Appendix H

Landscaping and Grounds Management Plan

Appendix H: Landscaping and Grounds Management Plan

The attached appendix is the Landscaping and Grounds Management Plan which includes the following attachments:

Attachment H-1	Golf Course Environmental Management Plan
Attachment H-2	Pruning Specifications
Attachment H-3	Specification for Planting Sod
Attachment H-4	45 SW Native/Salt Tolerant Plant List
Attachment H-5	Planting Specifications

Appendix H: LANDSCAPING AND GROUNDS MANAGEMENT PLAN

U.S. Air Force (USAF) grounds maintenance focuses on mission support integrated with protection and enhancement of natural and man-made landscape features in harmony with the environment. Grounds maintenance actions as outlined below may have to be modified due to constraints on the budget. This Appendix H covers Cape Canaveral Air Force Station (CCAFS), including the Naval Ordnance Test Unit (NOTU) with CCAFS and Patrick Air Force Base (PAFB), unless otherwise noted. The Gold Course Environmental Management (GEM) Plan (Attachment H-1) only applies at PAFB, as that is the only installation with a golf course. The smaller installations have few grounds maintenance issues and are not included in this Appendix H.

H.1 Grounds Maintenance Categories

Proper grounds maintenance and landscaping will be implemented on USAF property to maintain healthy grass, trees, shrubs, and plants, and present a clean, neat, and professional appearance. Grounds will be divided into three categories to distinguish the level of grounds maintenance and landscaping design activities required. The three categories are defined below. See Figures H-1 and H-2 for the grounds maintenance categories at CCAFS and PAFB, respectively.

H.1.1 Improved Grounds

Improved grounds are those areas where intensive development and maintenance measures are performed. This category applies to areas within the built-up section of an installation, which contains landscaping, parade grounds, berms, picnic areas, road shoulders and medians along main thoroughfares. Military family housing common areas are considered improved grounds, along with all other areas with buildings and parking lots. These are also areas that are mowed frequently.

H.1.2 Semi-Improved Grounds

Semi-improved grounds require maintenance of a lesser degree than improved grounds. Often these areas are mowed occasionally, rather than regularly and may or may not have turf grass. In some cases, these areas may have semi-native vegetation. This category includes, but is not limited to, the airfield and its clear zones, rifle ranges, antenna farms, ammunition storage areas (bunkers), fire/security breaks, mission critical lines-of-sight, road shoulders on secondary roads, open areas that are not used for recreation or regular operations, and banks of drainage ditches. This classification for CCAFS is divided into Semi-improved “A” and Semi-improved “B” categories. Preferred height in other areas designated as semi-improved “A” is 4 to 10 inches. Preferred height in areas designated as semi-improved “B” is 20 inches and will be mowed three times per year.

H.2 Unimproved Grounds

Unimproved grounds are those not included in the above categories and typically do not undergo grounds maintenance. They may experience prescribed fires or other forms of large scale vegetation management but are generally native vegetation. This classification includes,

but is not limited to, timber and forest areas, lakes, ponds, coastal beaches, dunes and wetland areas where natural vegetation occurs without impediment.

Figure H-1. CCAFS Mowing Map Zone (Fiscal Year 2014-2018)

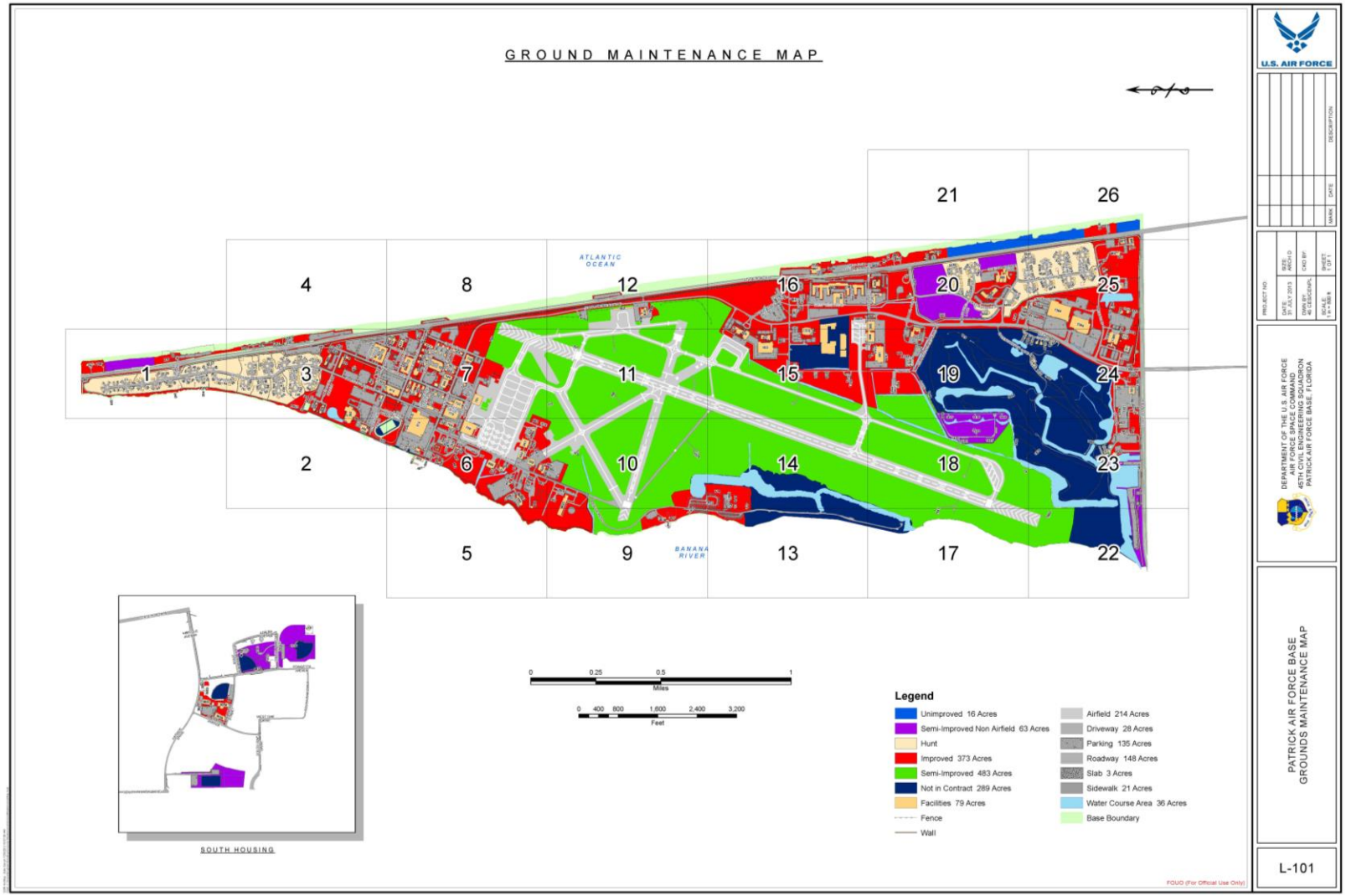


Figure H-2. PAFB Grounds Maintenance Map (July 2014)

H.3 Grounds Maintenance Actions

Precautions shall be taken during mowing to prevent scalping, uneven mowing, rutting by equipment, and damage to trees, shrubs, sprinkler heads, and wildlife. Clippings will be removed or mulched with mowing. Grounds maintenance is generally performed through the Grounds Contract (effective date November 1, 2013).

H.3.1 Improved Grounds

Preferred height of grass and weeds shall be between 3 to 6 inches. Grass and weeds should not be cut to less than 3 inches. Edging/trimming will be accomplished per the Grounds Maintenance Contract in Improved Grounds Areas. Precautions shall be taken to prevent scalping, rutting by equipment, and damage to trees, shrubs, sprinkler heads, and wildlife. Trimmings must not be swept or blown down drains/grates (stormwater). Edging of sidewalks, driveways, curbs, shrub and flower beds, and landscaped areas in improved grounds shall be completed on an as required basis (per the contract) so that vegetation does not extend over edges by more than 1-1/2". For areas designated in the contract for edging/trimming, the Grounds group shall trim around trees, shrubs, fences, poles, airfield lighting, and any other protruding objects on an as required basis.

H.3.1.1 Grounds Maintenance for Military Family Housing (PAFB only)

In the Family Military Housing Areas of PAFB, the contractor shall mow grass, remove grass clippings, trim shrubbery, edge sidewalks, driveways and curbs, trim grass around fire hydrants, poles, trees, fences, parking lots, bumper blocks and other items to the same height as grass was cut. In the COM and vacant quarters, the contractor shall mow grass no higher than 4 inches and no lower than 3 inches, and remove grass clippings. Shrubs and flower beds will be maintained by removing all grass, leaves and debris, replacing mulch/border blocks, etc. The contractor will rake yards, so yards are free of grass clippings, leaves, straw and other debris. The contractor shall seed, sod, plug or sprig lawns as required by the Quality Assurance Personnel (QAP). Yards shall be properly prepared prior to plugging, siding, or seeding by cultivating and filling in with fill dirt. The contractor shall accomplish this grounds maintenance in conjunction with Change of Occupancy Maintenance (COM) and vacant quarters as directed by the QAP and shall be completed within the allowed downtime for each unit (each unit is five days). Yards extend from the unit out 50 feet in all directions or to the end at the street or half the distance between the units. Lawn watering shall be accomplished twice weekly, April through October, and once every week November through March, or as directed by the QAP, and will strictly adhere to the base watering policy. The common areas of Family Military Housing that require grounds maintenance are not the responsibility of military family housing residents. Residents are responsible for grounds maintenance within 50 feet of their building with the exception of retention ponds. The contractor shall maintain all retention ponds.

H.3.1.2 Semi-Improved Grounds

Grass and vegetation along runways and taxiways (restricted airfield areas) will be mowed to maintain appropriate vegetation. An attempt should be made to cut the entire airfield in one day to reduce foraging behaviors of birds, thereby reducing Bird Aircraft Strike Hazards (BASH) risk.

Cutting should occur when the airfield is not active, again to reduce BASH risk. Clippings on runways shall be removed immediately after mowing to prevent aircraft hazards. Preferred height of grass in the airfield area is 4 to 10 inches, and the grass in the airfield should not be cut to less than 7 inches. Cutting grass lower than 7 inches will allow birds to have a greater ability to forage thus increasing BASH risk. Taller grass is preferred to deter landing/foraging of most birds.

If dirt mounds or burrows are observed around the airfield, the 45th Space Wing Civil Engineer Squadron, Environmental Conservation Element (45 CES/CEIE-C) must be consulted to provide guidance for avoidance of burrowing owls and gopher tortoises (protected species).

H.3.1.3 Semi-Improved "A" Areas

Preferred height in other areas designated as semi-improved "A" is 4 to 10 inches. Mowing of ditches adjacent to runways and taxiways shall be accomplished only after 45 CES/Civil Engineer Launch Support (CEL)/Airfield Operations has approved scheduled times. Mowing of ditches in restricted areas shall require clearance or escort by appropriate authority. Preferred height of grass shall not exceed 10 inches or be cut no less than 7 inches. Native grasses should only be trimmed lower if Airfield Operations and 45 CES/CEIE-C determine that the grasses are impeding flight safety. A buffer of grass of at least 7 inches in height must be kept along the top of the ditch bank at least 12 inches upland of the slope and at least 6 inches along the slope to prevent erosion. This same buffer approach should be used along the river shoreline. Native vegetation should be avoided.

H.3.1.4 Semi-Improved "B" Areas

Preferred height in areas designated as semi-improved "B" is 20 inches and will be mowed three times per year. Operators of articulating mower heads used for drainage ditch banks will avoid injuring wildlife (turtles, birds, etc.) by surveying area and scaring off wildlife before mower arm is lowered to mowing height. If eggs or non-mobile animals are observed and could be impacted by mowing blades, the area should be avoided and periodically checked every two weeks to determine if the area is clear for mowing. Grass and vegetation cutting shall be accomplished on both banks of open drainage ditches as indicated in the Grounds Maintenance contract. Mowing of ditch banks should maintain at least a 12 inch buffer of grass, at least 7 inches in height, along the upland side of the ditch/canal being careful to keep the mowing head height consistent, and in line with the terrain. Mowing should be minimized near the river's shoreline and trimming of landscape grasses (i.e., Bahia, etc.) should occur while avoiding native wetland/marsh vegetation.

Unless wetland areas are involved, the following semi-improved areas should be maintained via mowing and rotational disc harrow: security clear zones, fire breaks, fence lines and lines-of-sight. Any activity in wetlands must be coordinated with 45 CES/CEIE-C. Information on wetlands and wetland management is outlined in Appendix E, Wetlands and Floodplains.

H.3.2 Unimproved Grounds

Unimproved Grounds – will be mowed only once per year or not at all.

H.4 Trash Collection in Grounds Maintenance Areas

The Contractor shall police all improved grounds, parking lots, canals, to include taking trash out of the water, shrub and flower beds, sidewalks, covered walkways/breezeways, streets, roads, and recreation areas on a daily basis. All the accumulated debris shall properly disposed of into USAF dumpsters.

H.5 Eliminate Grass/Weeds

H.5.1 Improved Grounds

In improved grounds areas, eliminate grass/weeds/crack-grass as required in shrub, turf, flowerbeds, and other landscaped areas. All grass/weeds/crack-grass shall be removed manually, mechanically, or chemically.

H.5.2 Semi-improved Grounds

In semi-improved grounds areas, eliminate grass/weeds/crack-grass as required on all active aircraft runways, taxiways, and parking aprons. All grass/weeds/crack-grass shall be removed manually, mechanically, or chemically. This includes improved grounds, recreation, and airfield areas. Grass/weeds/crack-grass in excess of 2 inches in height shall be eliminated.

Elimination of crack grass/weeds on runways, aprons, and taxiways (restricted areas) shall be accomplished only after Airfield Operations has approved scheduled times for grounds maintenance. This work shall require clearance and escort by an appropriate authority who is under 100% radio control from the tower. As work progresses, all runways, taxiways, and aprons shall be cleared immediately of any clippings or other debris.

H.5.3 Use of Pesticides

Herbicides, fungicides, and other pesticides will be referred to collectively as pesticides in this document. Grounds maintenance personnel should consider all alternatives to pesticide use and apply only the minimum necessary to accomplish the objective. If pesticides are used for grounds maintenance, only pesticides that are listed on the Armed Forces Pest Management Board (AFPMB) Standard Pesticides List are authorized http://www.afpmb.org/pubs/standardlists/ dod%20pesticides%20list.pdf. Their use must be in accordance with the 45 SW Integrated Pest Management Plan and AFI 32-1053, Integrated Pest Management Program (http://static.e-publishing.af.mil/production/1/af_a4_7/publication/afi32-1053/afi32-1053.pdf). All herbicide labels and Material Safety Data Sheets (MSDS) must be provided to the Contracting or QAP prior to application. Guidance can be obtained through the Base Pest Manager (45 CES Entomology Shop) or the Base Environmental Office (45 CES/CEIE-C). If the need arises for a pesticide not on the approved list, the 45 CES Entomology Shop will be contacted to determine if the pesticide can be used. The pesticide must then go through the Hazardous Material (HAZMAT) authorization/tracking process. Grounds maintenance personnel can only store, mix, and transfer pesticides into final delivery apparatus at off-base locations only. Pesticides must be applied in strict accordance with manufacturer's recommendations. Contractors using pesticides shall submit a report on a monthly basis to the QAP, which shows type (Active Ingredient) and quantity of pesticide, applied during the month. The QAP will submit data to the

45 CES/CEIE-C and 45 CES/CEL no later than the 5th working day after the quarter ends. Data must be reported to command quarterly and the Air Force Center for Environmental Excellence (AFCEE) semi-annually. Additional information on pesticides can be found in Appendix L, 45 SW Integrated Pest Management Plan.

All Hazardous Material (HAZMAT) use shall be in accordance with AFI 32-7086, Chapter 2, Hazardous Materials Management (http://www.google.com/url?url=http://static.e-publishing.af.mil/production/1/ang/publication/afi32-7086_angsup_i/afi32-7086_angsup_i.pdf&rct=j&frm=1&q=&esrc=s&sa=U&ei=FajNU8GEAsr4oATBtoHwBQ&ved=0CBQQFjAA&usg=AFQjCNEVPRE835VgidtCcQXJuZmWCe-70Q). Contractor shall enroll in the Hazardous Material Pharmacy (HazMart) and all hazardous material shall be authorized/tracked through the approved electronic USAF hazardous material authorization/tracking system. In accordance with the Department of Defense (DoD) policy, only trained and certified applicators may apply pesticides on DoD installations.

H.6 Prune Trees/Shrubs/Hedges.

Trees in improved and semi-improved areas shall be pruned/trimmed in accordance with industry standards and will provide safety clearances and prevent structural damage. Additional informative guidance is provided at http://hort.ifas.ufl.edu/woody/pruning.shtml. Pruning should only occur using the American National Standards Institute (ANSI) A300 - Part 1 Pruning (http://tcia.org/business/ansi-a300-standards) and be completed by trained personnel to prevent improper pruning that will harm the tree health, stability, and appearance. Do not prune unless necessary. All cabbage palm trees shall be trimmed between 1 January and 30 June to prevent debris hazards with hurricane/tropical storm force winds. Other trees shall be pruned on an as-required basis throughout the year. Mangroves cannot be trimmed unless approved by the 45 CES/CEIE-C and in accord with the Florida Mangrove Trimming and Preservation Act. If nesting birds, eggs, chicks, fledglings are observed in an area that will be pruned/trimmed, the 45 CES/CEIE-C will be contacted to determine the course of action before pruning. Protected bird species will be avoided whenever possible. The 45 CES/CEIE-C personnel will be contacted if the nest of a non-protected bird species needs to be moved to another tree/shrub, only when necessary. The 45 CES/CEIE-C will work with the QAP and the grounds maintenance crew to determine the course of action if a protected species will impact mission requirements.

Shrubs and shrubbery shall be pruned/trimmed to maintain their natural growth habit. New growth above the specified sizes shall not be allowed to exceed eight (8) inches. Minimum clearances from buildings, utilities and other obstructions should be one (1) foot. This task includes the shrubs and shrubbery in the improved and semi-improved grounds, and recreation areas, as indicated in the Grounds Contract. The contractor shall remove the trimmings from pruning.

Hedges shall be maintained in their original height and shape. This includes Family Military Housing and the following areas near and within PAFB: along Rescue Road, along A1A between the beach and Central Housing, along Patrick Drive in South Housing and the dividing hedges in South housing area. No informal hedges or screen plantings shall be converted to formal shapes. When new growth on small hedges (two (2) feet or less) reaches three (3)

inches, hedges shall be trimmed. Other hedges shall be trimmed when new growth reaches six (6) inches. See Attachment H-2 for Pruning Specifications.

H.7 Fertilizer Application

Fertilizer approved by the Florida Department of Agriculture and Consumer Services (DOACS) and will be applied only in areas as specified in the Grounds Contract.

H.7.1 Improved Grounds

Fertilizer shall be applied to grass, trees, and shrubs on improved grounds and in recreation areas as indicated in the Grounds Contract, and in accordance with manufacturer's recommendations. All fertilizers applied must be a timed-release fertilizer with a nutrient release rate of 180 days.

H.7.2 Semi-improved Grounds

It is not anticipated that fertilizers will be needed in semi-improved areas. Consultation between the QAP, 45 CES/CEIE-C and the 45 CES Entomology Shop will occur before the grounds maintenance crew can apply fertilizer in these semi-improved areas.

H.8 Mulch

Mulch will be provided and applied to landscaped areas and planters per the Grounds Contract (may be accomplished anytime throughout the year.) The use of non-cypress mulches (other than pine straw) is highly encouraged, in order to reduce impacts to the cypress source's native habitats and species. The use of pine straw mulch is strictly prohibited, unless certified clean, to prevent importation of invasive exotic species, particularly Old World Climbing fern (*Lygodium microphyllum*), and other invasive species. The use of Chromated Copper Arsenate (CCA) mulch is prohibited as it contributes to leaching of arsenic into the soil and ground water.

H.9 Repair/Replace Grass Area

Areas damaged by vehicular traffic, utility system repair, drought, insects, or diseases shall be seeded, sprigged, or sodded to meet the standards of surrounding areas as directed by the QAP. See Attachment H-3 for Specifications for Planting Sod.

H.10 Remove Trees, Shrubs and Stumps

Dead, diseased, storm damaged, or other trees, shrubs, and stumps identified by job order shall be removed and debris disposed of at a site designated by the Contracting Officer or his/her designated representative. Stumps shall be removed to a depth of six (6) inches below grade level. After removal, the area shall be repaired or replanted in accordance with the job order. New plants, if applicable, shall then be included for maintenance, and must be native plant species, to the extent practical. Select plants from the Facility Excellence Plan Master Plant List http://afspc-feg.com/landscape-2/plant-list/, but ensure non-native species are not selected by comparing to plants listed in the 45 SW Native/Salt Tolerant Plant List in Attachment H-4 of this

document, and as indicated on the Florida Exotic Plant Pest Council (FLEPPC)[1] List of Invasive Exotic Plants (2013), available at: http://www.fleppc.org/list/list.htm.

H.11 Landscaping

Landscaping trees and shrubs must be approved by the QAP and 45 CES/CEIE-C to ensure invasive exotic species are not introduced to the installation. Desired landscaping plants should be native species to the maximum extent possible. A landscape design shall be provided and work may include clearing land, cutting sod, leveling and preparing the area for planting. If applicable, necessary fill and topsoil will be provided. The mulching of trees/shrubs/flowers within the landscape area may be accomplished by separate work order requests. New landscape assets shall then be included. Irrigation should be implemented in the landscape design only if it is necessary to fulfill justified aesthetics or functional use of the area. Maintenance cost/labor should be minimized by selecting and designing landscaping that is adapted to local environmental conditions and reduces the need for irrigation, fertilizers, and pesticides. The USAF Landscape Design Guide (https://www.wbdg.org/ccb/AF/AFDG/usaf_landscape.pdf) and the 45 SW Native/Salt Tolerant Plant Guide (see Attachment H-4 for 45 SW Native/Salt Tolerant Plant List).

Plant new or replace damaged trees, flowers, and shrubs. The contractor shall replace all dead trees, shrubs, and flowering plants within two weeks after identification by QAP, with nursery grown plants (trees, shrubs) of the same species unless the plants have since been classified as invasive, exotic species. Exotic invasive plant species will be replaced with an equivalent native plant species. Replacement of plant materials shall conform to industry standards as outlined in the Grounds Contract and discussed in Attachment H-5, Planting Specifications.

All newly planted trees, shrubs, and flowers will be watered until established. Grounds maintenance will develop a watering regime/program with regular monitoring to determine when the new plants no longer require water; and will only be watered periodically during drought conditions.

H.12 Additional Services

H.12.1 Emergency Support

In the event that government property is damaged from a natural disaster, such as a hurricane, wind storm, fire or civil disturbance and the Contracting Officer determines emergency action is necessary to protect government property, the contractor may be directed to do emergency work to the extent necessary to protect government property and personnel. Such work shall be subject to separate negotiation for reimbursement. It shall not include major rehabilitation or major repair.

H.12.2 Special Events/Services

The USAF will designate special events or services. The contractor shall not reduce his efforts elsewhere on CCAFS and PAFB due to these events. Mowing, edging, trimming and policing of

[1] FLEPPC. 2013. List of Florida invasive plant species. Website: : http://www.fleppc.org/list/list.htm

grounds shall be accomplished prior to the start of a special event. The contractor will work during the events to keep the area clean. After the special event, the area shall be assessed and any damage to the landscape will be repaired. The contractor will receive at least 48 hours notice from USAF before the start of a special event. Special Services refers to contractor efforts provided to a particular facility or area (e.g., base hospital) as directed on a job order. Efforts may include, but are not limited to, maintenance of landscaped areas (e.g., mulching, weeding, pruning, plant replacement, fertilization, etc.), mowing, edging, trimming, pruning, and fertilization out of normal cycle, and policing of grounds. Notification will be in the form of a job order issued by the QAP.

H.13 Urban Forestry/Forest Management

The most current urban forestry management plan (1997) needs to be updated to adequately develop management objectives and goals. It reported 1845 individual trees with geographical mapping and attributes indicating the health, maintenance, and risk potential of each tree. Follow up on tree health should occur to track any diseases or the need to replant where trees have been removed. Several areas within CCAFS would be improved by planting more trees/greenery. Additionally, as Brazilian pepper is removed, those areas should be replanted with native trees/ shrubs.

H.14 Related Management Plans

H.14.1 Integrated Pest Management

The Integrated Pest Management Plan (IPMP) for the 45 SW describes pest management requirements, outlines the resources necessary for surveillance and control, and describes the administrative, safety and environmental requirements of the program. For additional information regarding the IPMP, see Appendix L of the Integrated Natural Resources Management Plan (INRMP).

H.14.2 Bird/Wildlife Aircraft Strike Hazard (BASH) Plan

The BASH Plan describes the program to minimize bird/wildlife strike damage to aircraft, and therefore also minimizing death and injury to wildlife. Key requirements for successful strike reduction are: 1) Involve all organizations in discussion as set up with the Bird Hazard Working Group (BHWG), 2) Eliminate or reduce environmental factors which attract birds to the airfield, 3) Report hazardous bird activity and alter or discontinue flying operations, 4) Inform all assigned and transient aircrews on specific bird hazards and procedures for avoidance, and 5) Disperse birds on 45 SW airfields. Ground maintenance is a crucial piece of the 2nd item in that list. Mowing to the heights specified above is critical to reducing BASH risk for the 45 SW. Refer to Appendix K, BASH Plan for details of the BASH Plan (45SW PlanOPLAN 91-212).

H.14.3 Irrigation and Water Management

The goal of water management is to reduce water use by the most efficient and effective means possible. Landscaping can be developed in such a way as to reduce long-term irrigation requirements by following xeriscape principles and planting native vegetation that can withstand the coastal environment. Xeriscaping involves designing to minimize water use, using drought-tolerant plants, mulch, and efficient irrigation. Varying means of irrigation are available and

should be used according to the planting needs such as drip lines versus sprinkler heads. Irrigation monitoring should occur frequently to assess sprinkler heads, drip lines and electronic rain gauges to prevent under- or over-watering.

H.15 Invasive Species Management

Invasive plant species are plants that are not indigenous to the region where they are encountered. In most cases, invasive species disrupt the natural ecosystem of an area and can severely threaten the continued existence of native plant and/or animal species. For additional information regarding invasive plant species management, see Appendix G of the INRMP.

Most invasive plants that are identified for cutting must be treated with an appropriate herbicide. If an exotic plant is encountered during execution of a job, the plant must be treated with an approved herbicide and removed prior to resumption of the task. If an invasive plant has seeds present, it must be treated with an approved herbicide at least two weeks prior to disturbing the plant. Invasive plants that contain seeds must not be disturbed until after the herbicide has been applied and the plant has defoliated; a minimum of two weeks.

If cogon grass or other exotic invasive plant species are encountered, the identifying individual or agency must contact the 45 SW CES/CEIE-C and report the location. Personnel of the 45 CES/CEIE-C will identify the appropriate method of treatment for cogon grass and all other non-woody invasive plant species infestations on CCAFS.

Aquatic exotic weeds also present on PAFB. Hydrilla, elodea, and torpedo grass have been observed in several canals on PAFB. An aquatic weed control permit issued by Florida Department of Environmental Protection (FDEP) is held at PAFB. Aquatic herbicides are used occasionally. A biocontrol is also being used in PAFB canals: the triploid grass carp (TGC). A Florida Fish and Wildlife Conservation Commission (FWC) permit for stocking of TGC is held by PAFB and has recently been updated (2005). Re-stocking of TGC occurred (2006) to attempt to reduce the weeds that are limiting water flow in the canals which is degrading water quality and may cause flooding during heavy rain events.

H.15.1.1 Non-point Source Pollution and Soil Erosion Prevention

To reduce non-point source pollution and soil erosion, use Best Management Practices (BMPs), such as silt fencing during construction and buffering of waterways by means of stormwater diversion into dry retention swales and waterway bank/slope semi-improved to unimproved vegetative cover. Follow any Stormwater Pollution Prevention Plans and stormwater permit requirements.

H.15.1.2 Scrub Habitat

Due to the presence of Florida scrub-jay, a federally protected species, scrub habitat can only be managed according to USFWS permits and agreements. Ground maintenance should avoid scrub habitat unless the activity is coordinated with 45 CES/CEIE-C. See Appendix C, Attachment C-2 for the Florida Scrub-jay Management Plan for more information.

H.16 Wetlands/Riverine Shoreline Management

Wetland areas should be avoided by grounds maintenance personnel if at all possible. Any activity in wetlands must be coordinated with 45 CES/CEIE-C. Information on wetlands and wetland management is outlined in Appendix E, Wetlands and Floodplains.

Acronyms

AFCEE	Air Force Center for Environmental Excellence
AFPMB	Armed Forces Pest Management Board
ANSI	American National Standards Institute
BMP	Best Management Practices
CCA	Chromated Copper Arsenate
CCAFS	Cape Canaveral Air Force Station
CEL	Civil Engineering Launch
CES/CEIE-C	Civil Engineer Squadron, Environmental Conservation Element
COM	Change of Occupancy Maintenance
DOACS	Department of Agriculture and Consumer Services (Florida)
DoD	Department of Defense
ESA	Endangered Species Act
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FLEPPC	Florida Exotic Pest Plant Council
FWC	Florida Fish and Wildlife Conservation Commission
GEM	Golf Course Environmental Management
HazMart	Hazardous Material Pharmacy
HAZMAT	Hazardous Material
INRMP	Integrated Natural Resources Management Plan
IPMP	Integrated Pest Management Plan
JDMTA	Jonathan Dickinson Missile Tracking Annex
MTA	Malabar Transmitter Annex
NOTU	Naval Ordnance Test Unit
PAFB	Patrick Air Force Base
QAP	Quality Assurance Personnel
SW	Space Wing
TGC	Triploid Grass Carp
US	United States
USAF	US Air Force

Attachment H-1

Golf Course Environmental Management (GEM) Plan

Air Force Center for Engineering & the Environment

Manatee Cove Golf Course
Environmental Management (GEM) Plan
Patrick AFB, Florida

January 2010

San Antonio, Texas

Manatee Cove Golf Course Environmental Management Policy

In concert with the Patrick AFB mission, we pledge to employ only those management practices that minimize or eliminate the potential for negative impacts to the environment and the surrounding community, protect existing natural resources and improve natural communities to the extent allowable, ensure compliance with all appropriate regulations, and to regularly reevaluate our processes to achieve the highest standards of environmental excellence.

Table of Contents

Executive Summary

U. S. Air Force GEM Program

The U. S. Air Force Golf Course Environmental Management (GEM) program is a proactive Air Force Center for Engineering & the Environment (AFCEE) initiative to foster a better understanding of the environmental challenges facing our golf courses worldwide.

Armed with the support and approval of the Air Force Services Agency golf program, AFCEE's goal is to facilitate the creation of an environmentally friendly golf course facility while supporting the Installation mission. Chapter 11 of AFI 32-7064 requires a GEM Plan as part of the Integrated Natural Resources Management Plan (INRMP).

GEM Program process

There are five steps in the GEM program process:

- Analysis
- Documentation
- Implementation
- Evaluation
- Revision

Environmental Compatibility Quotient (ECQ) scores

The following is the summary of the environmental compatibility quotient (ECQ) scores for the site visit conducted in January 2010:

- **Actual ECQ = 76, Showing progress (Yellow)**
- **Potential ECQ = 92, Advanced (Green)**

Environmental challenges

The following environmental challenges were identified in compiling this Final GEM Plan:

- Bird/wildlife Aircraft Strike Hazard (BASH)
- Water quality
- Threatened or endangered species
- Installation Restoration Program (IRP) sites
- Invasive species
- Airfield safety criteria
- Explosive ordinance safety criteria
- Floodplains
- Nuisance wildlife
- Migratory birds

Where do we go from here?

The true measure of a successful GEM program is how well is it executed in the field each and every day. The Installation golf and environmental staffs should continue to analyze, document, monitor, evaluate, revise, and implement changes based on lessons learned. The GEM Plan should be updated annually and revised during the next INRMP iteration update. The entire GEM process can be found on the regularly improved AFCEE GEM program website (http://www.afcee.brooks.af.mil/ec/golf/).

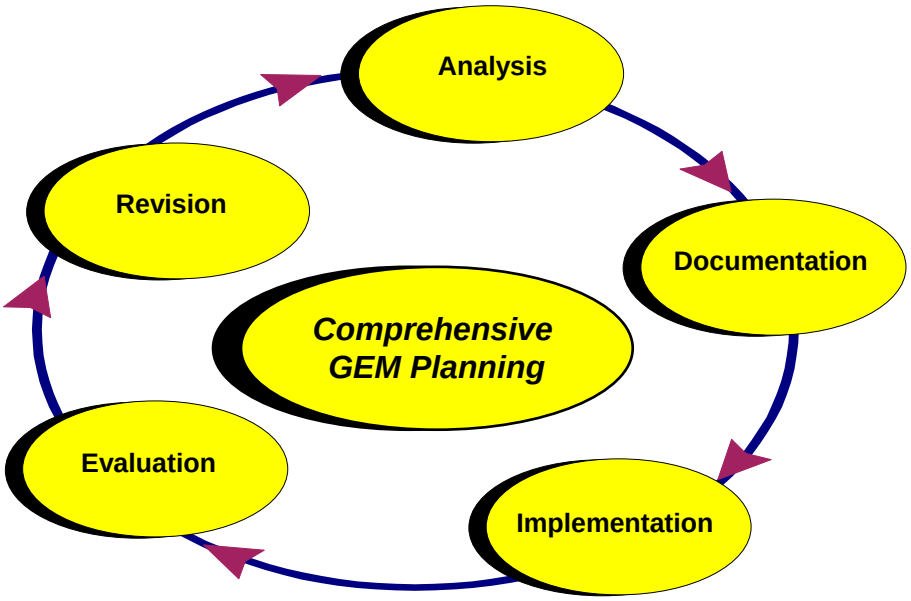
Manatee Cove Golf Course Patrick AFB, FL

Birds and water features are dominant elements at Manatee Cove.

The golf course environmental baseline assessment (GCEBA), or the Draft Golf Course Environmental Management (GEM) Plan is the initial step in creating a successful ecosystem-based comprehensive GEM Plan. The intent of the GEM Plan is to provide an efficient management tool that will enable course managers to devote more of their efforts to caring for their customers and the golf course. Properly designed and implemented, the GEM Plan will keep the entire golf facility in compliance with the constantly changing environmental requirements while contributing to the local community.

The GEM Initiative

The goal of the GEM initiative is to facilitate the creation of an environmentally friendly approach to golf course management while protecting and promoting the great game of golf. AFCEE is dedicated to helping to identify ways that more rounds can be played on better-conditioned courses while minimizing or eliminating negative impacts to the environment. Golf courses are being managed in consideration of environmental and resource constraints. The comprehensive GEM planning process is a vehicle to document and communicate our challenges and successes to our customers, commanders and local community.



GEM Process

The five steps of the GEM Process are based on continual improvement.

GEM Process

Efficient implementation is the most important aspect of any initiative where practices and procedures are examined and may undergo significant change. This is especially true of the comprehensive GEM planning process. The GEM Plan is derived from several diverse environmental regimes to include the National Environmental Policy Act and the ISO 14001 environmental management system.

There are five basic steps in the implementation of the GEM Planning process:

- Analysis
- Documentation
- Implementation
- Evaluation
- Revision

Analysis

Experienced environmental managers realize the importance of assembling all of the data relevant to a problem prior to determining its best solution. Comprehensive analysis is the most important task of the GEM process. Properly completing the analysis is paramount to the long-term compatibility of a golf course's management practices with the local community's natural resource and environmental management goals and objectives.

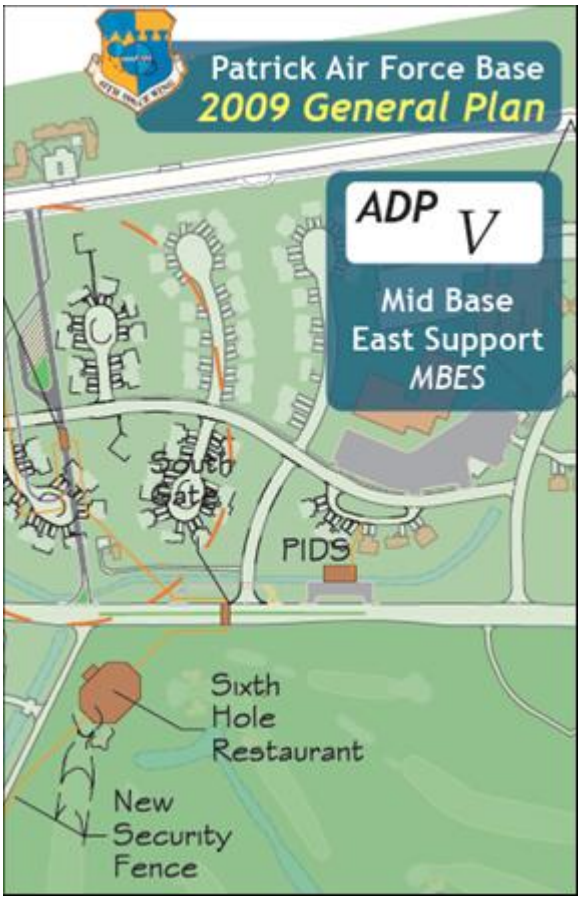
GCEBA COMPONENTS

The GCEBA is comprised of the following components:

- Site visit, interviews, and data collection
- Course specific analysis
- Miscellaneous facility review
- Environmental compatibility quotient checklists
- Identification of potential environmental management challenges
- Summary report

Documentation

It is not enough just to know how to create a successful golf course environmental management program. There must be a written record documenting existing site data, maintenance practices, pesticide applications, and other historical golf course activities. By documenting what we know, we will be able to determine how to make better decisions in the future. The completed GEM Plan will assist in the daily management of the course while providing a convenient vehicle to communicate to the community and customers alike the environmental issues that challenge golf course managers as well as their plans to deal with them. In order to reach established environmental stewardship goals the golf course staff must consistently employ only those management practices that minimize or eliminate potential negative impacts to the environment.



Proposed "Sixth Hole Restaurant may have impacts.

Manatee Cove Golf Course Patrick AFB, FL

U.S. AIR FORCE GEM PLAN COMPONENTS

The GEM Plan will be comprised of the following components:

- GCEBA report
- Map of the entire golf course facility grounds depicting locations of the significant environmental management challenges and the golf course facilities
- Booklet that describes the environmental management challenges depicted on the GEM Plan map
- Specific practices that will be employed by the golf course staff to deal with each environmental management challenge after coordination with and approval by the installation environmental staff
- Compilation of best management practices employed at the golf course in their implementation of the GEM initiative recommendations

Implementation

Positive and decisive action is the only true measure of the success of the GEM Plan. By implementing new practices, whether to knowingly improve the course's role in the environmental stewardship of the Installation or to just try new ideas to determine their value, will the golf staff and golfers benefit. The installation golf staff should consider adopting the GEM Initiative process and establish an environmental policy that minimizes or eliminates any and all potential negative environmental impacts.

Evaluation

In order to ensure the highest quality of customer service and environmental stewardship, there must be continual self-evaluation and improvement. There also should be consistent, on-going measurement of the reduction or elimination of environmental impacts the newly implemented practices have on the course. For example, documenting the reduced use of inputs such as fertilizers, pesticides, and irrigation can be used to demonstrate the increased environmental stewardship of the golf course management practices as well as the overall value of the GEM initiative. It is important for golf courses to show improvement over time. Improvements can be easily accomplished by regularly evaluating golf course maintenance methods, practices, and management approaches to day-to-day issues in concert with the desire and ability to change.

Revision

The very nature of a superior GEM Plan implies that all documents be regularly maintained to represent the most current conditions. Golf course managers and superintendents should be constantly looking for ways to improve their environmental stewardship. Acting on lessons learned is right behind initial implementation as the most important aspect of a successful GEM Plan. The GEM Plan should be kept as current as possible at all times. Ideally, it should be updated annually and completely rewritten on the same cycle as the Integrated Natural Resources Management Plan.

Course Specific Analysis

One of the most pragmatic and enjoyable tasks in the baseline assessment portion of the GEM process is the course specific analysis. From a general description of the course to the details of the course's history and makeup to the various observations on course playability, aesthetics, and style of management, the course specific analysis sets the stage for the rest of the GEM Plan report.

Manatee Cove Golf Course Layout

Manatee Cove Golf Course Description

Over the years, Patrick AFB's Manatee Cove Golf Course regularly provides a quality golf experience for more customers than any other 18-hole Air Force facility. The recent greens renovation by golf architects, Hurdzan-Fry, is beginning to pay dividends as rounds are up. The course is challenging and extremely playable. The Robert Trent Jones-designed course is nearly 7000 yards from the back and is typical of most Florida layouts as it is lacking in major elevation changes. In keeping with Trent Jones, Sr. tradition, the greens at Manatee Cove are large and rolling to test the golfers as well as to allow several pin locations to accommodate the heavy play. Management is in a constant fight against salt buildup in the soil profiles as the Atlantic Ocean is not far from the course's boundary on the east and the brackish Indian River to the west. Seemingly nonstop winds buffet the grounds around the clock. Well managed facilities, motivated staff, quality recreation values, and a wonderful, year round climate conducive to golf is the not so secret recipe at Manatee Cove.

Manatee Cove Golf Course

Manatee Cove Golf Course Patrick AFB, FL

Course management has undertaken an aggressive native grass installation program.

Manatee Cove Golf Course Details

Architect		Robert Trent Jones, Sr./Hurdzan Fry
Year constructed		1961 / 2006
Average annual precipitation		56 inches
Average growing season		335 days
Elevation		Just above sea level (~0-20' ASL)
Prevailing wind direction		North, east and south
Climate		Warm, humid and tropical
Total acreage / actively maintained		286 / 160 acres
Par		36-36-72
Yardage/Rating/Slope		Blue- 6808/71.9/123
		White- 6452/70.3/118
		Gold- 6099/69.1/116
		Red- 5636/72.9/127
		Green- 5020/69.4/124
Turfgrass	Tees-	Tifway 419 Bermuda grass
	Fairways-	Tifway 419 / Common Bermuda grass
	Greens	Paspalum
	Roughs-	Common Bermuda grass mix
Irrigation source / Sustainability rating		Recycled / Green

Environmental Compatibility Quotient (ECQ) Checklists

Many diverse and complex aspects of golf course management have been revealed through the literature search conducted to compile this study. In order to simplify the process, these aspects have been summarized into eight main topics and incorporated into five distinct environmental compatibility categories.

- Planning & Compliance
- Operations & Maintenance
- Water Resource Management
- Conservation
- Pesticides & Pollution Prevention

The environmental compatibility quotient (ECQ) checklist questions have been compiled using examples from several sources including Audubon International, Center for Resource Management, and Committed to Green. The ECQ checklists represent the best method currently available to determine the relative environmental compatibility of a golf course's management practices. The checklists can be used in many ways including:

- As a tool to establish a current snapshot or baseline of a golf course's relative environmental compatibility
- As a tool to identify areas for improvement or to demonstrate current successes
- As a self-assessment tool for the golf course manager and superintendent
- As documentation for an environmental award nomination
- As documentation for regulatory requirements or inquiries from customers, the media, or the general public

Determining the Environmental Compatibility Quotient (ECQ)

The ECQ is a snapshot of the overall performance and compliance with the GEM Plan. There are two measures obtained as a result of using the ECQ checklists to determine the status or quality of the environmental management program: 1) determining the actual and; 2) potential environmental compatibility quotients.

- **Actual ECQ-** the total percentage of "Yes" responses for all ten checklists. This number represents the current level of the golf course management practice compatibility with the environment
- **Potential ECQ-** the total percentage of "Yes" responses plus the total percentage of "Partial" responses for all ten checklists. Maybe the most significant measure; the potential ECQ represents a level of compatibility that could be reached by fully implementing a particular practice or procedure.

ECQ Scoring Scale

Percent Responses Yes
or Partial per Category Level

90-100%	Advanced (Green)
70-89%	Showing progress (Yellow)
69% or less	Getting started (Red)

The following ECQ checklists are a record of the interview conducted with Manatee Cove Golf Course superintendent during the installation site visit.

Planning & Compliance

#	Environmental Compatibility Indicator	Yes	Partial	No
1	Has management demonstrated that environmental stewardship is an important part of their responsibilities by initiating the Comprehensive Golf course Environmental Management (GEM) Planning process?	✓		
2	Is the GEM Plan complete, updated regularly, and readily available to employees and customers?		✓	
3	Has the golf course adopted and posted an environmental policy?		✓	
4	Is a map of the property highlighting environmental challenges posted for employees and customers?			✓
5	Does management conduct a comprehensive annual evaluation for each identified environmental challenge and its management approach, objective, and target?			✓
6	Does the course have a Tree Management Plan complete with planting plan and maintenance schedule?			✓
7	Is there a readily-available and regularly updated Integrated Pest Management Plan specifically written for the entire golf course property?	✓		
8	Is there a map of the course's "hot spots" or specific areas that may require regular special care or attention?			✓
9	Is there an up-to-date comprehensive golf course development plan or master plan that details the desired short- and long-term improvements to the facility?		✓	
10	Is there at least one project planned and funded for the next year that would increase the compatibility of the course's management program with comprehensive GEM planning goals and objectives?	✓		

Planning & Compliance Checklist (continued).

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Have all employees been familiarized with the GEM Plan and are they trained regularly on the importance of environmental performance and compliance with its goals and objectives?			✓
12	Are environmental management issues regularly discussed during staff meetings?	✓		
13	Are the actual amounts of each pesticide or fertilizer on the facility available in writing for every application over the last year?		✓	
14	Has the facility attained full certification in the Audubon Cooperative Sanctuary Program or similar industry-recognized environmental management program?			✓
15	Are employees trained in their native language on the benefits of minimizing potential negative impacts?	✓		
16	Are environmental targets being met based on an annual review or as needed basis?			✓
17	Are there documented functional or aesthetic thresholds integrated into pest control decisions?	✓		
18	Is there a written comprehensive Golf Course Water Resources Management Plan that delineates the care of each of the course's water features?			✓
19	Are employees trained on what to do in case of a spill and have spill containment kits been provided at all appropriate locations?	✓		
20	Have all maintenance procedures been examined to determine their potential to negatively impact an identified environmental challenge?		✓	
	Totals	**7**	**5**	**8**

Operations & Maintenance

#	Environmental Compatibility Indicator	Yes	Partial	No
1	Is there a written, regularly updated and comprehensive Turfgrass Management Plan for each type of turf and playing area?	✓		
2	Are there designated natural or minimally-maintained buffers around sensitive landforms and/or core wildlife habitats?		✓	
3	Are green, tee, and fairway mowing heights maintained at levels that do not excessively stress important playing surfaces?	✓		
4	Are aeration, topdressing and other drainage improvements regularly implemented to improve soil health and minimize or eliminate inputs of pesticides or fertilizers?	✓		
5	Are soil tests or plant tissue analysis regularly used to determine turfgrass nutritional requirements?	✓		
6	Is the information collected in soil tests and plant tissue analysis integrated into a regularly updated Nutrient Requirement Plan and map?	✓		
7	Is there at least one project planned and funded for the next year that would improve the course's protection of the environment?		✓	
8	Are all appropriate employees trained to be familiar with (national, federal, state, and OSHA) regulations that apply to storage and handling of potentially hazardous materials used on the property?	✓		
9	Has all aspects of the golf course property other than the course for potential negative environmental impacts?	✓		
10	Have all employees received documented training that would increase their awareness of the GEM program environmental stewardship goals and objectives?			✓

Operations & Maintenance Checklist (continued).

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Are containers used to store used oil for equipment maintenance in good condition, not leaking, and clearly labeled?	✓		
12	Are oil/water separators and/or golf course wash racks operating properly and correctly maintained?	✓		
13	Are all golf course vehicles and equipment maintained and cleaned in a manner that helps to eliminate the potential for spreading of disease or other contamination?	✓		
14	Are electric motor-powered equipment or vehicles being utilized where appropriate?	✓		
15	Are waste products such as oil, grease, tires, and batteries stored in a covered container and disposed of properly off site?	✓		
16	Does the superintendent use hand held GPS units to assist in GIS mapping of the golf course areas?			✓
17	Are energy efficiency ratings factored into equipment purchases for use throughout the facility?		✓	
18	Has the entire facility been studied to quantify solid waste streams to identify functions that produce the greatest quantities?	✓		
19	Are at least 90% plates, cups, and utensils in use by the restaurant/snack bar facility reusable rather than disposable?			✓
20	Does course management utilize a web-based golf course planning tool for every day decision-making and recordkeeping?			✓
	Totals	**13**	**3**	**4**

Water Resource Management				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Are written records of water quality monitoring activities, results, and pollution control measures readily available and used to establish appropriate maintenance practices?		✓	
2	Where appropriate, are slow-release fertilizers and/or spoon-feeding techniques used to reduce the potential for runoff impacts and nutrient loading to water quality?	✓		
3	Does the irrigation system operate using computerized controllers based on real-time evapotranspiration rates?		✓	
4	Are the golf course sprinklers and outdoor irrigation of non-golf course areas and indoor plumbing regularly monitored and maintained for proper distribution and leaks?	✓		
5	Have low-flow water saving devices been installed wherever possible?	✓		
6	Are triploid, non-reproducing grass carp or similar fish species used to control unwanted aquatic vegetation in major water features?	✓		
7	Is there at least one project planned and funded that would minimize or eliminate a potential water quality or erosion problem?	✓		
8	Are water features regularly monitored for algae, erosion, excessive aquatic plant growth, etc.?	✓		
9	Are low impact design (LID) principles such as using vegetative or drainage filters to cleanse parking lot runoff prior to leaving the property?			✓
10	Are there signs appropriately located to warn golfers of the potential hazard of drinking recycled or otherwise non-potable water?	✓		

Water Resource Management Checklist (continued).

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Are properly functioning flow meters employed to monitor total potable and non-potable water use?	✓		
12	Has the irrigation system or its components recently been upgraded to reduce or eliminate inefficiency and overall water use?	✓		
13	Is there a map of the watershed in which the golf course property resides and location(s) of floodplains and storm water drainage that exists on the property?	✓		
14	Is the quality of the irrigation water regularly checked to determine overall quality or nutrient, salt or total suspended solid parameters?		✓	
15	Is water quality data regularly collected to establish baseline conditions and maintenance procedures for all water features on the property?	✓		
16	Is at least 75% of the water used for irrigating the golf course property from recycled or other non-potable sources?	✓		
17	Is there at least one project planned and funded that increase the course's water use efficiency?		✓	
18	Have the property's Water Quality Management Zones been identified and mapped based on industry-standard risk factors?			✓
19	Has the property's water features been studied to determine the aquatic and amphibious species population?	✓		
20	Has the property been examined for potentially significant wetlands or associated sensitive water-based habitats?	✓		
	Totals	**14**	**4**	**2**

Conservation

#	Environmental Compatibility Indicator	Yes	Partial	No
1	Is all motorized equipment maintained for efficient operation that would minimize the potential of creating excessive air polluting emissions?	✓		
2	Has the entire golf course property been examined for critical habitats, species of concern and threatened or endangered species?	✓		
3	Are all manmade ponds or other large water features adequately lined to minimize or eliminate losses?			✓
4	Are employees encouraged to minimize their trips around the course to conserve on the use of fossil fuels?	✓		
5	Have efforts been made to physically connect natural areas to facilitate wildlife movement through the course property?	✓		
6	Have all necessary permits been secured and are they updated and their requirements satisfied in a timely manner?	✓		
7	Are recycling containers conveniently provided for customer and employee use throughout the golf course facility?	✓		
8	Has there been a study to determine the presence of invasive species on or near the course?	✓		
9	Is there a comprehensive and readily available Drought Management Plan for the entire golf course facility?			✓
10	Has there been a demonstrated 2% annual reduction in potable water use since FY07?			✓

Conservation Checklist (continued).

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Has there been a demonstrated 2% annual reduction in irrigation water use starting in FY10?			✓
12	Are at least 85% of plants used in landscaped areas drought-tolerant native trees, shrubs, groundcovers, or their cultivars?	✓		
13	Are there signs posted to highlight key habitats or have appropriate areas been designated "Environmentally Sensitive Zones" per The Rules of Golf?	✓		
14	Has a comprehensive energy audit been conducted for the entire golf course facility?			✓
15	Has the use of petroleum products been tracked and has there been a demonstrated 2% reduction each year since FY05?			✓
16	Is there an inventory of bird and mammal species documented, maintained and readily available?	✓		
17	Is there a comprehensive Energy Management Plan compiled for the entire golf course facility demonstrating a 3% annual reduction since FY03?			✓
18	Have all damaged or degraded habitats due to construction or maintenance of the course been fully restored or improved?	✓		
19	Has the entire property been examined for archaeological, cultural or historical resources?	✓		
20	Is the irrigation pump station an energy efficient, variable frequency drive?	✓		
	Totals	**13**	**0**	**7**

Pesticides & Pollution Prevention

#	Environmental Compatibility Indicator	Yes	Partial	No
1	Are there established, documented and communicated minimally-maintained and fertilizer and pesticide application buffer areas around water features or sensitive landscapes?	✓		
2	Is the equipment wash rack adequately covered to minimize or eliminate collection of precipitation?			✓
3	Does the chemical storage area have a sealed metal or concrete floor and are all pesticides handled over an impermeable surface?	✓		
4	Does the chemical storage area have a lip along the edges and does it have at least 150% of total storage volume secondary containment?	✓		
5	Are liquid products stored below dry products and are dry materials stored on pallets or shelves to keep them off the floor?	✓		
6	Has the least toxic pest control strategy been identified for each of the most common pests and is it always used first when an action threshold is reached?	✓		
7	Is equipment cleaned with compressed air or blowers on part of the course instead of, or prior to washing at a designated wash rack?		✓	
8	Are leachate potentials of pesticides considered in the integrated pest management process?	✓		
9	Does the fuel storage/delivery area comply with local, state, federal, or other applicable regulations?	✓		
10	Are written records maintained of all applications of pesticides to include: - the pest and treatment type (preventative/curative); - the location (specific area) of each pesticide used; - the area (SF/SM) & quantity of each pesticide used; - the chemical & common name of active ingredient(s); - the date, location, or purpose of the application?	✓		

Pesticides & Pollution Prevention Checklist (continued).

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Are all pesticide applications recorded and mapped to guide future pest control decisions?		✓	
12	Other than the superintendent, are there trained scouts on staff to monitor turf and plant health and pest problems?	✓		
13	Are there scouting forms utilized and are they collected and organized into a report or guide for use in future pest control decisions?	✓		
14	Is there an established aesthetic or functional threshold for each of the course's most common pests that may help reduce pesticide and fertilizer inputs?	✓		
15	Are current copies of all Material Safety Data Sheets (MSDS) for all chemicals used anywhere on the golf course property maintained and readily available?	✓		
16	Are fertilizers and pesticides stored in separate facilities?	✓		
17	Is the chemical storage structure/area locked, well-ventilated and fire-resistant and is access limited to appropriate personnel?	✓		
18	Are all fertilizer applications made by a certified fertilizer applicator and are they recorded and mapped to guide future actions?			✓
19	Are golfers adequately notified in the pro shop and on the first and tenth tees about the day's planned or recently completed spraying of any chemical or fertilizer?	✓		
20	Are there written pest profiles for common regional pests along with alternative potential control measures readily available?	✓		
	Totals	**16**	**2**	**2**

Manatee Cove Golf Course Patrick AFB, FL

The golf staff is committed to environmental protection.

Environmental Compatibility Quotient Summary			
Environmental Compatibility Category	**Yes**	**Partial**	**No**
Planning & Compliance	**7**	**5**	**8**
Operations & Maintenance	**13**	**3**	**4**
Water Resource Management	**14**	**4**	**2**
Conservation	**13**	**0**	**7**
Pesticides & Pollution Prevention	**16**	**2**	**2**
Totals	**63**	**14**	**23**

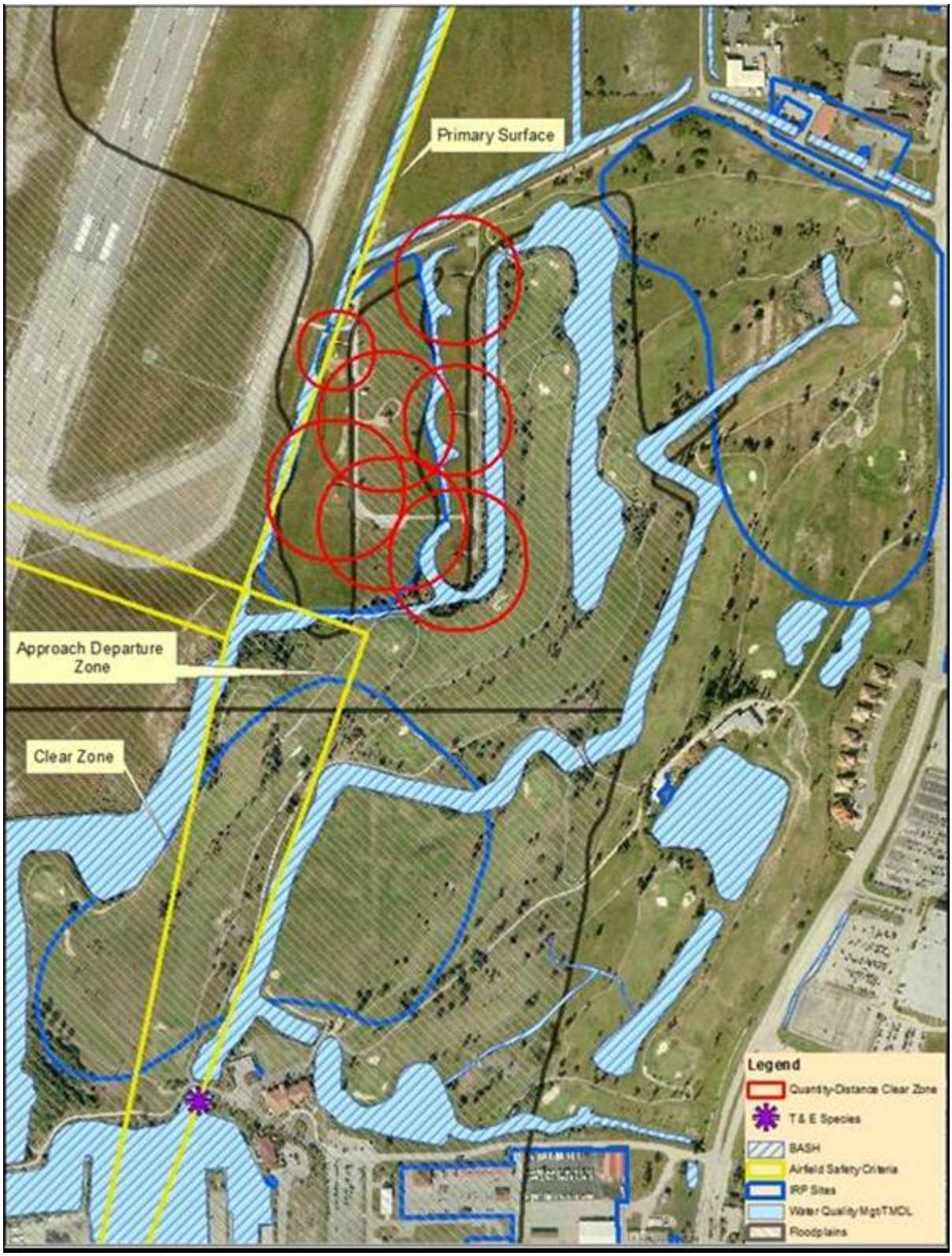
Key to checklist responses

- **Yes** = Practice is complete or ongoing and can be verified
- **Partial** = Practice has been initiated yet is not completed
- **No** = Practice is not in place

Jan 10 – Manatee Cove Golf Course ECQ:

- **Actual ECQ = 63, Just started (Red)**
- **Potential ECQ = 77, Showing progress (Yellow)**

Environmental Compatibility Quotient Scoring Scale	
Total Yes or Partial Responses	**Environmental Compatibility Level**
90-100%	**Advanced (Green)**
70-89%	**Showing progress (Yellow)**
69% or less	**Just started (Red)**



Manatee Cove Golf Course
Environmental Challenges Map

Manatee Cove Golf Course Patrick AFB, FL

Relatively recent clubhouse construction project has been a success.

Environmental Challenges

One of the important results of the GEM process is the identification of significant environmental challenges to be addressed in the GEM Plan. Along with the newly established baseline, the GEM Plan consists of a map and description of the final environmental challenges and the prescribed approach to their management. In addition, the GEM Plan includes a comprehensive list of future environmental management goals and objectives and a course-specific set of best practices.

The following environmental challenges were identified during the GEM process:

- Bird/wildlife Aircraft Strike Hazard (BASH)
- Water quality
- Wetlands
- Threatened or endangered species
- Installation Restoration Program (IRP) sites
- Invasive species
- Airfield safety criteria
- Explosive ordinance safety criteria
- Floodplains
- Nuisance wildlife
- Migratory birds

Assessing environmental challenges

The assessment of the environmental challenges is probably the most crucial as it provides a prioritized list of coordinated actions significant to the long-term success of the golf facility. The finalized GEM Plan will include the description, driver or requirement, management practice, objective, and target:

DESCRIPTION

Once the challenge has been identified, a short description and a few historical or statistical details assist greatly in understanding the key factors in devising management practices.

DRIVER/REQUIREMENT

Challenges are defined as "things that are bigger than the course". Some of the reasons behind why a particular issue becomes a challenge are important to recognize and understand. A driver or requirement may be a local, regional, or national law, regulation, or initiative that creates the requirement to protect species, habitat, or preserve a resource such as open space or unique ecosystems.

OBJECTIVE

Objectives are the overall goals for environmental performance focusing specifically on management activities associated with each challenge and the potential for impacts. The objective should directly relate to the environmental policy.

MANAGEMENT APPROACH

A course's approach to managing environmental challenges in accordance with the driver or requirement, environmental policy and established objectives and targets is the heart of the GEM Plan.

TARGET

The target is the time frame and/or quantifiable unit of measure to achieve the established objectives.

Manatee Cove Golf Course Patrick AFB, FL

There is a potential compliance issue with the course maintenance complex's wash pad.

Manatee Cove Golf Course Patrick AFB, FL

Water birds congregate around the course's water features.

BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD (BASH)

Situated between two major bodies of water Patrick AFB and the Manatee Cove Golf Course are in an area of significant bird activity and species diversity. The Bird Hazard Reduction Plan lists gull, egret, little and great blue heron, pelican, coot, willet, yellow legs, killdeer, plover, black skimmer, osprey, and kestrel hawk as potential concerns to aircraft safety. The golf course staff must coordinate any and all activities that affect this issue directly with the installation flying safety office. U. S. Air Force golf courses must never be connected in any way to BASH related aircraft or flying crew damage or losses.

Driver/requirement

- Bird/Wildlife Aircraft Strike Hazard (BASH) Plan, 91-212
- AFI 13-213, Airfield Management
- AFI 32-1053, Pest Management Program
- FAA Advisory Circular 150/5200-33A, Hazardous Wildlife Attractants On Or Near Airports
- AFI 91-202, The U. S. Air Force Mishap Prevention Program
- AFPAM 91-212, Bird/Wildlife Aircraft Strike Hazard (BASH) Management Techniques
- UFC 3-260-01, Airfield and Heliport Planning and Design
- AFPD 91-2, Safety Programs

Objective

In direct support of the installation's mission, the golf staff shall continue to cooperate and assist the environmental and airfield management staffs with BASH reduction efforts to minimize or eliminate the potential for installation BASH concerns as a result of golf course management practices.

Management approach

- Attend all BASH Working Group meetings
- Eliminate all unnecessary vegetation around water bodies
- Continue to assist installation airfield and environmental managers with BASH concerns on the golf course
- Manage all minimally-maintained areas in accordance with airfield mowing criteria
- Report large bird concentrations to Airfield Manager or designated representative
- Coordinate with Airfield Manager or designated representative and flight safety officer to ensure golf course improvements are deconflicted with BASH program and do not increase bird hazard for flight operations

Target

Initiate consultation immediately and regularly thereafter to ensure compliance with airfield management and BASH criteria.

Complete comprehensive Golf Course Tree Management Plan that identifies potentially BASH-contributing species and implement annual maintenance schedule.

Manatee Cove Golf Course Patrick AFB, FL

Cormorants can gather in large numbers.

Manatee Cove Golf Course Patrick AFB, FL

Protecting the quality of Manatee Cove's water features is a complex task.

WATER QUALITY

The protection of the many, interconnected water bodies are probably the main environmental concern for Patrick AFB managers. The golf course water bodies have the potential to receive inputs of pesticides, herbicides and fertilizer from course maintenance activities. A pond enhancement project has been undertaken that has "initiated to provide both a better habitat for fish located with the pond and a new habitat to the birds and other animals located around the pond".

According to a storm water study memorandum, the "PAFB golf course was constructed before storm water treatment requirements were implemented. The east and west canals which discharge to the Banana River were excavated to provide drainage of the golf course (refer to Figure 2). Overflow structures with sluice gates were constructed at the discharge point of the canals to control the water levels in the canals. The east canal receives storm water runoff from approximately golf course 118 acres."

Another water quality issue is the condition of the installation watershed. In order to quantify this issue, a study was undertaken to conduct a Total Maximum Daily Loads (TMDL) site compliance investigation and watershed model investigation. The purpose of this investigation was to create a comprehensive watershed assessment that would baseline the condition of the watershed and drainages within the installation that would provide a process for analyzing the watershed's current condition, the likely causes of these conditions, and recommendations for what must be done to protect and help restore the watershed to optimal levels as required from a TMDL perspective.

Manatee Cove Golf Course Patrick AFB, FL

Sluice gates like this one control golf course runoff into the Banana River.

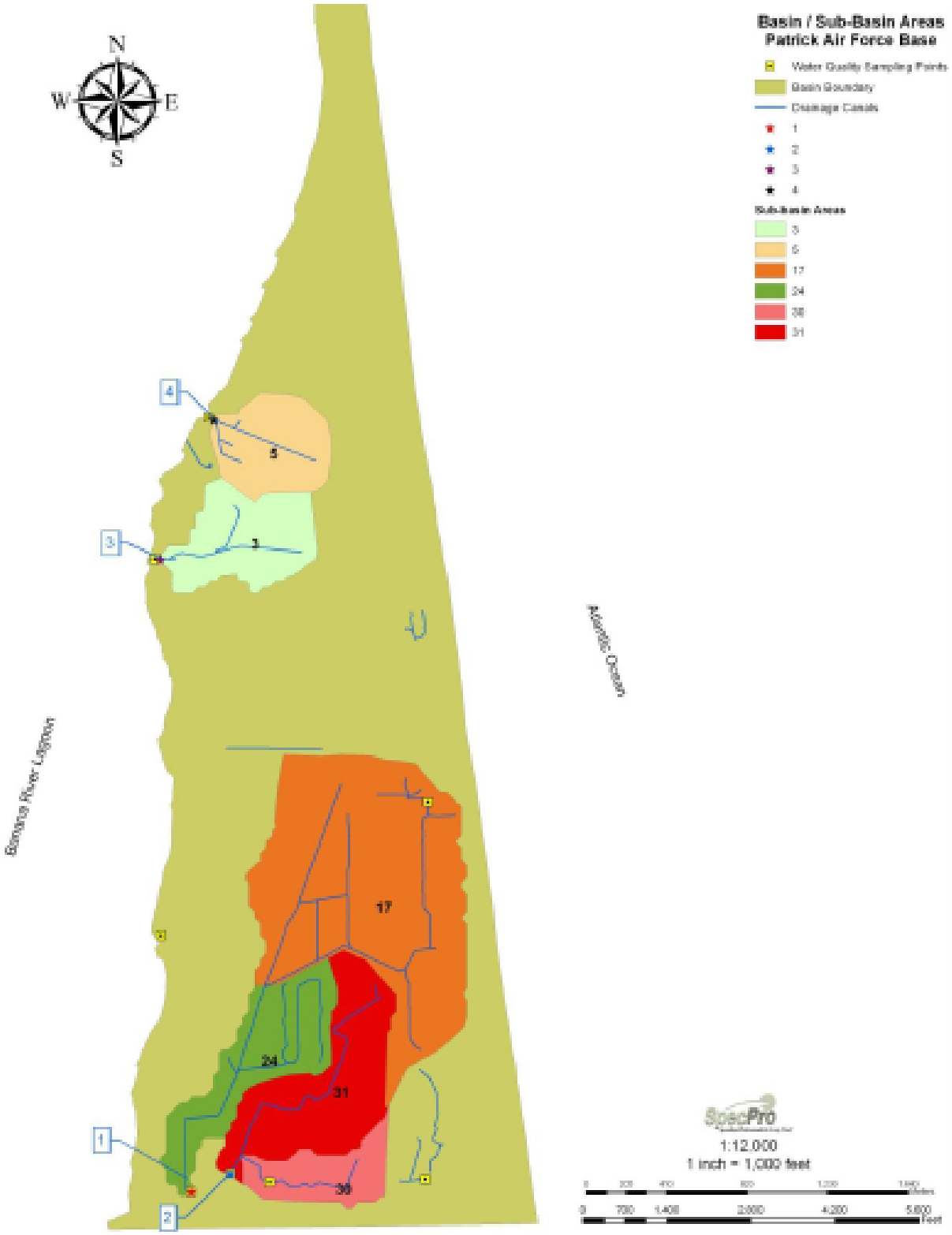
According to the surface water samples taken by the TMDL study, "the golf course is the dominant source for 77% of TP (total phosphorous) and 62% of TN (total nitrogen) discharging to the Banana River. The study attributed the majority of these nutrients to fertilizer use on the golf course and continues with "there are multiple projects that are currently in progress that will affect the nutrient loading to the Banana River. The PAFB Regional Stormwater Management System is having a large impact on the TMDLs due to the scope of the project. In this effort, the southern end of the base, including the golf course, will become regionalized for stormwater allowing for the water to collect in the main pond system of the golf course by blocking off the southern outfall and forcing the water to move through the entire system and out through outfall 1. By having a longer treatment time the nutrients should be removed before the water is discharged into the BRL." Best management practices will be identified to address nutrient loadings.

Driver/requirement

- Clean Water Act, Section 401
- National Pollutant Discharge Elimination System (NPDES)
- Safe Drinking Water Act
- Federal Water Pollution Control Act of 1977 (Clean Water Act), as amended (33 U.S.C. 1251-1376)
- St. Johns River Water Management District and Florida Department of Environmental Protection regulations on TMDL reductions and point source nutrient limits

Objective

Ensure that golf course management practices never diminish installation or community water quality.



Patrick's watershed is comprised of several basins and sub-basins.
Sub-basin 24, 30 and 31 are on the golf course.

Management approach

- Consult with installation environmental staff to ensure that golf course maintenance practices are fully compliant with complex regulations
- Compile a comprehensive Water Resource Management Plan for the entire golf course facility
- Establish, document and communicate pesticide and fertilizer application buffers around all water features
- Drums are stored on pallets
- Spill response equipment is provided
- Dumpsters are covered
- All material and waste is stored inside buildings or cabinets
- Wash rack is covered and is equipped with a grass cuttings trap
- Fuel tanks are double walled
- Secondary containment provided for fuel storage tanks
- Pesticide/herbicide storage and mixing area is covered & bermed
- Flammables are stored in secure cabinets
- Site personnel regularly perform visual inspections of the area
- Security fencing is installed

Manatee Cove Golf Course Patrick AFB, FL

Some of Manatee Cove's water features have been dredged to remove excess vegetation.

Target

Eliminate the potential for degradation of the water resources by immediately establishing, documenting and communicating all pesticide and fertilizer application buffers to appropriate personnel.

Maintain positive relationship with civil engineering and environmental staffers to attain and maintain compliance without delay on all water-related regulations and requirements.

Correct all non-compliant water resource aspects prior to the end of CY 2010.

Manatee Cove Golf Course Patrick AFB, FL

Jurisdictional wetlands are present behind the first hole's teeing area and include the marina and its waterway connection to the Banana River.

WETLANDS

Despite the huge quantity of water bodies on and around Patrick AFB, there are only a few jurisdictional wetlands on the installation. The largest of these wetlands is home to the marina and is in close proximity to the first teeing area and the clubhouse. The wetland is also home to manatees during the proper time of year. "A 'jurisdictional waters' delineation was completed by the Army Corps of Engineers (COE) in June 2006 and is officially valid for five years." Wetlands are "those areas that are inundated by surface or ground waters that support plants and animals that need saturated or seasonally saturated soil to grow and reproduce. Wetland ecosystems are considered to be some of the most biologically productive of all habitats."

Driver/requirement

- Clean Water Act, Section 404
- National Pollutant Discharge Elimination System (NPDES)
- Executive Order 11990, Protection of Wetlands

Objective

Ensure that all water bodies continue to be free of pollutants potentially attributable to a golf course management practice.

Management approach

- Establish, document and communicate fertilizer and pesticide application buffers to all appropriate employees or service providers
- Consult with environmental staff prior to any changes in water feature maintenance
- Comply with all requirements included in the approved installation SWPPP

- Ensure all spill prevention procedures and spill kits are in place and all pertinent employees are adequately trained to correctly and promptly perform required actions in an emergency situation
- Compile a comprehensive Water Resource Management Plan for the entire golf course facility
- Ensure that golf course maintenance practices are fully compliant with complex water regulations

Target

Eliminate the potential for degradation of the water resources by immediately establishing, documenting and communicating all pesticide and fertilizer application buffers to appropriate personnel.

Maintain positive relationship with civil engineering and environmental staffers to attain and maintain compliance without delay on all water-related regulations and requirements.

Correct all potentially non-compliant water resource aspects prior to the end of CY 2010.

Manatee Cove Golf Course Patrick AFB, FL

Ducks maneuver through dense duck weed on one of the ponds.

Manatee Cove Golf Course Patrick AFB, FL

The American alligator suns along one of Manatee Cove's water features.

THREATENED OR ENDANGERED SPECIES

An excerpt from past Integrated Natural Resources Management Program listed 19 threatened, endangered, or special concern species observed on Patrick AFB. The list includes stellar species such as the course's namesake, the Florida Manatee, which, along with the American alligator and the southeastern American kestrel are the only ones that specifically occur on the golf course grounds.

A large number of water birds have been observed using golf course ponds, vegetated areas surrounding the airfield, as well as areas along the Banana River shoreline. In addition to the BASH problem, a major concern for birds in these areas is the water quality.

The INRMP states state there are no "federally listed rare or endangered plant species" on Patrick AFB. However, the following threatened or endangered plants listed by the State of Florida or FNAI have been observed on the installation: spider lily; beach star; inkberry; and prickly pear cactus. State law also affords some protection to the black mangrove, red mangrove, and white mangrove which occur along the Banana River shoreline and the edges of some canals". These plants have a small chance of being a problem for the golf course facility. Awareness may prove to be the best defense.

Driver/requirement

- Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543)
- USAFI 32-7064, Integrated Natural Resources Management, 21 October 1996
- Air Force Policy Directive (AFPD) 32-70, Environmental Quality, 20 July 1994
- Federal Species Conservation Ordinance

Objective
Never allow a management practice to negatively impact a known threatened or endangered species on or near the golf course.

Management approach
- Ensure that the maintenance practices for all identified potential threatened or endangered species habitats are regularly coordinated with installation environmental staff

Target
Regularly request a site assessment and review of current management practices from the appropriate installation environmental manager.

The endangered Florida manatee can be seen in waters near the teeing area on Manatee Cove's first hole.

Manatee Cove
Golf Course
Patrick AFB, FL

Photo credit:
Phillip Colla

Manatee Cove Golf Course Patrick AFB, FL

Despite significant expenditures and effort, the Brazilian pepper still thrives in Florida.

INVASIVE SPECIES

One of the stated objectives of the INRMP is to "identify and eradicate exotic and invasive species". The golf course management staff should assist in that effort. This is especially true when considering the number and variety of potential invasive species habitat on the golf course. In addition, the entire state of Florida has undertaken the mammoth task of eliminating plant materials foreign to the United States. Of special concern are the so-called invasive exotics, that is, non-native plants that aggressively reproduce with little to no natural controls. These plants can clog waterways, replace less hardy natives, and generally take over the landscape. The Manatee Cove Golf Course grounds are home to at least melaleuca, Torpedo grass, hydrilla and Brazilian pepper.

Several large-scale efforts have already been undertaken by the installation to eliminate Brazilian pepper groves on the course. The golf staff has been integral to these efforts and should continue to facilitate removal of invasive species. Based on observation of the areas after removal operations, a comprehensive and professional landscape development scheme should integrate native plants that will minimize erosion and improve aesthetics while not decreasing playability for the average Manatee Cove golfer.

Driver/requirement

- Federal Noxious Weed Act of 1974
- Executive Order 13112, Invasive Species
- National Invasive Species Act (1996)
- Plant Protection Act (2000)
- Federal Noxious Weed Act of 1976 (7 U.S.C. 2801)
- Executive Order 13112, Invasive Species, February 3, 1999

Objective
Prevent introduction and establishment of invasive species to reduce their impact on the environment, economy and health of the United States.

Management approach
- Never knowingly install a listed or potentially invasive species
- Regularly inspect likely areas for invasives to establish themselves
- Work with installation environmental staff to contain or reduce invasives
- Train all pertinent employees on the latest invasive species identification and control measures
- Restore disturbed areas dominated by invasive species to natural vegetation where practical and consistent with mission requirements

Target
Assist the environmental staff with the compilation of an invasive species survey and completion of an approved plan to contain or reduce undesirable varieties prior to the end of FY10.

Manatee Cove Golf Course Patrick AFB, FL

Melaleuca trees are native to Australia and have been designated as an invasive species in the State of Florida.

Manatee Cove Golf Course Patrick AFB, FL

The airfield is nearby the golf course at Patrick AFB.

AIRFIELD SAFETY CRITERIA

Patrick AFB has two active runways. Each of the runways has specific airfield safety criteria to include a clear zone. Both clear zones are free of obstructions. As can be observed from the Environmental Challenges map on page 23, both the clear zone and the approach departure zone occur over golf course property. Extreme care must be taken by golf course management in this area. The mission is the primary consideration for all maintenance practices.

Driver/requirement

- AFI 32-7063, Airfield Installation Compatible Use Zones, (AICUZ)
- UFC 3-260-1, Airfield & Heliport Planning & Design

Objective

Assist with the elimination of all airfield criteria waivers and continue coordination and communication with airfield managers on maintenance practices.

Management approach

- Assist installation managers in providing a safe and efficient airfield

Target

Regularly consult with installation airfield management to ensure mitigation or elimination of potential impacts.

Manatee Cove Golf Course Patrick AFB, FL

Several water quality monitoring wells occur on the course.

INSTALLATION RESTORATION PROGRAM (IRP) SITES

There are several landfills in the area of the Manatee Cove Golf Course. These landfills were operated from the 1940s to 1961. Operations at Landfill 1, which is located approximately 250 yards southeast of the property, began in 1940 and ended in 1948. Landfill 2, located approximately 250 yards to the north was active between 1950 and 1956, while Landfills 3 and 4 operated from 1956 to 1961. Landfills 3 and 4 are located approximately 625 and 450 yards to the northwest and west of the property, respectively. The areas overlying these landfills have been developed since the time of their closure in 1961. The Base Commissary, Base Exchange, and Base Housing are now located on or near Landfill 1, while Landfills 2 and 4 underlie the golf course.

In addition to elevated concentrations of arsenic studies also documented elevated levels of cadmium. Although elevated from background concentrations, these levels were well below clean up levels for direct residential exposure. The report suggested these elevated levels might have resulted from the use of wastewater treatment plant (WWTP) effluent in golf course irrigation.

According to the installation environmental staff, “while there are various “Land Use Controls” due to the presence of landfills, the requirement to maintain the integrity of the cap probably most impacts golf course operations. Any invasive activities (digging, trenching, etc.) that might breach the cap require coordination well in advance with the IRP office. The landfill boundaries shown on the map on the next page are approximate at best. Care should be exercised when planning invasive activities anywhere in proximity to one of the landfill units.”

Driver/requirement

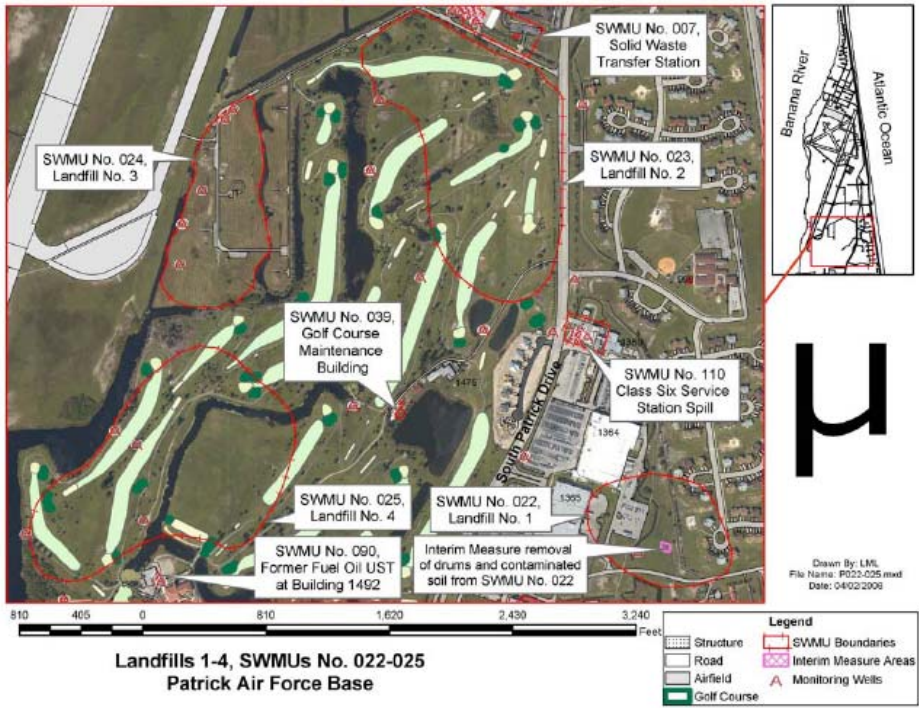
- AFI 32-7020, The Environmental Restoration Program

- Resource Conservation Recovery Act (RCRA)
- Comprehensive Environmental Response, Compensation, and Liability Act, (CERCLA)
- Superfund Amendments and Reauthorization Act (SARA)

Objective
Ensure daily compliance with restoration program site requirements.

Management approach
- Abide with all specified land use controls (LUCs)
- Work closely with installation restoration program manager to ensure compliance

Target
Immediately integrate specified land use controls into regular maintenance practices.



Three landfills occur on golf course property.

Manatee Cove Golf Course Patrick AFB, FL

Manatee Cove Golf Course Patrick AFB, FL

Explosive storage on Patrick AFB is in close proximity to Manatee Cove Golf Course.

EXPLOSIVE SAFETY STANDARDS

There are nine explosive storage areas and four "hot" cargo loading areas on Patrick AFB. The areas comprise approximately 180 acres of land, including their respective Quantity Distance (QD) clear zones. As evidenced by the information on the Environmental Challenges map on page 23, at least four holes on the Manatee Cove Golf Course are affected by the QD arcs. Care must be taken to ensure the safety of both customers and employees as this important mission requirement is maintained in such close proximity to the golf course.

Driver/requirement

- Air Force Policy Directive (AFPD) 91-2, Safety Programs
- DoD 6055.9-Std, DoD Ammunition and Explosives Safety Standards
- Air Force Manual (AFMAN) 91-201, Explosives Safety Standards

Objective

No losses due to inadequate explosives safety communication or planning.

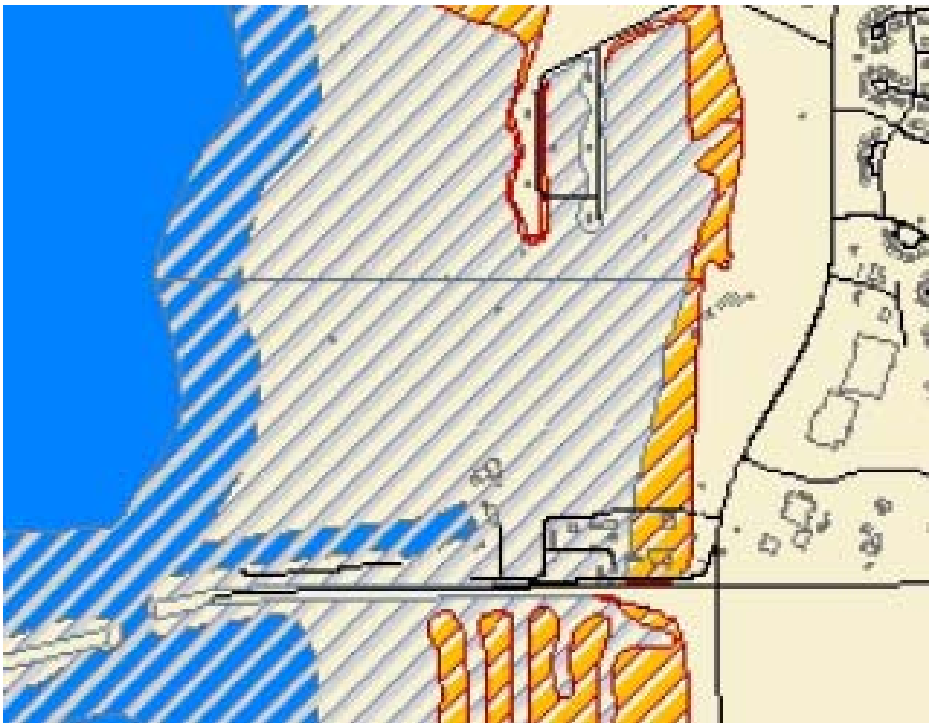
Management approach

- Limit access to affected areas during times of increased risk to personnel or property
- Warn all customers and employees of potential risks

Target

Continue to act immediately upon notification of potential increased risk.

Maintain compliance with all land use restrictions.



Manatee Cove Golf Course Patrick AFB, FL

100- and 500-year flood zones occur on Patrick AFB and Manatee Cove.

FLOODPLAINS

Due to the lack of significant variances in topography on Patrick AFB, floodplains extend beyond the coastal dune and wetlands and into portions of the developed land on the installation. Portions of the golf course property lie within the 100-year and 500-year floodplains.

According to the INRMP, "PAFB does have areas lying in defined floodplains. The elevation of the 100-year floodplain is five feet on the west side of the oceanfront along the Atlantic Ocean. The east side of the dune (next to the ocean) has a 100-year floodplain elevation of eight feet." The golf course is highly susceptible to flooding and is regularly inundated during high precipitation events.

The INRMP continues with the most important aspect of managing a facility located in a floodplain: "Executive Order 11988 requires all federal agencies to provide leadership and take action to reduce the risk of flood loss; to minimize the impacts of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains in acquiring, managing and disposing of Federal lands; providing Federally undertaken, financed, or assisted construction and improvements; and conducting Federal activities and programs affecting land use. Air Force installations have the responsibility to determine if proposed actions will occur in a floodplain, evaluate and document the potential effects; and consider alternatives to avoid these effects and incompatible development in the floodplain".

Driver/requirement

- Clean Water Act, Section 401
- National Pollutant Discharge Elimination System (NPDES)
- Executive Order 11988, Flood plain Management, 24 May 77

- AFI 32-7041, Water Quality Compliance,10 Dec 03

Objective
Maintain compliance with all floodplain-related laws and regulations through regular consultation with the installation environmental staff.

Management approach
- Assist with the preparation of a Finding of No Practical Alternative (FONPA) for each potentially proposed project within 100-year floodplain
- Consult with environmental staff prior to any changes or repairs to creek bed or bank maintenance
- Comply with all requirements included in the approved installation SWPPP
- Ensure all spill prevention procedures and spill kits are in place and all pertinent employees are adequately trained to correctly and promptly perform required actions in an emergency situation

Target
Eliminate the potential for degradation of the water resources by establishing, documenting and communicating all pesticide and fertilizer application buffers to appropriate personnel prior to the end of the year.

Manatee Cove Golf Course Patrick AFB, FL

The golf course in inundated after Tropical Storm Fay in 2009.

Manatee Cove Golf Course Patrick AFB, FL

Nuisance species can significantly damage important golf course playing surfaces.

NUISANCE SPECIES

Like many golf courses, Manatee Cove is home to several animal species that end up being either bothersome to customers and the maintenance staff or destructive to the course itself. These nuisance species include skunk, armadillo, opossum and raccoon. These species tear away turfgrasses in their search for grubs. Birds can also cause similar damage.

The American alligator can also be categorized as a nuisance species. In this case, though, it is their potential to harm customers and employees that makes them more than a nuisance. Any alligator that acts aggressive in any way is usually dealt with by experts.

Driver/requirement

- Customer expectations for acceptable quality playing conditions
- Real property protection
- Land use conflicts
- Risk to human health and safety
- Threat to military operations

Objective

Minimize the damage caused by controllable nuisance pests.

Management approach

- After complete coordination with all appropriate installation personnel, take all permitted actions to control nuisance pests

Target

Control nuisance species on the actively maintained portions of the golf course by the end of CY2011 as permitted or allowed by the installation environmental management staff.

Manatee Cove Golf Course Patrick AFB, FL

Traps are used to remove raccoons and other nuisance species from the golf course.

Manatee Cove Golf Course Patrick AFB, FL

Fascinating bird species abound on the course.

MIGRATORY BIRDS

The INRMP states that Patrick AFB is "located on a barrier island, a type of ecosystem that supports many species of plants and animals. Barrier islands along the Atlantic coast are especially important to nesting sea turtles, populations of small mammals, and as foraging and roosting habitat for a variety of resident and migratory birds. It continues stating that "the 45 Safety Wing reviews all projects to ensure compliance with the Migratory Bird Treaty Act (MBTA), which provides for protection against intentional and incidental take, and compliance with Executive Order 13186, January 10, 2001, *Responsibilities of Federal Agencies to Protect Migratory Birds*.

Unless permitted by regulations, the MBTA provides that it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product, manufactured or not."

The installation has a federal depredation permit for that covers all migratory bird species, either resident or migratory. Control methods vary from keeping the grass mowed to a specific height, scaring the birds away using air cannons, screamer devices, and/or bird scare shot to depredation and shooting which is used as a last resort.

Since the golf course is home to several large waterfowl that are covered under the Migratory Bird Treaty Act, extreme caution should regularly be exercised when performing maintenance practices that have any chance to cause harm.

Driver/requirement

- Migratory Bird Treaty Act, as amended (16 U.S.C. 703 *et. seq.*)
- Bald Eagle Act of 1940 (16 U.S.C. 668-668d)
- Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, January 10, 2001
- Migratory Bird Conservation Act

Objective

Ensure that golf course management practices consider the protection of all migratory birds and their habitats.

Management approach

- Discourage nest construction
- Employ harassment/hazing techniques to move protected bird species
- Use approved irritants as applicable
- Utilize the depredation permit as the last option
- Work closely with installation environmental staff to document presence of migratory birds such as the burrowing owl and follow all provided maintenance guidelines

Target

Immediately begin migratory bird management consultation with the installation environmental staff.

Manatee Cove Golf Course Patrick AFB, FL

The great blue heron is a prominent waterfowl species regularly observed at the Manatee Cove Golf Course as well as the State of Florida.

Implementation

No plan is worth the time it took to compile it if it does not generate or include active implementation in the field. The golf course management staff should use the following goals and objectives as the roadmap for their future. The GEM Plan is an example of the quality a cooperative effort can produce. Let's get something done and better take care of the environment, our community and our customers.

GEM Plan goals & objectives

Goals are defined as actions or results that should be accomplished within the next year.

- Adopt and post environmental policy and environmental challenge map for employees and customers
- Conduct and document introductory GEM training for all employees
- Compile and implement a Drought Management Plan for the entire golf course facility

Objectives are defined as actions or results that should be accomplished prior to the next INRMP update.

- Request a comprehensive energy audit to be conducted for the entire golf course facility and compile findings in an Energy Management Plan that may demonstrate a 3% reduction in energy use since FY03
- Ensure that all fertilizer applications are executed by a certified fertilizer applicator and that each application is recorded and mapped to guide future actions
- Compile a written comprehensive Water Resource Management Plan for the entire golf course facility

Conclusion

The U. S. Air Force Golf Course Environmental Management (GEM) program is a proactive Air Force Center for Engineering & the Environment (AFCEE) initiative to foster a better understanding of the environmental challenges facing our golf courses worldwide. Sustainable installations are possible with a coordinated and concerted effort by all. Implementation of the GEM program embraces continual improvement and environmental stewardship while supporting the mission of the U.S. Air Force.

The gallery

On the following pages are some of the more revealing photographs of challenges, maintenance practices, and other areas of the golf course facility.

Recently installed native grasses reduce mowing.

Protection of IRP site landfill caps is imperative.

Birds and water quality are a major concern.

Monitoring wells help managers assess cleanup efforts.

Failed asphalt curbing is in need of repair.

Clubhouse snack bar does a brisk business.

New superintendent has the course in fine condition.

Brazilian pepper is a tough invasive species to control.

Emergent vegetation provides cover for birds.

Manatees can be seen in this water feature.

Sparkling snack bar kitchen area.

The jury is still out on the new transition bunkers.

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Air Force Center for Engineering & the Environment
Technical Division
Built Infrastructure Branch

For additional assistance or more information, please contact:
U.S. Air Force GEM Program Manager – 210-395-8391 - DSN 969-8391
AFCEE/TDB, Bldg 171, 2261 Hughes Ave Ste 155, Lackland AFB TX 78236-9853

Please visit our Golf Course Environmental Management Program website:
http://www.afcee.lackland.af.mil/gem

Attachment H-2

Pruning Specifications

Attachment H-2: Pruning Specifications

The American National Standards Institute standard for tree pruning, ANSI A300 - Part 1 Pruning, must be used. The ANSI A300 Part 1 Pruning standards state the arborist will

- will not leave branch stubs,
- will make few or no heading cuts,
- will not cut off the branch collar (not make a flush cut),
- will not top or lion's tail trees,
- will not remove more than 25% of the foliage of a single branch,
- will not remove more than 25% of the total tree foliage in a single year,
- will not damage other parts of the tree during pruning, and
- will not use wound paint.

Cutting the top off of a tree (topping) should never occur as it destroys the branch structure of the tree, provides multiple points of entry for wood decay organisms, does not limit tree growth, and can cause the tree to become a hazard, creating a liability for which you could be held responsible.

Refer to these links as well for the most up-to-date information on proper pruning: http://hort.ifas.ufl.edu/woody/pruning/shtml. Pruning should be conducted by trained personnel to prevent improper pruning that will harm the tree's health, stability, and appearance. The Tree Care Industry Association, formerly the National Arborist Association, also can provide guidance for proper tree pruning based on the age of the tree, website can be found at: http://tcia.org/.

Attachment H-3

Specification for Planting Sod

Attachment H-3: Specifications for Planting Sod

Grass species for sod shall be Argentina Bahia, St Augustine or Bermuda 419, as specified by the Contracting Officer; cut into 1 foot by 2 foot, or 2 foot by 2 foot sections. Sod will have a minimum of one inch backing of stable soil so as not to fall apart during handling and installation. No sod will be accepted other than that grown in a sod nursery and that has been certified free of all insects, weeds and disease.

Remove all debris and vegetation to a minimum depth of two inches to allow for planting sod. Level the area so the new sod will be level with the existing surrounding elevation with no depression other than that designed for drainage. If the existing elevation does not facilitate proper drainage or present a level appearance, the area will be prepared to meet this requirement by excessive leveling. Excessive leveling is defined as any area where the contractor must cut or fill to a depth of four or more inches within the total area of 100 square feet. Before beginning the process of excessive leveling, the contractor must notify the QAP of any area that may require this action. The prepared soil will be smooth, free of large clods, roots, and other materials detrimental to good growth. On areas where the sod may slide, due to height and slope, the QAP may direct that the sod be pegged, with pegs driven through the sod blocks into firm earth, at suitable intervals.

Water the area to a depth of one inch just prior to installing sod. The prepared ground must be accepted by the QAP prior to placing sod.

After installation, the entire sodded area will be rolled with a weight of not less than 40 pounds per square inch or more than 45 pounds per square inch per 30-inch roller length. The sodded area must be maintained for 90 days after sod is laid.

Fertilizer used for sod material shall be approved by the Florida DOACS, or a balanced fertilizer approved by QAP, shall be uniform in composition, free flowing, and consist of a minimum 25% organic material,. The fertilizer shall comply with the Florida State fertilizer laws (Florida Administrative Code (F.A.C.) Rule chapter: 5E-1, Fertilizer). The quantitative analysis card and/or the manufacturer's certificate shall be attached to the bag or otherwise printed on the manufacturer's container.

Fertilizer will be applied to newly planted sod in a uniform manner approximately four weeks after sod is established. Application will be applied with a device capable of uniformly distributing the fertilizer.

All tags or certificates shall be removed from the fertilizer, marked with the date and location of usage, and, upon request, turned in to the Contracting Officer's representative when each job requirement is completed (and if the container of fertilizer is empty).

Attachment H-4

45 SW Native/Salt Tolerant Plant List

Attachment H-4: 45 SW Native/Salt Tolerant Plant List

SALT TOLERANT PLANT LIST-REVISED 2005

The listing below was compiled from Soil Conservation Service, County Agricultural Extension, Univ. of Florida, Florida Sea Grant Program, St. John's Water Management District, Florida Exotic Pest Plant Council publications, and the Maple Street Natives suggested beachside landscaping plant list.

Botanical Name	Common Name	Status
Trees		
*Acacia auriculiformis	Earleaf Acacia	**exotic- CAT I**
*Albizia julibrissin	Mimosa, silk tree	**exotic- CAT I**
Ardisia escalionivides	Marlberry	**native**
Avicennia germinans	Black mangrove	**native**
Bumelia tenax	Tough Bumelia	**native**
Butia spp.	Butai Palm	**exotic**
*Casuarina equisetifolia	Australian pine	**exotic- CAT I**
Citharexylum spinosum	Fiddlewood	**native**
Coccoloba uvifera	Sea Grape	**native**
Eucalyptus spp	Eucalyptus	**exotic**
Eugenia axillaris	White Stopper	**native**
Eugenia foetida	Spanish Stopper	**native**
*Ficus altissima	False banyan	**exotic-CAT II**
*Hibiscus tiliaceus	Mahoe/Sea Hibuscus	**exotic-CAT II**
Ilex cassine	Dahoon Holly	**native, uncommon on Cape**
Ilex vomitoria	Yaupon Holly	**native**
Juniperus chinensis	Juniper	**exotic, uncommon on Cape**
Laguncularia racemosa	White mangrove	**native**
*Manilkara zapota	Sapodilla	**exotic-CAT I**
*Melia azedarach	Chinaberry	**exotic-CAT II**
Morus rubra	Red Mulberry	**native**
Myrcianthes fragrans	Simpson Stopper	**native-State Threatened**
Myrica cerifera	Wax Myrtle	**native**
Olea europaea	European Olive	**exotic**
Osmanthus americanus	Wild Olive	**native**
Parkinsonia aculeata	Jerusalem Thorn	**exotic**
Paurotis wrightii	Paurotis Palm	**native**
Persea borbonia	Red Bay	**native**
*Phoenix reclinata	Senegal Date Palm	**exotic-CAT II**
Pinus elliotti	Slash Pine	**native**
Pithecellobium unguis-cati	Cat's Claw Tree	**native**
Podocarpus macrophylla	Yew Podocarpus	**exotic**
Prunus spp.	Plum	***Prunus caroliniana* native**
Trees		
Botanical Name	**Common Name**	**Status**
Quercus chapmanii	Chapman's Oak	**native**
Quercus geminata	Sand Oak	**native**
Quercus incana	Bluejack Oak	**native, but not on Cape**
Quercus myrtifolia	Myrtle Oak	**native**
Quercus virginiana	Live Oak	**native**

Botanical Name	Common Name	Status
Rhizophora mangle	Red mangrove	native
Sabal palmetto	Cabbage Palm	native
Sapinous saponiaria	Soapberry	native
*Schefflera actinophylla	Schefflera, Umbrella tree	exotic-CAT I
*Schinus terebinthifolius	Brazilian pepper	exotic-CAT I
Suriana maritima	Baycedar	native
Tabebuia argentea	Tabebuia	exotic
*Washingtonia robusta	Washington Palm	exotic-CAT II
Zantoxyllum fragara	Wild Lime	native
Shrubs		
Agave americana	Century Plant	probably naturalized
Baccharis spp.	Groundsel Bush	native
Batis maritima	Saltwort	native
Calicarpa americana	Beauty Berry	native
Carissa grandiflora	Natal-Plum	exotic
Carissa grandiflora 'Nana'	Dwarf Natal-Plum	exotic
Cassia ligustrina	Cassia	native
Ceratiola ericoides	Rosemary	native
Chiococca alba	Snowberry	native
Conocarpus erectus	Buttonwood	native
Croton punctatus	Silverleaf Croton	native
Cycas revoluta	Sago Palm	exotic
Dalbergia ecastaphyllum	Coin Vine	native
Dodonaea viscosa	Varnish leaf	native
*Elaeagnus pungens	Silverthorn	exotic-CAT II
Erondea littoralis	Beach Creeper	native
Erythrina herbacea	Coral Bean	native
Euphorbia milii	Crown of Thorns	exotic
Forestiera segregata	Florida privet	native
Fortunella japonica	Kumquat	exotic
Hamelia patens	Firebush	native
Ilex glabra	Gallberry	native
Ilex vomitoria	Yaupon Holly	native, uncommon on Cape
Ilex vomitoria 'Nana'	Dwarf Yaupon Holly	cultivar
Iva imbricata	Seashore Elder	native
Ixora coccinea	Ixora	exotic
Juniperus conferta	Shore Juniper	exotic
*Lantana camara	Lantana	exotic-CAT I
Lantana depressa	Lantana	native
Lantana depressa var. floridana	Florida coastal lantana	native-State Endangered
Shrubs		
Botanical Name	**Common Name**	**Status**
Liatris tenuifolia	Blazing Star	native
Lonicera sempervirens	Coral Honeysuckle	native
Lycium carolinianum	Christmas Berry	native
Monarda punctata	Horsemint	native
Myrica cerifera	Wax Myrtle	native
Nerium oleander	Oleander	exotic
Opuntia spp.	Prickly Pear	native
Passiflora incarnata	Passion Flower	native
Passiflora biflora	Two-flowered passion vine	exotic-CAT II

Botanical Name	Common Name	Status
Passiflora suberosa	Corky Stem Passion flower	native
Peperomia humilis	Peperomia	native
Pittosporum tobira	Pittosporum	exotic
Plumbago capensis	Plumbago	exotic
Psychotria nervosa	Wild coffee	native
Randia aculeata	White Indigo Berry	native, but out of range
Raphiolepis indica	India Hawthorn	exotic
Rhus copallinum	Winged Sumac	native
Rivina humils	Rouge Plant	native
Sabal etonia	Scrub Palmetto	native, but out of range
Salvia coccinea	Red Sage	native
Scaevola plumieri	Inkberry	native
*Scaevola taccada	Beach naupaka, half-flower	exotic-CAT I
Serenoa repens	Saw palmetto	native
Sophoro tomentosa	Necklace Pod	native
Tournefortia gnaphalodes	Sea Lavender	native
Trichostema dichotomum	Blue Curl	native
Verbena maritima	Verbena	native
Vernonia gigantia	Ironweed	native
Viburnum obovatum	Walters Viburnum	native
*Vitex trifolia 'Variegata'	Vitex/Chastetree	exotic-CAT II
*Xanthosoma sagittifolium	Elephant ear	exotic-CAT II
Yucca aloifolia	Spanish Bayonet	native
Yucca elephantipes	Spinless Yucca	exotic
Yucca filamentosa	Adam's-needle	native
Zamia pumila	Coontie	native
Ground Cover		
Borrichia frutescens	Sea Oxeye Daisy	native
Canavalia maritima	Beach Bean	native
Cryptostegia grandiflora	Rubber Vine	exotic
Distichlis spicata	Seashore Saltgrass	native
Eragrotis spectabilis	Lovegrass	native
Ernodea littoralis	Golden Creeper	native
Eustoma exaltatum	Seaside Gentian	native
Ficus pumila	Creeping Fig	exotic
Gaillardia puchella	Blanket Flower	native
Glottiphllum depressum	Fig Marigold	exotic
Ground Cover		
Botanical Name	**Common Name**	**Status**
Helianthus debilis	Cucumberleaf Sunflower	native
Heliopropium angiosperumum	Seaside Heliotrope	native
Ipomoea pes-caprae	Morningglory/Railroad vine	native
Ipomoea stolonifera	Fiddle-leaf Morningglory	native
Ipomopsis rubra	Standing Cypress	native
Licania michauxii	Gopher Apple	native
Mimosa strigillosa	Sunshine Mimosa	native
Muhlenbergia capillaris	Muhly Grass	native
Paspalum vaginatum	Seashore Paspalum	native
Plumbago zeylanica	Wild Plumbago	native
Rhoeo spathacea	Oyster Plant	exotic-CAT I (*Tradescantia spathacea)*
Ruellia caroliniensis	Wild Petunia	native

Botanical Name	Common Name	Status
Ruellia simplex	Mexican petunia	exotic-CAT I
Schizachyrium scoparium	Seacoast Bluestem	native
Sesuvium portulacastrum	Sea Purslane	native
Spartina bakeri	Bunch cordgrass	native
Spartina patens	Saltmeadow cordgrass	native
Tripsacum dactyloides	Eastern Gama grass	native
Uniola paniculata	Seaoats	native
*Wedelia trilobata	Wedelia	exotic-CAT II

* CATEGORY I and II exotic plants should not be used for landscape projects.

CAT I= Invasive exotics that are altering native plant communities.

CAT II= Invasive exotics that have increased in abundance or frequency but have not yet altered Florida plant communities.

State Threatened and State Endangered are protected plant species

Attachment H-5

Planting Specifications

Attachment H-5: Planting Specifications

After several hurricanes in 2004 and 2005, studies determined that trees that were planted close together in a clump type fashion (20-25 ft close centers) as well as trees with a single, dominating trunk and natural crown shape had higher resistance to wind forces. A study of the tree species that survived and failed during hurricanes also occurred; the failing trees were typically exotics. Information and publications are available on these subjects at: http://hort.ifas.ufl.edu/treesandhurricanes/.

Planting Specifications:

The planting compost shall consist of two parts Florida brown peat, one part of topsoil, one part site dirt, and a fertilizer approved by Florida DOACS.

All plant material furnished shall be well branched and well proportioned, particularly with respect to the width height relationship. The Government may inspect plants at place of growth, but such inspection shall not preclude the right of rejection at the site. All plants are to be Florida Fancy. Plants shall be in accordance with American Standards for Nursery Stock Z 60.1 of rules and grading adopted by the American Association of Nurserymen, Inc. All plants shall have a normal habit of growth and shall be sound, healthy, vigorous, and free from insect infestations. Any tree with a weak, thin trunk not capable of supporting itself when planted in the open will not be accepted. Palm trees shall be Clear Trunk unless otherwise specified.

Wrapping and Handling: Plants shall be dug up and prepared for shipment in a manner that will not cause damage to the branches, shape, and future development of the plants after replanting. Plant material labels shall be securely attached by wire to all plants, bundles, and/or containers of plant material delivered at the planting site, for the purpose of inspection and plant identification. All plants shall be handled so that roots are adequately protected at all times from drying out and from other injury. The balls of balled plants, which cannot be planted immediately on delivery, shall be well protected with soil or other acceptable material. Bare-rooted plants shall be planted or heeled-in immediately upon delivery. Shrubs intended for isolated specimen planting shall be selected for shape and symmetrical branching habit which at maturity will produce a strong, full foliaged plant. Particular care shall be exercised in the digging, binding, and wrapping of such specimens to assure safe loading, shipment, and handling.

All plants and landscaped areas shall be mulched to three inches after the planting soil around plants has been fully compacted and thoroughly watered. Mulching shall be re-accomplished annually to maintain these standards.

All plants shall be guaranteed to be growing in a vigorous condition 90 days after completion of job. All trees shall be guaranteed to be in a growing condition for a period of 12 months after completion of job.

References for Planting

The following are excellent references for planting methods:

Principles and Practices of Planting Trees and Shrubs by Gary W. Watson and E.B. Himelick

New Tree Planting pamphlet available from the International Society of Arboriculture at www.isa-arbor.com.

American Joint Committee and Horticultural Nomenclature, Standardized Plant Names, 1942 Edition.

American Association of Nurserymen, Inc., ANSI Z 60.1-1980, American Standard for Nursery Stock. The Standard is available from American Association of Nurserymen, Inc., 230 Southern Building, Washington, D.C. 20005.

State of Florida, Department of Agriculture, Grades and Standards for Nursery Plant, Part #1 and Part #2, Revised Edition 1963.