds of pounds. Females lay from one to three eggs, which are incubated for approximately 35 days. After four months the young leave the nest (USFWS, 2000a). One nest is known to exist near Rocky Bayou (Figure 3-14). This species was once described as rarely sighted in the Yellow River area (Florida Department of Natural Resources, 1991), but has been seen lately with increasing frequency particularly near the mouth of the Yellow River (Craft, 2001). Adults and juveniles have been sighted, indicating that bald eagles may be nesting within the area as well feeding. A survey may be necessary to identify any nesting sites within the region of influence.

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APPENDIX E

EROSION ANALYSIS OF YELLOW RIVER PINE BLUFF BOAT RAMP AND TRAINING AREA

EROSION ANALYSIS OF YELLOW RIVER PINE BLUFF BOAT RAMP AND TRAINING AREA

1.1. BACKGROUND

1.1.1 Purpose

The purpose of this technical report is to document the geomorphological resources and adverse riverbank erosion conditions of the Yellow River Pine Bluff Training Area (PBTA) and develop preliminary corrective action recommendations in support of the *Eglin Air Force Base Estuarine and Riverine Programmatic Environmental Assessment*. The information presented herein was collected through a site visit, a preliminary site survey, photographic documentation, and a review of applicable literature. Using this report as an initial assessment, solutions to the problem of erosion at all military-use boat ramps along the Yellow River can be developed to prevent further adverse effects to the environment while alleviating or preventing constraints on special operations training missions.

1.1.2 Methods and Materials

The PBTA was visited 12 February 2002 to perform preliminary site surveys and document site resources and condition. A "snapshot in time" record of features and conditions was recorded with photographs and a site survey. The site survey was accomplished by establishing a baseline from which site feature measurements were taken. Photographs and baseline measurements were accompanied by field notes. No sampling was performed at the site. In the sections that follow, field and office data are discussed and corrective action recommendations are presented.

1.2 SITE REVIEW

This section locates and generally describes the PBTA, discusses dedicated land use, and provides a review of the geomorphological features within the realm of influence of the PBTA.

1.2.1 Locations and Description

The PBTA is located in Okaloosa County, Florida Township 2 North, Range 26 West, Section 29 north of Range Road (RR) 211. An approximately 1.7 mile unpaved tertiary road intersecting RR 211 provides site access. The features of the approximately 0.37 acre training site include parking areas, gravel boat ramp, trainee bleachers, and riverbank boat landing.

1.2.2 Land Use

The PBTA is primarily used by the Army and Air Force special operations units for student training in river and swamp environments. Students enter the Yellow River at one of four primary access points, among which the most heavily used is the Pine Bluff Boat Ramp. During a given month, up to 240 Army Ranger trainees may use these access points, deploying up to

28 zodiac rafts. The boat ramps are used by other special operations units and recreational users, but to a lesser degree. During boat entry the zodiacs are lined against the bank and trainees embark at the bank and paddle downstream.

1.2.3 Resource Inventory and Assessment

The PBTA is located within the floodplain of the Yellow River, which constitutes the Eglin Air Force Base northern land boundary. As such, the site is a product of alluvial geomorphology erosion and deposition processes and wetland hydrology. The primary interactive components of the site discussed in the sections that follow include the Yellow River, the Pine Bluff Slough, and the Pine Bluff Training Area grounds and riverbank landing. The natural and anthropogenic processes associated with these components are critical to understanding site conditions, resource impact potentials, and corrective intervention.

Yellow River Meander

The Yellow River is classified as a meandering alluvial channel experiencing aggradation and degradation. Alluvial refers to streams that are formed in materials that have been and can be transported by the stream. In alluvial stream systems, banks will erode, sediments will be deposited, and floodplains will undergo alteration over time. Alluvial channels continually change shape and position as a result of forces exerted on channel beds and banks. The river meander is the most efficient way in which gradient and velocity are balanced under different conditions of discharge, sediment load, and channel roughness. The meander is the river feature that applies the brakes to channel flow. This is the reason that, on average, channel flow in fluvial mountain streams is the same as alluvial floodplain streams – approximately three to five feet per second.

Alluvial Processes

Alluvial channel bed aggradation and degradation and bank erosion are identified as dominant alluvial processes affecting the form and function of the Yellow River meander segment associated with the PBTA. These processes are briefly described in the next section, followed by a discussion of the influences of these processes on the PBTA.

1.2.4 Channel Erosion and Deposition

Aggradation and degradation is the raising and lowering of the channel bed. These processes not only affect the impacted stream but the tributaries to the stream and stream to which it is a tributary. A degrading condition in a principle stream can also cause tributaries to the stream to degrade, which increases sediment loads to the degrading stream. In sand bed streams, sand is easily eroded and is continually being moved and shaped by stream flows. Human activities that alter stream aggrading and degrading processes can have far-reaching compound effects on downstream sediment supply and transport capacity. Principal meander channel features discussed in this review include the river bend cutbank and point bar.

Some river bends have been known to move their banks a mile or more in a single year (Grissinger and Little, 1986). Flowing water in a river does not all move at the same speed; the current is fastest at the surface where it is not slowed by friction with the riverbed. As flowing water enters a river bend it is flung against the outer riverbank. Near the bank it plunges downward in a spiral motion with the surface current going toward the outer bank and the bottom current going toward the inner bank point bar. The spiral flow of the river current trains the force of the current onto the outer bank, causing scouring of the outer bank and deposition on the inner bank. Over time, a deep pool develops at the point of scour and a sandbar develops on the inner bank (Figure E-1). Armoring the outer bank does not stop the sediment conveyance; at best it moves the scour hole somewhere else. The key to controlling outer bank scour is controlling the spiral flow of the river current (Kunzig, 1989).

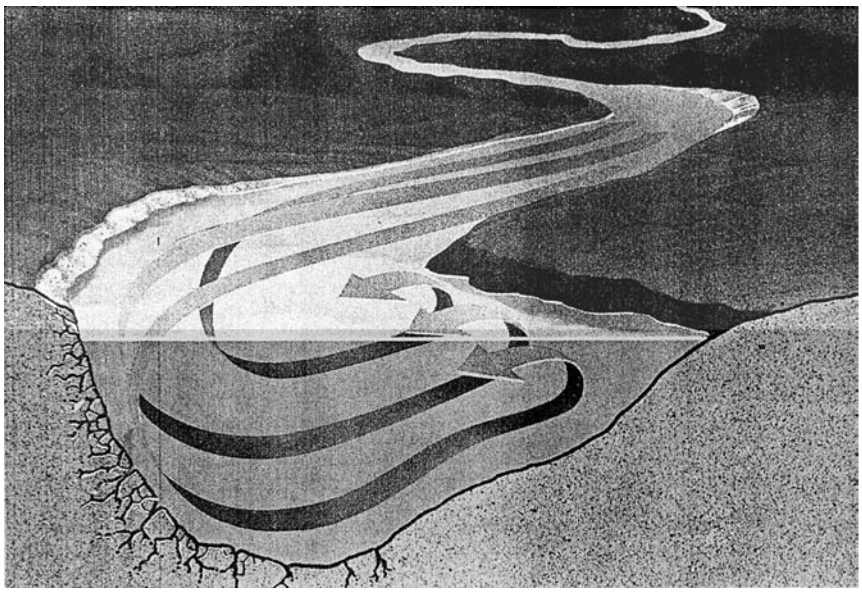

Figure E-1. Typical River Bend Cutbank and Point Bar Water Flows
(Kunzig, 1989)

The presence of a point bar opposite a cut bank is evidence of channel segment instability. At migrating bends on otherwise stable channels, point bars are usually wide and unvegetated, and the opposite bank is cut by erosion. Cut bank erosion adds to the overall instability of the channel segment requiring bedload adjustments and downstream sediment redistribution.

Bank Erosion

Under natural conditions streambank instabilities occur as a result of channel entrenchment and scouring of bendway cutbanks. Bank retreat is primarily a result of mass failure of overheightened and oversteepened banks. Indicators of active bank erosion include falling or fallen vegetation along the bank, tension cracks along the bank surface, slumps, live vegetation in the stream, fresh vertical bank faces, and fresh point bar of downstream sediment deposits.

Scour of the riverbed and bank toe increases the bank height and slope angle, decreasing its stability with respect to mass failure under gravity. Overheightening and oversteepening of the banks continues until the forces tending to cause failure balance those tending to oppose failure; mass failure is then imminent. Failure mechanisms depend on the topography (height and steepness) and stratigraphy of the bank and the physical properties of the bank materials (Little et al., 1982).

Noncohesive bank materials such as sandy soils tend to fail from bank slides and sloughing as the soil particles lose their shear strength because of saturation with water. Cohesive bank materials such as clays tend to fail from mass wasting when undercut or saturated. In composite bank materials, noncohesive materials may be protected from failure by adjacent cohesive layers.

Bank instability due to mass failure will be a chronic problem for all locations where the flow conditions are sufficient to erode bank slough material from the bank toe. Bank degradation is primarily attributed to changes in land use. Degradation results from upstream movement of a knickpoint often in the form of a headcut or overfall, which form where the channel bed breaks through resistant clay substrata. Upstream of the headcut, channels appear to be reasonably stable, but downstream the channels lose their stability from overheightened and oversteeped banks. The flow is responsible for transporting the failed material from the basal area of the bank toe resulting in steeper banks. Without basal scour and toe erosion, mass failures lead to bank slope reductions and stabilization within a few years (Grissinger and Little, 1986).

Condition Assessment

The features of the Yellow River meander are illustrated in Figure E-2. Based on preliminary evidence obtained during the field evaluation the Yellow River meander directly downstream of the PBTA is in an unstable condition. The meander cutbank is experiencing active bank erosion and channel migration (Figure E-2c). The relatively fresh sediment deposits on the point bar (Figure E-2f) opposite the cutbank are evidence of the cutbank scouring that results in channel migration. Vegetation along the cutbank also shows signs of soil loss. A mature longleaf pine tree was observed in the water (Figure E-2d); the riverbank apron soil materials that are typically present following tree loss had also been eroded. Numerous shrubs were observed to be leaning near horizontal by roots to a declining cutbank soil matrix (Figure E-2e). Data for calculating the rate of migration were not available.

Figure E-2a. PBTA Upstream View of the Yellow River

Figure E-2b. PBTA Downstream View of the Yellow River

Figure E-2c. River Bend Cutbank

Figure E-2d. River Bend Cutbank Fallen Longleaf Pine

Figure E-2e. River Bend Falling Trees and Shrubs

Figure E-2f. River Bend Point Bar

Figure E-2. PBTA River Bend Cutbank and Point Bar Features

Pine Bluff Lake Slough

The Pine Bluff Lake Slough at one time was the channel for the Yellow River. Once river channel flow was removed, the form and function of the abandoned course drastically changed. This floodplain portion of the Yellow River now serves as an important regulator of flood and erosion control and groundwater recharge. Anthropogenic activities that in any way alter these hydrologic functions can degrade the receiving river system. The following narrative briefly discusses the soils, wetland vegetation, and hydrologic functions important to this review.

Soils

The floodplain soils along both sides of the slough are the hydric Kinston-Johnston-Bibb soil series that are generally characterized as very deep, poorly drained, moderately permeable soils that formed in stratified loamy and sandy recent alluvium. The typically dominant Kinston series soil is flooded a few to several times each year, and the water table is within 10 inches of the surface during periods of high rainfall. The loamy sediments range from 40 to 60 inches or more over gravel that is stratified with loamy and sandy material. Organic carbon content decreases irregularly to depths of 50 inches. Dark concretions are common in some pedons. The soils are strongly acid or very strongly acid.

Wetland Vegetation

The vegetative community of the Pine Bluff Lake Slough is a bottomland hardwood swamp. The dominant woody vegetation is bald cypress (*Taxodium distichum*) and water tupelo (*Nyssa sylvatica*). Titi (*Cyrilla racemiflora*) and sweetbay magnolia (*Magnolia virginiana*) occupy the fringe of upland transition areas. The slough bottomland hardwood swamp is shown in Figures E-3a through E-3d.

Hydrology

Since the abandonment by the Yellow River, the slough has undergone extensive rebuilding of the wetland landscape. With the exception of the existing open water slough, most of the abandoned course has been filled with sediment and occupied by vegetation. In its current condition, the slough and adjacent bottomland hardwood wetlands actively regulate extreme fluctuations in flooding and erosion that are important to the overall function of the river system. Wetlands help control erosion in the same manner they reduce flooding, by reducing the magnitude and velocity of channel flow and retention of suspended materials such as sediment.

The PBTA is located at the mouth of the slough at its confluence with the Yellow River. Water flow that does occur through the slough is primarily dependent on fluctuations in the water level of the Yellow River. Typically, slough water flow is a discharge event as the wetlands slowly drain. It is important to the maintenance of this floodplain system that localized bank erosion does not exceed the transport capability of the slough flow regime otherwise the channel may begin to fill with sediment which over time could compromise the function of the system. The bank of the slough adjacent to the boat ramp exhibits evidence of frequent disturbance that have initiated bank erosion. The area above the bank has been used for parking and/or troop gathering, which has compacted the soil and increased runoff. Attempts to correct the problem with sandbags have been relatively ineffective (Figures E-3e and E-3f).

Figure E-3a. Entry to Pine Bluff Lake Slough

Figure E-3b. Slough Midpoint

Figure E-3c. End of Slough Open Channel

Figure E-3d. Adjacent Stand of Water Tupelo and Cypress

Figure E-3e. Eroded Slough Bank Near Boat Ramp

Figure E-3f. Denuded Slough Grounds Near Boat Ramp

Figure E-3. Pine Bluff Lake Slough

PBTA Site

The PBTA is comprised of an instruction area, boat ramp, and boat landing site that are used by special operations units. Features of the PBTA site are presented in Figure E-4.

PBTA Instruction Area

The PBTA instruction area is comprised of parking, bleachers, and open areas for student instruction. The grounds have been cleared of trees and shrubs except for two mature longleaf pines along the riverbank. Ground cover is comprised of native and introduced grasses (Figures E-5a and E-5b). Three four-tier bleachers, with a total length of approximately 83 feet, are located on the grounds (Figure E-5b). The overall slope of the grounds area is nearly level and no active erosion sites were identified.

The Yemassee soil series that composes the training grounds consists of very deep, somewhat poorly drained, moderately permeable, loamy soils that formed in marine sediments (Table E-1). These soils are on nearly level terraces and broad flats of the lower Coastal Plain. The water table is about 1.0 to 1.5 feet below the soil surface for as much as 4 months during winter and early spring in most years. The soil is extremely acid to slightly acid in the A horizon and extremely acid to strongly acid in the B and C horizons. This soil is discussed in greater detail in the boat landing section on page E-11.

Boat Ramp

The boat ramp is constructed of gravel and lined along the sides and at the waters edge with sandbags. One side of the boat ramp is covered by salvaged concrete blocks. The ramp is approximately 20 feet wide at the water's edge. The boat ramp gradient is about 5 percent. Surface runoff from the surrounding training grounds and denuded slough area are eroding the toe of the cutbank on each side of the boat ramp. Sandbags have been placed along the ramp banks to protect the near vertical cutbank slopes (Figures E-5c, E-5d, and E-5e).

Table E-1. PBTA Landing Bluff Yemassee Soil Profile

Soil Horizon	Characteristics
A, 0 to 6 inches	Black loamy sand; high organic matter; weak very friable structure; many fine roots; many medium holes
E, 6 to 11 inches	Gray to pale brown, loamy sand; weak very friable structure; many fine roots; few fine holes; iron depletions
Bt, 11 to 26 inches	Pale brown sandy clay loam; friable subangular blocky structure; common fine roots; few medium root channels; many yellowish brown masses of iron accumulations
Btg1, 26 to 36 inches	Gray sandy clay loam; friable subangular blocky structure; few fine roots; many strong yellowish brown iron accumulations; clear smooth boundary
Btg2, 36 to 45 inches	Gray to grayish brown sandy clay; friable subangular blocky structure; few fine roots; many yellowish brown iron accumulations
Notes Soil moisture is classified as aquic – a saturated soil that exhibits anaerobic conditions and is virtually free of dissolved oxygen. The soil is somewhat poorly drained and has moderate permeability. The water table is about 1 to 1.5 feet below the surface for as much as 4 months during winter and early spring in most years. Examination of the landing bluff soil profile was limited to a depth of 45 inches. These soils may transitions from a sandy clay texture to a single grained sand texture at about 70 to 90 inches making sand a potential constituent of the Yellow River channel.	

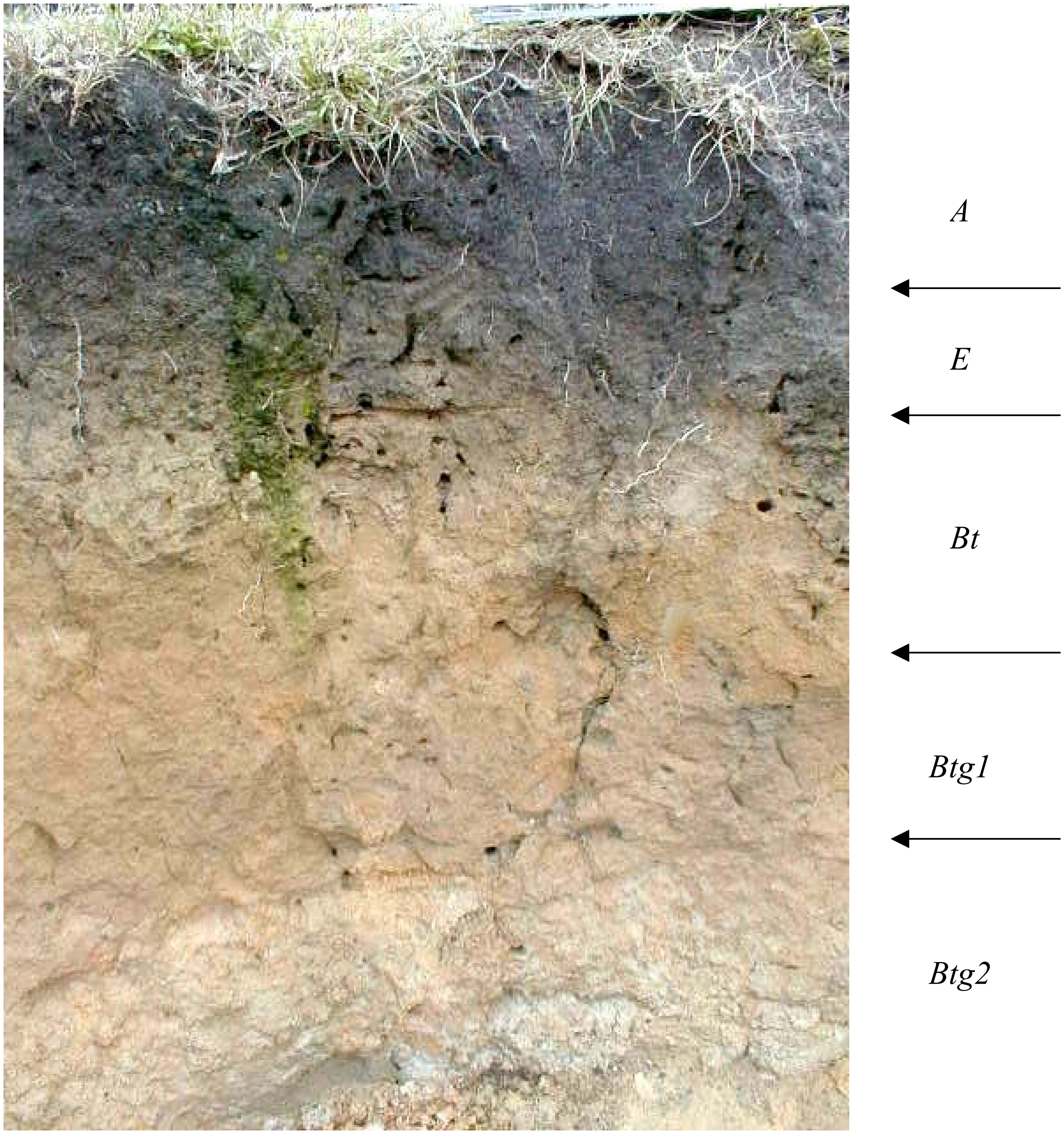

Figure E-4. PBTA Landing Bluff Yemassee Soil Profile

Figure E-5a. PBTA Grounds View Towards River

Figure E-5b. PBTA Grounds from Beginning of Boat Ramp

Figure E-5c. Boat Ramp Water Entry

Figure E-5d. Boat Ramp Cutbank

Figure E-5e. Boat Ramp Water Exit

Figure E-5. PBTA Instruction Area and Boat Ramp

Boat Landing

The boat landing covers approximately 172 feet of riverbank from the downstream edge of the boat ramp to the edge of the cleared area. Military and recreational use of the area has contributed to mass riverbank failure, loss of training area, and direct sedimentation of the Yellow River. The following narrative discusses the bank slope failures occurring along the boat landing riverbank.

The human- and river-induced alterations of riverbank slope and configuration have been dramatic (Figures E-6a through E-6f). Bank slopes have attained an overall vertical bluff face configuration and a narrow clay terrace at the base of the bluff. Loss of native longleaf pine trees that protects the site from erosion is imminent (Figures E-6e and E-6f).

The principal mechanics of bank failure along the landing include highly concentrated surface disturbance from student entry into watercraft, boat activities, and periodic flooding events that further saturate the soil and expose the face of the bank bluff to erosive water velocities. Prior to disturbance of the site to accommodate river training activities, the landing bank area was vegetated by native grasses, shrubs, and trees that protected the riverbank soils from erosion. With vegetation in place, the bankslopes were maintained at a more stable grade. The existing grade of the boat ramp is a likely benchmark of previously stable slope grades for the upstream portion of the landing area (Figures E-6c and E-6d). The lower portion of the landing area is strongly influenced by the Yellow River erosion processes at the river bend. The close proximity of the landing site of a naturally migrating meander of the Yellow River increases the susceptibility of the area to natural erosion processes; however, military and recreation activities have increased the mass failure of the riverbank and degradation of the PBTA site.

During Army Ranger training events, zodiac boats are lined up against the bank and the students enter their boats from the bank. To access the boats moored along the toe of the bluff, students must breach a vertical drop of 3 to 3.8 feet (Figures E-6a through E-6f). On the narrow terrace at the toe of the bluff, training activities disturb the exposed soils. The increased water elevation and velocity of the Yellow River during flooding events further erodes the face of the bluff causing sloughing of soil material directly into the river channel. The result has been the development of an irregular bluff with a vertical or negative slope bank face that periodically sloughs bank material into the river. It is estimated that over the last 30 years of use, the riverbank has migrated 30 feet or more inland.

Figure E-6c illustrates the tendency for the upper sandy loam organic soil horizon bound by grass roots to fail following loss of the underlying sandy clay loam soils. The sandy clay to sandy clay loam bluff terrace at the water edge is the area built up by bank sloughing events. The upstream portion of the landing along the fringe of the confluence with the Yellow River shows minimal erosion below the water line. The downstream portion of the landing near the bank edge shows evidence of exposure to river currents that have scoured and transported bank sloughing materials. Note the exposed roots of the longleaf pine in Figures E-6e and E-6f. A delineation and description of the landing bluff soil is presented in Table E-1 and illustrated in Figure E-4.

Figure E-6a. Landing Bluff From Top of Bank

Figure E-6b. Cross Section of Landing Bluff from Boat Ramp

Figure E-6c. Landing Bluff Exhibiting Tendency for Subsoils to Failure Followed by Failure of Sandy Loam Topsoils

Figure E-6d. Landing Bluff Profile Showing Tension Cracks and Uneroded Bank Toe Slump Area

Figure E-6e. Before-and-After View of Bluff Bank Loss Associated with Tree Dislodging from Bank

Figure E-6f. Longleaf Pine with About 50 Percent of Underlying Soils Washed Away Exposing Root Mass

Figure E-6. Pine Bluff Training Area

1.3 GUIDELINES AND RECOMMENDATIONS

The following guidelines and recommendations were formulated as a baseline of viable alternatives for developing site-specific solutions to identified problems. Preliminary treatment strategies considered include biotechnical as well as structural measures that afford long-term remedies. It follows that attention must be given to each of the interactive system components previously discussed. The objective is to provide continued mission support while minimizing interference with natural processes. Guidelines for making river bank treatment decisions should include a theoretical as well as practical framework, which considers the validity and potential success of restoration or rehabilitation projects. A restoration or rehabilitation project should apply these considerations:

1. *Evaluate Each Situation Independently*: Not all bank erosion is bad. Sometimes fixing the erosion may do more harm than good.
2. *Understand the Hydrology*: It is imperative that there is a through understanding of the present and historical channel morphology and sediment production, transport, and deposition dynamics to guide decision-making.
3. *Understand the History*: The same physical processes that operate today operated in geologic time although not necessarily at the same intensity.
4. *Apply Multiple Disciplines*: Because of the diversity and complexity of interactive resources, river designs require the integration of multiple skills and disciplines. The USFWS Hydrologist from Panama City should be including in the planning stage.
5. *Base River Treatment Designs on Bankfull Flow*: Channel shape is not controlled by catastrophic events but by bankfull flow, which is the dominant high flow conveyed by the channel occurring about once per year. Bankfull flow moves the greatest amount of soil and water for the least amount of energy. During bankfull flow the wetted channel perimeter increases in depth and width resulting in less sinuous, steeper flows.
6. *Consider Energy Dissipation of Floodplains and Channel Roughness*: River channel and floodplain roughness are the principal mechanisms by which a stream expends energy before it reaches the damaging stage of bank and bed erosion. A simplistic view of the order of energy expenditure is overcoming internal friction, overcoming the friction of bed and banks, transporting organic debris and sediment, and eroding banks and beds. Therefore, it is the removal of roughness elements that initiates the onset of riverbank and bed erosion. There is a direct correlation between stream meandering and the lack of channel roughness.
7. *Understand Sediment Transport*: Streams are the theoretical conveyor belts used by watersheds to move energy and materials to the lowest point on the landscape. Stream-bound watershed sediments are constantly being suspended, transported, and deposited within the channel and floodplain system. Sediments move during low flow conditions as well as during major events, resulting in sediment pulses or slug downstream movements of high volumes at one time.

1.3.1 Yellow River Meander

It is important to understand that protecting a channel bank from erosion at one location might create new problems upstream and/or downstream. Site-specific changes in channel meander erosion or deposition may be the river's response to changes in discharge characteristics, sediment loading, or other action occurring outside the spatial limits of the project area. Although aggradation and degradation processes may seem random events, they are in fact responses of alluvial systems to adjust to change and achieve a level of equilibrium. It is therefore difficult to make a determination of the channel shape and configuration under current or future conditions. Regardless of the issue, decisions with regard to river treatments are difficult and complex. There is a tendency to apply increased project scrutiny with respect to fish passage, instream habitats, and the dynamics and functions of river system.

The Yellow River meander cutbank scouring and point bar sediment deposition has created unstable riverbank conditions that are contributing to the erosive bank conditions of the lower portion of the PBTA boat landing. ***The critical conditions for this type of bank instability suggest two possible stabilization strategies: flow regulation sufficient to create noneroding conditions at the bank toe, or bank toe protection.*** One option is the dual utilization of revetment to protect the bank toe against discrete particle scour and to add sufficient mass such that the effective bank height is less than the actual height by an amount equal to the revetment height.

Another alternative to bank armor is the installation of specially designed vanes that are submerged in the channel in a manner that reduces secondary currents, attendant undercutting, and flow attack on concave cutbanks. Vanes also serve as sediment control structures.

1.3.2 Pine Bluff Lake Slough

The Pine Bluff Lake slough and associated swamps are an important roughness component of the Yellow River system with respect to energy and flow dispensation. Erosion of the PBTA boat landing and lower end of the slough bank could alter gradients in a manner that would adversely alter swamp outflow regimes into the Yellow River. It is important to maintain the integrity of the open channel component of the slough. ***Since the slough bank is not used for boat entry activities, vegetative techniques could be applied to stabilize eroding banks***.

1.3.3 PBTA Site

Controlling soil erosion of the PBTA site could best be accomplished by selectively using vegetative and structural treatments designed to fit the intended use of the area.

Training Grounds and Boat Ramp

Treatment of the training grounds should be focused on establishing and maintaining vegetative cover and controlling surface runoff. ***Barren areas require revegetation, and berms could be effectively used to divert runoff from areas such as the boat ramp where the banks of the ramp are susceptible to erosion.***

Boat Landing

Human activities that individually may be considered minor may cumulatively produce major changes in the local and overall characteristics of the stream system. In some instances, improvements in stream conditions may net a greater departure from equilibrium than what existed before improvements. It is important that stream improvement engineering designs create conditions that foster trends toward natural stability in sediment supply and transport conditions. Riverbank armoring designs must take into account the response of the channel to continued disturbance and the anticipated response of the channel to the riverbank treatment itself.

Bank and bed toe stability are of paramount importance to the continued use of the PBTA boat landing since the area is dedicated to trainee operations that by their nature are prone to cause pronounced disturbance to unprotected areas. ***Because of the frequency and intensity of disturbance, vegetative measures alone are inadequate to stabilize eroded banks while supporting training use.***

Various grade and flow control structures can be used to stop further bed degradation or even to reduce bank heights by setting the grade control invert above the present channel bottom. Porous spur dikes and toe revetments can also be used quite effectively to stabilize banks. These structures are an effective remedy for mass bank failures since they decrease both the height and angle of bank and also prevent erosion of the toe. The toe revetment reduces bank height, but its lasting effect results from preventing removal of the toe material as basal endpoint control. In many cases a minimum height of toe revetment induces bank stability mainly by preventing removal of bank toe material, but also by permitting vegetation to be established on the bank just above the toe revetment (Little et al., 1982).

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APPENDIX F

TOXICITY OF M-18 SMOKE GRENADES

TOXICITY OF M-18 SMOKE GRENADES

The DoD sponsored a review of smoke and obscurant toxicity data by the National Research Council (NRC, 2000) in order to establish exposure guidelines for personnel in training or the general public. Insufficient data existed to establish exposure limits with respect to M-18 colored smoke grenades, and the NRC review concluded that additional studies should be conducted with animals to determine acute and subchronic effects of the combusted-dye products to people. Other important facts about the different M-18 smoke dyes condensed from the NRC report are discussed as follows.

Smoke grenade dyes include Solvent Yellow 33, Solvent Green 3, Solvent Red 1, Disperse Red 11, and a violet smoke dye composition consisting of Disperse Red 9 and DDA (1,4-diamino-2,3-dihydroanthraquinone).

Solvent Yellow 33. Studies with animals suggest that Solvent Yellow 33 will be rapidly absorbed from the respiratory tract after inhalation in humans and extensively metabolized, with metabolites excreted primarily in bile and eliminated in feces. The tissues of the human body do not appear to store significant quantities of Solvent Yellow 33. In short, this dye:

- Metabolizes quickly
- Is excreted
- Is not stored in tissues
- Is mutagenic in mouse lymphoma cells
- Skin irritant effects still under review
- Respiratory tract irritant effects still under review

Solvent Green 3. Solvent Green 3 was retained in the lungs of rats during a 70 hour post exposure period with an estimated minimum half-life of 22 days for clearance. Solvent Green 3 was not detected in other tissues during that period. Increased retention of Solvent Green 3 has been noted by other researchers. In short, Solvent Green 3:

- Is retained in lungs with a half-life of 22 to 280 days
- Is not stored in tissues
- Causes mild pulmonary inflammation and slight type II cell hyperplasia in lungs of rats

Solvent Red 1 and Disperse Red 11: There are no studies on the combustion products of the new M-18 red smoke formulation or Solvent Red 1. There is one study with rats on the retention of Disperse Red 11 that indicated rapid (>95 percent) clearance from the lungs within 24 hours. In short, for Solvent Red 1 and Disperse Red 11:

- There are a minimum number of studies, some conflicting.

- The mixture is nonirritating to skin.
- The mixture is irritating to eyes.
- It causes no lung hypersensitivity in mice.
- There is low or no mutagenicity.

Violet Smoke Dye (Disperse Red 9 and DDA (1,4-diamino-2,3-dihydroanthraquinone): This old formulation is still in use today; a new formulation for violet grenades has not been developed. The violet grenade mixture:

- Tested positive for mutagenicity in Ames assay.
- Converts easily to DAA (1,4-diaminoanthraquinone) from DDA.
- Is slightly more mutagenic following combustion (DAA is more mutagenic than DDA).
- Is a potential eye irritant (DAA) according to tests with rabbits. Moderate eye irritation occurred at a dose of .5 g over 24 hours
- Is acutely toxic to rabbits when ingested at 4.9 g/kg (grams per kilogram) body weight (DAA LD_{50} = 4.9 g/kg of body weight).

M-18 smoke grenades produce smoke through a chemical reaction of sugar and potassium chlorate. When combined, potassium chlorate oxidizes sugar to produce heat, and the heat in turn expels a dye from the grenade container. Once in the air, the dye condenses and forms a colored cloud. Potassium chloride is produced in amounts of roughly .25 pounds per grenade. Magnesium carbonate acts as a coolant and functions to prevent excessive decomposition of the dye. The major component of the cloud is the unaltered dye in its original chemical form. Ninety to 95 percent of the dye remains unchanged during the combustion process. The 5 to 10-percent of dye material that does combust decomposes into polynuclear aromatic hydrocarbons, polynuclear organic materials, carbon dioxide, carbon monoxide, hydrochloric acid, and water. After discharging from the grenade cannister, smoke material readily dissipates and deposits out of the atmosphere onto the ground or water surface, where it eventually binds to soil and sediments.

Once deposited onto land and water surfaces, smoke dyes would undergo decomposition from exposure to light. Approximately 40 to 50 percent of the dye would decompose into smaller, less-persistent molecules within a period of 50 hours of exposure to sunlight, after which photoreactivity decreases. Subsequent degradation varies: Solvent Yellow 33 has a half-life of 6 months, Disperse Red 11 has a half-life of 2 to 3 months, and the other M-18 dyes generally have half-lives of less than a few days (U.S. Air Force, 1997a). Photoreactions do not eliminate all of the dye material. Dyes are further reduced by reaction in compacted sediments. Nutrients from combustion products are minor in amount and would have no significant impact on large water systems such as Choctawhatchee Bay or Santa Rosa Sound. Smoke grenades are not used in the Yellow River. Smoke grenades have the potential to affect air quality, water quality, sediment quality, and biological resources.

Smoke-grenade dye amounts released into the environment can be expressed in grams or milligrams per unit volume (mg/m^3) for air, water, and sediment exposure and grams per weight (mg/kg) for biological exposure.

With the exception of the violet smoke grenades, M-18s in use at Eglin have been reformulated, though some of the dye compositions remain the same (e.g., Solvent Yellow 33 is still used). The new formulations have not been thoroughly studied for potential health effects from exposure to combusted materials, but were designed to reduce the toxicity found in older formulations. Studies performed on older, more toxic dyes showed that a single dose of 2 g/kg applied to the skin causes minimal to mild dermal and gastrointestinal effects, whereas repeated exposures of 50 to 1,000 mg/kg cause more serious effects to the skin, gastrointestinal tract, and liver. A single inhalation exposure to approximately 1,000 mg/m^3 of the older dyes is not toxic, whereas, repeated exposures of 1,290 mg/m^3 cause irritation and inflammation of the nasal cavity (U.S. Air Force, 1997). In experiments with rabbits, 4.9 mg/kg DAA, a breakdown product of violet smoke grenade compositions, was determined to be acutely toxic when ingested, with this dosage causing lethality in 50 percent of test animals (LD_{50} = 4.9 mg/kg) (NRC, 2000). At this level, 4.9 mg would be acutely toxic to an animal weighing 1 kg. Likewise, an animal weighing 45.4 kg (100 lb) would have to ingest 222.5 mg or bio-concentrate that amount through food sources in order to experience acute effects. Chronic effect concentrations are unknown. Because DAA appears to be one of, if not the most, toxic components of smoke grenade by-products, and data are available for rabbits, the toxicity data for DAA with rabbits will serve as conservative (i.e., overly cautious) ingestion/bioconcentration criteria for all wildlife but only as a screening tool, meaning only for the purposes of identifying situations that may require more rigorous scientific examination.

The selected water quality criterion is .2 mg/L, the level that exhibited chronic effects with algae exposed to Solvent Yellow 33 Dye. Effect concentrations are not available for all dyes and dye by-products.

Analysis of Smoke Grenade Use in the Estuarine and Riverine Areas

Analysis of chemical materials will focus on smoke grenade materials since the amounts expended are easily quantified and this item potentially produces more emissions in a given location than any single item employed in riverine and estuarine missions. To analyze potential effects, combusted dye materials are estimated within a given area to determine at what point, or within what space, a potentially toxic level would be reached. No federal or state standards exist with respect to dye material expenditures. The primary risk is to the military users of this item, in particular instructors that may experience repeated exposure to dye smoke.

Resources Potentially Affected

Smoke grenade dye material would potentially affect air, water, and sediment quality and biological resources.

Impacts to Air Quality

Impacts to air quality would be temporary and localized. This issue was analyzed by estimating the potential temporary concentration within a given air space and comparing it with an acceptable level based on available toxicity data with old smoke grenade formulations. The analysis is discussed as follows.

A certain air space is required for smoke material, upon the dissemination of a signal smoke, to reach a level above 1,000 mg/m^3, which is a no-effect level for a single inhalation. Above this level it is assumed that a single exposure, and certainly repeated exposures, would begin to have adverse effects on air quality. Dissemination of 136 g of smoke material, the amount in one grenade, to an air concentration of >1,000 mg/m^3 would expand to a space of 136 m^3. This potentially toxic area would exist for a short time period due to rapid dissipation of smoke particles. Less than 26 m^2 (0.006 acres) of ground or water surface area would be exposed to these concentrations for a brief period after the smoke is released. The rate of dissipation of the smoke is not known, so that the time that the smoke is confined to a 136 m^3 area cannot be calculated. There were a total of 151 missions that used smoke grenades in conjunction with activities at TA D-54 from 1996 to 1999. The average number of grenades expended per mission was 4.5. If 136 m^3 were exposed per grenade to >1,000 mg/m^3, then 4.5 grenades would temporarily expose a volume of air of 612 m^3 or a surface area of 117 m^2 (.027 acres) to potentially toxic levels. This area is less than .0005 percent of the total surface area of TA D-54.

Danger to personnel involved in training missions utilizing colored smokes is minimal if use is in accordance with standard procedures and current mitigations and with conversion of smoke material to less toxic smokes. Air Force procedures call for use of smoke grenades by qualified instructors only and for the throwing of smoke grenades in a direction that the wind will dissipate the vapor away from personnel. The effects to air quality would be temporary and insignificant.

Impacts to Water Quality

Dyes used in smoke grenades have limited solubility, which means that only a small amount of the dye will dissolve in water and the rest will remain as solid particles. The solubility of Solvent Yellow 33 ranges from 0.089 mg/L (89 parts per billion) at a temperature of 12 °C to 0.18 mg/L (180 parts per billion) at 22 °C, a range of concentrations was not acutely lethal to fish or aquatic invertebrates (Davidson and Horvatter, 1987). However, algal growth was significantly affected at solubility limits of .20 mg/L. The low solubility of the dyes means that residence in the water column would be short with the dyes ending up in the sediments.

The average number of Solvent Yellow M-18 grenades deployed per mission is 1.4 based on 151 missions from 1996 to 1999. The amount of Solvent Yellow Dye introduced into the environment each mission would then be 186.85 grams. If .20 mg/L is the concentration known to inhibit algal growth, then a minimal and temporary impact area based on water volume may be estimated. If 186.85 grams are divided by .2 mg/L, then 934,250 liters of water would have a concentration of .2 mg/L. This volume converts to approximately 200,000 gallons or 30,000 cubic feet, which is equal to the volume of a circular water body with a radius of 100 feet and a depth of 1 foot. Dye concentrations would continue to disperse to undetectable levels in the water column and ultimately be bound to sediments such that water quality impacts would be insignificant.

Smoke grenade dyes would temporarily affect water quality but would have no lasting or significant effects due to quick dispersal of materials in the water column.

Impacts to Sediment Quality

Given that missions utilizing smoke grenades occur monthly, some smoke dye, especially Solvent Yellow 33, should be present in the soil/sediment environment at all times, though it is unlikely that the same area is continuously affected due to variability in wind and wave conditions and changes in locations.

As previously mentioned, smoke grenade dyes would not stay in the air or water but be bound to soil and sediments. Once in the sediments, the extent of the effect of the dyes on sediment quality and on animals that live in the sediments has to do with the concentration of the dyes in the sediments, the availability of the dye to organisms, and the feeding and respiration mechanisms of organisms that live in the sediments. Chemical properties of the dyes such as the solubilities and partition coefficients indicate that once dyes are input into the environment, they will be absorbed or adhere to soil or sediments. Because they would be tightly bound to sediments, they would not be readily available to animals that live and feed in the water column. The degree to which the dyes move through the environment depends on how the sediments to which they are attached migrate.

Solvent Yellow 33 can be used as an example to estimate the amount of dye material potentially present in the sediments near TA D-54. Each grenade has a total of 136,000 mg of Solvent Yellow 33 dye. Ninety-five percent of the dye from each grenade, approximately 129,000 mg, would be introduced into the environment. Solvent Yellow 33 has a half-life of 6 months. This means that after one year, approximately 32,000 mg of Solvent Yellow 33 dye from each grenade used would persist in the environment. If 53 grenades are deposited on average annually, then 26 grenades represent the 6-month average. Twenty-six yellow grenades have a total of 3.5 million mg of Solvent Yellow 33 dye and approximately 95 percent, or 3.3 million mg, of this would be introduced into the environment over a six-month period. For the purposes of analysis, this entire amount is assumed to be incorporated into the sediments of TA D-54 though wind dispersal, water currents, and other means of transport that may carry dye materials over a much wider geographic area.

Impacts to Biological Resources

Bioconcentration is the increasing of a substance in the tissues of animals beyond the concentrations that exist in the animals' immediate surroundings, possibly as a result of repeated inhalation or ingestion, or due to the consumption of other plant or animal species, which have in turn ingested or incorporated the substance. Smoke grenade dyes possess certain properties that enable them to be bioconcentrated. Disperse Red 11, Disperse Red 9, and Solvent Yellow 33 have the potential to bioconcentrate approximately 1,000 times (NRC, 2000). Solvent Red 1 and Solvent Green 3 have potential bioconcentration factors of 10^5 and 10^7 but also have large molecules, which take longer to accumulate (Garrison et al., 1992).

A simple scenario may be developed to assess potential bioconcentration in the American oyster, a species that feeds by filtering the water column and lives in soft muddy bottoms. Though no oysters occur within TA D-54, this species can help illustrate how contaminants can be transported through bioconcentration.

If the filtration rate of oysters is known along with the amount of contaminant suspended in the water column or attached to sediments, then a theoretical concentration of dye in oyster tissues may be estimated. Since this would require sophisticated modeling, a bracketing approach using a range of possible concentrations was applied. Table F-1 lists a range of possible dye amounts incorporated into the water and assumed to reside at the sediment water interface where oysters feed. A one month use of grenades was assumed such that dye amounts initially equaled .02 mg/L, the assumed concentration in waters of TA D-54. Typical weight of one oyster (tissue) was assumed to be 45 grams. The maximum bioconcentration rate of oysters has been estimated at 100 times a given substance or contaminant filtered from the water and incorporated into tissues. To estimate the bioconcentrated amount of dye in oyster tissues, the initial concentration of dye in water was multiplied by 100 and divided by the tissue weight, which was 45 grams. A range of possible amounts was then calculated for the table below.

Table F-1. Potential Uptake by American Oyster: 1 Month Total Smoke Grenade Use

Percent Dye in Water	Initial Concentration (mg/L)	Total Dye Amount in One Oyster
0.01	0.00000002	4.4×10^{-12} mg
0.10	0.00000020	4.4×10^{-11} mg
1	0.00000200	4.4×10^{-10} mg
10	0.00002000	4.4×10^{-9} mg
100	0.00020000	4.4×10^{-8} mg

There are some important aspects with regard to oyster biology that make this scenario even more conservative: oysters typically filter algae at the 5 to 100 micrometer size, while dye particles range from .95 to 1.55 micrometers; in addition, some of the material filtered is passed back into the water column. To achieve the potentially toxic level of 4.9 g/kg observed in toxicity tests with rabbits, another organism would have to consume literally millions of oysters. Organisms that feed by ingesting sediments include various types of worms; these may also be able to bioconcentrate contaminants.

Potential Impacts on Wildlife

Wildlife would be potentially exposed to dye-colored smoke through inhalation, direct contact, and bioconcentration. The most likely opportunity for such exposure would be immediately after the smoke has been dispelled. Therefore, the primary hazard to wildlife, as with people, would be during use. Static acute toxicity tests indicate that Solvent Yellow 33 is not lethal to fish and aquatic invertebrates at its solubility limits ranging from 0.089 mg/L at 12 °C to 0.18 mg/L at 22 °C. However, in chronic tests, the green alga *Selenastrum capricornutum* exhibited significantly reduced growth at concentrations 0.20 mg/L. Chronic values were not available for fish and invertebrates.

Potential Impacts to Threatened and Endangered Species

Because smoke grenades are not used on the Yellow River, sturgeon in those areas would not be affected. There is a potential for sturgeon in Choctawhatchee Bay to be exposed to dyes that have been incorporated into the sediments. Impacts would only occur if the dyes have been bioconcentrated in the prey organisms of sturgeon to potentially toxic levels. Sturgeon in Choctawhatchee Bay typically feed over sandy sediments as opposed to muddy bottoms typical of the area under TA D-54. USFWS scientists have determined that sturgeon that spawn in the Choctawhatchee River spend their winters in Choctawhatchee Bay rather than migrate out into the Gulf of Mexico with increased numbers in Alaqua, Hogtown, and LaGrange Bayous. Prey organisms for sturgeon are insects, crustaceans (crabs, shrimp), molluscs (clams, snails), worms, and small fish. The potential for impacts from bioconcentrated dyes is expected to be low due to the wide geographic area in which these animals feed and their preference for prey organisms not generally found in the muddy sediments of TA D-54.

Potential Impacts to the Public

Military personnel are trained in the handling of smoke grenades and observe procedures to reduce or eliminate the potential hazards of inhaling dye smoke. The public would not be exposed due to safety procedures that prevent their access (or stop the training activity) to areas under use by military testing or training groups. Smoke would dissipate before reaching populated or civilian-used areas.

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APPENDIX G

SITE SELECTION ANALYSIS FOR ALTERNATIVE 5 RIVERINE LIVE-FIRE RANGE

SITE SELECTION ANALYSIS FOR RIVERINE LIVE-FIRE RANGE

1. INTRODUCTION

Six sites along the Yellow River and its tributaries were identified as potential candidate sites for a Live-Fire Riverine Range. Each site represents a mile stretch of water with sufficient depth to support mission activities. Using a Geographical Information System (GIS), buffer zones were created along each site to represent the effective and maximum ranges for both frangible and standard munitions (Tables G-1 and G-2). Targets would be placed within a munition's effective range. These buffers were established as a conservative measure to 1) allow for the possibility that weapons might accidentally be fired in any direction, or 2) account for stream segments with potential targets located on either side. Therefore, the buffers are of equal distance in any direction from a given site. The analysis in this section is designed to answer the following questions:

- What are the potential environmental impacts associated with each candidate site?
- Which munitions can be used at a given site with the fewest potential impacts?

Resources analyzed were people (population, residential land use, and environmental justice as determined by percent minority/low income), habitats (FNAI Tier areas), and sensitive species (i.e., species federally or state listed as threatened or endangered) (Figure G-1). Environmental justice impacts are discussed separately in Section 4, Results. Though not included in the GIS analysis discussion to follow, cultural resources were considered as a potentially affected resource of each candidate riverine site.

Streams and riverbanks are identified throughout Eglin as high-probability cultural resource zones. Some of these areas have been surveyed on Eglin, but many areas may have undiscovered or known but unsurveyed cultural resources. Thus, due to their association with rivers and streams, each candidate site has a high potential for affecting cultural resources. The greatest potential for effects would occur within the effective range of a given munition since the greatest amount of ground disturbance (i.e., from land clearing, target placement and live fire) would occur within that area. Consultation with AAC/EMH would be required for any site selected, and cultural resource surveys and/or consultation with the State Historic Preservation Office may be required.

Table G-1. Maximum Range Buffer Analysis for Impacts to People, Habitats, and Sensitive Species

Site Name	Stream Buffer Zone (m)	Total Area (acres)	Estimated Persons	Residential Land Use (acres)	FNAI Tier 1 (Acres)	FNAI Tier 2 (Acres)	FNAI Tier 3 (Acres)	FNAI Tier 4 (Acres)	Potential Salamander Habitat (acres)	Bog Frog Locations	Active RCW Cavity Trees	Inactive RCW Cavity Trees
Boiling Creek	250	226	0			25			11			
Broxson’s Landing	250	224	0			4			4			
Metts Creek	250	244	0			173			39			
Weaver Creek	250	233	0			44	99					
Weaver River	250	229	9									
Yellow River East	250	225	2			0	2		7			
Boiling Creek	600	690	0			156	2	3	39			2
Broxson’s Landing	600	679	0			7			7			
Metts Creek	600	740	0			554	6		161			
Weaver Creek	600	706	0			138	424	2		1		
Weaver River	600	666	23									
Yellow River East	600	661	5			73	33		94			
Boiling Creek	700	857	0			220	8	4	48			2
Broxson’s Landing	700	843	0			7			7			
Metts Creek	700	915	0			683	7		212			
Weaver Creek	700	875	0			169	538	10		1		
Weaver River	700	823	28									
Yellow River East	700	818	6			107	36		133			
Boiling Creek	3,100	9,431	15		293	4,009	1,157	41	1,088		6	75
Broxson’s Landing	3,100	9,312	114	18	107	2,006	1,021	10	271	2	42	142
Metts Creek	3,100	9,636	97	64		4,392	640	669	1,020	3	7	13
Weaver Creek	3,100	9,475	42			1,877	5,138	164	204	2		60
Weaver River	3,100	9,143	328	103		635	462	31	173	1		
Yellow River East	3,100	9,129	163	123		2,172	451	5	1,135	3		3
Boiling Creek	3,600	12,325	31		398	4,834	1,893	41	1,161		29	148
Broxson’s Landing	3,600	12,180	166	26	194	2,698	1,557	18	412	2	60	210
Metts Creek	3,600	12,553	161	110		5,536	792	871	1,133	4	14	40
Weaver Creek	3,600	12,371	73			2,381	6,404	180	354	2	3	70
Weaver River	3,600	11,981	472	166		941	921	119	173	1		
Yellow River East	3,600	11,961	292	157		3,206	470	10	1,238	3	4	17
Boiling Creek	4,800	20,835	314	130	732	6,801	4,303	94	1,191		67	264
Broxson’s Landing	4,800	20,621	408	167	373	5,113	2,467	64	589	3	104	328
Metts Creek	4,800	21,103	304	178		9,051	1,098	1,074	1,391	5	29	84
Weaver Creek	4,800	20,878	200	5		4,681	8,488	611	673	2	11	106
Weaver River	4,800	20,349	1,237	713		1,698	2,239	498	274	2		

Table G-1. Maximum Range Buffer Analysis for Impacts to People, Habitats and Sensitive Species Cont'd

Site Name	Stream Buffer Zone (m)	Total Area (acres)	Estimated Persons	Residential Land Use (acres)	FNAI Tier 1 (Acres)	FNAI Tier 2 (Acres)	FNAI Tier 3 (Acres)	FNAI Tier 4 (Acres)	Potential Salamander Habitat (acres)	Bog Frog Locations	Active RCW Cavity Trees	Inactive RCW Cavity Trees
Yellow River East	4,800	20,310	621	339		6,153	615	149	1,397	3	12	53
Boiling Creek	6,700	38,820	1,356	505	1,279	11,839	7,491	1,143	1,243	2	173	503
Broxson's Landing	6,700	38,485	1,261	501	919	8,657	3,100	1,944	1,026	5	181	542
Metts Creek	6,700	39,118	950	545	314	15,245	1,501	1,112	1,481	7	148	424
Weaver Creek	6,700	38,851	937	461	333	9,082	12,041	1,020	1,100	2	70	185
Weaver River	6,700	38,089	3,100	1,734		2,380	5,808	892	499	2		24
Yellow River East	6,700	38,010	1,459	890		11,780	1,513	997	1,415	4	84	267

Table G-2. Effective Range Buffer Analysis for Impacts to People, Habitats and Sensitive Species

Site Name	Stream Buffer Zone (m)	Total Area (acres)	Estimated Persons	Residential Land Use (acres)	FNAI Tier 1 (Acres)	FNAI Tier 2 (Acres)	FNAI Tier 3 (Acres)	FNAI Tier 4 (Acres)	Potential Salamander Habitat (acres)	Bog Frog Locations	Active RCW Cavity Trees	Inactive RCW Cavity Trees
Boiling Creek	25	20	0	0.0		0.44						
Broxson’s Landing	25	20	0	0.0								
Mett’s Creek	25	20	0	0.0		0.75			0.09			
Weaver Creek	25	20	0	0.0		0.14	4.61					
Weaver River	25	20	1	0.0								
Yellow River East	25	20	0	0.0								
Boiling Creek	100	82	0	0.0		4.42			1.17			
Broxson’s Landing	100	83	0	0.0								
Mett’s Creek	100	87	0	0.0		36.96			6.38			
Weaver Creek	100	84	0	0.0		6.67	23.90					
Weaver River	100	86	3	0.0								
Yellow River East	100	85	1	0.0					0.11			
Boiling Creek	150	126	0	0.0		9.87			4.16			
Broxson’s Landing	150	126	0	0.0								
Mett’s Creek	150	136	0	0.0		79.42			13.94			
Weaver Creek	150	131	0	0.0		17.49	43.61					
Weaver River	150	133	5	0.0								
Yellow River East	150	129	1	0.0					1.30			
Boiling Creek	460	482	0	0.0		82.98			27.94			2
Broxson’s Landing	460	476	0	0.0		6.71			6.71			
Mett’s Creek	460	520	0	0.0		393.66	3.84		101.33			
Weaver Creek	460	495	0	0.0		104.02	270.46	1.82		1		
Weaver River	460	470	17	0.0								
Yellow River East	460	466	3	0.0		28.48	23.30		47.51			
Boiling Creek	550	612	0	0.0		126.16	0.54	1.62	35.05			2
Broxson’s Landing	550	603	0	0.0		6.71			6.71			
Mett’s Creek	550	658	0	0.0		495.64	6.37		138.57			
Weaver Creek	550	628	0	0.0		125.54	365.28	1.82		1		
Weaver River	550	593	20	0.0								
Yellow River East	550	588	4	0.0		55.92	28.92		75.95			
Boiling Creek	1,000	1,448	0	0.0		479.15	64.18	4.72	88.01			4
Broxson’s Landing	1,000	1,424	0	0.0		54.98	4.38	0.07	6.71			
Mett’s Creek	1,000	1,529	0	0.0		1,114.06	25.58	5.21	373.67			
Weaver Creek	1,000	1,471	0	0.0		299.42	917.90	54.21		1		
Weaver River	1,000	1,385	46	0.0		13.50			10.00			

Table G-2. Effective Range Buffer Analysis for Impacts to People, Habitats and Sensitive Species Cont'd

Site Name	Stream Buffer Zone (m)	Total Area (acres)	Estimated Persons	Residential Land Use (acres)	FNAI Tier 1 (Acres)	FNAI Tier 2 (Acres)	FNAI Tier 3 (Acres)	FNAI Tier 4 (Acres)	Potential Salamander Habitat (acres)	Bog Frog Locations	Active RCW Cavity Trees	Inactive RCW Cavity Trees
Yellow River East	1,000	1,380	11	0.0		221.91	48.87		268.10			
Boiling Creek	2,000	4,409	0	0.0	128.01	1,808.21	419.52	16.08	573.15			19
Broxson's Landing	2,000	4,342	50	15.7		632.37	335.26	4.94	7.41	1	11	26
Mett's Creek	2,000	4,556	4	0.0		2,662.12	204.67	199.87	797.69	1		
Weaver Creek	2,000	4,445	2	0.0		935.84	2,742.53	119.66	52.64	1		26
Weaver River	2,000	4,242	192	47.5		95.97			140.31			
Yellow River East	2,000	4,236	34	0.5		758.10	299.33		823.17	3		

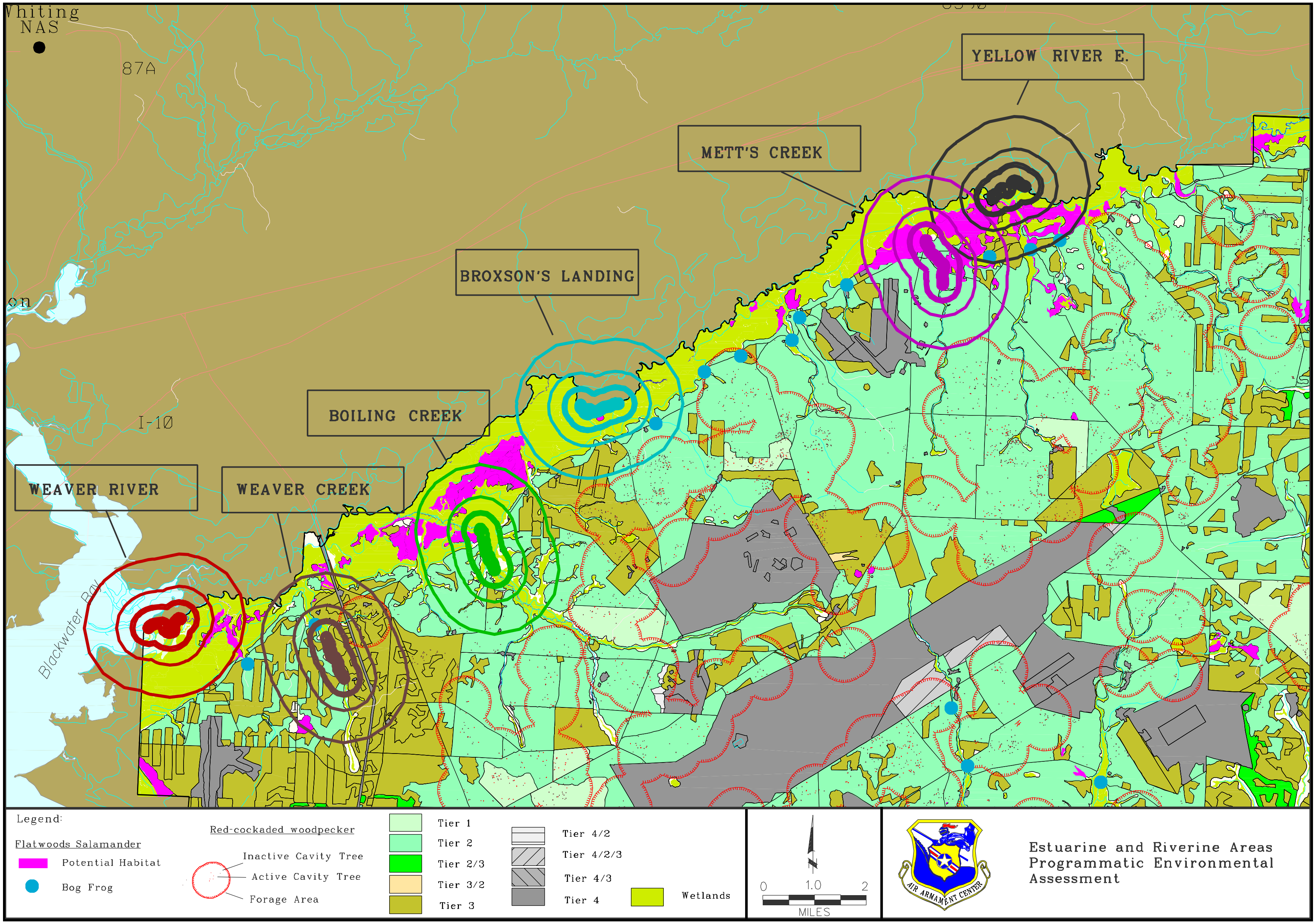


Figure G-1. Effective Range Buffers, Habitats, and Sensitive Species Therein

2. METHODS

At each site, buffer zones defined by the effective and maximum range of a given munition were overlaid upon various environmental, biological, and socioeconomic features using a GIS process known as spatial intersection. Effective and maximum ranges of munitions were provided by the Eglin Safety Office or obtained from the Federation of American Scientists Military Analysis Network website. This process involves clipping an input feature to the geographic extent of an overlay theme in order to produce results that include attribute information from both data sets. This attribute information includes the acreage or quantity of a feature within a buffer zone.

The input features for this study included Census 2000 population blocks and FDEP land use areas (Figure G-2) both inside the Eglin Reservation and on adjacent county land. Census population blocks were area-weighted based on each buffer zone for a given site (Figure G-3). This was accomplished by multiplying the effective Census block land area within a given buffer by the Census block's population density. This calculation assumes that the population is evenly distributed with the Census block and corrects for large water bodies (zero population areas). Land use areas that were attributed as any type of residential use (low density, medium density, or high density) were combined within each unique buffer.

Within the Eglin Reservation, FNAI Tier areas, potential flatwoods salamander habitat, bog frog locations, and red-cockaded woodpecker (RCW) cavity trees were also analyzed. The FNAI Tier areas were distinguished by their classification ranging from 1 to 4. A tier classification of 1 indicates a pristine habitat with each sequential classification representing degrees of degradation including the effect of anthropogenic activities (Tier 4). The RCW cavity trees were distinguished based on whether their use status was active or inactive.

The results were summarized based on total acreages or total counts within a buffer zone for a given site (Tables G-1 through G-3). These results provide a mechanism for comparing not only individual sites but also the potential effects associated with the effective and maximum ranges for each of the provided munitions.

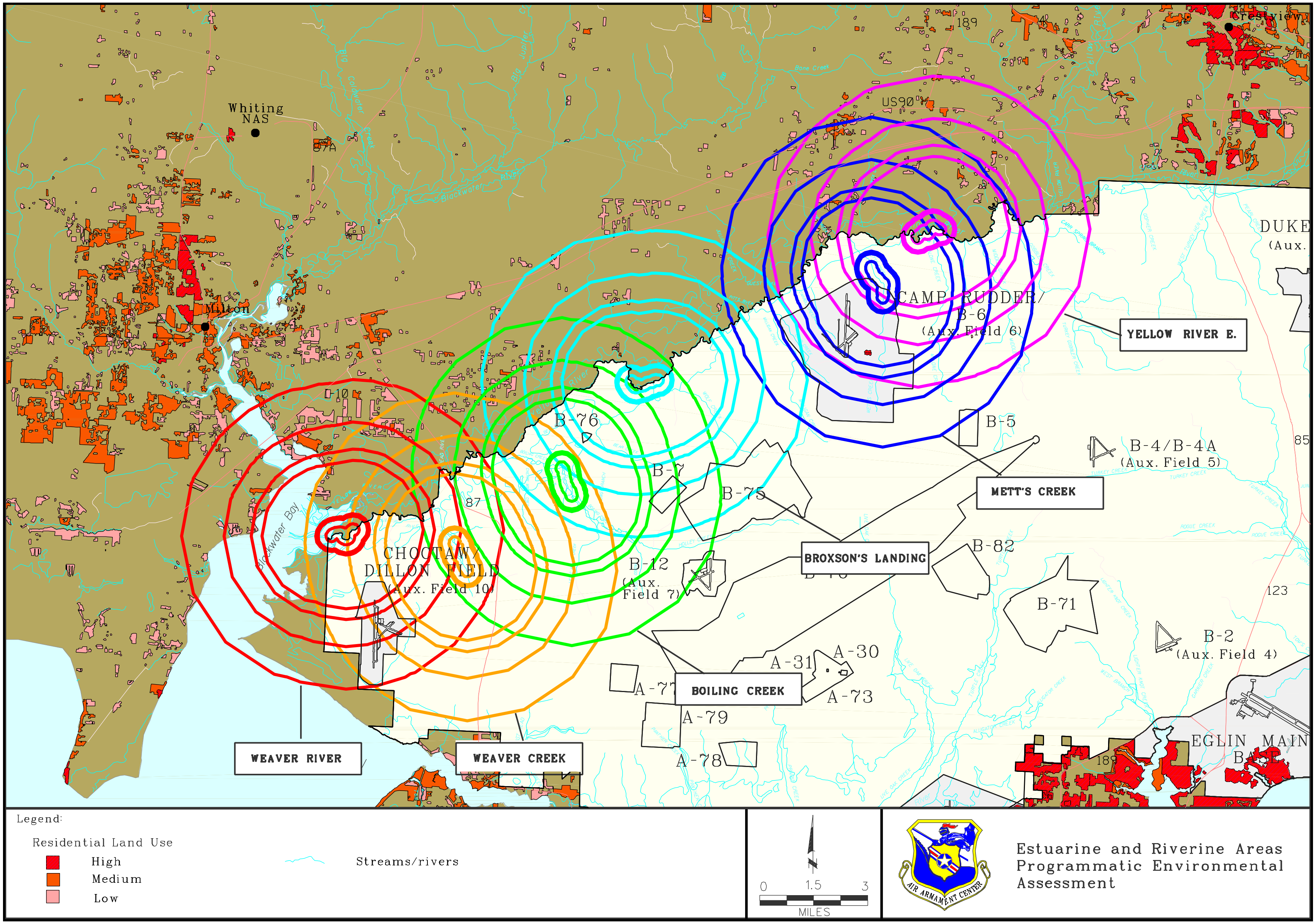


Figure G-2. Residential Land Use Within Maximum Range Buffers

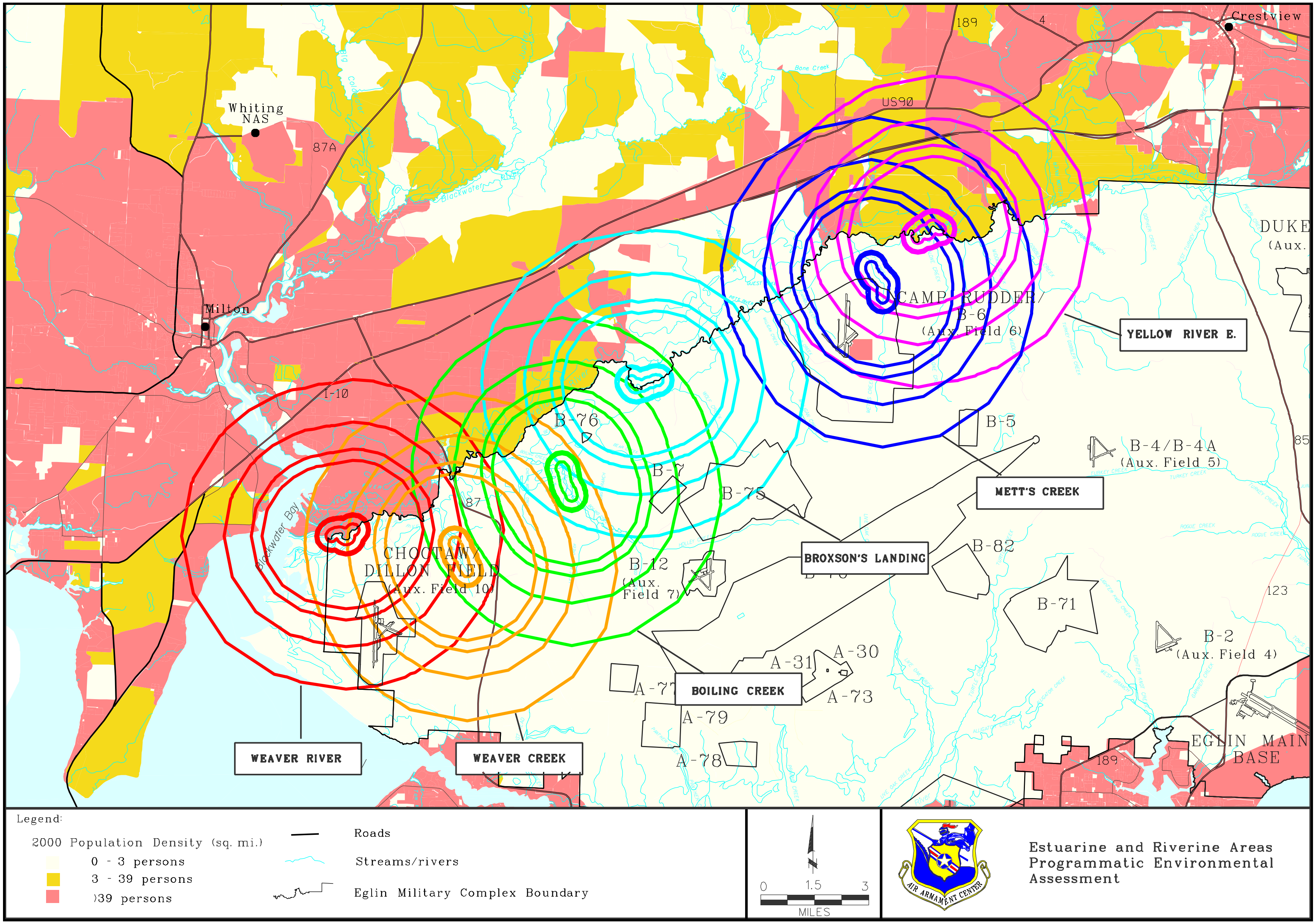


Figure G-3. Population Within Maximum Range Buffers

Table G-3. Environmental Justice Analysis by Maximum Range Buffer Zone

Site Name	Stream Buffer Zone (m)	Minority (acres)	Low Income (acres)	Minority & Low Income (acres)
Boiling Creek	250	0.0	0.0	0.0
Broxson's Landing	250	0.0	97.0	0.0
Metts Creek	250	0.0	0.0	0.0
Weaver Creek	250	0.0	0.0	0.0
Weaver River	250	0.0	0.0	0.0
Yellow River East	250	0.0	113.5	0.0
Boiling Creek	600	0.0	0.0	0.0
Broxson's Landing	600	0.0	246.7	0.0
Metts Creek	600	0.0	0.0	0.0
Weaver Creek	600	0.0	0.0	0.0
Weaver River	600	0.0	1.9	0.0
Yellow River East	600	0.0	336.9	0.0
Boiling Creek	700	0.0	0.0	0.0
Broxson's Landing	700	0.0	295.4	0.0
Metts Creek	700	0.0	0.0	0.0
Weaver Creek	700	0.0	0.0	0.0
Weaver River	700	0.0	6.7	0.0
Yellow River East	700	0.0	419.6	0.0
Boiling Creek	3,100	0.0	618.2	0.0
Broxson's Landing	3,100	0.0	2,227.7	0.0
Metts Creek	3,100	222.4	1,611.2	0.0
Weaver Creek	3,100	0.0	210.1	0.0
Weaver River	3,100	0.0	2,515.3	0.0
Yellow River East	3,100	0.0	4,382.4	0.0
Boiling Creek	3,600	0.0	1,224.6	0.0
Broxson's Landing	3,600	0.0	3,009.8	0.0
Metts Creek	3,600	226.3	2,505.1	20.1
Weaver Creek	3,600	0.0	563.8	0.0
Weaver River	3,600	0.0	3,507.1	58.7
Yellow River East	3,600	0.0	5,160.4	18.9
Boiling Creek	4,800	0.0	3,204.4	67.3
Broxson's Landing	4,800	0.0	5,277.6	14.7
Metts Creek	4,800	226.3	5,770.9	20.1

Table G-3. Environmental Justice Analysis By Maximum Range Buffer Zone Cont'd

Site Name	Stream Buffer Zone (m)	Minority (acres)	Low Income (acres)	Minority & Low Income (acres)
Weaver Creek	4,800	0.0	2,190.8	0.0
Weaver River	4,800	0.0	6,884.0	100.5
Yellow River East	4,800	101.0	7,286.9	20.1
Boiling Creek	6,700	0.0	8,802.8	100.9
Broxson's Landing	6,700	0.0	9,757.1	115.6
Metts Creek	6,700	230.0	12,670.7	20.1
Weaver Creek	6,700	0.0	7,597.7	7.4
Weaver River	6,700	15.3	13,629.8	259.7
Yellow River East	6,700	575.1	12,069.6	20.1

3. ANALYSIS

The risk to people and residential land areas falls within the maximum range of a munition, which encompasses the effective range. Overlays of maximum range buffer zones were used in concert with Census 2000 population data and FDEP land use maps to determine potential affects to the public. Bullet backstops or natural land contours (i.e., hilly areas) behind the targets would reduce the risks within the maximum munition ranges by limiting the distance to which projectiles could travel. However, for situations where weapon trajectories (e.g., accidental firing) exceeded the height of the backstop a projectile could still travel the maximum distance.

Effective ranges were overlaid on FNAI Tier areas to assess potential habitat impacts since, within that range, munitions would have the most destructive force; over time, vegetation would be severely affected within the effective range. The greatest risk of injury or death is within the effective range; thus, potential impacts to sensitive species were analyzed through overlays of this range onto known locations or habitats of sensitive species. Briefly, FNAI Tier areas are described as follows:

FNAI Tier 1 – Vegetative communities that are relatively undisturbed and closely approximate their natural state. Due to the excellent condition of these communities, they can withstand certain kinds of disturbances, but extensive ground-disturbing activities in habitats of this classification should be minimized when possible. Coordination with Eglin Natural Resources is required, and plant surveys may be necessary to identify listed plant species that could potentially be affected.

FNAI Tier 2 – Possess a good representation of the natural state but have undergone moderate disturbance. Minimal restoration or management required to restore this habitat to Tier 1. Extensive ground-disturbing activities in habitats of this classification should be minimized when possible; coordination with Eglin Natural Resources is required.

FNAI Tier 3 – Vegetative communities exposed to severe amounts and intensities of disruptive events (i.e., pine plantations). Impacts to habitats of this classification are preferred over impacts to Tier 1 or Tier 2. Large percentages of Tier 3 areas within munitions footprints may allow for greater flexibility in target placement with minimal habitat impacts.

FNAI Tier 4 – Areas with a designated land use. Impacts to habitats of this classification are preferred over impacts to Tier 1 or Tier 2. Field reconnaissance is required to identify any existing land use conflicts. Large percentages of Tier 4 areas within munitions footprints may allow for greater flexibility in target placement with minimal habitat impacts.

For small areas potentially affected (e.g., <20 acres), impacts to a particular resource (public, habitat, listed species, or cultural resource) may be minimized through minor adjustments in range location and target placement.

Environmental Justice Methodology

Environmental justice analysis involves a calculation of potential minority and low-income areas using the best credible data. The demographic profile of the region underlying the maximum range buffer zones provides the context within which the environmental justice analysis is conducted. Table G-3 lists the results of the analysis of the maximum range buffer zones for each munition. Figure G-4 indicates the potential environmental justice impacts for the six sites within the maximum range of the frangible .50 cal, the lowest caliber with no apparent impacts to residential lands or populations (for the majority of sites).

The first step in conducting an environmental justice analysis consists of calculating the percentages of minority and low-income populations within the area of concern (AOC). This represents the area in which an adverse impact may occur. These calculations are defined below:

$$\% \text{ Minority} = \frac{(\text{Total Population} - \text{Non-Hispanic White}) \times 100}{\text{Total Population}}$$

$$\% \text{ Low Income} = \frac{\text{Number of persons with income below poverty level} \times 100}{\text{Total population for which income data was taken}}$$

These values were compared against the Community of Comparison (CoC) results. The CoC values represent the percentages of minority and low-income populations within a geographic extent representing the region of influence. Areas where the AOC percentages are greater than the CoC percentages are identified as having potential environmental justice concerns.

Typically, county-wide percentages have been used for the AOC and state-wide percentages for the CoC. For Florida, USEPA Region 4 has identified CoC as 31.99 percent for minority populations and 30.01 percent for low-income families (1990 Census).

On a county-wide basis, there appears to be no environmental justice concerns. Perception is lacking of factual analysis of socioeconomic data surrounding Eglin, as there are a number of "depressed areas" around the Eglin Reservation, perhaps deserving of environmental justice considerations. Therefore, a more targeted approach using accepted methodologies is needed.

This targeted approach follows the general guidelines presented in the *USAF Interim Guide for Environmental Justice Analysis with the Environmental Impact Analysis Process* (November 1997). Additionally, the finest spatial resolution possible is utilized while capturing the necessary level of demographics. The 2000 Census blocks were used for the minority calculation, and the 1990 block groups were used for the low-income calculation. It should be noted that the 2000 low-income data was unavailable at the time of publication.

4. RESULTS

Table G-4 identifies the largest munition footprint that would yield the lowest potential impact for each candidate riverine live-fire site. The table was constructed using data from the buffer zone overlay of potentially affected resources, which are illustrated in Figures G-5 through G-39.

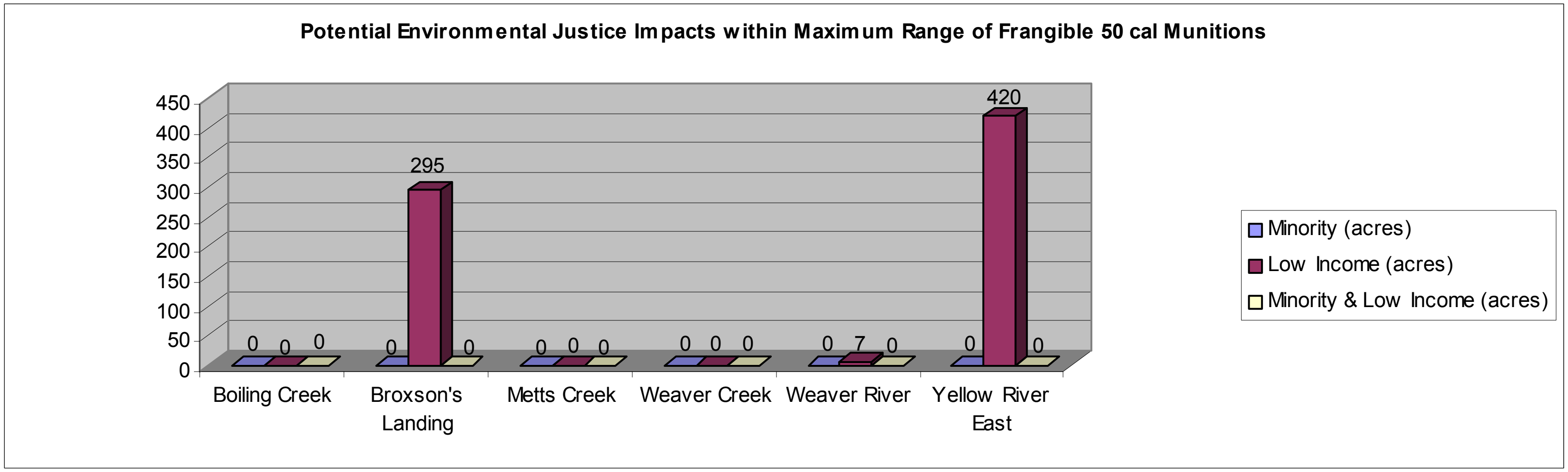
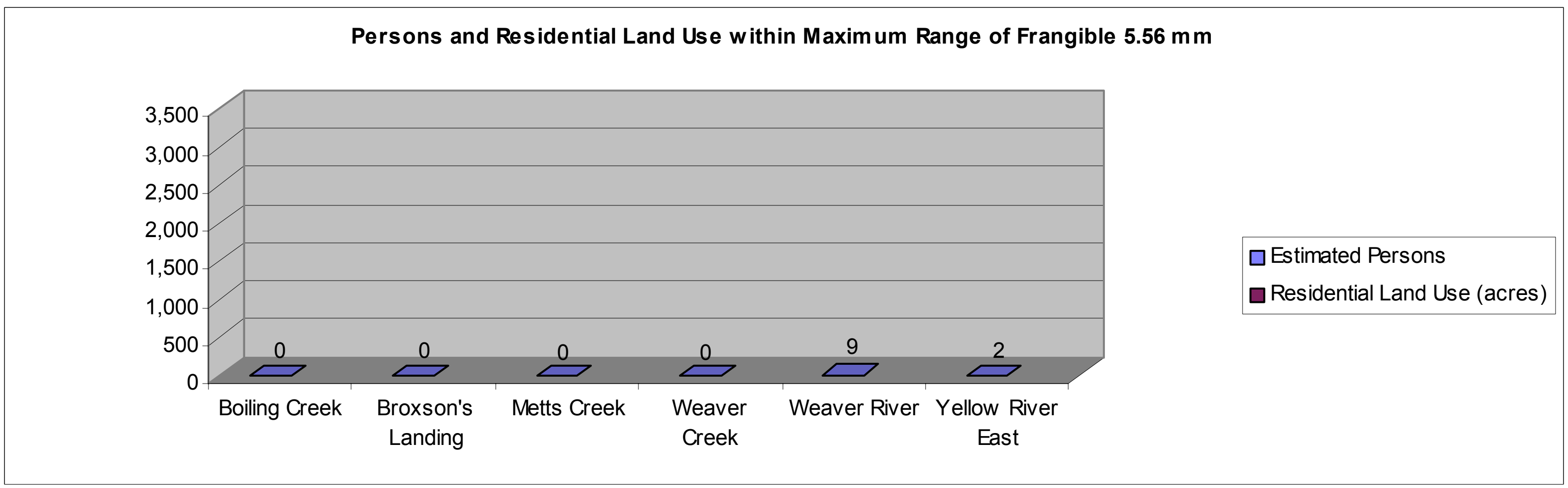


Figure G-4



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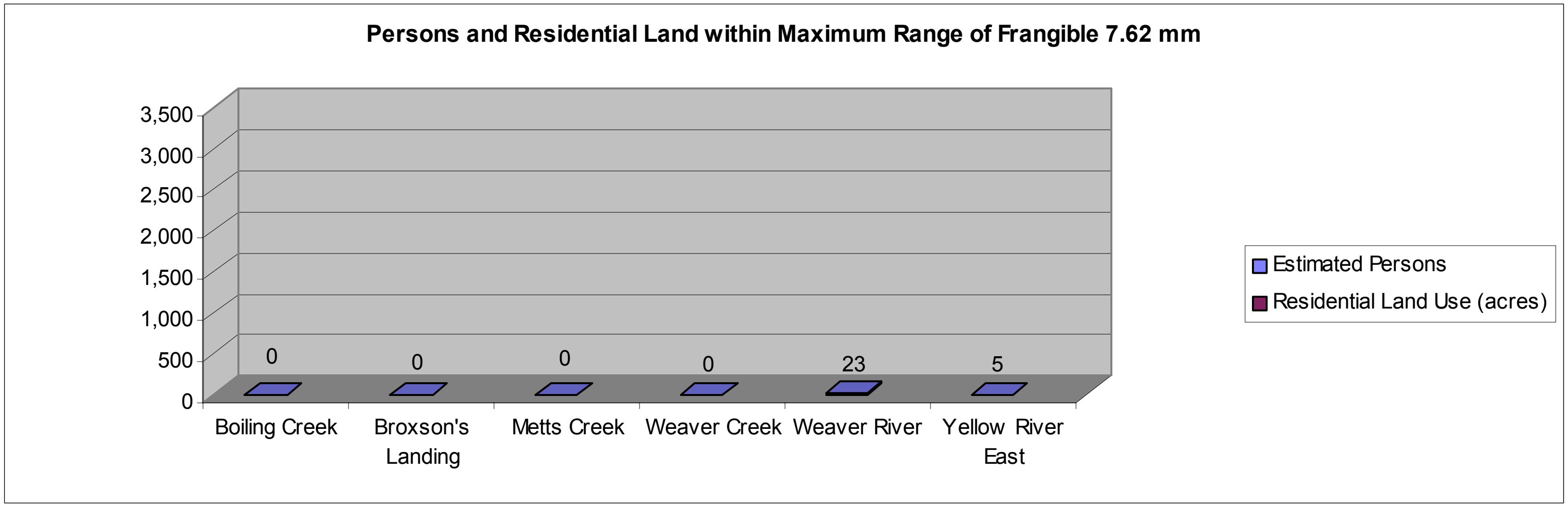

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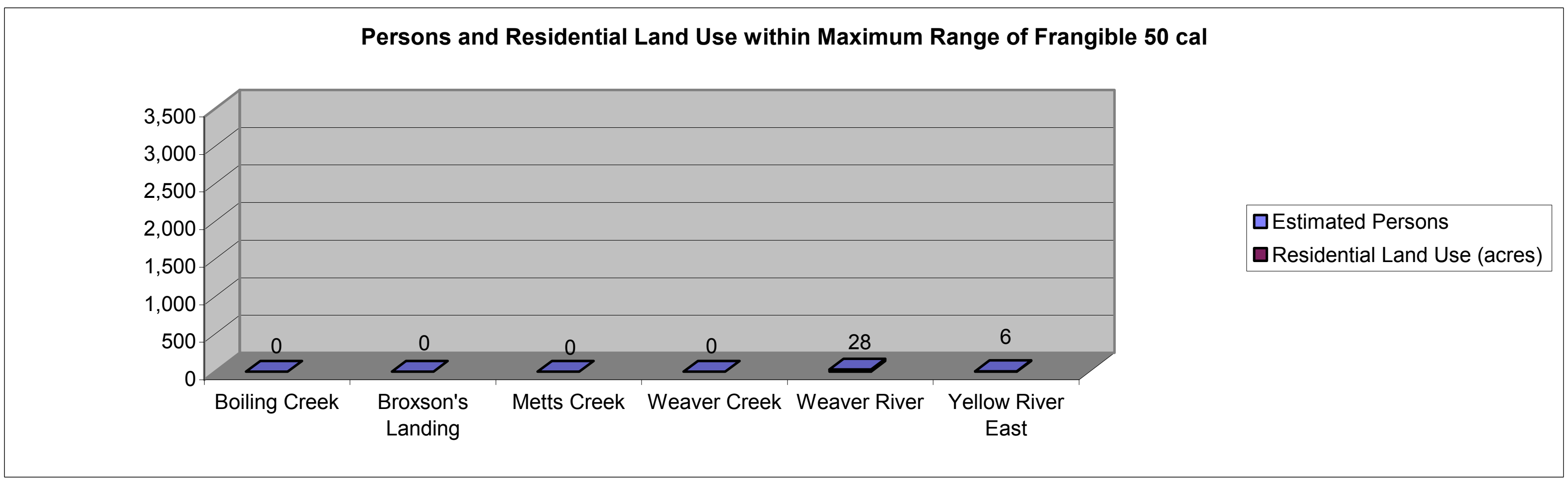

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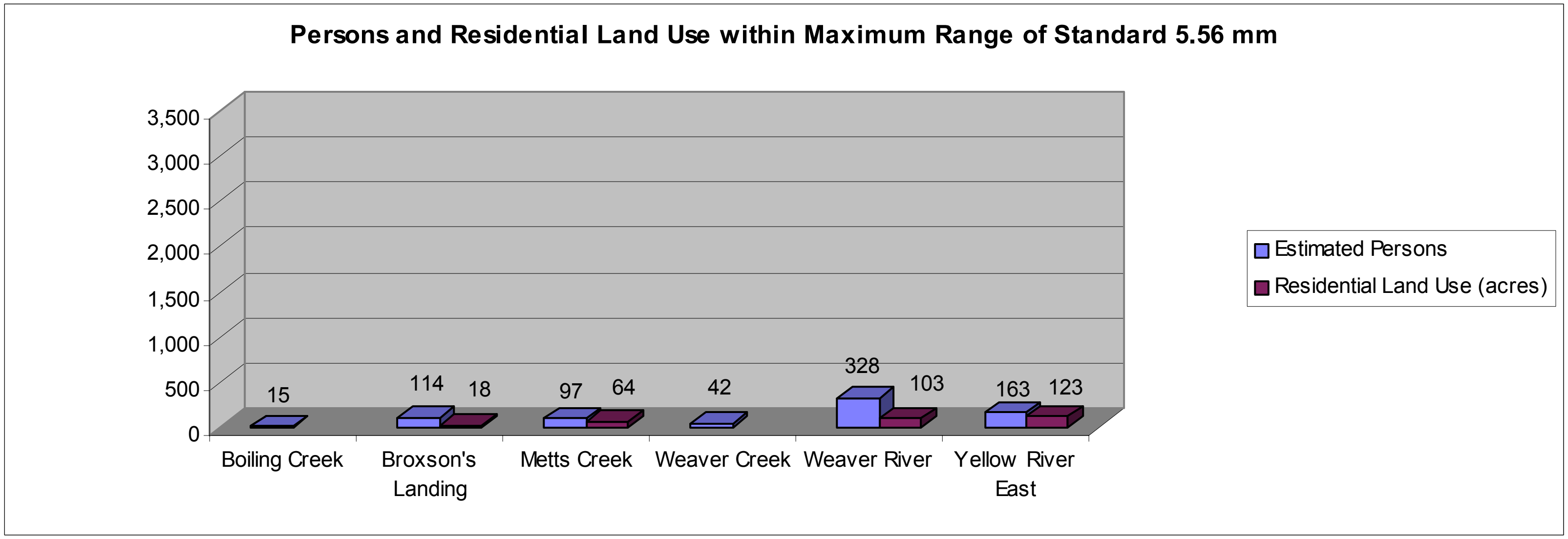

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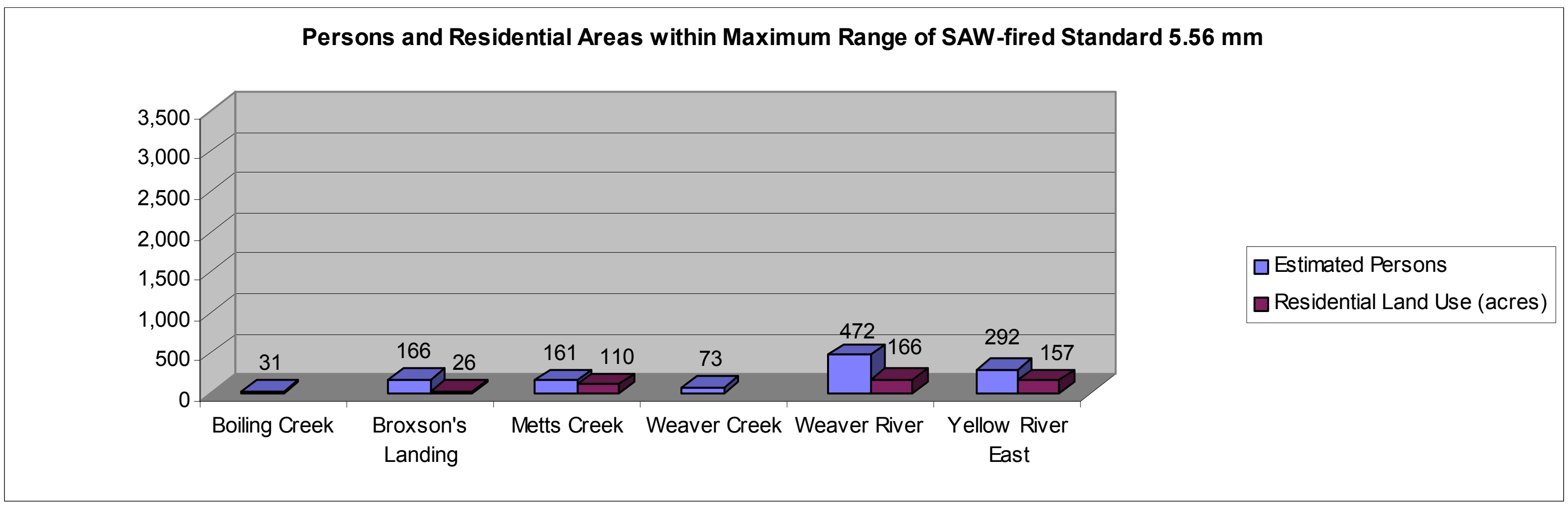

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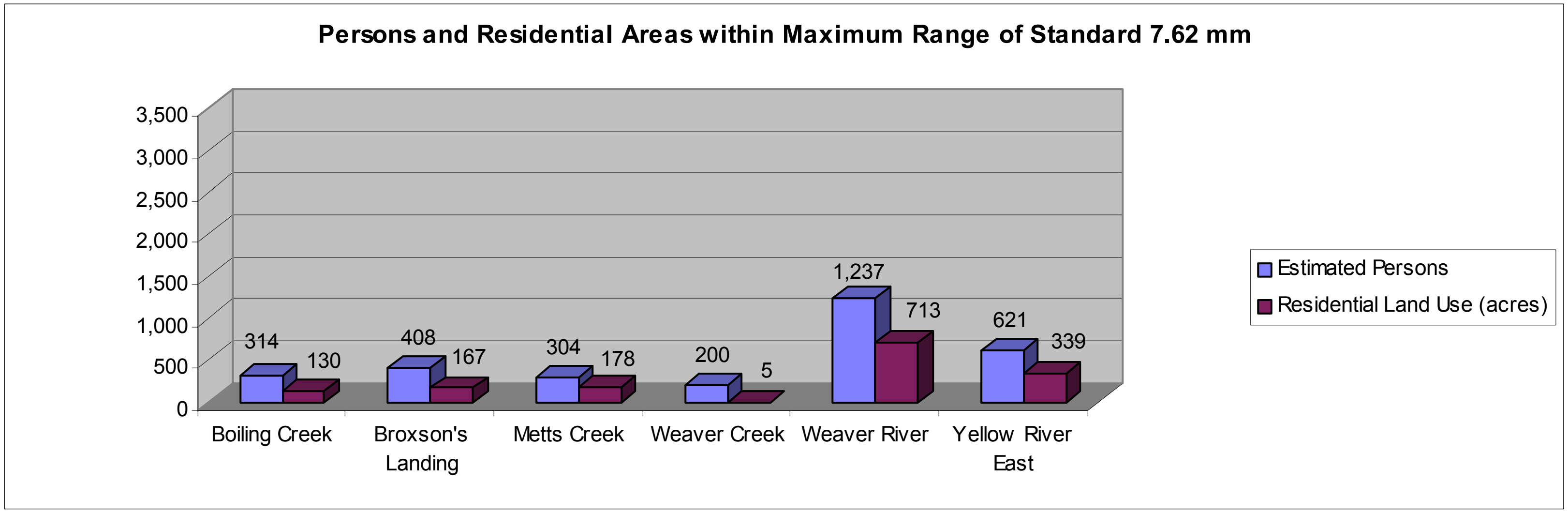

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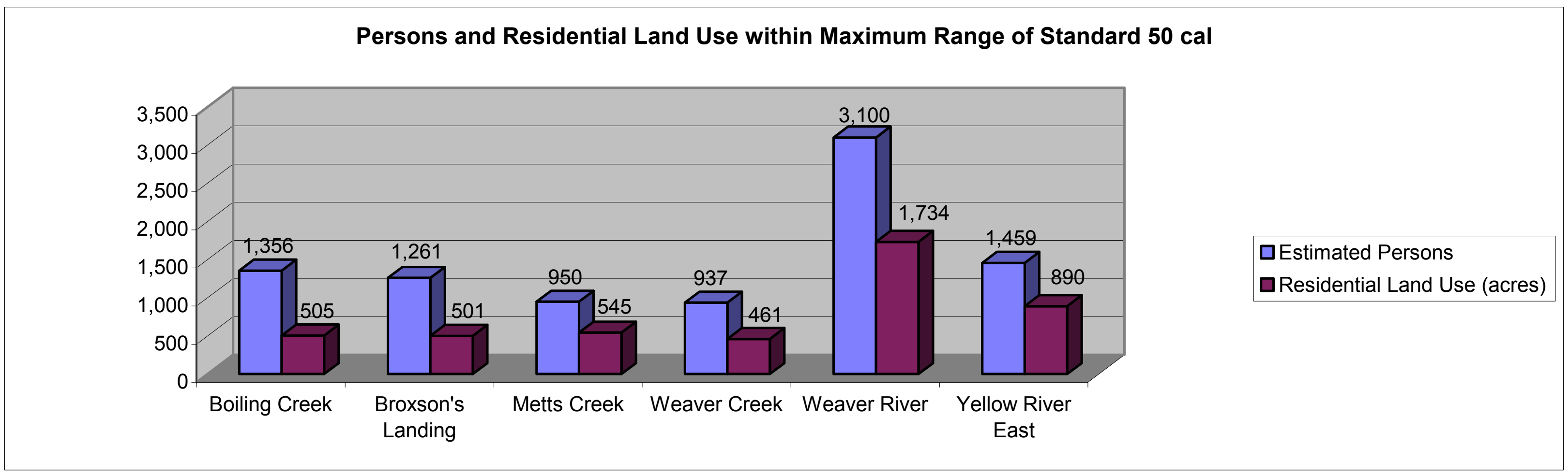

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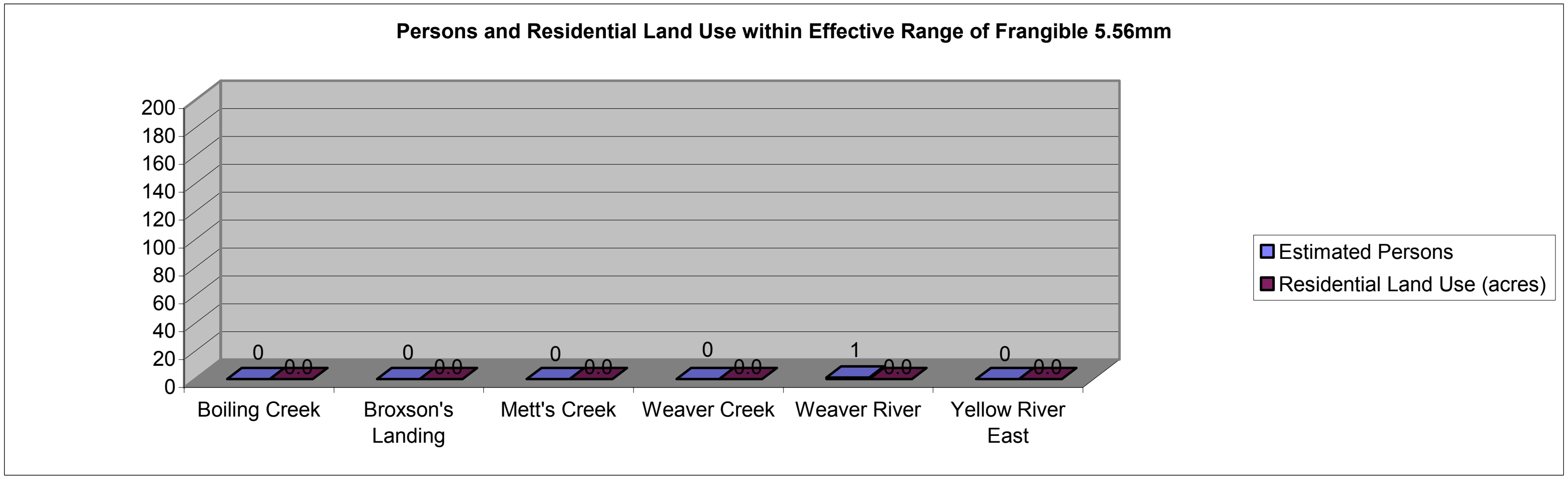

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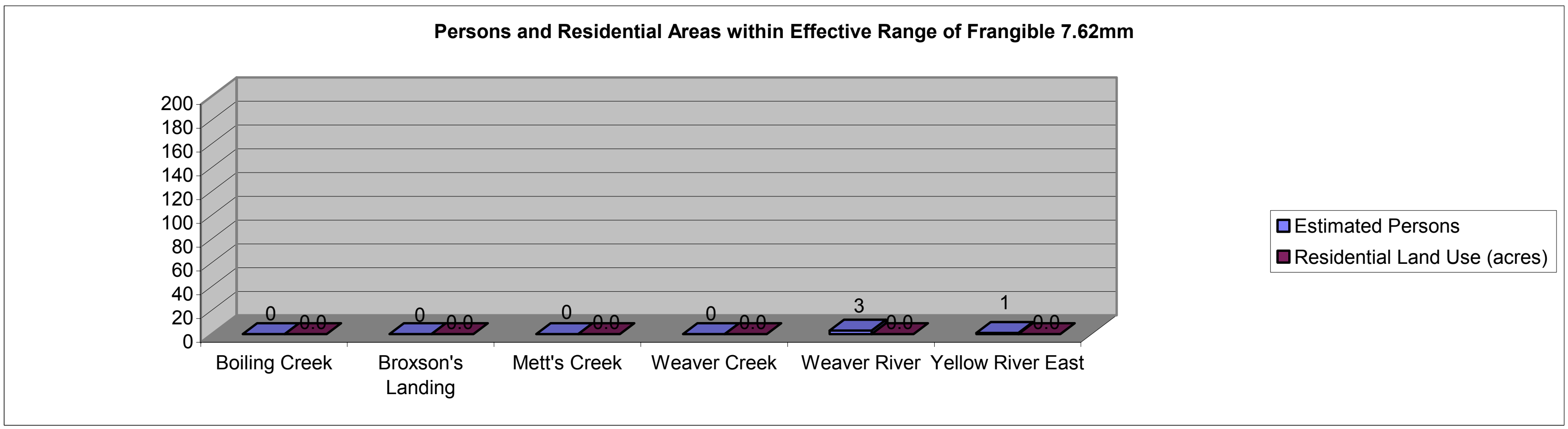

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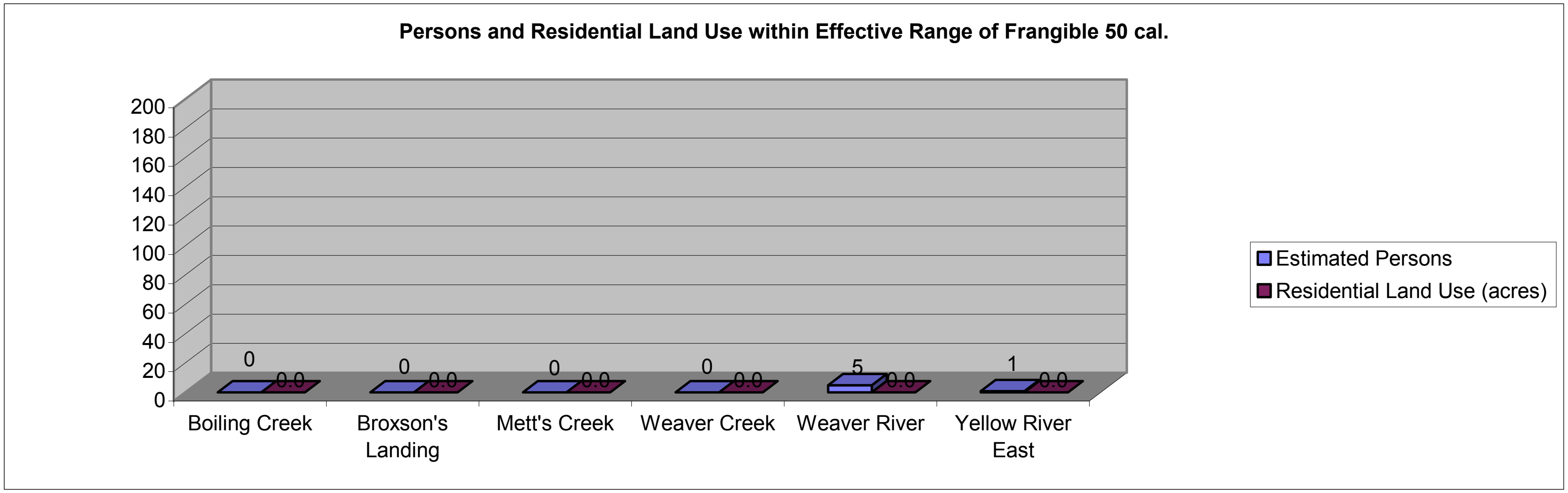

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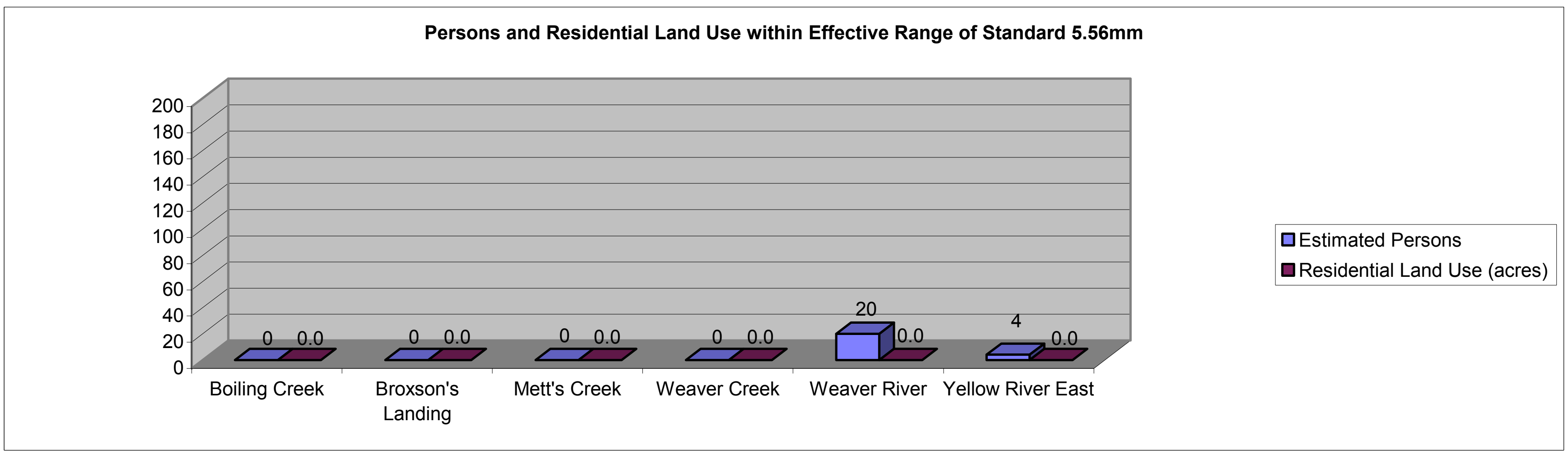

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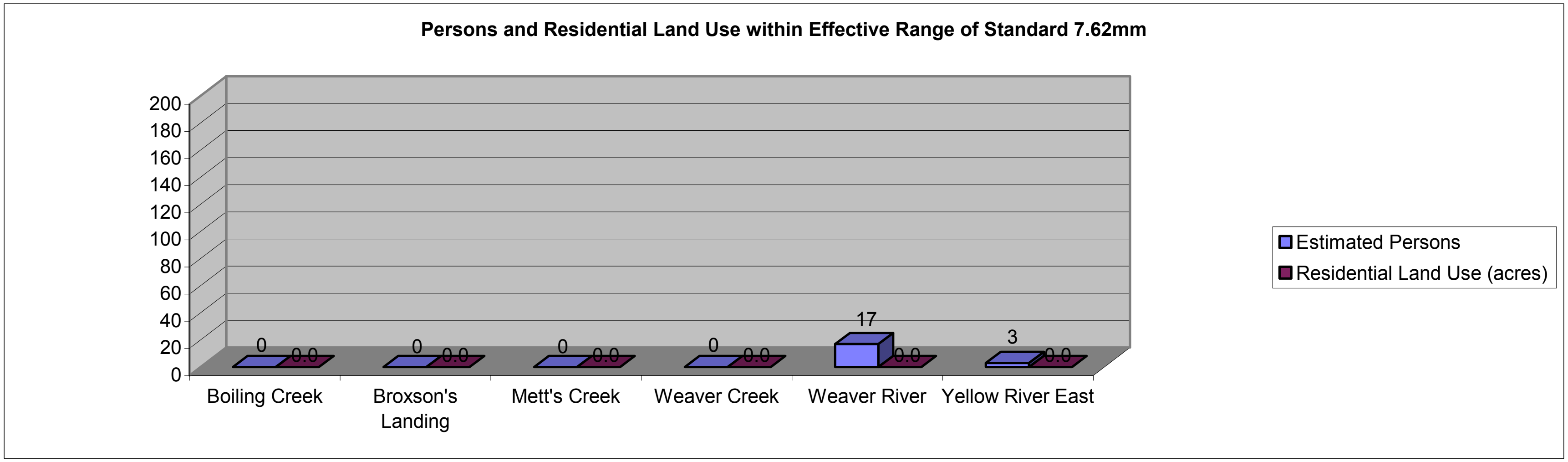

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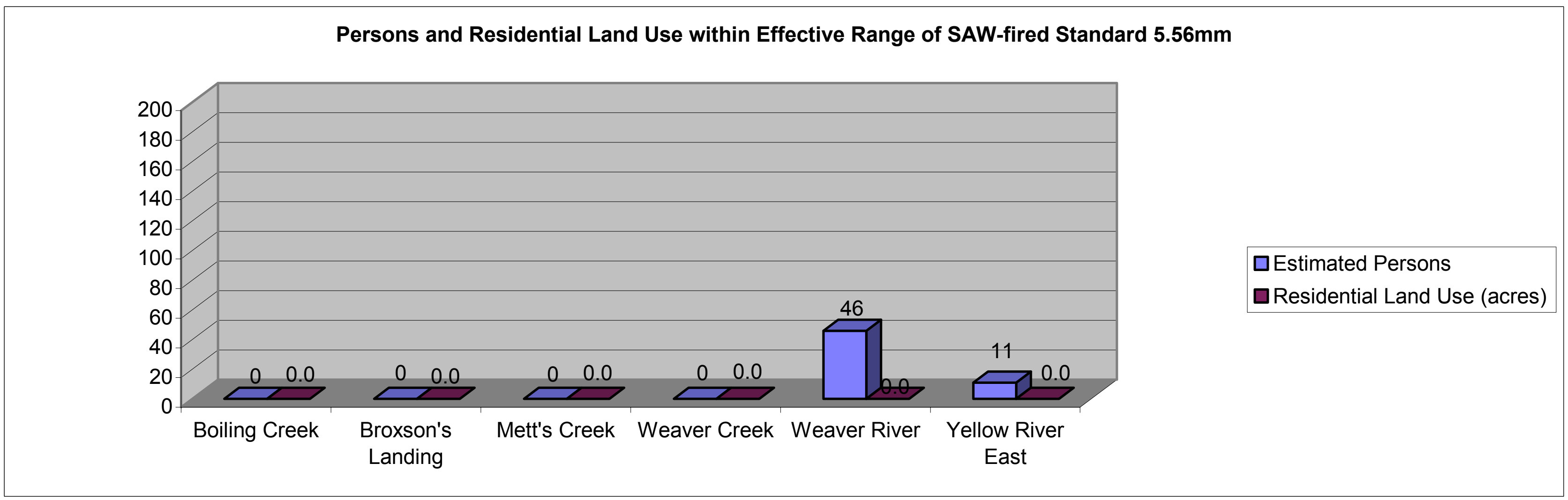

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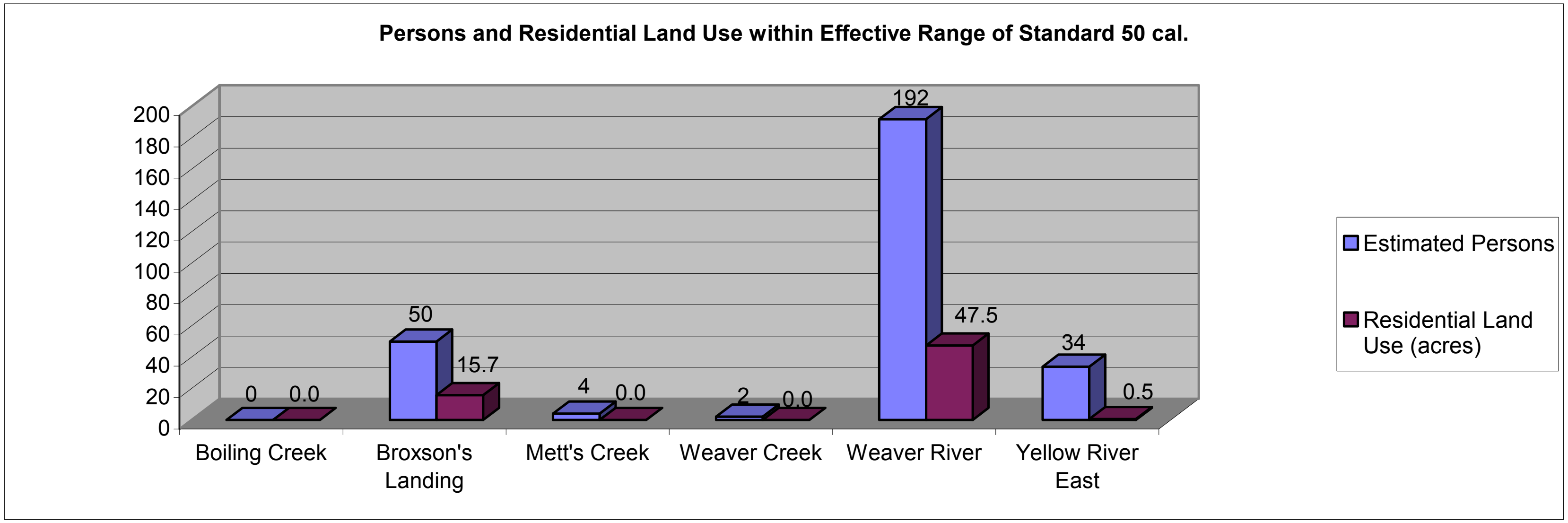

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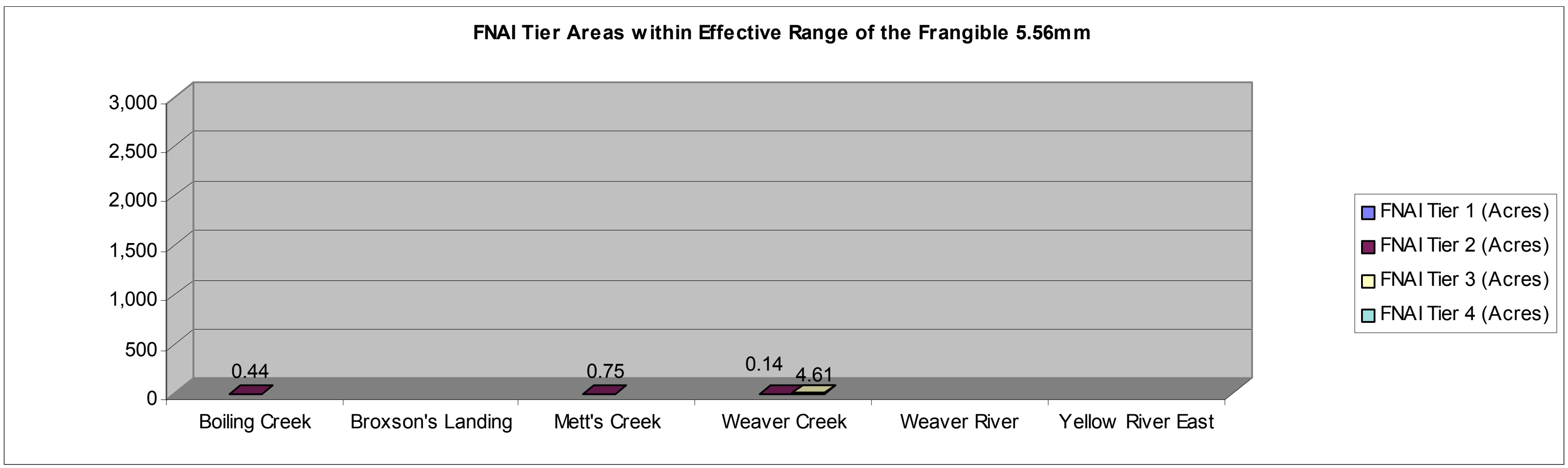

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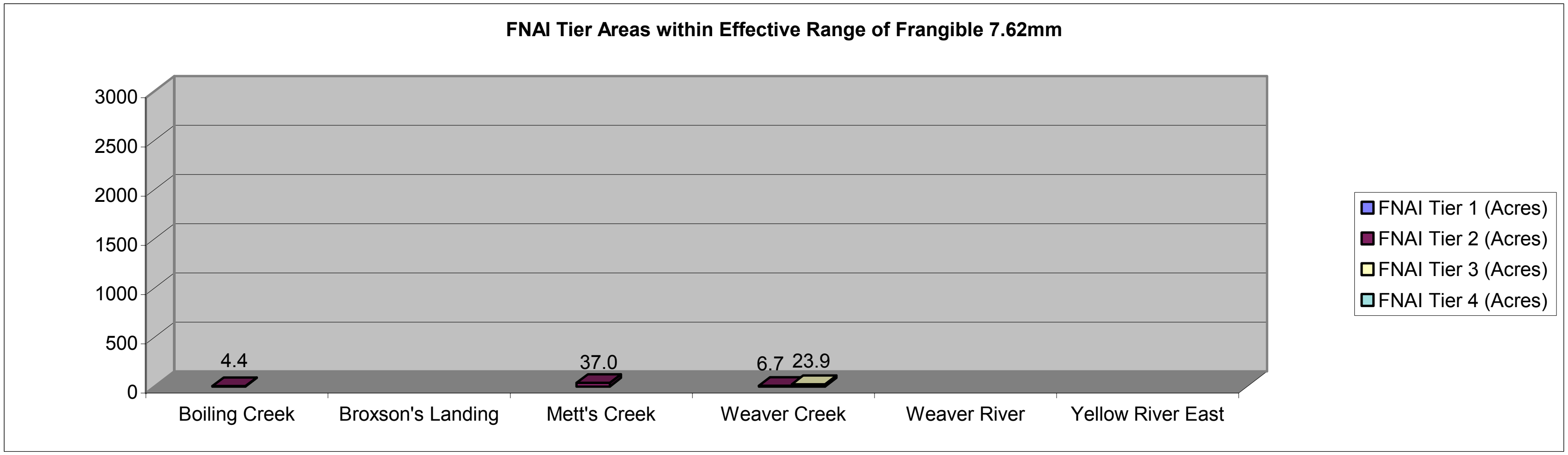

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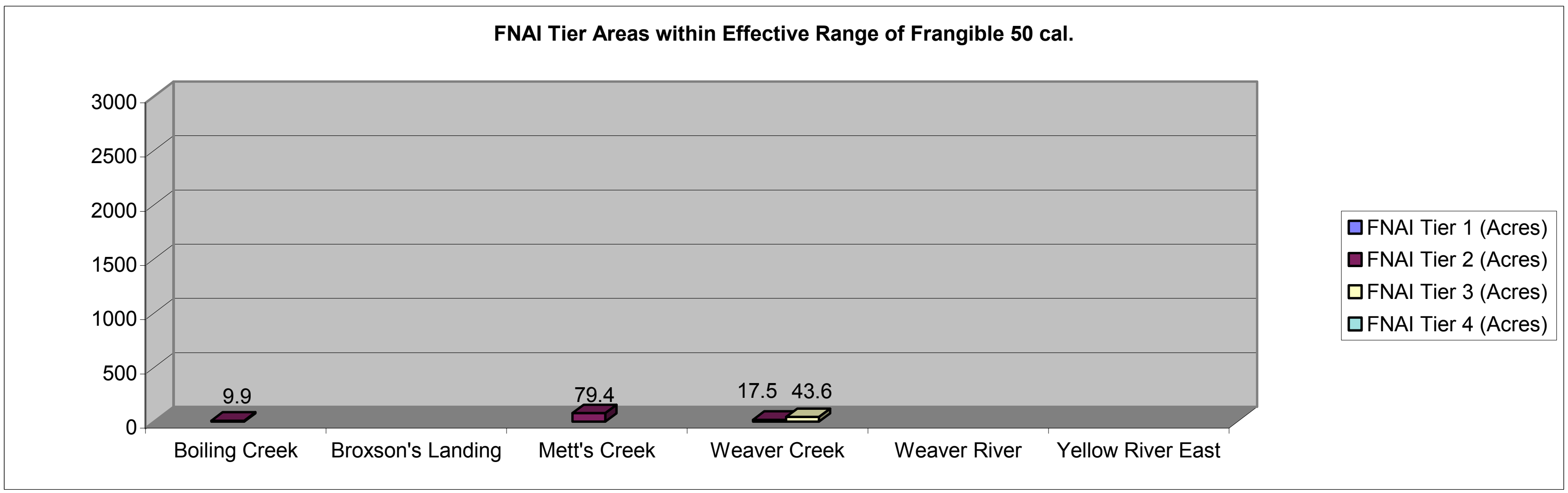

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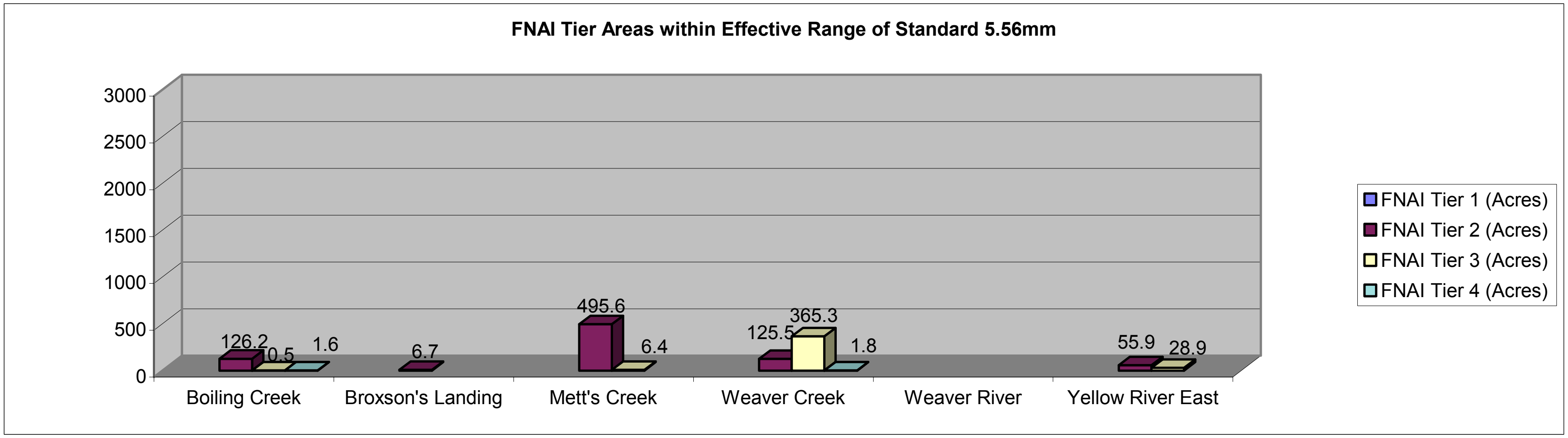

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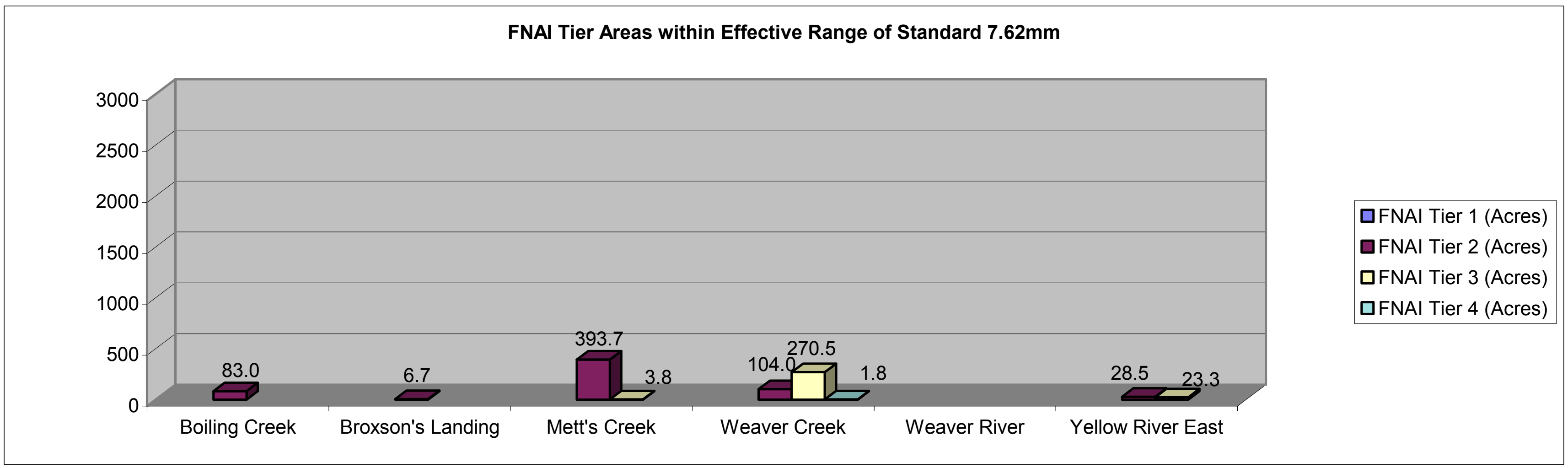

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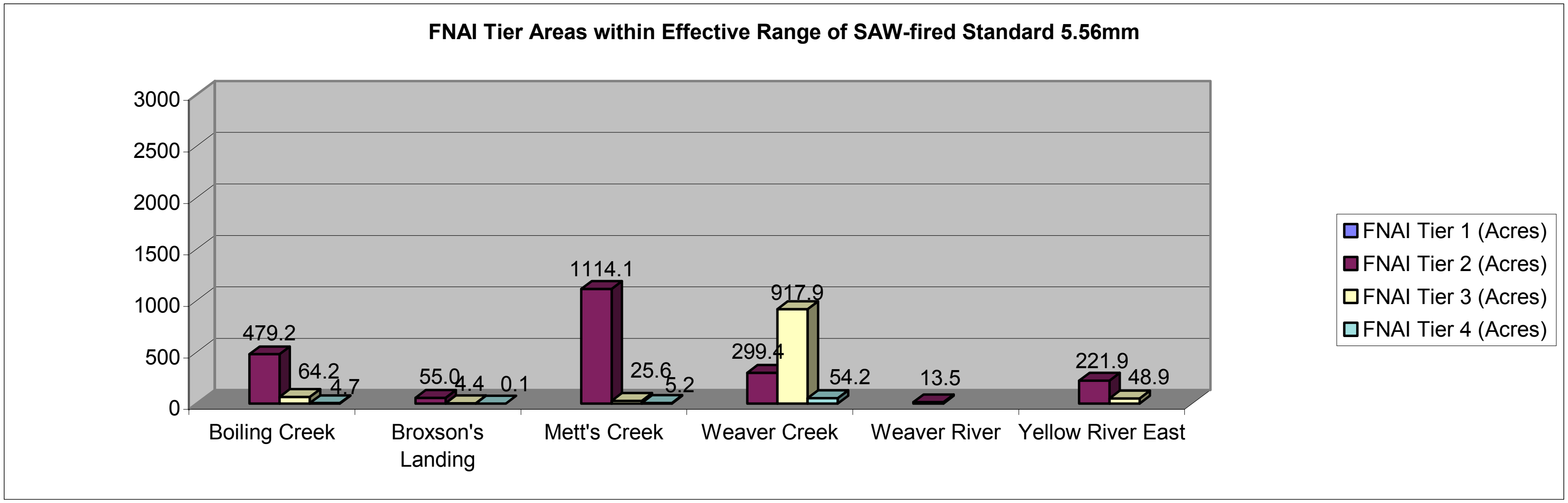

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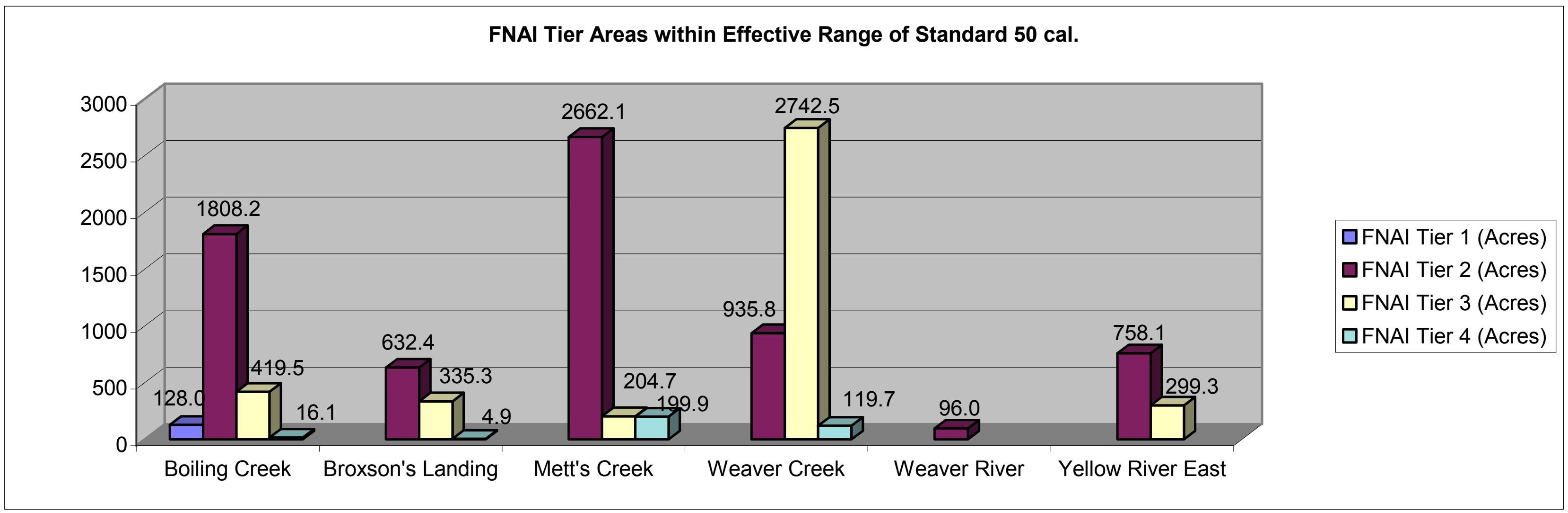

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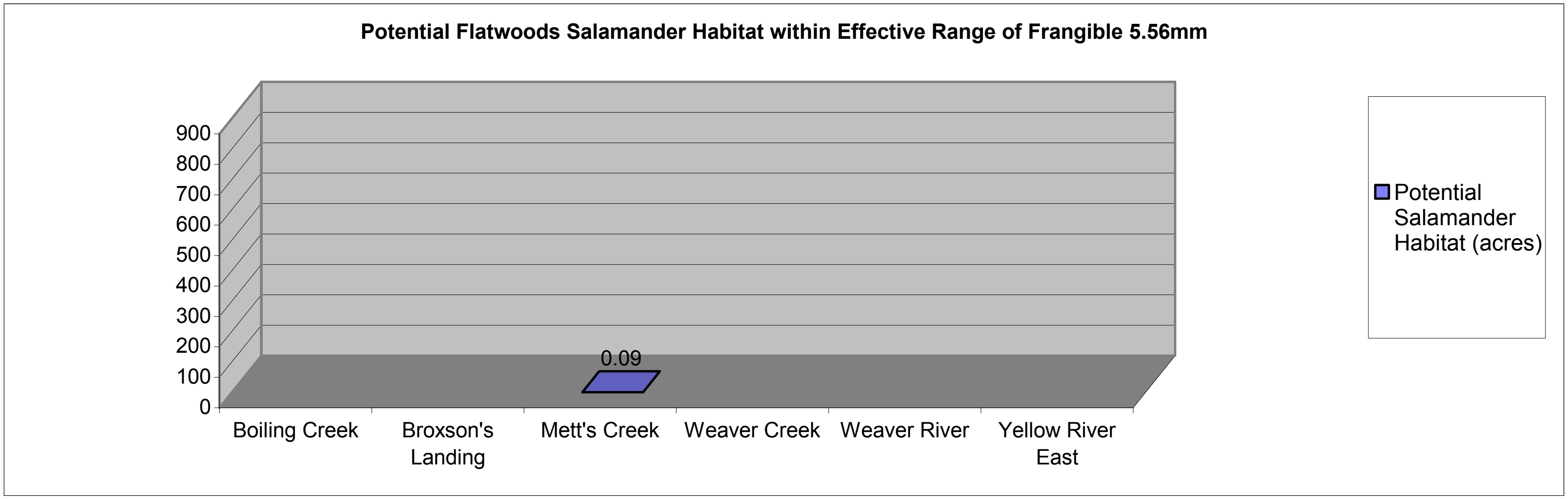

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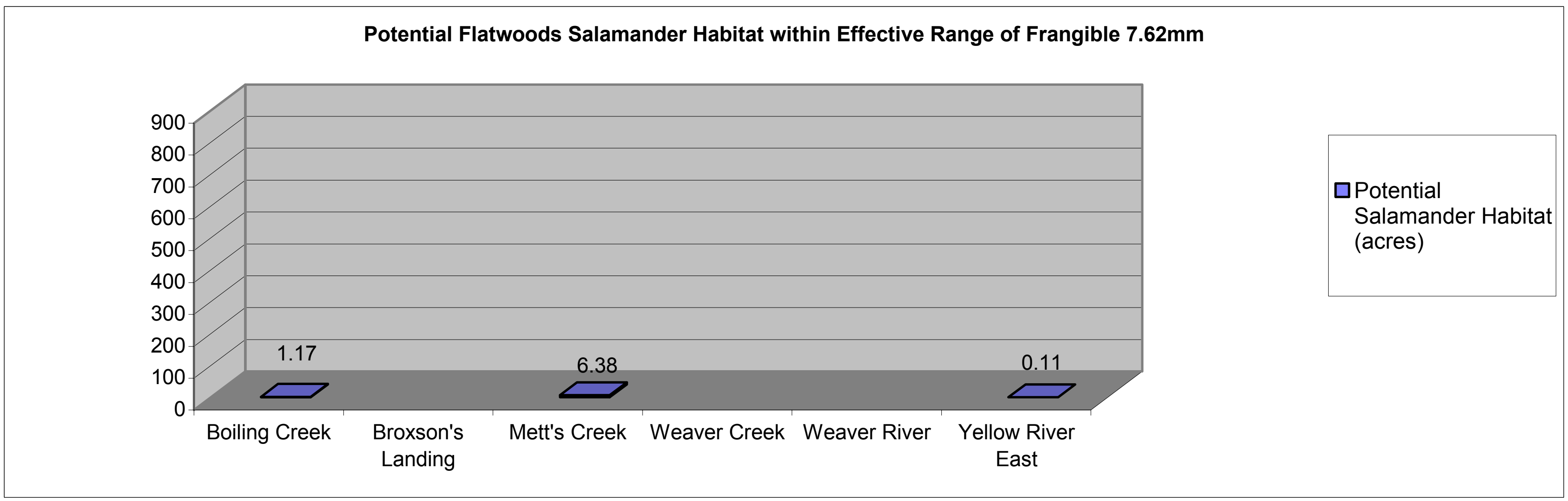

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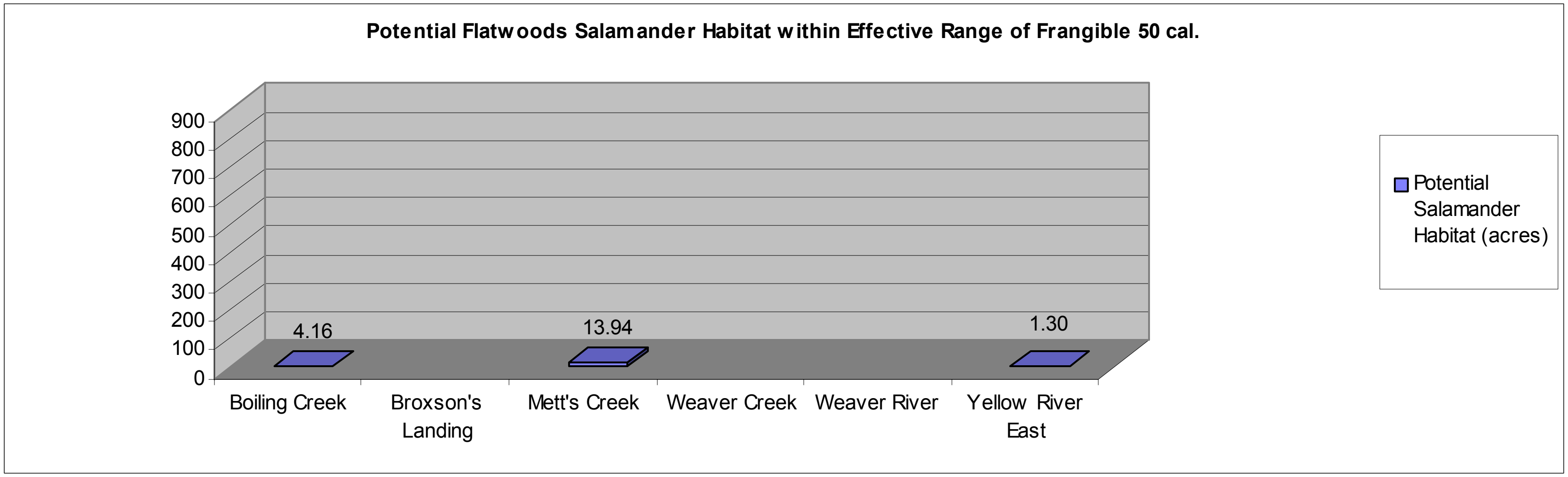

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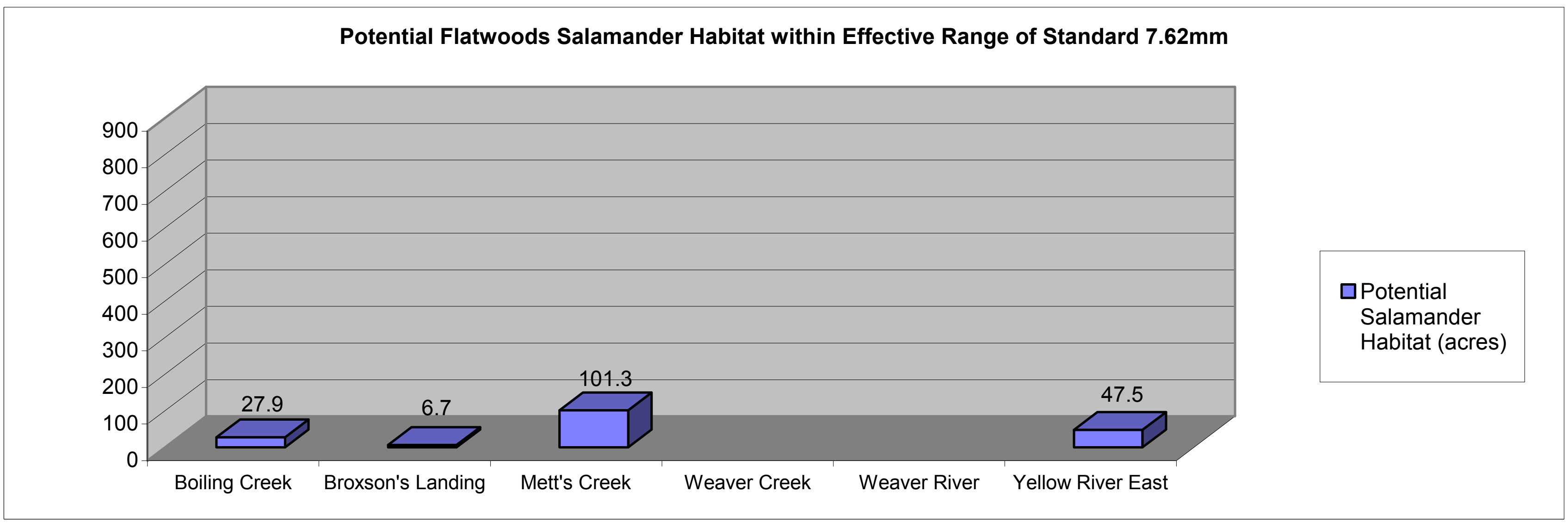

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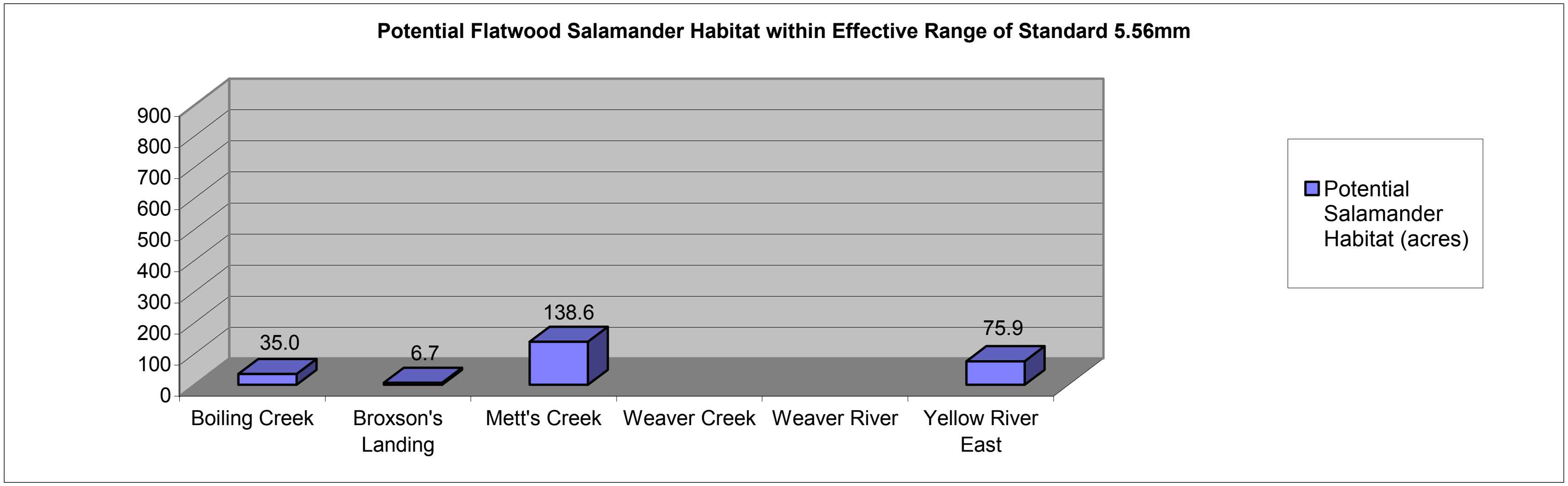

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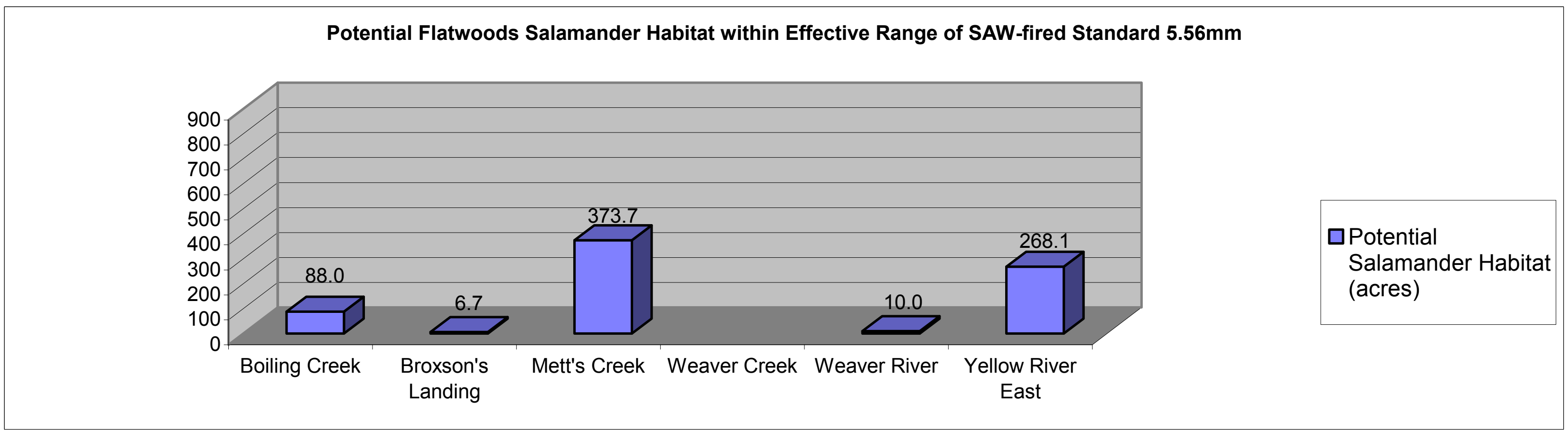

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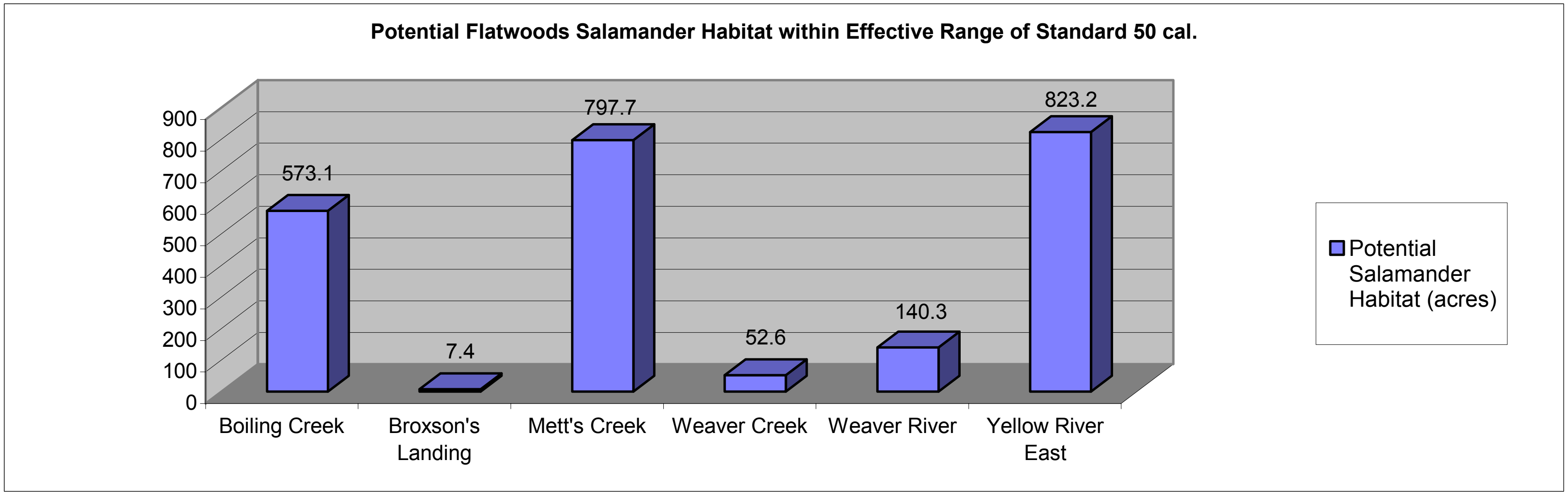

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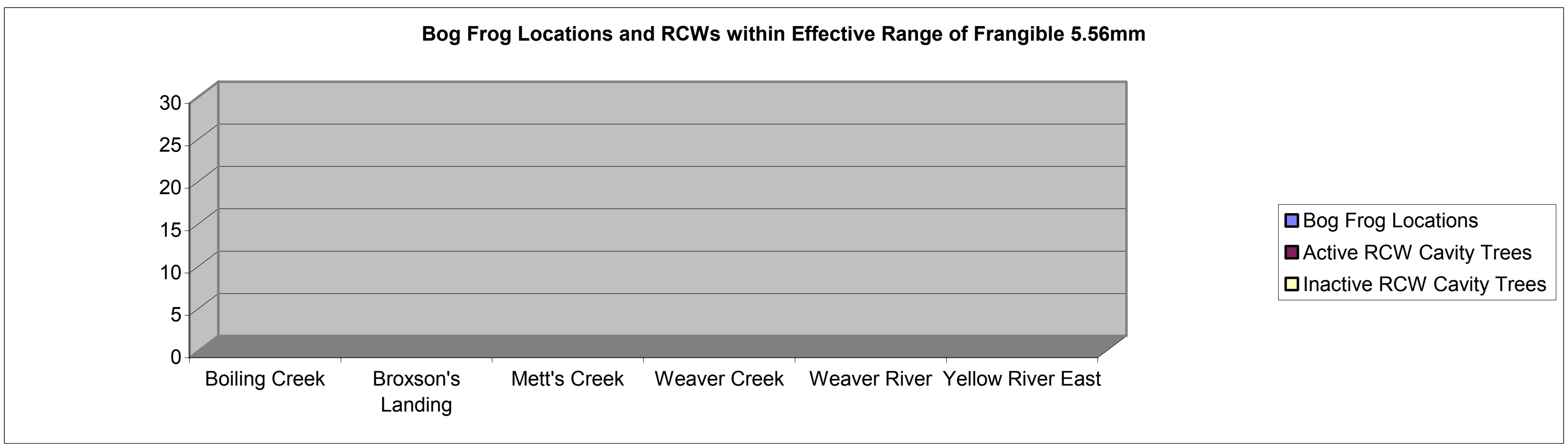

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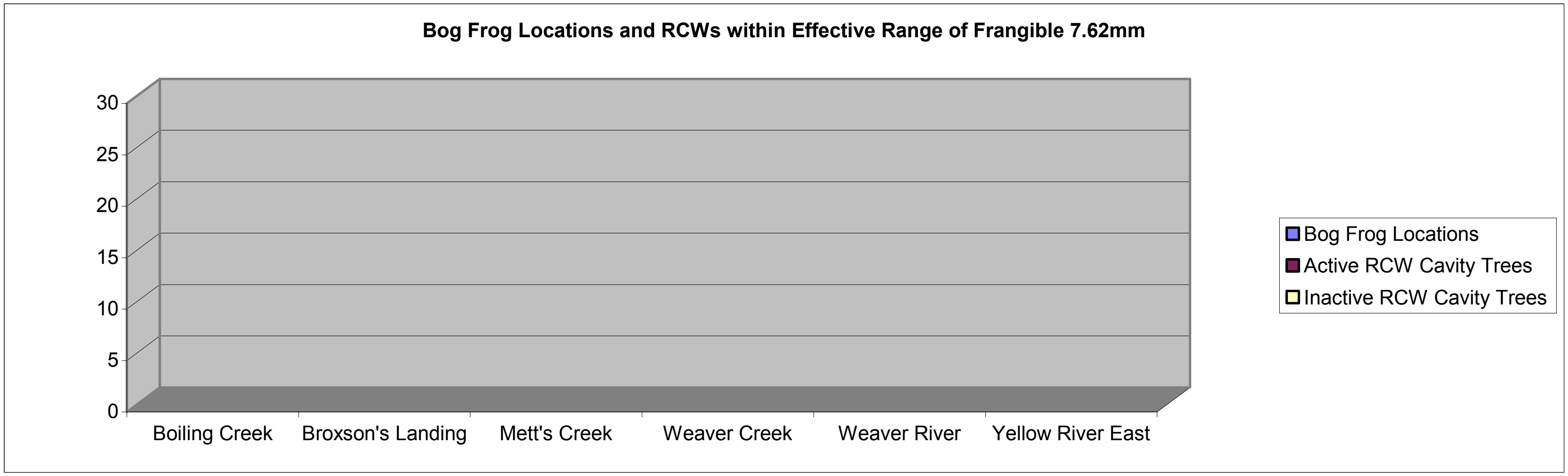

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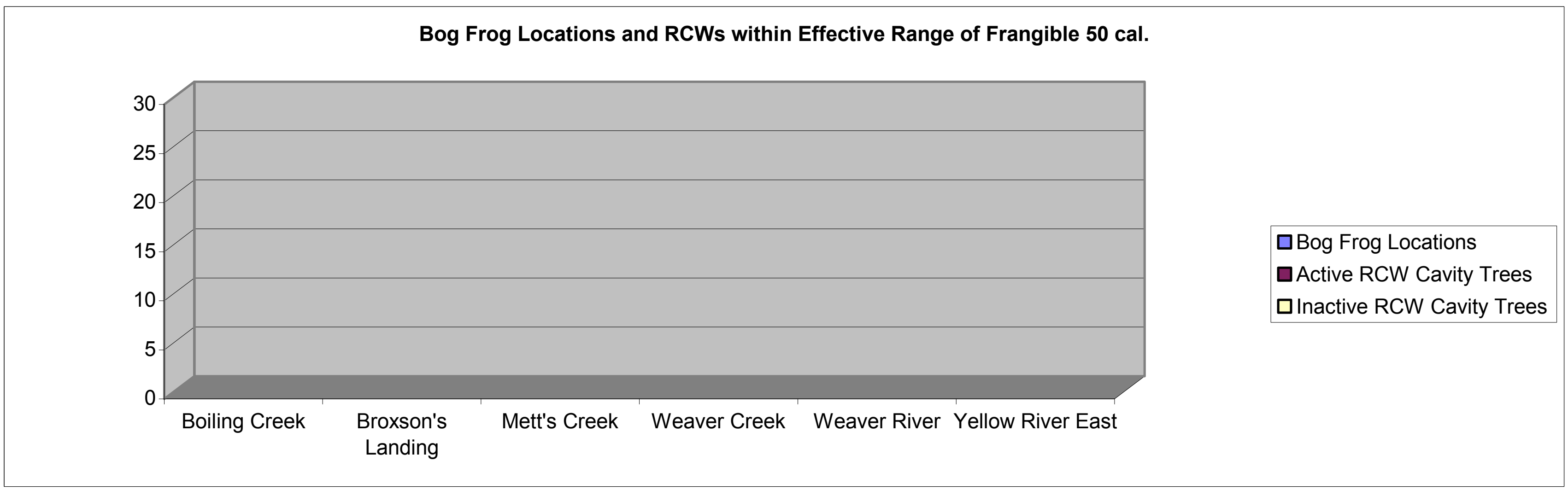

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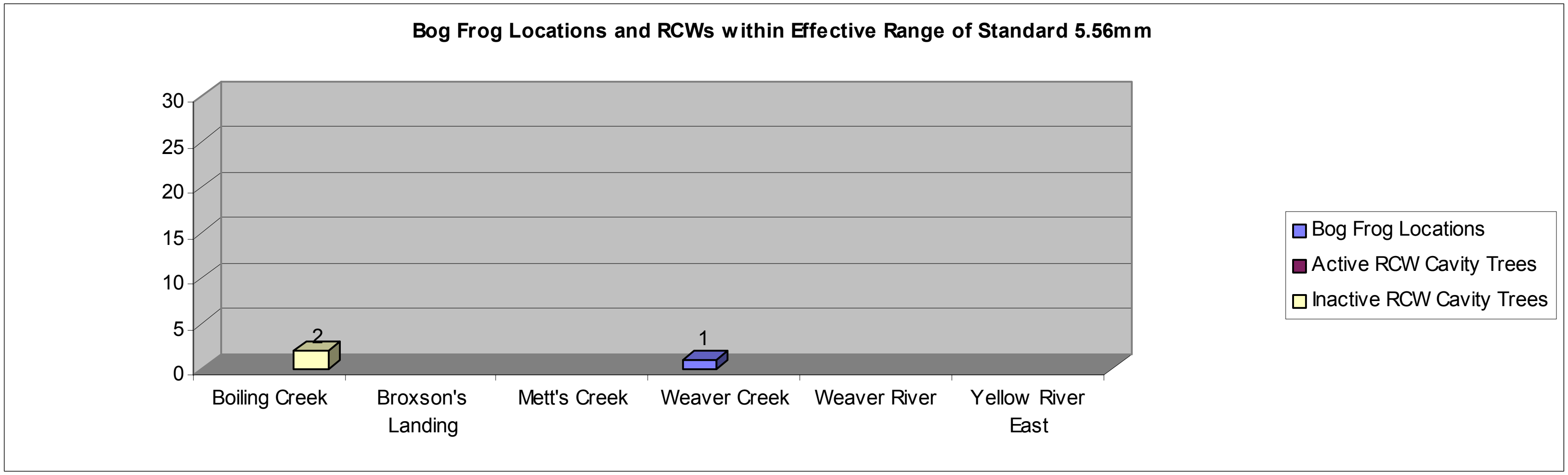

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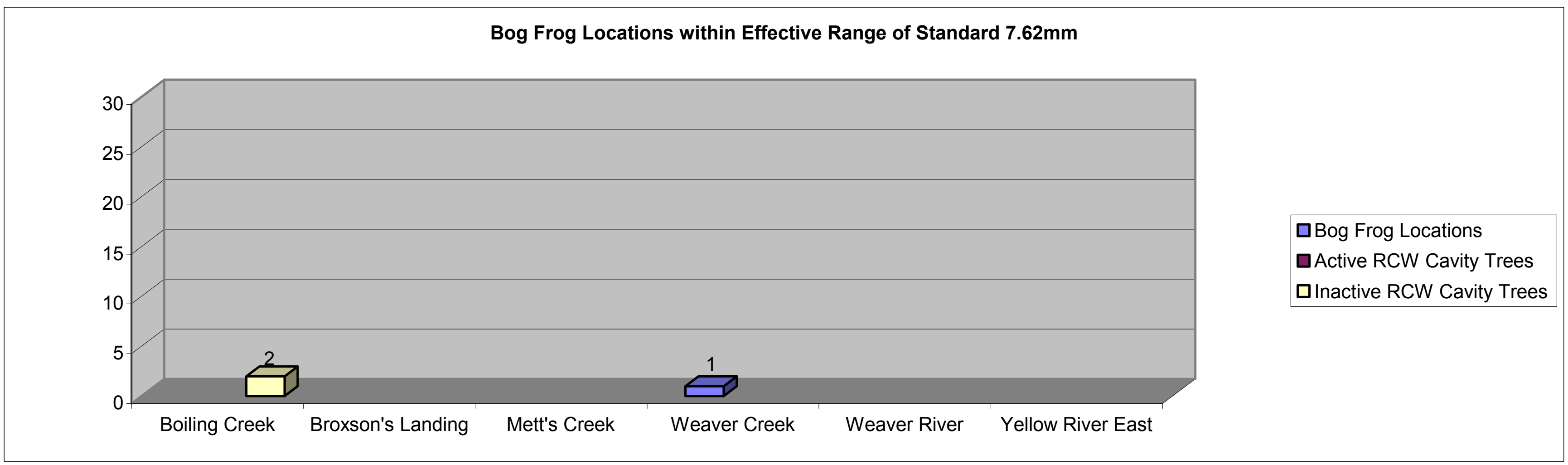

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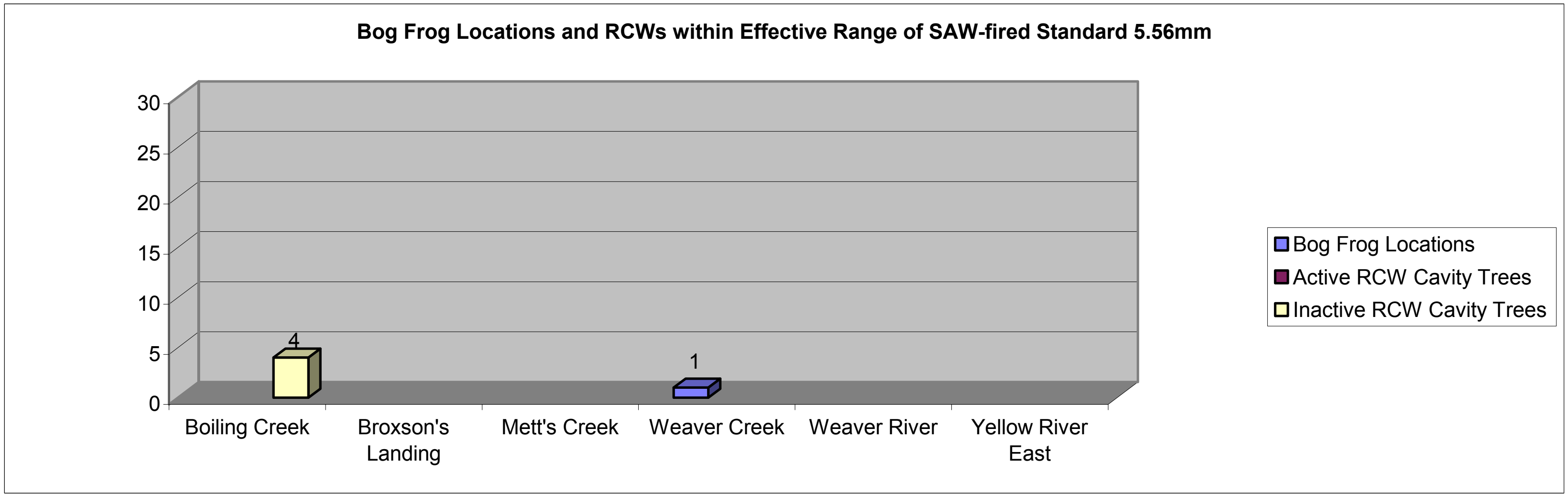

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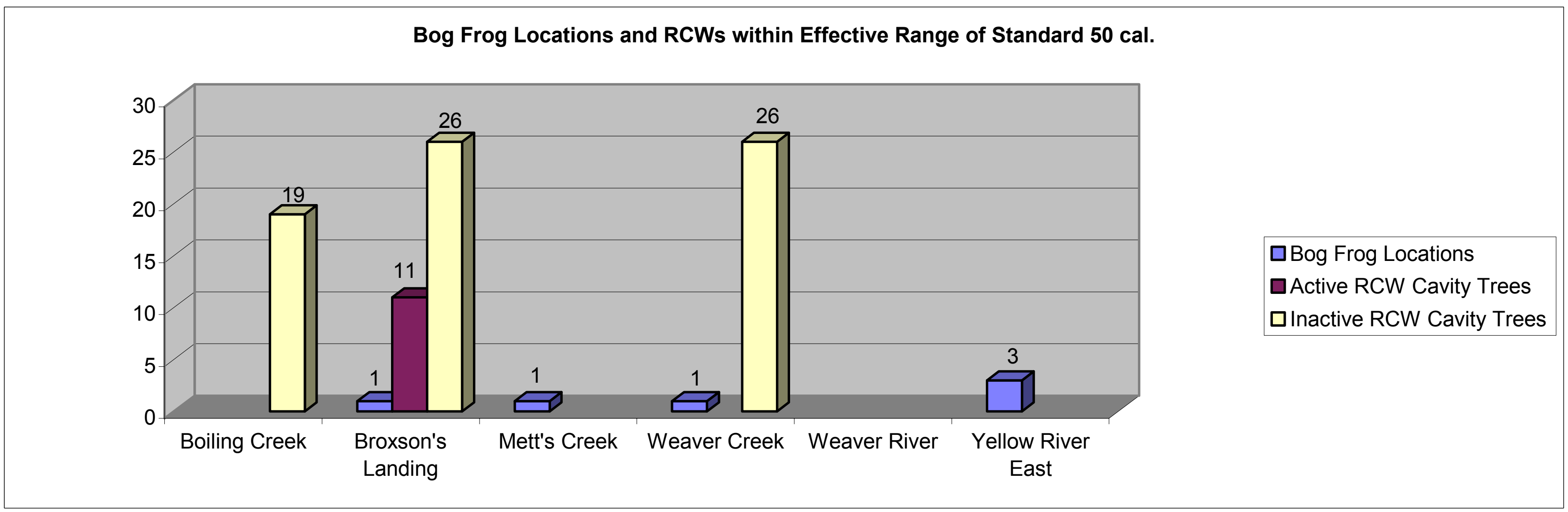

Figure G-39

Table G-4. Maximum Caliber Munition that can be Used at Each Candidate Site with No or Low Apparent Impact

Resource Affected	Weaver River	Weaver Creek	Boiling Creek	Broxson's Landing	Mett's Creek	Yellow River East
Persons within maximum range	All munitions potentially affect this category.	Frangible[a] .50 cal	Frangible .50 cal	Frangible .50 cal	Frangible .50 cal	All munitions potentially affect this category.
Residential area within maximum range	Frangible .50 cal	SAW-fired 5.56 mm	SAW-fired 5.56mm	Frangible .50 cal	Frangible .50 cal	Frangible .50 cal
FNAI Tier 1 areas[b]	Standard .50 cal	Standard .50 cal	SAW-fired 5.56mm	Standard .50 cal	Standard .50 cal	Standard .50 cal
FNAI tier 2 areas[b]	SAW-fired 5.56 mm	Frangible .50 cal (<20 acres Tier 2, <45 acres Tier 3 affected)	Frangible 7.62 mm (<5 acres of Tier 2 affected)	Standard 7.62 mm (<6.7 acres of Tier 2 affected)	Frangible 5.56 mm	Frangible 50 cal
Potential salamander habitat[b]	Standard 5.56 mm	SAW-fired 5.56 mm	Frangible 5.56 mm	Frangible .50 cal	Frangible 5.56 mm (.09 acres affected)	Frangible 7.62 mm (.11 acres affected)
Bog frog[b]	Standard .50 cal	Frangible .50 cal	Standard .50 cal	SAW-fired 5.56 mm	SAW-fired 5.56 mm	SAW-fired 5.56 mm
RCW inactive[b]	Standard .50 cal	SAW-fired 5.56	Frangible .50 cal	SAW-fired 5.56 mm	Standard .50 cal	Standard .50 cal
RCW active[b]	Standard .50 cal	Standard. 50 cal	Standard .50 cal	SAW-fired 5.5 mm	Standard .50 cal	Standard .50 cal

[a]Shaded areas denote largest munition footprint accommodated with the lowest resource impact.
[b]Effective range of munitions used to assess potential impacts to habitats and sensitive species.

A discussion of analysis results of each candidate site follows.

Weaver River

The Weaver River site is almost wholly located within the Yellow River Aquatic Preserve. The logical orientation of fire for this site is in a south-southeasterly direction. A potential mission or training objective, Choctaw Field, is located within two miles south of the Weaver River site.

Potential Impacts to People

According to the spatial analysis using the Census 2000 population blocks, an estimated nine persons live within the buffer for the frangible 5.56 mm, which is the smallest buffer analyzed. However, there were no residential lands according to Florida Land Use Classification GIS files. Possible explanations may be that the Census 2000 data is more current than the Florida Land Use data and people have moved into areas not previously occupied. Or, Census blocks, which in Figure G-3 show an average density per square mile, may not be broken down to sufficient resolution (i.e., the same resolution as Florida Land Use maps) as to indicate the populated areas of a specific block. In this way, false positives of people affected may occur. Comparing the population in Figure G-3 with the residential land use in Figure G-2, it is possible that there are no persons living within any buffer until the maximum range of the standard 5.56 mm is considered. At this point, more residential land is affected than at any other site. This site is also limited by Choctaw Field, which is south of the Weaver River. Choctaw Field falls within the maximum range of the standard 5.56 mm, an indication that frangible munitions may be the only type of munition that could be used at the Weaver River site. **Overall, the Weaver River site appears to have the greatest potential for impacts to people and residential areas off the Eglin Military Complex.** For any site selected, verification of populated areas by field investigation would be required.

Potential Impacts to Habitats

Up to and including the standard 7.62-mm munition, no FNAI tier habitats would be affected. The SAW-fired standard 5.56 mm would potentially affect 13.5 acres of Tier 2 habitat. A comparison with other sites indicates that **the Weaver River site would have the lowest potential impact to important vegetative habitats.**

Potential Impacts to Sensitive Species

Buffer zone analysis indicates that for standard 5.56 mm no impacts to flatwoods salamanders would occur, and standard .50 cal munitions could be fired without impact to known bog frog locations or RCW active or inactive cavity trees. The Weaver River has the lowest potential impacts for RCWs and bog frogs and the third lowest potential for affecting flatwoods salamanders. Firing oriented in a south-southeasterly direction would minimize impacts to habitats and sensitive species. **Overall, the Weaver River site appears to have the least impact to sensitive species.**

Potential Environmental Justice Impacts

Environmental Justice analysis indicates a potential for impacts to persons of low income living near the Weaver River site. The Weaver River site ranked third for potential environmental justice impacts.

Weaver Creek

The Weaver Creek site is located about two miles east of the Weaver River site in the western portion of the Eglin Military Complex. Highway 87 and a utility easement are located approximately one mile east of this site; thus the most logical (and safest) direction of fire is southwest in the direction of Choctaw Field, which could be used as a potential mission or training objective. Due to the location of Choctaw Field, the largest caliber munitions potentially available for use would be the standard 5.56 or 7.62 mm.

Potential Impacts to People

Weaver Creek could accommodate the frangible .50 cal munition without potential impact to people off the reservation. The .50 cal frangible footprint would be wholly contained on Eglin with no overlap onto state roads or major facilities. A ground reconnaissance would be necessary to identify other structures that may occur within any munition footprint. Residential areas would not be affected until the SAW-fired 5.56 munition were considered, but a southwest direction of fire would overlap Choctaw Field. Firing in an east or southeasterly direction would require closure of Highway 87 for several munitions. The location of the utility easement and Highway 87 precludes firing of calibers with maximum ranges greater than that of the frangible 7.62mm. Maximum range buffer analysis indicates that frangible 7.62 mm could potentially be fired in an easterly direction with no impact to Highway 87 or the utility easement.

Potential Impacts to Habitats

The frangible .50 cal, which would affect <20 acres of Tier 2 habitat at Weaver Creek, is the largest caliber of munitions that could be used at Weaver Creek without major impact. Minor adjustments to the direction of fire, which would be generally to the southwest, and specific target placement along the 1-mile length of the range may reduce the amount of Tier 2 habitat affected. If firing in an easterly direction, munitions up to frangible 7.62 mm could be accommodated with impacts limited to primarily Tier 3 habitat.

Potential Impacts to Sensitive Species

One known location of a bog frog exists within the standard 5.56-mm effective range; thus frangible .50 cal could be accommodated with no risk to this species (based on known locations). Active RCW trees would not be affected by any of the munitions considered. Inactive trees would not be affected by SAW-fired 5.56 mm. Potential salamander habitat would not be affected by use of the SAW-fired 5.56 mm.

Potential Environmental Justice Impacts

Analysis indicates no potential environmental justice impacts at this site.

Boiling Creek

The Boiling Creek segment identified as a potential candidate site for riverine live fire is located entirely on Eglin property in the southwest area of the Eglin Military Complex. The logical orientation of fire is either in a southeasterly or southwesterly direction. A potential mission objective, Test Area B-76, is located within one mile to the northeast of Boiling Creek.

Potential Impacts to People

People and residential areas would not be affected from frangible munitions of .50 caliber and smaller as determined by maximum range buffer analysis. The next largest munition footprint or buffer, associated with the standard 5.56-mm maximum range would potentially affect

15 persons, which is the comparatively lowest impact of all candidate sites for that munition. Effective range buffer analysis indicates that no persons or residential areas exist within range of standard (lead or tungsten) .50 cal or smaller munitions. In summary, **the Boiling Creek site would have the lowest potential impact of all candidate sites to persons or residential land.**

Potential Impacts to Habitats

Approximately .44 acres of FNAI Tier 2 habitat would be affected by the munition with the smallest effective range, the frangible 5.56 mm. The next largest buffer, for the frangible 7.62 mm, overlays (i.e., potentially affects) 4.4 acres of FNAI Tier 2 habitat. The frangible .50 cal buffer overlays approximately 10 acres of Tier 2 habitat. Tier 1 habitat would not be affected until the largest munition, the standard .50 cal, was used; the SAW-fired 5.56-mm munition would not affect Tier 1 habitat, but would affect up to approximately 500 acres of Tier 2. For the standard .50 cal, approximately 128 acres of Tier 1 habitat are located within the effective range of that munition and would be adversely affected. A significant botanical site occurs within the effective range but can be avoided by slightly adjusting the direction of fire more eastward. Thus, for this candidate site, minimal environmental impacts would occur to high quality natural vegetative habitats through use of the frangible .50 cal and smaller munitions.

Potential Impacts to Sensitive Species

Approximately 1.2 acres of potential flatwoods salamander habitat would be affected by the frangible 7.62 mm, but none from the use of the frangible 5.56 mm, which has the smallest effective range of all munitions. Impacts to flatwoods salamander habitat may be avoided entirely for all munitions if firing is oriented in a southeasterly direction. There is no risk to known locations of bog frogs from any of the munitions considered. No active RCW cavity trees occur within the effective range of any of the munitions considered. Inactive cavity trees occur within effective range of the standard 5.56 mm and higher calibers. **The Boiling Creek site has a low potential impact to sensitive species.**

Potential Environmental Justice Impacts

Analysis indicates no potential environmental justice impacts at this site.

Broxson's Landing

Broxson's Landing is located on a natural bend of the Yellow River on the northwest boundary of the Eglin Military Complex. The logical orientation of fire for this site ranges from southwest to southeast. A potential mission or training objective, Test Area B-76 is located within two miles to the west of Broxson's Landing.

Potential Impacts to People

There are no persons or residential lands within the maximum range of the frangible .50 cal munition. Munitions larger than the frangible .50 cal would have potential impacts to persons outside of the Eglin Military Complex.

Potential Impacts to Habitats

There are no Tier 1 Areas within the effective range of any munition considered at the Broxson's Landing site. Tier 2 areas would be minimally affected by the use of standard 7.62-mm munitions and lower. Use of the SAW-fired 5.56 mm would potentially affect 55 acres of Tier 2. A considerable percentage of Tier 3 lands near this site may allow for flexible target placement to avoid impacts to Tier 2 habitats. **Comparatively, use of Broxson's Landing would have the second lowest potential for impacts to vegetative habitats.**

Potential Impacts to Sensitive Species

A small amount (~7 acres) of potential flatwoods salamander habitat exists directly south of Broxson's Landing, close to the Yellow River, and essentially in the center of the one-mile range segment. Thus, avoiding this area would be difficult. Use of frangible .50 cal would have no impact on salamander habitat, while increasing the caliber to standard 5.56 and 7.62mm would affect 6.7 acres of habitat. Though this amount is small compared to other sites such as Boiling Creek, Mett's Creek and Yellow River East (Figure G-1), it is within the logical firing direction and would possibly have to be cleared to accommodate target placement. Further investigation of this site would be required to determine whether this habitat could be avoided. Potential impacts to bog frogs and RCWs are low until footprints of standard .50 cal are considered, at which point considerable effects to RCW active (11) and inactive (26) cavity trees would occur.

Potential Environmental Justice Impacts

Analysis indicates a potential for environmental justice impacts to persons of low income living near Broxson's Landing. This site has the second highest potential for environmental justice impacts.

Mett's Creek

The Mett's Creek site is located wholly within the Eglin Military Complex approximately one mile northeast of Camp Rudder. The location of Camp Rudder dictates that the most flexible firing direction, that is the one that would accommodate the greatest number of munitions, would be to the southeast.

Potential Impacts to People

Frangible .50 cal munitions could potentially be used with no impacts to persons (including Camp Rudder) or residential areas.

Potential Impacts to Habitats

There are no Tier 1 areas within maximum range of the standard .50 cal munition. The Mett's Creek area has the highest concentration of Tier 2 acreage among the six candidate sites. The frangible 5.56 mm could potentially be used without impacts to Tier 2 areas, but the next higher caliber, the frangible 7.62 mm, would require clearing approximately 37 acres of Tier 2 habitat.

Thus, Mett's Creek would have the highest potential of all candidate sites to impact important vegetative habitats.

Potential Impacts to Sensitive Species

A minimal amount of potential flatwoods salamander habitat would be affected from use of frangible 5.56-mm munitions. Analysis indicates that the greatest amount of flatwoods salamander habitat falls within the effective range of munitions at this site, but Figure G-1 illustrates that most of this habitat exists opposite of the logical direction of fire for this site. Still, for standard munitions, the amount of potential flatwoods salamander habitat that may have to be cleared could exceed 100 acres. Mett's Creek has a very low occurrence of other sensitive species concerns, with only one known bog frog location and no RCW trees, active or inactive, within the maximum range of the standard .50 cal Still, potential impacts to flatwoods salamander habitat would be considerable. **Thus, Mett's Creek has a high potential for impacts to sensitive species.**

Potential Environmental Justice Impacts

There are no environmental justice impacts for this site.

Yellow River East

This site is located on the Yellow River along the north boundary of the Eglin Military Complex, about 2.5 miles northeast of Camp Rudder. The logical direction of fire for this site would be south or to the southeast away from the direction of Camp Rudder.

Potential Impacts to People

Analysis indicates there are people within the maximum ranges of all munitions considered. No residential lands are located within the maximum range of the frangible .50 cal, but above that both people and residential areas would be affected. **This site has the second greatest potential for impacts to persons or residential areas off the Eglin Military Complex.**

Potential Impacts to Habitats

No Tier 1 areas would be affected for any munition considered in the analysis. Tier 2 areas would not be affected until use of standard munitions, at which point sufficient Tier 3 areas within the footprint could be considered for target placement. Thus, impacts to Tier 2 areas at this site could be minimized or avoided. Analysis for the standard 5.56 mm indicates the presence of 125 acres of Tier 2 and 365 acres of Tier 3. A southerly direction of fire would minimize impacts to Tier 2.

Potential Impacts to Sensitive Species

The frangible 7.62-mm munition could potentially be used with no or low impacts to flatwoods salamanders. A frangible .50 cal would potentially affect 1.3 acres of flatwoods salamander habitat, but this habitat could likely be avoided since it occurs west of the site and not within the logical direction of fire. An increase to standard munitions (i.e., the 5.56 mm) would encounter flatwoods salamander habitat to the south and southeast of the site that could not be avoided. Some flatwoods salamander habitat would likely be cleared if standard munitions were used at this site. There are three known bog frog locations within effective range of the standard .50 cal, but none within range of the SAW-fired 5.56 mm. No RCWs would be affected.

Potential Environmental Justice Impacts

The Yellow River East site has the **highest potential** of all candidate sites for environmental justice impacts to persons of low income.

5. CONCLUSION

The Boiling Creek site presents relatively few environmental effects while retaining the greatest degree of mission flexibility. It is wholly located on Eglin, is within one mile of a desirable mission objective (Test Area B-76), and poses the least concern to persons and residential areas off of the Eglin Military Complex. Residential lands have not been identified within maximum range of the 7.62 mm; thus the potential for use of calibers up to this size is a possibility, but some additional control (i.e., lease or purchase) of non-Eglin lands adjacent to this site would be required to establish safety buffers for the 7.62 mm. Erosion from clearing of any of the potential sites discussed above has the potential to affect the Gulf sturgeon because all of the sites drain into the Yellow River system, which is known Gulf sturgeon habitat; however, erosion-control measures can minimize any runoff. Flatwoods salamander habitat has been identified within the effective ranges of the larger standard munitions, but is located opposite the direction of fire; thus, impacts to this species could be avoided.

APPENDIX H

TOXICITY ASSESSMENT OF AMMUNITION

TOXICITY ASSESSMENT OF AMMUNITION

1. BACKGROUND – FRANGIBLE MUNITIONS

Frangible bullets are commonly used in training exercises to reduce lead hazards on firing ranges. The Interagency-working Group for Non-Toxic Small Arms Ammunition known as the "Green Bullet" team has focused on non-lead bullet material composed of tin and tungsten as leading candidates for use in military ammunition. The rounds have been tested by the military with favorable results. The armed forces uses between 300 million to 400 million rounds of small caliber ammunition each year. Officials intend to replace all lead in bullets by 2003 (Global Security, 2003).

Frangible bullets break into smaller fragments upon contact with hard surfaces. Each small fragment quickly loses energy, thus eliminating danger at close quarters to the shooter or others during training. Frangible rounds are made in a variety of configurations but all perform in the same basic manner. Some are hollow point rounds filled with small metal beads, while others are solid rounds with grooves or notches intended to facilitate rapid breakup. Frangible rounds are available in a variety of pistol calibers, but due to inherent high velocities of rifle rounds, frangible ammunition is less effective in rifles. Frangible rounds currently used are the 5.56 mm and 7.62 mm. Both 9-mm and .50 caliber rounds are being developed.

The Department of Energy's Oak Ridge National Laboratory (ORNL) has developed an all-metal replacement for lead in bullets using powder metallurgy techniques. Bullets are fabricated from mixtures of powdered metals that are pressed at room temperature to produce a solid cylindrical core. Then they are changed into the shape of a bullet using a technique called swagging.

The environmental stability, mobility, and biological uptake of tungsten from bullets made of tungsten-nylon and tungsten-tin were studied by (ORNL). Concentrations of tungsten in leachate from experiments using sand showed the greatest mobility of tungsten. Outdoor exposures and accelerated aging tests studied the stability of materials. Data showed that tungsten powder oxidizes to form tungsten-oxide, which is insoluble in water and fairly stable in the environment. Biological uptake revealed that earthworms were not adversely affected by exposure to soil contaminated with the tungsten containing bullets and the uptake of tungsten by the earthworms was minimal to zero (Lowden, 2003).

2. TOXICITY ASSESSMENT

Bioaccumulation factors and ecological benchmarks are tools used to assess environmental impacts from contaminants. The fish bioaccumulation factor is often used as a threshold used for screening purposes in aquatic systems. When a BAF is above 1,000, bioaccumulation should be considered. None of the chemical constituents of ammunition have a fish BAF greater than 1,000. Ecological benchmarks for soil, soil microbes, soil invertebrates, plants and surface water provide levels at which exceedance may cause adverse impacts. Table H-1 lists BAFs and ecological benchmarks for heavy metals associated with both frangible and non-frangible standard ammunition.

Table H-1. Fish Bioaccumulation Factors and Ecological Screening Benchmarks for Metals in Ammunition

Chemical	CAS #	Fish BAF (L/kg)	USEPA Region IV Soil Screening Benchmarks (mg/kg)	ORNL Soil Microbe Benchmarks (mg/kg)	ORNL Soil Invertebrate Benchmarks (mg/kg)	ORNL Plant Benchmarks (mg/kg)	USEPA Region IV Acute Surface Water Screening Benchmarks (mg/L)
Copper	7440508	3.2	40	100	50	100	0.0177
Iron	7439896	3.2	200	200	ND	ND	ND
Lead	7439921	3.2	50	900	500	50	0.0816
Tin	7440315	100	53	2000	ND	50	ND
Tungsten	7440337	3.2	400	400	ND	ND	ND
Zinc	7440666	3.2	50	100	100	50	0.117

Source: ORNL, 2003

The adverse environmental impacts of lead in shooting rounds are well documented. Although lead replacement metals such as tungsten and tin are considered to be less environmentally impactive than lead (Bogard, 2002), studies on the chemical fate and transport of all frangible munitions composite materials (i.e., copper, zinc) are lacking. Of concern is the predisposition of frangible munitions to break apart into tiny fragments, which may become more readily bioavailable to terrestrial and aquatic biota. Table H-2 lists the potential fate and transport and an ecological toxicity assessment of metals used in frangible and standard training rounds.

Table H-2. Chemical Fate and Transport and Toxicity Assessment Metals in Ammunition

Chemical	ENVIRONMENTAL FATE AND TRANSPORT	ECOLOGICAL TOXICITY
Copper	Copper can enter the environment on military ranges from the corrosion of brass weaponry or small arms ammunition. Copper is also found naturally in the environment. The majority of copper released to soils becomes bound to soils or organic matter. Much of the copper discharged into waterways is in particulate matter and settles out, precipitates out, or adsorbs to organic matter, hydrous iron and manganese oxides, and clay in sediment or in the water column. A significant fraction of the copper is adsorbed within the first hour, and in most cases, equilibrium is obtained within 24 hours. Copper binds primarily to organic matter in estuarine sediment, unless the sediment is organically poor. The ability of copper to leach from soils is dependent upon the acidic content of rainfall through the soil (ATSDR, 1990). One study showed that copper became mobile only following rainfall that was acidic at a pH of <3. Thus the primary transport pathway of copper would be from leaching through the acidic to slightly acidic permeable sandy soils. Because copper binds so strongly to suspended particles and sediments, it typically does not enter groundwater. Because copper adsorbs to organic matter, carbonates and clay in the environment, its bioavailability is reduced.	Copper sulfate and other copper compounds are used as algaecides with the free copper ions acting as the lethal agents. Single-cell and filamentous algae and cyanobacteria are very susceptible to the effects, which include reductions in photosynthesis and growth, loss of photosynthetic pigments and death. Sensitive algae can be affected at low concentrations of free copper in freshwater. It is highly toxic to fish and has been lethal to trout even at recommended applications. Copper is acutely toxic to a variety of freshwater species ranging from sensitivities of 17.74 μg/L for pike minnow species to 10,240 μg/L for stonefly species (USEPA, 1986). In laboratory studies, animals exposed to copper showed liver and kidney death at doses > 100 mg/kg/day. Copper has been shown to be poisonous to terrestrial organisms in soil (e.g., earthworms). Extensive use of copper containing fungicides in orchards has been known to eradicate soil organisms (TOXNET, 2003). Copper sulfate is fairly non-toxic to birds with the lowest lethal dose shown at 1,000 mg/kg in pigeons and 600 mg/kg in ducks. The bioconcentration factor (BCF) of copper in fish obtained in field studies is 10–100, indicating a low potential for bioconcentration. The BCF is higher in mollusks, especially oysters, where it may reach 30,000 possibly due to the fact that they are filter feeders, and copper concentrations are higher in particulates than in water. However, there is abundant evidence that there is no biomagnification of copper in the food chain (ATSDR, 1990).
Tin	Tin is combined with other chemicals to form compounds. When combined with chemicals such as chlorine, sulfur, or oxygen, it is called an inorganic tin compound. When combined with materials that contain carbon, it is called an organotin. In water, some tin compounds dissolve and adsorb to sediments. Photodegradation and biodegradation of organotins may occur at relatively slow rates. Organotin compounds may be significantly bioconcentrated by aquatic organisms (ATSDR, 1992).	Studies on the effects of tin on terrestrial and aquatic biota are minimal. Metallic tin is considered of low oral toxicity due to poor absorption following ingestion. Results from animal laboratory toxicity studies showed that the ingestion of large amounts of powdered tin resulted in vomiting but no permanent injury was reported (Toxnet, 2003).

Table H-2. Chemical Fate and Transport and Toxicity Assessment Metals in Ammunition Cont'd

Chemical	ENVIRONMENTAL FATE AND TRANSPORT	ECOLOGICAL TOXICITY
Lead compounds	Lead oxidizes when exposed to air and dissolves when exposed to acidic water and soil. Lead bullets, bullet particles, or dissolved lead can be moved by stormwater runoff and dissolved lead can migrate through soils to the groundwater. The primary cause of lead mobilization from ammunition is from metallic lead to form Pb^{+2} (dissolved from the crust of ammunition) and a combination of oxidized compounds. Acidic soils tend to increase lead oxidation and dissolution (ATSDR, 1999). The downward movement of elemental lead and inorganic lead compounds from soil to groundwater by leaching is very slow under most natural conditions except for highly acidic situations. Soils low in clay (sandy), and containing organic matter, iron and aluminum oxides, and are acidic, are all conditions that are favorable to lead mobility and leachability. Plants and animals may bioconcentrate lead. Lead partitions primarily to sediments, but becomes more bioavailable under low pH, hardness and organic matter content (among other factors). Lead bioaccumulates in algae, macrophytes and benthic organisms, but the inorganic forms do not biomagnify. (ATSDR, 1999).	Lead is cancer causing, and adversely affects reproduction, liver and thyroid function, disease resistance. Plants and animals may bioconcentrate lead but biomagnification has not been detected (ATSDR, 1999). Fish exposed to high levels of lead have shown muscular and neurological degeneration and destruction, growth inhibition, death, reproductive problems, and paralysis. Birds and mammals suffer effects from lead poisoning such as damage to the nervous system, kidneys, liver, sterility, growth inhibition, developmental retardation, and detrimental effects in blood (USEPA, 2003). Lead poisoning in higher organisms has been associated with lead shot and organolead compounds. The main potential ecological impacts of the wetland contaminants result from direct exposure of algae, benthic invertebrates, and embryos and fingerlings of freshwater fish and amphibians to lead. Potential endpoints include growth reductions and impaired survival (USEPA, 2003). In the form of simple salts, lead is acutely toxic to freshwater organisms at concentrations above 40 mg/L and for marine organisms above 500 mg/L (WHO, 1989). Calves pastured on a target area of a military shooting range showed acute lead poisoning that included symptoms of maniacal movements, drooling, rolling eyes, and convulsions. Most calves died, and blood levels of lead were as high as 940 µg/L. Concentrations of lead in the grass and soil were 29,550 mg/kg and 3,900 mg/kg, respectively (Braun, et al., 1997). Birds including fowl, ducks, geese and pigeons are all prone to **lead** poisoning. All exhibit anorexia and ataxia, followed by excitement and loss of function. Egg production, fertility, and hatchability decrease and mortality is high (Toxnet, 2003). Lead shot is highly toxic to birds; ingestion of a single pellet can be fatal to some birds (WHO, 1989).

Table H-2. Chemical Fate and Transport and Toxicity Assessment Metals in Ammunition Cont'd

Chemical	ENVIRONMENTAL FATE AND TRANSPORT	ECOLOGICAL TOXICITY
Tungsten	Tungsten oxidizes in air. It has excellent corrosion resistance and is attacked only slightly by most mineral acids. **Tungsten** compounds exist as ions or insoluble solids in the environment (Toxnet, 2003). Tungsten is insoluble in water and, therefore, not mobile in most environments. Thus, if released to soil, **tungsten** compounds will have moderate to low mobility due to high sorption coefficients ranging from 10,000 to 50,000 at pHs 5 to 6.5 (Toxnet, 2003). If released into water, **tungsten** compounds will adsorb to suspended solids and sediment.	There is considerable difference in the toxicity of soluble and insoluble compounds of tungsten. Elemental tungsten is virtually insoluble and is, therefore, expected to be relatively nontoxic. Based on results from a toxicological report and toxicity testing the USFWS concluded that TP shot (95.5 percent tungsten and 4.5 percent Nylon 6 or 11, by weight with <1 percent residual lead), did not pose a significant danger to migratory birds or other wildlife and their habitats (Federal Register, 1998). There was concern that the absorption of tungsten into the femur, kidney, and liver could potentially affect the spectacled eider (*Somateria fischeri*), a species already subject to adverse weather, predation, and lead poisoning on the Yukon-Kuskokwim (Y-K) Delta, Alaska, thus, TP shot was not approved for the Y-K Delta (Federal Register, 1998). Preliminary uptake studies revealed that earthworms were not adversely affected by exposure to soil contaminated with tungsten-containing bullets and that uptake by earthworms was minimal to zero (Lowden, 2003).
Zinc	Zinc is not found in free form in nature but rather occurs as zinc sulfide or zinc oxide. As with copper, zinc can enter the environment from corrosion of brass weaponry or small arms. When released to the air it can bind to soil, sediments, and dust particles. Zinc ions and zinc complexes can migrate to groundwater and move to surface waters. Most of the zinc in soils stays bound to soil particles. Neutral soils between pH of 6 and 7 reduce the availability of zinc to soils. Zinc in aquatic systems tends to be partitioned into sediment and less frequently dissolved as hydrated zinc ions and organic and inorganic complexes (USEPA, 2003). Zinc has been shown to bioaccumulate in fish and other organisms; however, it does not bioaccumulate in plants (ATSDR, 1995).	In many types of aquatic plants and animals, growth, survival, and reproduction can all be adversely affected by elevated zinc levels. Zinc is toxic to plants at elevated levels, causing adverse effects on growth, survival, and reproduction (USEPA, 2003). Terrestrial invertebrates show sensitivity to elevated zinc levels, with reduced survival, growth, and reproduction. Elevated zinc levels can cause mortality, pancreatic degradation, reduced growth, and decreased weight gain in birds; and they can cause a wide range of problems in mammals including: cardiovascular, developmental, immunological, hepatic, renal, neurological, hematological, pancreatic, and reproductive (USEPA, 2003). The aquatic toxicity of zinc is dependent upon organism age, size, prior exposure, water hardness, pH, dissolved organic carbon, and temperature. Reported acute toxicity values of dissolved zinc to freshwater and marine organisms are as follows: freshwater invertebrates (0.07 mg/L), water flea (575 mg/L), marine invertebrates (0.097 mg/L), grass shrimp (11.3 mg/L). Acutely lethal concentrations for freshwater fish range from 0.066 to 2.6 mg/L; the range for marine fish is 0.19 to 17.66 mg/L (USEPA, 1980). Zinc has shown adverse reproductive, biochemical, physiological, and behavioral effects on aquatic organisms.

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APPENDIX I

FEDERAL AGENCY CZMA CONSISTENCY 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.

Pursuant to Section 307 of the Coastal Zone Management Act, 16 U.S.C. § 1456, as amended, its implementing regulations at 15 C.F.R. Part 930, this is a Federal Consistency Determination for mission activities described within the Estuarine and Riverine Areas Programmatic Environmental Assessment (Chapter 2 of the EA).

Proposed Federal Agency Action

The proposed action and the preferred alternative of the EA is Alternative 5, which entails the establishment of a Live-Fire Riverine Range on a tributary of the Yellow River, a Live-Fire Estuarine Range with locations on Santa Rosa Island and the selected areas of Air Force owned property along the shoreline of Choctawhatchee Bay and a 100 percent increase of missions activity as evaluated during the baseline years from 1995 to 1999. Estuarine and Riverine missions feature air/land/water transitions of small groups of primarily special forces and similar units. More detail of Estuarine and Riverine missions is provided in Chapter 2 of the EA.

The U.S. Air Force, Air Armament Center has evaluated the missions described in the Estuarine and Riverine Areas Programmatic Environmental Assessment for potential effects to the land or water uses or natural resources of the State of Florida's coastal zone within the context of the statutes listed in the Florida Coastal Zone Management Plan (below).

Federal Consistency 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 its response is not received by Eglin AFB on the 60th day from receipt of this determination.

Statute	Scope	Consistency
Chapter 161 Beach and Shore Preservation	Authorizes the Bureau of Beaches and Coastal Systems within DEP to regulate construction on or seaward of the states' beaches.	The proposed project will not adversely affect beach and shore management, specifically as pertains to: -The Coastal Construction Permit Program. Construction would not occur seaward of the mean high water line. -The Coastal Construction Control Line (CCCL) Permit Program. Construction would not occur seaward of the CCCL, where wind and wave forces would potentially cause significant fluctuations in the beach/dune system. Further, all land activities occur on federal property. -The Coastal Zone Protection Program. Buildings would not be constructed between the seasonal high-water line and 1,500 feet landward of the CCCL.
Chapter 163, Part II Growth Policy; County and Municipal Planning; Land Development Regulation	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.	The proposed action, which occurs primarily on federal property, conforms with local government comprehensive development plans. Transitions from federal property into state waters primarily occur within restricted and prohibited areas controlled by the U.S. Air Force and would not interfere with development.
Chapter 186 State and Regional Planning	Details state-level planning requirements. Requires the development of special statewide plans governing water use, land development, and transportation.	State and regional agencies were provided the opportunity to review the environmental assessment. The proposed action, which occurs primarily on federal property, conforms with the State Comprehensive Plan and associated translational plans, including the State Land Development Plan, Florida Water Plan, Florida Transportation Plan, and strategic regional policy plans.
Chapter 252 Emergency Management	Provides for planning and implementation of the state's response to, efforts to recover from, and the mitigation of natural and manmade disasters.	The proposed action would not increase the state's vulnerability to natural disasters. Emergency response and evacuation procedures would not be impacted by the proposed action. Activities described in the EA did not historically require closures of state roadways; thus, traffic delays are not expected.
Chapter 253 State 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.	The proposed action would involve the use of state submerged lands. However, the water areas used in Choctawhatchee Bay, Santa Rosa Sound, and the Gulf of Mexico exist within Air Force controlled restricted, prohibited and warning areas. Though the project would occur on state lands or state submerged lands, an Environmental Resource Permit (ERP) or Joint Coastal Permit (JCP) is not necessary given that the proposed action would not result in impacts to submerged resources.

Statute	Scope	Consistency
Chapter 258 State Parks and Preserves Chapter 259 Land Acquisition for Conservation or Recreation Chapter 260 Recreational Trails System Chapter 375 Multipurpose Outdoor Recreation; Land Acquisition, Management, and Conservation	Addresses administration and management of state parks and preserves (Chapter 258). Authorizes acquisition of environmentally endangered lands and outdoor recreation lands (Chapter 259). Authorizes acquisition of land to create a recreational trails system and to facilitate management of the system (Chapter 260). 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 375).	State parks, recreational areas and aquatic preserves would be affected by the proposed action in that some missions involve boat operations within the Yellow River Marsh Aquatic Preserve. The effects would not be significant and are compatible with the types of uses presently occurring on the river. Dredge and fill operations, or erection and repair of structures would not occur within any aquatic preserves. Tourism and outdoor recreation, discussed in Chapter 4, Sections 4.3.1 and 4.3.5 would not be significantly affected. Opportunities for recreation on state lands would not be significantly decreased.
Chapter 267 Historical Resources	Addresses management and preservation of the state's archaeological and historical resources.	Potential impacts to cultural resources are discussed in Chapter 4, Section 4.6 of the EA. Archeological sites occur at East Bay Point, Yellow River, Wynnhaven Beach, Ft. Rucker Recreation Area and Alaqua Point. Some of the sites are in various stages of investigation and/or data collection by the Eglin Cultural Resources Branch (AAC/EMH), and the information gathered will be used to manage and minimize the impact of activities discussed in this PEA. Due to the presence of other sites that have not been evaluated, coordination with AAC/EMH and consultation with the State Historic Preservation Office is required.
Chapter 288 Commercial Development and Capital Improvements	Provides the framework for promoting and developing the general business, trade, and tourism components of the state economy.	The proposed action occurs primarily on federal property. The proposed action is not anticipated to have any effect on future business opportunities on state lands, or the promotion of tourism in the region.

Statute	Scope	Consistency
Chapter 334 Transportation Administration Chapter 339 Transportation Finance and Planning	Addresses the state's policy concerning transportation administration (Chapter 334). Addresses the finance and planning needs of the state's transportation system (Chapter 339).	Potential impacts to public transportation were evaluated in Chapter 4, Section 4.3 of the EA. Some potential for short-term closure of highways and waterways exist. Based on the analysis, the proposed action would not have a significant effect on water and land transportation within the region of influence. Coordination (i.e., notification) with local government and the State Department of Transportation and/or U.S. Coast Guard is required. Management practices to minimize impacts would be implemented and are presented in Appendix B.
Chapter 370 Saltwater Fisheries	Addresses management and protection of the state's saltwater fisheries.	Saltwater fisheries would not be significantly affected. Access to some water areas may be temporarily restricted. Guidelines for the frequency of closure of Gulf and Sound water areas are published in the U.S. Coast Pilot and would be followed. Potential impacts were evaluated in Chapter 4, Section 4.3.
Chapter 372 Wildlife	Addresses the management of the wildlife resources of the state.	Potential impacts to wildlife, including threatened and endangered species are evaluated in Chapter 4, Section 4.2.1 and Appendix G. The proposed action would not significantly affect threatened and/or endangered species. Impacts to threatened and endangered species would be minimized or prevented through the implementation of management practices, and coordination with Eglin Natural Resources, and state and federal protected resource management agencies. A biological assessment would be prepared for potential impacts to federally listed species.
Chapter 373 Water Resources	Addresses the state's policy concerning water resources.	The proposed action would affect surface waters since all of the activities involve some aspect of water transportation or use. Erosion and impacts to water quality are discussed in Chapter 4. Consumptive water use, though not discussed in the EA, will not interfere with any presently existing legal use of water, and use of water resources is consistent with the public interest. Best management practices would be implemented to minimize erosion and associated water quality impacts. As discussed in Chapter 4, potential impacts to water resources would not be significant.
Chapter 376 Pollutant Discharge Prevention and Removal	Regulates transfer, storage, and transportation of pollutants, and cleanup of pollutant discharges.	The proposed action does not involve the storage and transportation of pollutants. The discharge of solid materials, including brass casings, copper bullets and debris, may occur during training exercises. Incidental amounts of petroleum products may be released during small boat operations. There would be no significant impacts to the environment from pollutant discharges.

Statute	Scope	Consistency
Chapter 377 Energy Resources	Addresses regulation, planning, and development of energy resources of the state.	Energy resource production, including oil and gas, and the transportation of oil and gas, would not be affected by the proposed action.
Chapter 380 Land and Water Management	Establishes land and water management policies to guide and coordinate local decisions relating to growth and development.	The proposed action would primarily occur on federally owned lands. Under the proposed action, development of state lands with regional (i.e., more than one county) impacts would not occur. Areas of Critical State Concern or areas with approved state resource management plans such as the Northwest Florida Coast and the Escambia and Santa Rosa Counties coastal area would not be affected. Changes to coastal infrastructure such as bridge construction, capacity increases of existing coastal infrastructure, or use of state funds for infrastructure planning, designing or construction would not occur.
Chapter 381 Public Health, General Provisions	Establishes public policy concerning the state's public health system.	The proposed action does not involve the construction of an on-site sewage treatment and disposal system. Field wastes would be collected via portable latrines and disposed at an offsite sewage treatment facility. A permit is not applicable for the proposed action.
Chapter 388 Mosquito Control	Addresses mosquito control effort in the state.	The proposed action would not affect mosquito control.
Chapter 403 Environmental Control	Establishes public policy concerning environmental control in the state.	Some aspects of the proposed action occur in state waters and would affect ecological systems and water quality of state waters to a small degree. Effects on water quality would not be significant. No dredge and fill operations, discharges into groundwater or effects to public drinking water supplies would occur. Debris from training such as shell casings may be input into state waters but attempts would be made to minimize the expenditure of casings into surface waters. The proposed action would involve air emissions from boats, helicopters, smoke grenades and small arms ammunition but this amount is comparatively small with respect to other air emission sources. Air quality impacts, analyzed in Chapter 4, Section 4.4.1, 4.4.2, 4.4.3 and 4.4.4, would not be significant.
Chapter 582 Soil and Water Conservation	Provides for the control and prevention of soil erosion.	The proposed action would result in soil erosion and increases in turbidity from soil erosion. Best management practices for preventing and controlling erosion would be necessary and are described in Appendices B and H.

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APPENDIX J

STATE CLEARINGHOUSE COMMENTS AND CZMA CONCURRENCE

Department of Environmental Protection

Jeb Bush
Governor

Marjory Stoneman Douglas Building
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David B. Struhs
Secretary

February 3, 2004

Ms. Elizabeth B. Vanta
Chief, Environmental Analysis Branch
501 DeLeon St, Ste 101
Eglin AFB, FL 32542-5133

RE: U.S. Department of the Air Force – Draft Programmatic Environmental Assessment (PEA) For Estuarine and Riverine Areas – Eglin Air Force Base – Santa Rosa, Okaloosa and Walton Counties, Florida
SAI FL200312084782C

Dear Ms. Vanta:

The Florida State Clearinghouse, pursuant to Presidential Executive Order 12372, Gubernatorial Executive Order 95-359, 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, has coordinated the review of the above-referenced Draft Programmatic Environmental Assessment (PEA).

The proposed action is for the 46th Test Wing Commander to establish an authorized level of activity within estuarine and riverine areas based on an anticipated maximum usage, plus the establishment of live-fire riverine and beach ranges. Locations of the proposed training activities include Choctawatchee Bay, Santa Rosa Sound, Yellow River, Blackwater Bay, East Bay River, and nearshore waters of the Gulf of Mexico.

The Department of Environmental Protection (DEP) notes that the activities will be located in a part of northwest Florida that has naturally acidic soils and groundwater. Expendables such as ammunition may react under acidic conditions, eventually leaching into the groundwater or surface water. This would suggest the use of non-lead ammunition near the base's freshwater resources, especially in the Boiling Creek drainage. The DEP understands that Eglin's Jackson Guard/United States Fish and Wildlife Service has an active stream benthic monitoring program and believes that the information from this program would provide an excellent background for future missions. Background stream benthic monitoring is recommended at all potential military training sites.

Support activities that have the potential to impact wetlands or other surface waters (i.e., access facilities, construction of targets, borrow pits for sand/clay) may require a Wetland Resource Permit and/or a stormwater management permit. The Air Force is advised to contact the Department's Northwest District Office in Pensacola at (850) 595-8300 regarding permit requirements for such activities.

"More Protection, Less Process"

Printed on recycled paper.

Ms. Elizabeth B. Vanta
SAI # FL200312084782C
Page Two

The biweekly exercises proposed along the Gulf side of Santa Rosa Island may have the potential to affect the marine turtle nesting activity which generally runs from May through October. In addition, activities may interfere with beach mice and shorebird nesting, resting, and foraging. Therefore, close coordination with the Florida Fish and Wildlife Conservation Commission (FWC), Bureau of Protected Species Management regarding the protection of sea turtles is advised.

Archeological sites occur at East Bay Point, Yellow River, and Alaqua Point. Some of these sites are in various stages of investigation and/or data collection by the Eglin Cultural Resources Branch. The information gathered should be used to manage and minimize the impact of activities discussed in the PEA. Due to the presence of other sites that have not been evaluated, coordination with the Florida Department of State, Division of Historical Resources is advised.

The Florida Department of Transportation (FDOT) supports the aims of this effort and the adoption of Alternative 5, however, the use of blank munitions are recommended to prevent access impacts on State Road 20 and adjoining residential areas. Close coordination with the FDOT is advised. Please contact Jimmy Bailey at jimmey.bailey@dot.state.fl.us or via fax at (850) 638-6368 for further coordination on this issue.

Based on the information contained in the above-referenced draft EA and the comments provided by our reviewing agencies, as summarized above and enclosed, the state has determined that, at this stage, the proposed project is consistent with the Florida Coastal Management Program (FCMP). All subsequent environmental documents prepared for the project must be reviewed to determine the project's continued consistency with the FCMP. The state's consistency concurrence with the project will be based, in part, on the adequate resolution of 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.

Thank you for the opportunity to review the project. Should you have any questions regarding this letter, please contact Mr. Daniel Lawson at (850) 245-2174.

Yours sincerely,

Sally B. Mann

Sally B. Mann, Director
Office of Intergovernmental Programs

SBM/dl

cc: Dick Fancher, DEP, Northwest District

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Florida
Department of Environmental Protection

"More Protection, Less Process"

Categories

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Project Information	
Project:	FL200312084782C
Comments Due:	January 04, 2004
Letter Due:	February 03, 2004
Description:	DEPARTMENT OF THE AIR FORCE - DRAFT PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (PEA) FOR ESTUARINE AND RIVERINE AREAS - EGLIN AIR FORCE BASE - SANTA ROSA, OKALOOSA AND WALTON COUNTIES, FLORIDA.
Keywords:	USAF - PEA, ESTUARINE AND RIVERINE AREAS - EGLIN AFB
CFDA #:	12.200

Agency Comments:
WALTON -
No Comment
WEST FLORIDA RPC - WEST FLORIDA REGIONAL PLANNING COUNCIL
No Comments
OKALOOSA - OKALOOSA COUNTY
No Comment
SANTA ROSA - SANTA ROSA COUNTY
No Comment
ENVIRONMENTAL POLICY UNIT - OFFICE OF POLICY AND BUDGET, ENVIRONMENTAL POLICY UNIT
No Comment
COMMUNITY AFFAIRS - FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS
Released Without Comment
FISH and WILDLIFE COMMISSION - FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
NO COMMENT BY BRIANT BARNETT ON 12/17/03.
STATE - FLORIDA DEPARTMENT OF STATE
No Comment
TRANSPORTATION - FLORIDA DEPARTMENT OF TRANSPORTATION
The FDOT is entirely supportive of the aims of this effort. We would like to see Alternative 5 be adopted with the use of blank munitions to avoid access impacts on SR 20 and adjoining residential areas. Should you desire further comment/coordination from this office, please e-mail Jimmey Bailey at jimmey.bailey@dot.state.fl.us or via fax at (850)638-6368.
ENVIRONMENTAL PROTECTION - FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

No Final Comments Received
NORTHWEST FLORIDA WMD - NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT
No Comment

Agency Name: FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
Reviewer: laurenm
Date: FEB-03-2004

02/03/2004 16:31 8502452190 FL ST CLEARINGHSE PAGE 05/09

COUNTY: ALL

DATE: 12/5/2003
COMMENTS DUE DATE: 1/4/2004
CLEARANCE DUE DATE: 2/3/2004
SAI#: FL200312084782C

MESSAGE:
REFERENCE SAI # FL200210313047C

STATE AGENCIES	WATER MNGMNT. DISTRICTS	OPB POLICY UNIT	RPCS & LOC GOVS
COMMUNITY AFFAIRS	NORTHWEST FLORIDA WMD	ENVIRONMENTAL POLICY UNIT	
ENVIRONMENTAL PROTECTION			
X FISH and WILDLIFE COMMISSION			
STATE			
TRANSPORTATION			

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 PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (PEA) FOR ESTUARINE AND RIVERINE AREAS - 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
- [x] No Comment
- [ ] Comment Attached
- [ ] Not Applicable

Federal Consistency
- [x] No Comment/Consistent
- [ ] Consistent/Comments Attached
- [ ] Inconsistent/Comments Attached
- [ ] Not Applicable

From:
Division/Bureau: ENVIRONMENTAL SERVICES
Reviewer: BRIAN BARNETT
Date: 12/17/03

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DEC 09 2003
OFFICE OF ENVIRONMENTAL SERVICES

RECEIVED
DEC 19 2003
OIP/OLGA

02/03/2004 16:31 8502452190 FL ST CLEARINGHSE PAGE 06/09

COUNTY: ALL FLA

SAI-USAF-EG
2003-0936

DATE: 12/5/2003
COMMENTS DUE DATE: 1/4/2004
CLEARANCE DUE DATE: 2/3/2004
SAI#: FL200312084782C

MESSAGE:
REFERENCE SAI # FL200210313047C

STATE AGENCIES	WATER MNGMNT. DISTRICTS	OPB POLICY UNIT	RPCS & LOC GOVS
COMMUNITY AFFAIRS	NORTHWEST FLORIDA WMD	ENVIRONMENTAL POLICY UNIT	
ENVIRONMENTAL PROTECTION			
FISH and WILDLIFE COMMISSION			
X STATE			
TRANSPORTATION			

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Project Description:

DEPARTMENT OF THE AIR FORCE - DRAFT PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (PEA) FOR ESTUARINE AND RIVERINE AREAS - EGLIN AIR FORCE BASE - SANTA ROSA, OKALOOSA AND WALTON COUNTIES, FLORIDA.

To: Florida State Clearinghouse

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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 lec [signature] Deputy SHPO
Date: 12-22-03 12-22-03 12/23/03

RECEIVED
DEC 29 2003
OIP/OLGA

03 DEC 10 PM 5:03
RECEIVED BUREAU OF HISTORIC PRESERVATION

22/03/2004 16:01 8502452190 FL ST CLEARINGHSE PAGE 07/09

COUNTY: ALL

DATE: 12/5/2003
COMMENTS DUE DATE: 1/4/2004
CLEARANCE DUE DATE: 2/3/2004
SAI#: FL200312084782C

MESSAGE:
REFERENCE SAI # FL200210313047C

STATE AGENCIES	WATER MNGMNT. DISTRICTS	OPB POLICY UNIT	RPCS & LOC GOVS
COMMUNITY AFFAIRS	X NORTHWEST FLORIDA WMD	ENVIRONMENTAL POLICY UNIT	
ENVIRONMENTAL PROTECTION			
FISH and WILDLIFE COMMISSION			
STATE			
TRANSPORTATION			

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.
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Project Description:

DEPARTMENT OF THE AIR FORCE - DRAFT PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (PEA) FOR ESTUARINE AND RIVERINE AREAS - 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

NO COMMENTS

From:
Division/Bureau: NWFWMD Resource Management Div.
Reviewer: Duncan J. Cairns
Date: Date 16 DECEMBER 2003

02/03/2004 16:31 8502452190 FL ST CLEARINGHSE PAGE 08/09

COUNTY: ALL

DATE: 12/5/2003
COMMENTS DUE DATE: 1/4/2004
CLEARANCE DUE DATE: 2/3/2004
SAI#: FL200312084782C

MESSAGE:
REFERENCE SAI # FL200210313047C

STATE AGENCIES	WATER MNGMNT. DISTRICTS	OPB POLICY UNIT	RPCS & LOC GOVS
COMMUNITY AFFAIRS	NORTHWEST FLORIDA WMD	X ENVIRONMENTAL POLICY UNIT	
ENVIRONMENTAL PROTECTION			
FISH and WILDLIFE COMMISSION			
STATE			
TRANSPORTATION			

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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.

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To: Florida State Clearinghouse

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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: OPB. Env. Policy
Reviewer: [illegible]
Date: 1/26/04

RECEIVED
JAN 28 2004
OIP/OLGA

RECEIVED
DEC - 9 2003
OFFICE OF POLICY AND BUDGET
ENVIRONMENTAL POLICY UNIT

02/03/2004 16:31 8502452190 FL ST CLEARINGHSE PAGE 09/09
JAN.05.2004 15:23 850 595 8967 W FL REGIONAL PLANNING COUNCIL #2780 P.001/001

WFRPC
West Florida Regional Planning Council

WEST FLORIDA REGIONAL PLANNING COUNCIL
Post Office Box 9759 • 3435 North 12th Avenue • Pensacola, Florida 32513-9759
Phone (850) 595-8910 • S/C 695-8910 • (800) 226-8914 • Fax (850) 595-8967

Lel Czeck
Executive Director

Cody Taylor
Chairman

Sydney Joel Pate
Vice-Chairman

FAX TRANSMITTAL (S) Total # of Pages (including cover) 1

TO: **STATE CLEARINGHOUSE • FAX:** **(850) 245-2190/(850) 245-2189**
Phone: 850-245-2161

DATE: January 5, 2004

FROM: Terry Joseph, Intergovernmental Review Coordinator
Extension 206
josephT@wfrpc.dst.fl.us

SUBJECT: **State Clearinghouse Review(s) Fax Transmittals:**

SAI #	Project Description	RPC #
FL200312084782C	Department of the Air Force- Draft Programmatic Environmental Assessment (PEA) for Estuarine and Riverine Areas- Eglin Air Force Base-Santa Rosa, Okaloosa and Walton Counties, Florida.	MJ701-12-11-2003

X	No Comments – Generally consistent with the WFSRPP
	Comments Attached

If you have any questions, please call.

"...Serving Escambia, Santa Rosa, Okaloosa, Walton, Bay, Holmes & Washington Counties and their municipalities..."

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APPENDIX K

PUBLIC REVIEW PROCESS

Public Notification and Comments

The following public notification appeared in the Fort Walton Beach Daily News on Friday March 5, 2004. The public comment period extended from March 5th to March 19th. There were no public comments.

PAGE A8 Daily News **FRIDAY, MARCH 5, 2004**

PUBLIC NOTIFICATION

In compliance with the National Environmental Policy Act, Eglin Air Force Base announces the availability of RCS 02-891 The Estuarine and Riverine Areas Draft Programmatic Environmental Assessment (PEA) and Finding of No Significant Impact (FONSI) for public review and comment.

The Air Armament Center at Eglin Air Force Base Florida, proposes to authorize an increased level of military tests and training activities in the Estuarine and Riverine Areas (E&R) in the immediate vicinity of Eglin AFB, FL. The areas under consideration include the waters and adjacent shoreline areas of Choctawhatchee Bay, Santa Rosa Sound, the Yellow and East Bay Rivers and East Bay. During the baseline period, fiscal years 1995 to 1999, these areas supported nearly 10,000 missions.

The Proposed Action will allow the Commander, 46th Test Wing, to authorize levels of activity for the E&R based upon estimates of increased use. Five alternatives were considered:
Alternative 1: (No Action): Maintain the baseline level of activity (FY95-99 Range Utilization Report)
Alternative 2: Authorize activity at the baseline-level (same as Alternative 1),
Alternative 3: Authorize the activities contained in Alternate 2 and increase the mission intensity by 100%.
Alternative 4: Authorize the activities contained in Alternative 3 and add live-fire estuarine/marine shoreline range,
Alternative 5: Authorize the activities in Alternative 4 and add live-fire riverine range.

Your comments on this Draft PEA are requested. Letters or other written or oral comments provided may be published in the Final PEA. As required by law, comments will be addressed in the Final PEA and made available to the public. Any personal information provided will be used only to identify your desire to make a statement during the public comment period or to fulfill requests for copies of the Final PEA or associated documents. Private addresses will be compiled to develop a mailing list for those requesting copies of the Final PEA. 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 PEA.

Copies of the Environmental Assessment and Finding of No Significant Impact (FONSI) may be reviewed at the Fort Walton Beach Public Library, 185 SE Miracle Strip Parkway, Fort Walton Beach Florida; Milton Library 805 Alabama St., Milton Fla., 32539; and the Niceville Library, 100 Armstrong Avenue, Niceville, Florida; Navarre Public Library 8484 James M. Harvell Road, Navarre; and Walton County Library System, 75 State Highway 20 West. Copies will be available for review from Mar. 5th through Mar. 19th 2004 Comments must be received by Mar. 22, 2004.

For more information or to comment on these proposed actions, contact:
Mr. Mike Spaits AAC/EM-PAV, 501 De Leon St., Suite 101, Eglin AFB, Florida 32542-5133 or email: mike.spaits@eglin.af.mil. Tel: (850) 882-3761, Fax (850) 882-3761

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