



***Blanchard Golf Course
Environmental Management (GEM) Plan
Davis-Monthan AFB, AZ***



February 2010



San Antonio, Texas



Blanchard Golf Course Environmental Management Policy

**In concert with the
Davis-Monthan 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,
ensure compliance with all
appropriate regulations,
and to regularly reevaluate our processes
to achieve the highest standards
of environmental excellence.**

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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 Month Year:

- **Actual ECQ = 65, Just started (Red)**
- **Potential ECQ = 80, Showing progress (Yellow)**

Potential or Final environmental challenges

The following potential environmental challenges were identified in compiling this document:

- Migratory birds
- Water conservation
- Water quality
- Air quality
- Invasive species
- Erosion

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/>).



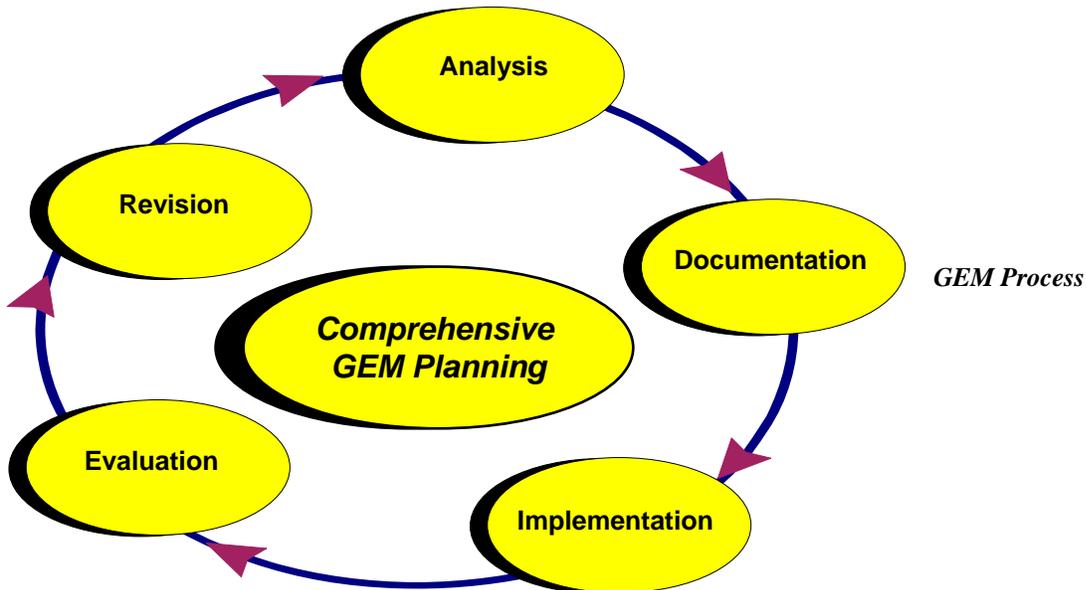
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Blanchard Golf Course's practice facilities are an active source of income.

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. In most cases, golf courses are being managed compatibly with the environment. The comprehensive GEM planning process is the vehicle to document our successes while communicating directly with our customers, commanders, and local community.



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.



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Fine greens are a given at Davis-Monthan's Blanchard Golf Course.

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.



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The Blanchard Golf Course.

Course Description

The climate in Tucson region is arid, with over 300 days of clear sunny skies and is ideal for the game of golf. Located in the unique and beautiful Sonoran Desert, Arizona's second largest city averages around 12 inches of precipitation a year. Accordingly, the Blanchard Golf Course is not a lush, turf-laden paradise. An efficient irrigation delivery system, high quality water, and informed maintenance practices gleaned from years of experience is what makes great golf in this climate. Since both the Director of Golf and superintendent are veterans with stellar career contributions to the game, they have made great strides in making the Blanchard Golf Course one of Tucson's finest golfing venues.



Blanchard Golf Course Aerial Photo

Course Details

Architect	Civil Engineering
Year constructed	1962/1968
Climate	Arid & hot
Average annual precipitation	Nearly 12 inches
Average growing season	Over 320 days
Elevation	2750' ASL
Prevailing wind direction	SE/NW
Total facility acreage	165 acres
Total actively maintained acreage	~ 90 acres
Par	36-36-72
Yardage/Rating/Slope	Blue- 6611/70.6/128 White- 6155/68.2/119 Red- 5792/72.7/120
Turfgrass	Common/328
Tees-	Common Bermudagrass
Fairways-	Tifgreen
Greens	Mixed/Common
Roughs-	
Irrigation source	"Reuse" from City of Tucson (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:

- 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 compiled for an installation's course 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 finalizing or 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 Blanchard Golf Course manager and superintendent during the visit to Davis-Monthan AFB, AZ.

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 written and regularly updated Integrated Pest Management Plan 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 comprehensive written records maintained to measure and document the environmental compatibility of the entire facility's management practices?	✓		
17	Are there documented functional and aesthetic thresholds integrated into pest control decisions?		✓	
18	Is there a written comprehensive 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 the maintenance activities and their performance been examined to determine the potential to negatively impact an identified environmental challenge?		✓	
Totals		7	8	5

<u>Operations & Maintenance</u>				
#	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 or features 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 there been an examination of all aspects of the operation for potential negative impacts for the snack bar/restaurant, clubhouse, pro shop, pesticide mixing and storage facilities, fuel storage and delivery areas, and maintenance complex?	✓		
10	Have all employees received documented training that would increase their awareness of 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 eliminates the potential for spreading of disease or other contamination?	✓		
14	Are biodiesel and/or ethanol products utilized everywhere they may be 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		14	3	3

<u>Water Resource Management</u>				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Are written records of water quality monitoring activities, results, and pollution control measures readily available?		✓	
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	Is at least 65% of the irrigation water for the golf course property recycled or non-potable?	✓		
7	Are there projects planned and funded that may eliminate or minimize a potential water quality or erosion problem?	✓		
8	Are water features regularly monitored for algae, erosion, excessive aquatic plant growth, eutrophication, and sedimentation?	✓		
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 there flow meters for monitoring total 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	Are settling ponds and/or detention ponds used to effectively remove sediments and pollutants from entering important water features?			✓
17	Are biological processes such as the addition of grass carp or white amur used to control unwanted aquatic vegetation in major water features?	✓		
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		15	1	4

<u>Conservation</u>				
#	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, state 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 connect natural areas to facilitate wildlife movement through the course property by returning an area to its natural state or revising maintenance procedures?	✓		
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 exotic species on or near the course?	✓		
9	Is there a comprehensive and readily available Drought Management Plan for the entire golf course facility?			✓
10	Is there at least one project planned and funded that may minimize or eliminate the course's potential negative environmental impacts?	✓		

Conservation Checklist (continued).

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Does management harvest storm water to supplement irrigation water supplies for use anywhere on the golf course facility grounds?			✓
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	Are all employees trained to understand that poor management practices may adversely impact worker and environmental health and welfare?	✓		
16	Is there an inventory of bird and mammal species documented, maintained, and readily available?	✓		
17	Are food, shelter, and nesting attributes of plant species for landscape development considered during the design/selection process?			✓
18	Have all damaged or degraded habitats due to construction or maintenance of the course been fully restored?	✓		
19	Has the entire property been examined for archaeological, cultural, or historical resources?	✓		
20	Is the irrigation pump station a variable frequency drive model for energy efficiency?	✓		
Totals		15	1	4

<u>Pesticides & Pollution Prevention</u>				
#	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 where pollution prevention measures are employed?	✓		
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 playing area) of each pesticide used; - the area (SF/SM) and quantity of each pesticide used; - the chemical or common name of the 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 head 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 IPMIS being used to track activities including surveillance and biological, cultural, mechanical, and chemical controls?			✓
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	Is there a regularly updated Water Pollution Abatement Plan readily available for the golf course property?			✓
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		15	2	3



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The Sonoran desert may be the world's finest.

Environmental Compatibility Quotient Summary			
Environmental Compatibility Category	Yes	Partial	No
Planning & Compliance	6	8	6
Operations & Maintenance	14	3	3
Water Resource Management	15	1	4
Conservation	15	1	4
Pesticides & Pollution Prevention	15	2	3
Totals	65	15	20

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

February 2010 - Blanchard Golf Course ECQ:

- **Actual ECQ = 65, Just started (Red)**
- **Potential ECQ = 80, 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)



Environmental Challenges Map

Environmental Challenges

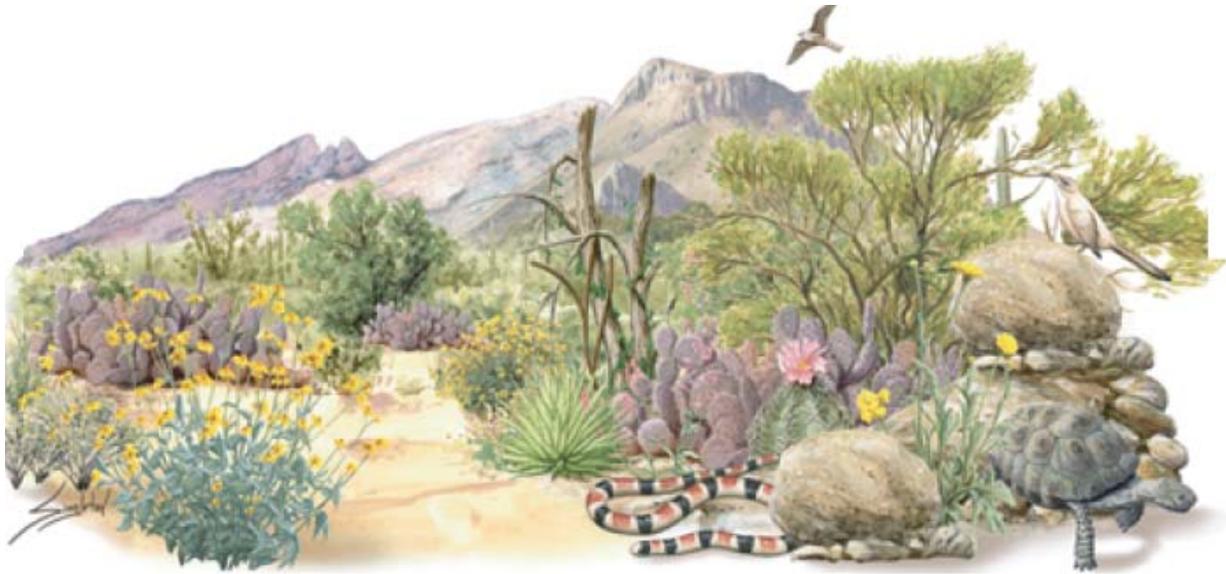
One of the important results of the GEM process is the identification of significant environmental challenges for consideration in the GEM Plan. Along with the newly established baseline, the GEM Plan consists of a map and description of the final environmental challenges and the prescribed approach to their management along with 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 GCEBA process:

- Migratory Bird Treaty Act
- Maintenance complex design deficiency
- Water conservation
- Water quality management
- Installation Restoration Program (IRP) Site

The following environmental challenges were identified during the GEM process:

- Migratory birds
- Water conservation
- Water quality
- Air quality
- Invasive species
- Erosion



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 (see inside front cover), 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.



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*Photo credit:
Wikipedia*

Roadrunners are ubiquitous and eccentric birds of the Sonoran desert.

MIGRATORY BIRDS

With the exception of starlings, sparrows, and pigeons, all birds are protected under the Migratory Bird Treaty Act. There are no endangered or threatened species present on Davis-Monthan AFB. Several burrowing owls, a relatively common Sonoran Desert resident, make the installation their home. Care must be taken to ensure that owls or their nests are not disturbed, harmed or destroyed as a result of the course's management practices.

The owls live in a burrow usually created by another species such as ground squirrels and their diet includes small mammals, insects and sometimes other birds, amphibians and reptiles. Unlike most owls, the burrowing owl hunts both during the day and night. The installation's relatively undisturbed, relatively flat and sparsely vegetated landscape is a perfect home for these remarkable birds.

Several other bird species occur at Davis-Monthan and include vermilion flycatcher, roadrunner, Swainson's hawk, Cooper's hawk, cactus wren, Gambel's quail, hummingbird, Gila woodpecker, loggerhead shrike and great horned owl. Keeping current populations viable through habitat protection should be a major consideration when formulating management plans.

Driver/requirement

- Migratory Bird Treaty Act, as amended (16 U.S.C. 703 *et. seq.*)
- Bald Eagle and Golden Eagle Protection Act (16 U.S.C. 668a-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

- 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.



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*Graphic credit:
Keith Haley*

The burrowing owl is protected under the Migratory Bird Treaty Act.



*Blanchard
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AZ*

Blanchard Golf Course currently uses only reuse water for irrigation purposes.

WATER USE

Water is the limiting factor to everything in Tucson. Water is also Davis-Monthan's only major production utility. According to the General Plan, the installation "is totally dependent on subsurface water. It produces, treats, and distributes its own water for consumption and fire protection". According to the water manager, the installation operates 9 wells that pump groundwater from the Tinaja Beds and the Fort Lowell Formation of the Tucson Basin aquifer. Currently, the base is withdrawing more water from the aquifer than is replaced each year through natural recharge. Since completion of pump station improvements and irrigation water storage facilities in 1998, Blanchard Golf Course uses reuse water purchased from the City of Tucson for irrigation.

Summer is the peak water use period in Tucson. As the excerpted General Plan graphic below shows, winter consumption is roughly less than a fifth of the annual usage totals. Reuse water use ranges from a summer peak of nearly 20 million gallons per month to a winter use total of nearly 3 million gallons per month. The General Plan states that the "use of recycled [reuse] water accounts for a reduction of one-sixth of the total amount of water annually consumed on the base".

One of the three goals the INRMP lists under Landscape Management is to "develop a water conservation plan". Since the installation has had a comprehensive approach to landscape development since 1984, consistent implementation of the adopted installation standards is paramount. Creating a water conservation plan for the entire installation based on current and future missions may be more important in light of recent developments with pricing changes soon to be employed by Tucson Water. Radical thinking or at least a departure from the norm may soon be required! According to the City of Tucson Water Department, Blanchard Golf Course uses about

300 acre-feet or roughly 98 million gallons of reuse water per year. The February 2010 price is \$252 per acre-foot. The new “standard” rate for reuse water will be \$797 per acre-foot per the latest proposal from the City on Davis-Monthan due to a “serious shortfall in General Fund revenues”. While the Tucson Water Department hopes the “Base will continue using reclaimed water which is a sustainable water supply for the community” they “recognize that D-M has the option of discontinuing reclaimed water service and returning to its groundwater wells for irrigation of the golf course”.

With recent federal and presidential mandates to reduce water use, it would be politically impossible for the installation to return to potentially potable water sources. Unfortunately, this alternative is estimated to cost at least 30% less every year. Using historical water use data, the estimated cost for FY11 water bills at Blanchard Golf Course will be over \$250,000. Several courses of action may be required to compensate for this operating cost increase – none good. They include watering less, reducing staff size and raising the price of golf at Davis-Monthan AFB.

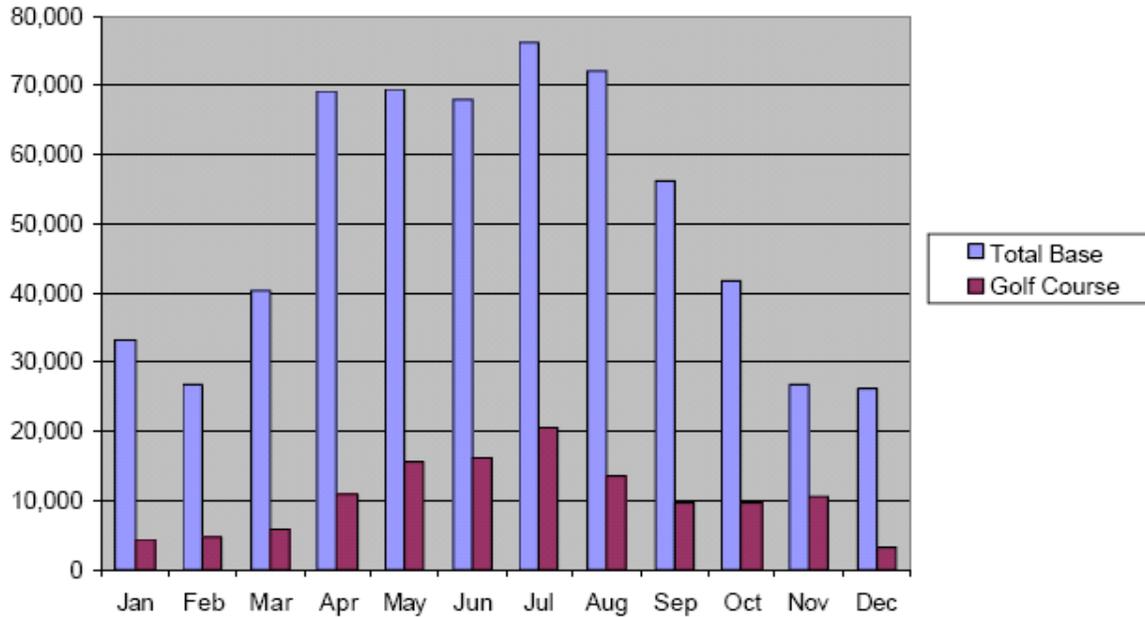
Another alternative yet to be fully explored was suggested by the civil engineering staff. Construct a sewage treatment plant on the installation and provide treated reuse water through a carefully designed supply network that would not only satisfy the golf course’s needs but could also be tapped for all large, common turf areas like parks and ball fields. Not only would the installation become self-sufficient, it would not have to pay the City of Tucson to treat their wastewater or for the treated reuse water for irrigation.

Driver/requirement

- Executive Order 13123, Greening the Government Through Efficient Energy Management
- Executive Order 13423, Strengthening Federal Environmental, Energy and Transportation Management
- Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance
- Energy Independence & Security Act
- Energy Policy Act

Objective

Contribute to the region-wide conservation of all water resources while still providing the best quality golfing experience for customers.



- Comparative water use during a typical year -
 The golf course figures show reuse water use.

Management approach

- Water only as much as the turf needs and the soils can absorb
- Compile a comprehensive Water Resource Management Plan to include a Drought Management Plan for the entire golf course facility
- Obtain a new computerized irrigation system provides accurate, current water use information
- Explore possibility of securing sustainable and affordable new water supplies through the construction of an installation-operated sanitary sewage treatment plant

Target

Maintain vigilance on water conservation concerns at all times.



***Blanchard
Golf Course
Davis-Monthan AFB,
AZ***

Flows from AMARG could be collected to supplement supplies and could reduce overall water use and protect downstream facilities from potential flooding. Along with a modern and efficient irrigation system upgrade, water use could be remarkably decreased while preserving affordability of the recreational resource for Davis-Monthan Airmen and their families.



*Blanchard
Golf Course
Davis-Monthan AFB,
AZ*

This wash flows from AMARG and bisects the golf course from south to north.

WATER QUALITY

One of the key tenets of a sound water quality management approach, whether for a golf course or an entire installation, is to know your watershed. The Tucson Basin is drained by the Santa Cruz River. Major tributaries of the Santa Cruz River near DMAFB include the Rillito River, flowing west into the Santa Cruz River; Julian Wash, flowing northwest into the Santa Cruz River; and Pantano Wash, flowing northwest into the Rillito River. These drainages, like many in the desert southwest, are ephemeral and flow only during and immediately after storms, otherwise remaining dry. The low level and irregularity of rainfall results in erratic flows in the local drainages and there are no perennial drainages within the boundaries of DMAFB.

The dominant drainage system on base is Atterbury Wash. Atterbury Wash is prone to flash flooding during the rainy months of July and August. This dendritic ephemeral drainage contains almost 92,000 linear feet of water-cut channels with an estimated peak discharge for a 100-year flood of 2906 cubic feet per second (cfs).

The protection of Waters of the United States is a primary concern for all U. S. Air Force installations. The Army Corps of Engineers administers this program under the auspices of the Clean Water Act. The large wash that drains the AMARG area to the south of the golf course bisects the facility creating a water hazard for Blanchard Golf Course customers to negotiate several times during their round. The INRMP describes the wash as an ‘ephemeral channelized drainage’ and quantifies its length at just over 21,000 feet or an area of 9.49 acres. All maintenance activities should be coordinated with installation environmental staff to ensure compliance with all applicable requirements.

According to the INRMP, surface water from the base may contain herbicides and pesticides related to grounds maintenance, particularly on the golf course and other

developed portions of the base. Excess surface water at six outfall locations originates in areas where industrial activities occur: the flight line, the bulk fuels storage area, AMARG, aircraft wash racks, vehicle maintenance areas, DRMO, the Weapons Storage Area, and the IRP sites. Storm water from these areas has the potential to contain industrial pollutants such as fuels, oils and lubricants, detergents, waste oils, and hazardous chemicals.

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)

Objective

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



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Golf Course
Davis-Monthan AFB,
AZ*

Cart path crosses through the wash leading to increased erosion and ponding.

Management approach

- Consult with installation environmental staff to ensure that golf course maintenance practices are fully compliant with complex water-related 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

- Direct floor drains to sanitary drains with oil/water separator
- Store drums on pallets
- Ensure spill response equipment is available and personnel are trained
- Cover all dumpsters
- Store materials and waste inside buildings or cabinets
- Cover wash rack and collect and regularly dispose of grass clippings properly
- Perform all equipment washing or rinsing operations at an appropriate wash rack
- Perform all repair activities under a covered area
- Cover and berm pesticide/herbicide storage and mixing areas
- Store flammables in properly located, secure cabinets
- Use drip pans under dispensing units
- Regularly perform visual inspections of the area
- Properly install adequate security fencing

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.



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Wash pad maintenance is paramount to good water quality management.



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Davis-Monthan AFB,
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Fueling and operating golf maintenance equipment may contribute to air emissions.

AIR QUALITY

The Tucson Air Planning Area is in maintenance for carbon monoxide. Accordingly, Pima Association of Governments' *Live Breath Clean Air* campaign encourages Tucsonans to minimize their potential impacts to regional air quality. Their web site states "In March 2008, the U.S. Environmental Protection Agency tightened the National Ambient Air Quality Standards for ozone to be more protective of public health. Currently, Tucson experiences good air quality and meets ozone standards. However, several days of high ozone this summer could put Pima County into noncompliance, also known as nonattainment.

Nonattainment status often results in several costly consequences for businesses and residents. The region would be required to analyze emissions and identify and enforce measures to reduce pollutant levels. Residents may be required to change the fuel they use, industries may face additional regulations and this may negatively influence tourism and economic development."

The Clean Air Act (CAA) is designed to protect the nation's air and thereby the health of all ecosystems. The CAA approach is to limit the release of air pollutants. Davis-Monthan AFB has been classified as a major source of air pollutants because its potential, not actual emissions exceed the threshold limits specified for one or more air pollutants. As a consequence, the installation is required to develop an annual inventory of air emissions as a function of its application for a Title V Operating Permit (The General Plan). Installation environmental managers must consider potential air emissions resulting from any new or proposed activity, and modify existing permits or make new applications as necessary.

Driver/requirement

- Clean Air Act
- Pima County State Implementation Plan (SIP)
- Chapter 17.16 Articles II and III of the Pima County Code

Objective

Minimize or eliminate excessive emissions from golf course equipment, vehicles and equipment care.

Management approach

- Replace older equipment when funding allows
- Encourage employees to minimize their trips on and around the course
- Ensure equipment cleaning solution containers are closed at all times
- Eliminate all aerosols from maintenance and clubhouse inventories
- Replace 2-cycle powered equipment as funding and technology allow
- Prepare policy to alter maintenance staff work plans during announced regional air quality health alert days

Target

Perform scheduled annual engine overhauls and regular equipment maintenance as necessary to minimize or eliminate excessive exhaust emissions.

Air Quality Index Values
For the Most Current Polled Data
 (hour ending at 12:00 on 6/3/2010)

Pollutant	Highest Air Quality Index (AQI) Value	Monitoring Site	Air Quality Index (AQI) Category	Health Effects Statement
Carbon Monoxide	6	22nd St. & Alvernon	Good	None
Ozone	32	Saguaro Park East	Good	None
PM10	28	Near Grant & First Avenue	Good	None
PM2.5	29	Near Grant & First Avenue	Good	None
The highest average wind speed = 4.7mph blowing from the west at 267° at the 22nd & Craycroft site. The highest average temperature was 90.6°F at the Coachline site.				

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 Davis-Monthan AFB,
 AZ*

The Air Info Now website provides daily air quality reports.



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Golf Course
Davis-Monthan AFB,
AZ*

*Photo credit:
Buffelgrass
Information Center*

Buffelgrass is rapidly invading the Tucson ecosystem.

INVASIVE SPECIES

“In Southern Arizona, the rapid spread of the invasive plant known as buffelgrass (*Pennisetum ciliare*) and the slow conversion of the previously flameproof desert to flammable grassland as buffelgrass invades more areas has become the region's most pressing environmental issue. Without coordinated and decisive regional action, the Tucson region will soon face the threat of frequent and extensive fires, threats to conservation areas and initiatives, and significant economic impacts, from reduced property values to lost tourist revenues. Since 2005, buffelgrass has been listed as a regulated and restricted noxious weed in the state.

Both the public and private sectors are quickly ramping up to meet the buffelgrass challenge. Strict ordinances are now being drafted and vetted by municipal and county governments to help eliminate buffelgrass and other invasive species on private property and utility and road right-of-ways. Controlling buffelgrass infestations will demand multiple treatments of the same patches over consecutive years, sustained commitment, careful documentation and focused evaluation of treatment success.”

Driver/requirement

- Federal Noxious Weed Act of 1974
- 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
- Arizona Statute R3-4-244
- Pima County Resolution No. 2005-165

Objective

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

Management approach

- Regularly inspect likely areas for known invasives to establish themselves
- Work with installation environmental staff to contain or reduce invasives
- When possible, restore native species and habitat conditions
- 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
- Utilize native or indigenous plant materials whenever possible

Target

Regularly assist with invasive species survey and completion of an approved plan to contain or reduce these species according to the accompanying schedule.



Arundo donax (Giant reed) is an invasive to watch.

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Golf Course
Davis-Monthan AFB,
AZ*

*Photo credit:
Long's Garden Inc.*



*Blanchard
Golf Course
Davis-Monthan AFB,
AZ*

Rapidly flowing storm waters are eroding this bank near a bridge on the 7th hole.

EROSION

Loss of valuable topsoil is one of the obvious reasons why erosion is undesirable. Catastrophic erosion can damage or destroy real property like bridges, greens complexes and other important golf course investments. The key to controlling erosion is through regular inspection and observation. It is most important to conduct inspections after especially intense precipitation events. The powerful thunderstorms of the monsoon season can turn a dry wash into a torrid river of destructive force. Once the evidence of erosion is documented the next step is to take action to fix the situation before it gets out of control. Fixing erosion problems if action is delayed can be very expensive, time-consuming and may require permitting.

Driver/requirement

- Clean Water Act, Section 401

Objective

Soil erosion control measures are implemented during all construction projects and monitored by quality assurance and environmental personnel.

Ensure areas subject to potential soil erosion are regularly monitored by quality assurance and environmental personnel and control measures are implemented promptly when necessary.

Management approach

- Comply with all requirements included in the approved installation SWPPP
- Implement pre-approved soil erosion control measures for all construction projects

- Regularly monitor areas subject to potential erosion
- Improve all identified erosive areas appropriately

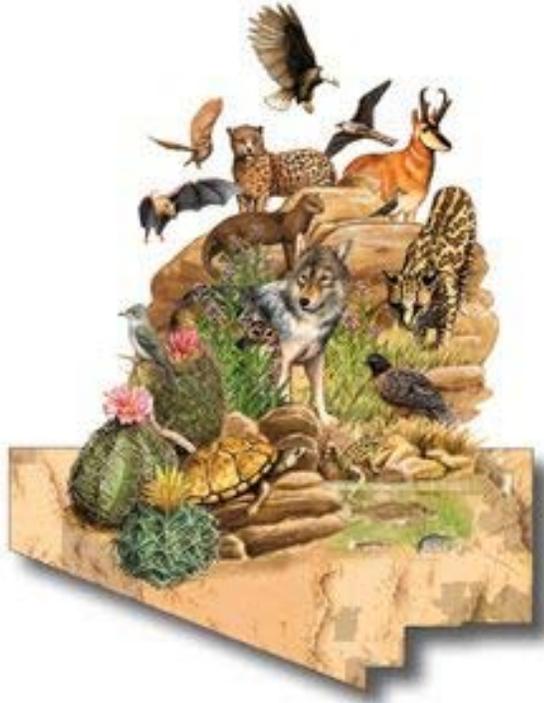
Target

Comply with all erosion control guidance, measures and best management practices at all times.



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Large unpaved areas are used for circulation between the course and the maintenance complex facility creating a potential for fugitive dust and wind erosion.



*Blanchard
Golf Course
Davis-Monthan AFB,
AZ*

Tucson is an unique habitat supporting many diverse and distinctive species of birds, plants, mammals and reptiles.

Implementation

Setting goals and objectives is an important step in the implementation of an installation's GEM Plan. Implementation is the single best evidence that the installation GEM team is working well together in their task of supporting the mission.

GEM Plan goals & objectives

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

- Post environmental policy and a map of the property highlighting environmental challenges for both employees and customers
- Compile a comprehensive golf course development or master plan that details desired short- and long-term improvements
- Regularly discuss environmental management issues at staff meetings
- Provide documented environmental awareness training to all employees
- Compile drought management plan for the entire golf course facility
- Create and utilize scouting forms and integrate into IPMIS surveillance and data collection activities

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

- Collect and map the course's "hot spots" or those areas that require special care or attention
- Compile a written Water Resources Management Plan for the entire golf facility



*Blanchard
Golf Course
Davis-Monthan AFB,
AZ*

The 18th green is framed by mesquite and palms.

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.

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).

Sustainable installations are possible with a coordinated and concerted effort by all. Implement the GEM program, as it embraces continual improvement and environmental stewardship while steadfastly supporting the missions of the installation and 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.



Maintenance area not large enough for all equipment.



Clean and efficient snack bar complements friendly staff.



Compliant battery storage.



The former IRP site behind range.



Drainage issues in maintenance complex.



Round-tailed ground squirrels can be destructive pests.



Aging eucalypts detract from course's aesthetics.



Wash pads require regular maintenance to function.



Irrigation lake is undersized for a course in the desert.



Greens quality is always a highlight at D-M.



The mechanic may be the most important employee.



Only water efficient trees should be installed on Blanchard.



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Please visit our Golf Course Environmental Management Program website:
<http://www.afcee.brooks.af.mil/ec/golf/>