



***Muroc Lake Golf Course***  
**Environmental Baseline Assessment**  
**Edwards AFB, California      Sep 02**



## Executive Summary

### U. S. AIR FORCE GEM PROGRAM GOALS

The U. S. Air Force Golf Course Environmental Management (GEM) program is a proactive Air Force Center for Environmental Excellence (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 mission.

The primary tenets of the GEM Program are to minimize or eliminate potential negative environmental impacts, attain and maintain daily compliance with all appropriate regulations, and constantly examine our processes on all aspects of golf course management to achieve the highest standards of environmental excellence.

### GEM PROGRAM PROCESS

There are five steps in the GEM program process.

- Analysis
- Documentation
- Implementation
- Evaluation
- Revision

This report is the result of the analysis step.

### MUROC LAKE GOLF COURSE EDWARDS AFB, CALIFORNIA ENVIRONMENTAL CHALLENGES

The following environmental challenges were identified during the GCEBA process:

- Environmental Compliance and Management Program (ECAMP)
- Pesticide use & Integrated Pest Management
- Natural resource management
- Water use
- Bird/Wildlife Aircraft Strike Hazard (BASH)
- Threatened & endangered species
- Proposed maintenance facility
- Tree management & landscape development

Further information on the environmental challenges at Muroc Lake Golf Course can be found in the Conclusion of this Golf Course Environmental Baseline Assessment.

### WHERE DO WE GO FROM HERE?

The golf course staff should determine their preferred management approach for the challenges above in context with their ongoing goals of providing the best golfing experience for the money. They should then coordinate these practices with the installation environmental staff to ensure their compatibility with installation wide natural resources and environmental goals and objectives followed by implementation.

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## Introduction

The golf course environmental baseline assessment (GCEBA) is the initial step in the process of creating a successful ecosystem-based Golf Course Environmental Management (GEM) Plan.

The ultimate intent of the program is to provide a foolproof, customer-driven management tool that will free up course managers and superintendents to devote more of their efforts to caring for their customers and the course. Properly designed and implemented, the GEM Plan will keep the facility in compliance with the ever-changing environmental rules and regulations while providing a vital recreational opportunity for the installation.



*Wide and inviting fairways dominate the Edwards AFB golf facility.*



*A lone Joshua tree, the Mojave Desert's indicator plant and the course's sole survivor, guards the approach to the 18<sup>th</sup>.*

## Goal of the GEM Program

The goal of the U. S. Air Force GEM program is to facilitate the creation of an environmentally friendly golf course facility for its customers while supporting the installation mission. The Air Force Center for Environmental Excellence (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, the U. S. Air Force's golf courses are being managed compatibly with the environment. The GEM program is the vehicle to document our successes while communicating directly with the golfers, our commanders, and the local community.



*Dogleg fairways abound at Muroc Lakes.*

## Program Process

Implementation is the most important phase of any initiative where practices and procedures are examined and may undergo significant change. This is especially true of the GEM Plan process. The specifics for the GEM Plan components and directions for their completion will be delineated in AFCEE's ***Golf and the Environment, Guidelines for the 21<sup>st</sup> Century***.

The GEM Program is derived from many diverse environmental regimes such as the National Environmental Policy Act, the Environmental Compliance Assessment and Management Program, and the ISO 14000 environmental management system. The primary tenets of the GEM Program are

to minimize or eliminate potential negative environmental impacts, attain and maintain daily compliance with all appropriate regulations, and constantly examine our processes on all aspects of golf course management to achieve the highest standards of environmental excellence. There are five basic steps in the implementation of the GEM Program process:

- Analysis
- Documentation
- Implementation
- Evaluation
- Revision



*Poor water quality and inconsistent soil conditions complicate the cultivation of quality turfgrass.*



*The elevated 8<sup>th</sup> green's surface is invisible from the teeing area.*

## Analysis

Experienced environmental managers realize the importance of assembling all of the data relevant to a problem prior to determining its best solution. Analysis is the first and most important task of the golf course environmental baseline assessment (GCEBA) and the GCEBA is the initial step in the process of creating an ecosystem-based Golf Course Environmental Management (GEM) Plan. Properly completing the GCEBA is paramount to the long-term compatibility of an installation's golf course management practices with the GEM Program, and more importantly, the U. S. Air Force'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 environmental management challenges
- Summary report

## Documentation

It is not enough just to know how to create a successful golf course environmental management program. There has to be a written record of 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 be a comprehensive report with a map that will assist in the daily management of the course while providing a convenient vehicle to communicate to our customers the environmental issues that challenge us on our golf course and our plans to deal with them. In order to reach the environmental stewardship goals set by the U. S. Air Force, we must consistently employ only those management practices that minimize or eliminate potential negative impacts to the environment.

## **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 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 program recommendations

## **Implementation**

Positive and decisive action is the only true measure of the success of a GEM Program. 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 Muroc Lake staff should adopt the GEM Program Environmental Policy and immediately begin finding ways to minimize or eliminate any and all negative impacts to the environment.

## **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 Program. It is important for U. S. Air Force golf courses to show improvement over time. This can be easily accomplished by regularly evaluating golf course maintenance methods, practices, and management approaches changing when appropriate.

## **Revision**

The very nature of a superior GEM program implies that all documents be regularly maintained to represent the most current conditions. U. S. Air Force 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 Program. The GEM Plan should be kept as current as possible at all times. Ideally, it should be completely updated at least every three years.

## Course Specific Analysis

One of the most pragmatic and enjoyable tasks in the GCEBA process is the course specific analysis. From a general overall description of the course to the details of the course's history and makeup to the various observations on the way the course plays, looks, and is managed, the course specific analysis sets the stage for the rest of the GCEBA report. It is comprised of the following tasks:

- Course description
- Course details
- Maintenance facility evaluation
- Miscellaneous facilities examination



*The 12<sup>th</sup> green at Muroc Lake is elevated at least 40 feet above the tee.*



*The natural landscape is dominated by creosote bush and little else.*

## Course description

Muroc Lake Golf Course is located in the north central portion of the gigantic, 301,000 acre Edwards AFB in California’s Antelope Valley, a broad alluvial plain. The extremely dry and windy western Mojave Desert provides the setting for the taxing 18-hole facility that features only 80 acres of irrigated turfgrass. The manager and her staff are challenged by the remoteness of the facility from the surrounding community and the limited number of resident personnel. Relatively new to Edwards AFB and the Muroc Lake course= Superintendent brings optimism and turf growing skills to the operation with his influence already being seen with improving playing conditions. There is nothing better than a “can do” attitude and a little hard work to turn around a difficult situation.

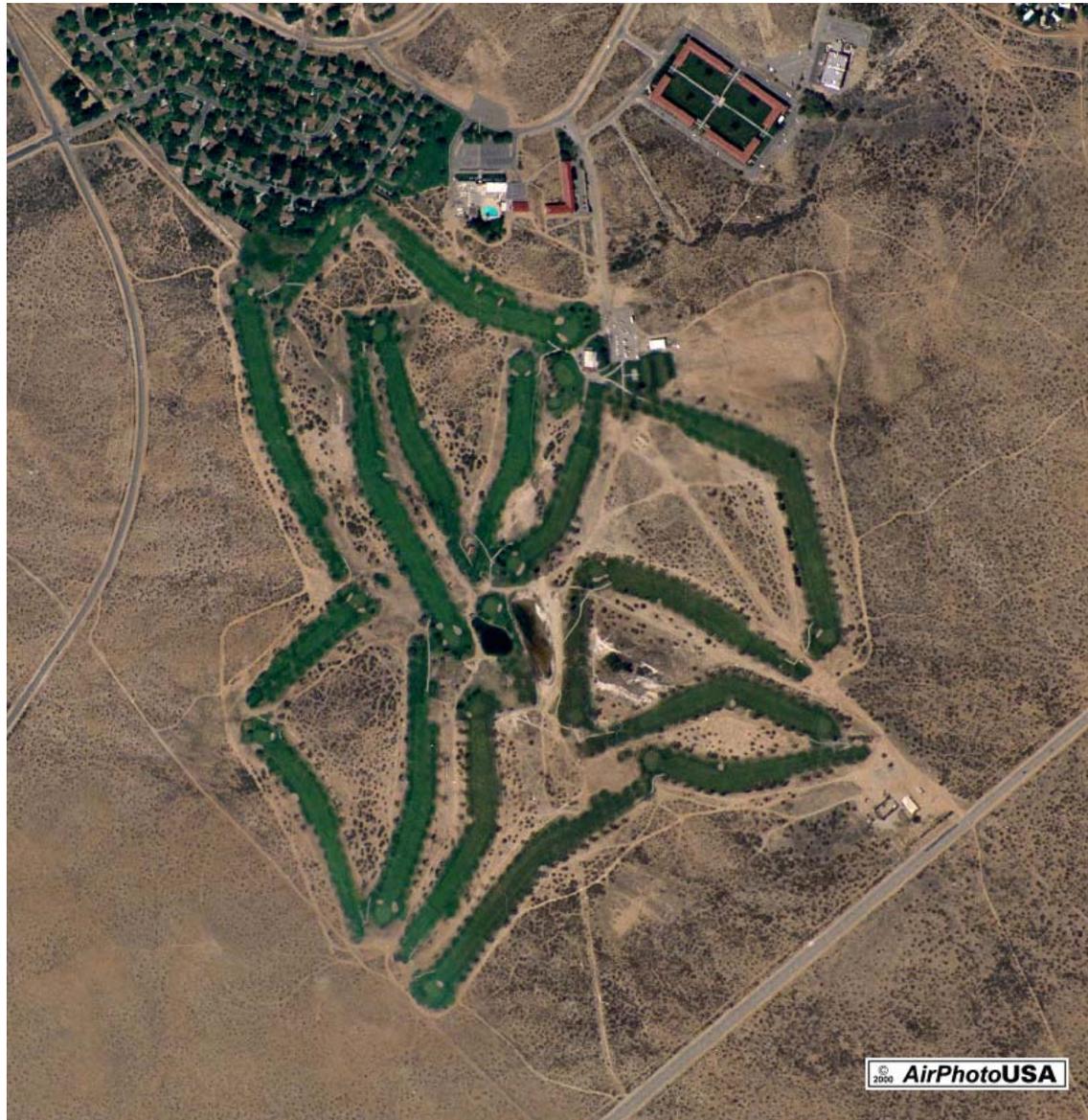
The course is in fair to good condition overall. An aging irrigation system and an unsuccessful attempt to establish high water using cottonwood trees detract from the course’s aesthetic quality. In the end, Muroc Lakes has tremendous potential to be a stellar example of U. S. Air Force recreational opportunities.



*Windswept and dry describes Edward’s Muroc Lake Golf Course*

## Course details

Architect	Not provided	
Year constructed	Not provided	
Climate	Hot, dry, windy	
Average annual rainfall	4 inches	
Average growing season	Approx. 300 days per year	
Winds/Prevailing Direction	West/Southwest	
Par	36-36-72	
Yardage/Rating/Slope	Blue- 6915/73.5/129 White- 6446/71.3/125 Red- 5561/72.2/123	
Turfgrass	Tees	Common Bermudagrass
	Fairways	Common Bermudagrass
	Greens	Bentgrass/Poa annua
	Roughs	Common Bermudagrass



**Muroc Lake Golf Course**

## Miscellaneous Facility Review

Although the course is primary to the enjoyment and eventual return of most of Muroc Lake’s customers, the support facilities play a huge role in the overall success of the operation. This section of the GCEBA will examine the following facilities for their aesthetic, functional, and environmental values:

- Clubhouse/pro shop/snack bar
- Practice areas
- Maintenance complex
- Cart barn
- Infrastructure



*Muroc Lakes G. C. clubhouse works well for the Edwards clientele.*



*Snack bar dining area is aesthetically pleasing and well sized.*

## Clubhouse

The clubhouse at Muroc Lake is proportionately sized for its relative level of business activity. Attractively appointed snack bar, grill, pro shop, and locker rooms reflect tasteful design and long-term functionality. The exterior of the facility melds with the site and its architectural style appears compatible with installation standards. The landscape development of the clubhouse could be improved while reducing maintenance requirements and water use.



*Putting green is nicely maintained.*



*Driving range only lacks customers.*

## Practice areas

Muroc Lake Golf Course is outfitted with an adequate driving range and a properly sized practice putting green. Some innovative marketing techniques are needed to encourage higher use. Ball machine, club cleaning station, and lights should be all that is needed to get customers “sweating out” a few buckets every evening after work.



*Full ball machine and quality turf await Hoganesque golfers.*



*Golf carts are within a few feet of customer's vehicles and the first tee.*

## Cart barn

The cart barn at Muroc Lakes is a “Butler” building located just off the parking lot. Access to clubhouse and first tee is good but there has been no attempt to screen the facility from customer's view. Facility is not unattractive though, and it does work well in all other aspects.

## Infrastructure

This section examines important elements of a quality golf course that are difficult to group into another category. Cart paths are in far to poor condition. The parking lot is in fair condition and is adequately sized to accommodate the customers of Muroc Lake Golf Course. Landscape development attempts have been marginally successful. There is a site amenity group near most teeing areas. Overall, the course signage is adequate.



*Irrigation pump house could use landscape development to help it blend in as well as a lock on the door to keep out curious personnel.*

## Maintenance complex

The maintenance complex is ready for replacement. Storage and equipment maintenance space is border line at best. A new facility would allow for a more organized and efficient approach, raise morale, and ensure high priced equipment stays in the best condition possible.



*Multipurpose space utilization is a necessity rather than a choice.*



*Maintenance complex is in full view of players from the 14<sup>th</sup> tee.*



*Not sure if this is a safe, well-maintained workspace....*

## Environmental Compatibility Quotient Checklists

The following is a brief compilation of some of the observations in each of the ten Environmental Compatibility Quotient (ECQ) categories during the site visit.

### ECQ Categories

- Overall Management Philosophy & Documentation
- Safety, Training, And Awareness
- Compliance
- Course Playability
- Pollution Prevention
- Conservation Practices
- Aesthetics & Naturality
- Maintenance Practices
- Customer Relations & Education
- Miscellaneous Special Projects & Activities

## ECQ Checklists

The Environmental Compatibility Quotient (ECQ) checklists are a convenient method of assessing the overall performance, implementation, and completeness of an installation's Golf Course Environmental Management Plan. The checklists can be used in many ways including:

- As an analytical tool while compiling a Golf Course Environmental Baseline Assessment like this one.
- As a self-assessment tool for the golf course manager or superintendent.
- As an award nomination evaluation by a Golf Course Assessment Team (GCAT).



*Muroc Lakes is a driver's course.  
Hit it long and straight off the tee and the rest is easy!*



*Pro shop is clean, well appointed, and stocked with quality products.*

## Determining the Environmental Compatibility Quotient

The ECQ compiled for an installation's course is a snapshot of the overall performance and compliance with the GEM Plan. There are two ways to use the ECQ checklists to determine the status or quality of the environmental management program: determining the actual and potential environmental compatibility quotients.

- **Actual ECQ-** the total percentage of "Yes" responses for all ten checklists.
- **Potential ECQ-** the total percentage of "Yes" responses plus the total percentage of "Partial" responses for all ten checklists.

## Key to checklist responses

- **Yes** = Practice is complete or ongoing and can be verified.
- **Partial** = Practice has been initiated but needs further attention and improvement.
- **No** = Practice is not in place.

## ECQ Scoring Scale

Percent Responses Yes or Partial per Category	Level
93-100%	Advanced
83-92%	Getting there
73-82%	Showing progress
63-72%	Early stages
Less than 62%	Just started

## Overall Management Philosophy & Documentation

### U.S. Air Force GEM program goals

- Enhance the installation ecologically and economically
- Demonstrate that the golf course is managed with consideration for the unique conditions of the ecosystem of which it is a part
- Document management practices to promote more widespread understanding and appreciation for environmentally sound golf course facilities
- Share information on the environmental opportunities and constraints of your golf facility with your customers, the golfers

### Observations

- Need to compile and document actions already taken to create “continuity” document
- Implement planned improvements to all aspects of the golf facility management
- Utilize installation geographic information system and digital aerial photographs for mapping requirements
- Secure computer hardware and software upgrades to increase overall efficiency and provide high speed internet access



*Superintendent's office is as lean and mean as the rest of the operation.*

<b>Overall Management Philosophy &amp; Documentation</b>				
<b>#</b>	<b>Environmental Compatibility Indicator</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
1	Has management demonstrated that the environment is an important part of their responsibilities by initiating the GEM Planning process?	✓		
2	Has the golf course adopted and posted an Environmental Policy?			✓
3	Is the GEM Plan underway or completed, available, and updated regularly?		✓	
4	Is a map of the property highlighting environmental opportunities or constraints such as wildlife habitat, water resources, sensitive landscapes, special management zones, etc. posted for customers?			✓
5	Environmental goals, objectives, issues, projects, and progress are evaluated at least annually and are regularly communicated to employees, customers, management, and the local community?			✓
6	Are written records of water quality monitoring activities, results, and control measures readily available?		✓	
7	Is there an inventory of bird and mammal species documented, maintained, and readily available?		✓	
8	Is there a general understanding of how course management practices may positively enhance or adversely impact wildlife species and habitats?	✓		
9	Are the environmental impacts of pest control measures such as leaching and runoff potential, toxicity to non-target organisms, soil absorption capacity, pesticide persistence, water solubility, and effects on soil microorganisms and non-target species considered as part of the course management planning process?	✓		
10	Are records of pest treatments employed and their effectiveness maintained and used to guide future pest control decisions?	✓		
	<b>Point totals for each column</b>	<b>4</b>	<b>3</b>	<b>3</b>

## Safety, Training, & Awareness

### U.S. Air Force GEM program goals

- Educate all employees on the benefits of an ecosystem based golf course environmental management program
- Store and handle all potentially harmful products to minimize employee exposure
- Regularly train employees on the potential health hazards associated with their duties
- Involve entire staff in ensuring a safe golfing opportunity for their customers



*Size of the printing on this sign indicates there's been a bad experience in the recent past.*



*Appropriate signs protect the health and welfare of customers.*

### Observations

- Expanded training for all employees a must to completely realize GEM goals
- Ensure employee's health is prime consideration
- Demonstrate genuine concern for player health and safety through actions
- Lack of funding hinders training plans

<b>Safety, Training, &amp; Awareness</b>				
<b>#</b>	<b>Environmental Compatibility Indicator</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
1	All employees are familiar with the GEM Plan and are trained regularly on the importance of environmental performance and compliance with the goals and objectives of the program?			✓
2	All appropriate employees are trained to be familiar with USAF, federal, state, and OSHA regulations that apply to storage and handling of chemicals used on the property?	✓		
3	All employees are aware that chemical manufacturing, use, storage, and disposal may pose risks to human health and the environment?	✓		
4	All employees are trained to understand that poor management practices may adversely impact worker health, on- and off-site water quality, local soil health, and wildlife species and their habitats?		✓	
5	A current copy of all Material Safety Data Sheets (MSDS) for all chemicals used anywhere on the golf course property is maintained and readily available for use by employees?		✓	
6	Chemical applicators are encouraged to apply for continuing education programs and receive regular training to maintain currency?	✓		
7	The chemical storage structure/area is locked, well-ventilated, fire proof, and access is limited to select personnel?	✓		
8	Pesticides, fertilizers, and other chemicals are stored on plastic or metal shelving?	✓		
9	Are golfers 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 that may be hazardous to human health and safety?	✓		
10	Are key staff members trained regarding water quality and conservation issues?	✓		
	<b>Point totals for each column - Response percentage</b>	<b>7</b>	<b>2</b>	<b>1</b>

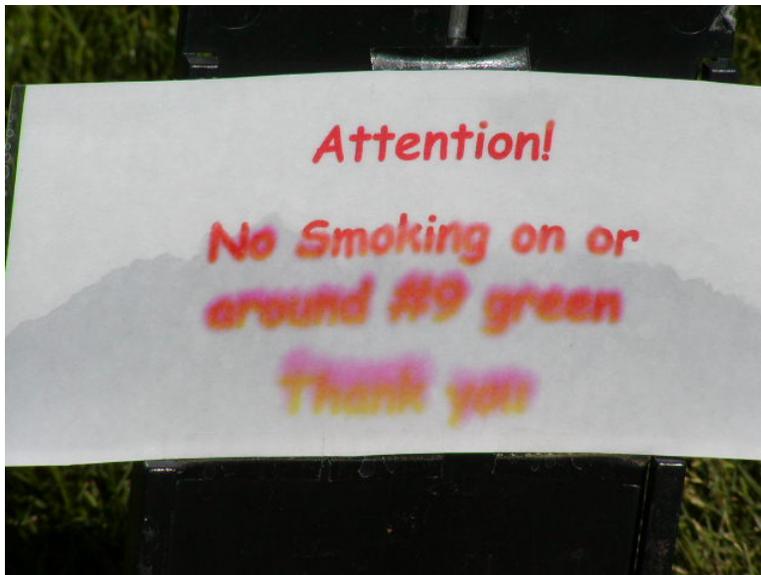
## Compliance

### U.S. Air Force GEM program goals

- Integrate management practices with appropriate regulatory requirements and procedures
- Guarantee safe, healthy, and enjoyable experience for golfers while ensuring long-term operation of the facility
- Utilize installation expertise regularly on all matters dealing with bird aircraft strike hazards, regulators, impact analysis, and cleanup



*Irrigation lake overflow area is rapidly becoming a “wetland”.*



*Probably not an adequate sign.*

### Observations

- Assemble all compliance documents in one place
- Do more than what is required
- Inconsistent interpretations of compliance actions among installation, MAJCOM, and ECAMP evaluators confuses and confounds one and all
- Ensure ECAMP results are outstanding
- Set a goal for the relationship with installation environmental and engineering staff to become exemplary

<b>Compliance</b>				
<b>#</b>	<b>Environmental Compatibility Indicator</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
1	Is fuel storage/delivery managed in accordance with federal, state and local regulations?	✓		
2	Are installation environmental staff members included in on-going course management discussions and plans at regularly scheduled meetings?			✓
3	Are there regularly scheduled staff meetings to discuss environmental management issues?			✓
4	Does the director of golf and the superintendent attend ECAMP in-briefings and out-briefings?	✓		
5	Does the director of golf and/or the superintendent coordinate with installation environmental staff on the various management plans that affect or include the golf course?		✓	
6	Are MSDSs readily available for all required substances?			✓
7	Has appropriate impact analysis (NEPA) been performed on all proposed actions on or affecting the golf course property?	✓		
8	Are containers used to store used oil in good condition, not leaking, and clearly labeled?		✓	
9	Are oil/water separators operating properly and correctly maintained?	✓		
10	Are written and readily available records maintained of all applications of pesticides made by certified applicators, including the following? <ul style="list-style-type: none"> <li>- the quantity of each pesticide used</li> <li>- the chemical or common name of the active pesticidal ingredient(s) (not the product name)</li> <li>- the pest or purpose for which the pesticide was applied</li> <li>--the date and place of application.</li> </ul>	✓		
	<b>Point totals for each column - Response percentage</b>	<b>5</b>	<b>2</b>	<b>3</b>

## Course Playability

### U.S. Air Force GEM program goals

- Create desirable playing conditions through the utilization of sound, ecosystem based environmental management practices
- To daily offer an enjoyable and challenging yet fair golfing experience for all levels of golfers
- Establish an open, courteous, and friendly relationship between the course manager, the superintendent, and the customer to maintain enthusiasm and interest



*Excellent playability makes Muroc Lake a value to customers.*



*Turf quality and playability is more than adequate to draw customers.*

### Observations

- Continue focusing maintenance efforts on in-appropriate play areas of the course
- Increase contour mowing for greater definition of fairway landing areas
- Eliminate all unnecessary irrigation and mowing and concentrate on “in-play” areas of the course
- Squirrels are becoming a nuisance and need to be monitored so that damage to priority areas such as greens or tees are not damaged

<b>Course Playability</b>				
<b>#</b>	<b>Environmental Compatibility Indicator</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
1	Pin placements and tee markers are regularly moved to minimize the impacts of play while increasing the enjoyment and diversity of the experience of the customer?	✓		
2	Course has sufficient number of tees to satisfy need of all types of golfers and their individual talent levels?		✓	
3	At least 75% of the greens are proportionally sized for the average length of approach shot for required all levels of golfers?	✓		
4	The speed of the greens is appropriate to their contours and size?	✓		
5	Fairway width and turf quality is sufficient for equitable challenges to all levels of golfers?	✓		
6	Roughs are regularly maintained to produce an equitable challenge to all levels of golfers?	✓		
7	Course conditioning and maintenance practices do not contribute to extending average playing times?	✓		
8	Extraneous fairway bunkers have been eliminated or converted to grass bunkers to help speed play?	✓		
9	Is bunker sand of appropriate quality and consistency?			✓
10	Is proper drainage maintained near at least 95% of all greens and tees?		✓	
	<b>Point totals for each column - Response percentage</b>	<b>7</b>	<b>2</b>	<b>1</b>

## Pollution Prevention

### U.S. Air Force GEM program goals

- Employ practices that eliminate or avoid the potential for polluting the environment
- Guarantee that the golf course facility will not allow chemicals, fertilizers, detergents, or petroleum products they use to migrate outside their property boundaries
- Create and utilize a comprehensive pollution prevention plan for all aspects of the golf course and its facilities



*Refueling tanks are contained and access is restricted.*



*Old Quonset hut should be retired from fertilizer storage duty.*

### Observations

- Further reduce solid waste streams from clubhouse operations
- Increase the use of slow release fertilizers
- Regularly provide training for all employees on the specifics of pollution prevention and how they can help

<b>Pollution Prevention</b>				
<b>#</b>	<b>Environmental Compatibility Indicator</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
1	Are there designated "no-mow" areas and established "no spray zones" and buffer areas around pond, stream, or lake edges and have they been communicated to mower operators and technicians?	✓		
2	A spill containment kit is readily available and spill containment procedures are in place?	✓		
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 to contain spills?	✓		
5	Are liquid products stored below dry products and are dry materials stored on pallets or shelves to keep them off the floor?	✓		
6	Wash and wastewater is kept from making direct contact with surface water and is recycled or allowed to filter through a vegetative area when cleaning and maintaining equipment?	✓		
7	Are grass clippings blown off equipment with compressed air instead of or prior to washing?	✓		
8	Are gasoline, motor oil, brake and transmission fluid, solvents, and other chemicals used to operate or maintain equipment and vehicles prevented from directly or indirectly entering water bodies?	✓		
9	Does the fuel storage and delivery area comply with local, state, and federal regulations?	✓		
10	Are slow-release fertilizers used to reduce the negative potential for runoff?	✓		
<b>Point totals for each column - Response percentage</b>		<b>10</b>	<b>0</b>	<b>0</b>

## Conservation Practices

### U.S. Air Force GEM program goals

- Use natural resources efficiently while respecting their long term value to the local community and the mission of the USAF
- Provide important greenspace benefits
- Closely monitor and manage water use to prevent unnecessary depletion of installation or local water resources



*Extreme care must be taken when designating areas of the course “Environmentally Sensitive” according to USGA rules.*



*Birds of prey regularly frequent the course.*

### Observations

- Increase communication with customer on conservation practices that are already in place
- Continue building relationships with installation natural resources manager and other environmental professionals
- Provide detailed input to the scheduled update of installation integrated natural resources management plan (INRMP)

<b>Conservation Practices</b>				
<b>#</b>	<b>Environmental Compatibility Indicator</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
1	Are all motorized golf course equipment checked regularly for excessive air polluting emissions?			✓
2	Has the irrigation system been completely checked for proper water distribution in all irrigated areas and are water leaks fixed in a timely manner?		✓	
3	Has the irrigation system or its components recently been upgraded to reduce inefficiency, malfunction, and overall water use?		✓	
4	Has all "non-target" irrigation (ponds, out of play areas, etc.) been eliminated or minimized?	✓		
5	Have flow meters been installed to monitor water use and detect potential waste?	✓		
6	Have part circle irrigation heads been installed where possible to save water resources?	✓		
7	Are employees encouraged to minimize their trips around the course to conserve on the use of fossil fuels?	✓		
8	Does the snack bar utilize reusable plates and silverware for use by customers throughout the facility's operating hours?			✓
9	Have all potential wildlife habitats and their maintenance practices been coordinated with the installation BASH officer and environmental management personnel?	✓		
10	Are recycling containers conveniently provided for customer and employee use throughout the golf course facility?		✓	
<b>Point totals for each column - Response percentage</b>		<b>5</b>	<b>3</b>	<b>2</b>

## Aesthetics & Naturality

### U.S. Air Force GEM program goals

- Create and maintain an attractive golf course facility that requires minimal outside chemical or fertilizer inputs
- Utilize native or indigenous plant materials exclusively
- Consider every aspect of the golf course facility as a positive contributor to the overall satisfaction of the customer



*Native, low water species have a much better chance for survival.*



*Irrigation system replacement and soil management might help.*

### Observations

- Enlist environmental staff to determine how the golf course staff can assist in the removal of dead and dying cottonwoods that dominate the landscape
- Increase number and variety of new native trees added to course every year
- Funds needed to expand landscape improvements to selected areas on the course should be programmed for the near future

<b>Aesthetics &amp; Naturality</b>				
<b>#</b>	<b>Environmental Compatibility Indicator</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
1	Is the area near the clubhouse attractively landscaped and maintained?	✓		
2	Is there an appropriately located and attractive facility sign and has the on course signage been designed and maintained attractively?			✓
3	Does the course seem to be part of the natural landscape and overall contours?		✓	
4	Are pest-resistant and drought-tolerant native trees, shrubs, groundcovers, or their cultivars used in landscaped areas?			✓
5	Are there "targeted", highly visible areas where flowering annuals or perennials are appropriately maintained?	✓		
6	Are the relative numbers of the prominent deciduous, evergreen, and flowering golf course trees balanced and at least 75% native species?			✓
7	Are the maintenance facility and the course's miscellaneous "outbuildings" maintained sufficiently and/or screened from view?		✓	
8	Is there an attractive and well-maintained site amenity group (bench, washer, etc.) at least 75% of the tees?	✓		
9	Do the driving range, practice areas, and parking areas present a positive image?		✓	
10	Is the cart barn integrated into the overall landscape plan of the course or the area in which it is located?			✓
	<b>Point totals for each column - Response percentage</b>	<b>3</b>	<b>3</b>	<b>4</b>

## Maintenance Practices

### U.S. Air Force GEM program goals

- Integrate the concept of ecosystem management into all course management decisions and practices
- Employ the principles of integrated pest management
- Document all activities for future reference
- Constantly examine management practices to look for improvements
- Insist on a well-trained staff



*The finishing hole at Muroc Lake Golf Course ends a windswept day.*



*A well-located bunker guards the 11th green.*

### Observations

- Increased training and involvement of staff on integrated pest management procedures
- Compile written pest profiles of common pest species
- Improve water hazard care to eliminate unwanted vegetation while improving aesthetics and habitat
- Increase number of trained scouts on the maintenance staff

<b>Maintenance Practices</b>				
<b>#</b>	<b>Environmental Compatibility Indicator</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
1	Is contour mowing used to conserve fuel and increase playability and aesthetics?		✓	
2	Are there designated non-maintained or minimally maintained buffers around core wildlife habitats?	✓		
3	Are green, tee, and fairway mowing heights maintained at reasonable levels without continually stressing turf or maximizing chemical inputs?	✓		
4	Are there regular procedures in place to continually improve soil health such as organic amendments, aeration, and drainage?	✓		
5	Is there a map of the course's "hot spots" requiring special care or regular attention?			✓
6	Are there trained scouts on staff other than the superintendent to monitor turf and plant health and pest populations using scouting forms to record the type, severity, location, and treatment of pest problems and organized into a report or guide so that they can be used for future pest control solutions?	✓		
7	Are there written pest profiles of common pest species with a variety of potential control measures pre-evaluated including alterations in cultural management, biological, physical, and mechanical controls prior to treating the problem on the course?			✓
8	Are there established and documented aesthetic and functional thresholds for insects, fungal diseases, and weeds for all managed areas to precisely and effectively manage pest populations and reduce chemical inputs?			✓
9	Have all playing surfaces been inventoried and mapped for soil types including soil structure, nutrient levels, organic content, compaction, and water infiltration?			✓
10	Are soil tests and plant tissue analysis used to determine nutritional requirements?	✓		
<b>Point totals for each column - Response percentage</b>		<b>5</b>	<b>1</b>	<b>4</b>

## Customer Relations & Education

### U.S. Air Force GEM program goals

- Ensure that the customer knows that their opinions count and will be acknowledged, assessed, and acted upon
- Educate the customers about the benefits of environmentally responsible golf course management and the future of the game and the environment
- Enlist customer support and assistance on caring for the course and its facilities as well as GEM Plan goals



*Select a highly visible location in the clubhouse or dining area to communicate environmental challenges to customers.*



*Club cleaning station is a nice addition to the practice area.*

### Observations

- Efforts to solicit customer opinions and concerns are a great example for all U. S. Air Force golf facilities
- Create a location to communicate environmental management goals and maintenance plan in the new clubhouse
- Continue to involve installation youth through rules and instruction clinics
- A concerted effort to demonstrate the quality and value of the course to area golfers must be made to increase play and improve the course

<b>Customer Relations &amp; Education</b>				
<b>#</b>	<b>Environmental Compatibility Indicator</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
1	Are the course manager and superintendent involved in a long-term customer educational program that is regularly updated and documented?		✓	
2	Is there a conveniently located and highly visible place at the course or clubhouse where golf course environmental management notices and informational messages are regularly posted?			✓
3	Do the course manager and superintendent actively communicate with customers to determine and document their points of view?	✓		
4	Is there active and regular communication with the Golf Council, Civil Engineering, Environmental Management, the Services manager, and commanders by course management?		✓	
5	Are there warning signs posted near parking lots to make highly sensitive individuals aware of the potential danger to their health and are all state posting requirements being met?	✓		
6	Is there consistent and attractive signage around the course and grounds that would increase the awareness of the average golfer to the environmental management practices employed?			✓
7	Are there signs appropriately located to warn golfers of hazards when drinking reclaimed or otherwise non-potable water?	✓		
8	Are there interpretive signs posted to highlight key habitats or have appropriate areas been designated "Environmentally Sensitive Zones" per USGA rules?	✓		
9	Are course staff members trained regularly on how to improve their dealings with customers?	✓		
10	Are there clinics provided to teach beginning golfers the basics of the game and to teach all levels of golfers the rules of the game?	✓		
	<b>Point totals for each column</b>	<b>6</b>	<b>2</b>	<b>2</b>

## Miscellaneous Special Projects & Activities

### U.S. Air Force GEM program goals

- Educate the local community about the benefits of an environmentally responsible golf course management approach is for the future of the game and the environment
- Reach out to school children to raise their awareness and appreciation for the game of golf and the GEM Plan principles
- Further the great game of golf at all times in as many ways as possible



*Where's the beef?*



*Ditto!*

### Observations

- Conduct field trips at the course for local school children
- Enlist the assistance of local city and county officials on golf course environmental planning initiatives
- Initiate Earth Day environmental awareness golf tournament
- Educate customers about the benefits of an environmentally friendly golf course
- Need to demonstrate dedication to “growing” the great game of golf to young airmen, other installation non-golfers, and youth

<b>Miscellaneous Special Projects &amp; Activities</b>				
<b>#</b>	<b>Environmental Compatibility Indicator</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
1	Are there projects planned and funded for the next year that would communicate the compatibility of the course's management methods with protection of the environment?			✓
2	Are there projects planned and funded to reduce the course's potential negative environmental impacts?		✓	
3	Are there awareness raising tournaments planned that may provide for future environmentally-related projects?	✓		
4	Are there regular field trips for local students or other local community groups hosted at the course?			✓
5	Are there projects planned to eliminate or minimize a potential erosion problem?	✓		
6	Does the course have a native tree installation program complete with planting plan and maintenance schedule?	✓		
7	Are any of the local schools or universities involved in educational or research activities at your course?		✓	
8	Are there special facility-wide recycling programs underway?	✓		
9	Is your course an active participant in the USAF Golf Environmental Management Program?	✓		
10	Has your facility been nominated by your MAJCOM for the golf course environmental management award in the last 3 years?			✓
	<b>Point totals for each column</b>	<b>5</b>	<b>2</b>	<b>3</b>

## ECQ Summary

#	Environmental Compatibility Quotient Category	Yes	Partial	No
1	Overall Management Philosophy & Documentation	4	3	3
2	Safety, Training, & Awareness	7	2	1
3	Compliance	5	2	3
4	Course Playability	7	2	1
5	Pollution Prevention	10	0	0
6	Conservation Practices	5	3	2
7	Aesthetics & Naturality	3	3	4
8	Maintenance Practices	5	1	4
9	Customer Relations and Education	6	2	2
10	Miscellaneous Special Projects & Activities	5	2	3
	<b>Composite points &amp; response percentage</b>	<b>57</b>	<b>20</b>	<b>23</b>

## GCEBA Results

Σ Muroc Lake Golf Course, Edwards AFB, CA

- Actual ECQ (# of “Yes”) = 57 “Just started”

- Potential ECQ (Actual ECQ plus “Partial”) = 77 “Showing Progress”



*Cottonwood-lined fairways do not fit with Mojave Desert ecosystem.*

## Conclusion

Muroc Lake Golf Course has tremendous potential to be one of the U. S. Air Force's best courses. With Deb Ashlee and Don Huisjen on the job, the future becomes more certain at Edwards AFB. Capital improvements such as the irrigation system and maintenance complex combined with a successful marketing plan to draw in golfers are much needed. Corrections to the clubhouse have already been made with those needed on the course approaching fruition. Time and patience will be necessary to attain the Muroc Lake Golf Course staff's desired level of quality.

## Areas needing improvement

The ECQ Summary on the previous page highlights the following areas for relative improvement at Edwards AFB:

- Conservation Practices
- Compliance
- Conservation
- Aesthetics & Naturality
- Maintenance Practices
- Miscellaneous Special Projects & Activities

## The gallery

This section of the report will be where some of the more revealing photographs (of the literally hundreds taken during the site visit) of pests, maintenance practices, and other areas where improvements may be made or exemplary practices are encouraged for continued use to create the best possible golf facility.



*Chlorosis and bare spots are a result of poor water quality and soils.*



*Curious tree irrigation practices have not been successful.*



*The "Young and the Supportless" along with another dead cottonwood.*



*It's getting a little cluttered on the 8<sup>th</sup> tee.*



*Nice turfgrass on Muroc Lake's greens should keep golfers happy.*



*Confounding location of soda machine in the middle of nowhere!*



*Minor cart path repairs will increase customer satisfaction.*



*Aleppo pines seem to work fairly well in the fierce climate of Edwards.*

## Environmental challenges

One of the important results of the GCEBA process is the identification of significant issues or challenges that should be addressed in the long term GEM Planning process. Ideally, the golf staff will address each issue from the best way to satisfy the goals of the golf facility and acceptable levels of course playability and customer satisfaction. The golf staff's preferred management approach for these issues should then be coordinated with the installation's environmental staff for refinement, coordination, and approval.

The GEM Plan would then consist of the environmental challenges, the approach to their management, a map showing where these challenges occur on the golf course, a booklet that describes the mapped challenges, goals and objectives for future years, and a set of best management practices.

The following environmental challenges were identified during the GCEBA process at Muroc Lake Golf Course, Edwards AFB, CA:

- Environmental Compliance and Management Program (ECAMP)
- Pesticide Use & Integrated Pest Management
- Natural resource management
- Water use
- Bird/Wildlife Aircraft Strike Hazard (BASH)
- Threatened & endangered species
- Proposed maintenance facility
- Tree management & landscape development

## ENVIRONMENTAL COMPLIANCE AND MANAGEMENT PROGRAM (ECAMP)

Immediately prior to the AFCEE site visit to compile this report, the environmental staff at Edwards sent their in-house personnel to complete a "rolling" investigation of the golf course's pesticide compliance. Unfortunately, things were not in very good order (the course had been without a superintendent and a manager for some time). All chemicals were removed from the golf course grounds. The environmental staff ruled that pesticide applications would be performed by contract. Initially, this seemed like a drastic, unworkable decision. Upon further study, this solution had many advantages including no lost time training and licensing applicators, no storage, handling equipment, or mixing areas would be needed, no excess amounts of pesticides would need to be disposed of, or any funds used to send personnel away for training, etc. All in all resulting in a very workable and desirable situation for Edwards AFB.

## PESTICIDE USE & INTEGRATED PEST MANAGEMENT (IPM)

Edwards AFB is one of the few installations where all of the pesticide applications are accomplished by contract. The Pest Management Plan of the INRMP reflects contracted applications at the golf course. The superintendent should accompany pest applicators to ensure appropriate areas are treated with the correct chemicals. The contractor will accomplish all pesticide use reporting requirements with copies provided to the superintendent for his use in IPM program.

The DoD Integrated Pest Management section of the Integrated Natural Resources Management Plan (INRMP) lists “adopt-a-hole” as a potential way to reduce chemical inputs and that the course “use natural vegetation and other ground covers instead of turf in some areas of the rough.” These are admirable goals but are largely unworkable. Turf, or any other non-native species, will thrive only where it is irrigated regularly. Natural vegetation has been largely preserved in the “out of play” areas (for some golfers).



*Leak or irrigation lake overflow?*

### **NATURAL RESOURCES MANAGEMENT**

The INRMP states that the overall goal of natural resource management at Edwards AFB “is to fulfill the defense mission while maintaining and enhancing natural resources on Base through ecosystem

management. The GEM Plan espoused by this study should fit neatly into the INRMP and its goal.

The golf course is located in Management Area C. Invasive exotic species observed on the course include tamarisk or salt cedar. This plant is “an exotic phreatophyte (a deep rooted plant that obtains its water from the water table or the layer of soil just above it) and consumes a great amount of water.” Adaptive management and long term monitoring are key aspects of the Edwards natural resource management scheme.

### **BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD (BASH)**

A report of the BASH recommendations was completed in 1995. One of the solutions was to revegetate disturbed areas to reduce the incidence of horned larks that have been identified as the highest BASH occurrence on Edwards AFB.

### **WATER USE**

Since Edwards AFB receives only a paltry four inches of precipitation annually, water use is a major concern. The course is located in an area of the installation where water resource issues such as high water use, groundwater contamination, and stormwater flow. The golf course is obviously one of the primary water users on Edwards AFB. Since the installation provides a sufficient quantity of treated or recycled water for their irrigation needs, the golf course is relieved from at least some of the water use concerns. The intrinsic value of the recycled water dictates that even it must be conserved for other

uses, both currently and in the future. The golf course staff should compile a Drought Management Plan that assesses and prioritize water requirements to prepare for unforeseen shortages or interruptions in supply of recycled water.

According to the USGA report, the irrigation system is in drastic need of redesign and modernization. This is a large project but will eventually be one of the most important improvements for the course in the long run. The INRMP states that the installation should “maximize use of reclaimed water” which, of course, the golf course is already accomplishing.



*Aquatic vegetative growth in irrigation supply pond should be monitored for deleterious affects.*



*A great blue heron adds a touch of class to the 17<sup>th</sup>.*

### **THREATENED & ENDANGERED SPECIES**

Sensitive habitats include designated critical habitats for desert tortoise even though “densities were found to be generally low to very low throughout the installation”. “Less than 1.2% of the total critical habitat designated for the tortoise occurs on Edwards”. Species of interest that may occur on or near the golf course include the Mohave ground squirrel, desert tortoise and the chuckwalla. Potential golf course visitors in this category include golden eagle, bald eagle, and peregrine falcon.

## PROPOSED MAINTENANCE FACILITY

There is a desire to construct a new facility for the golf course maintenance function. This complex is highly needed and can only contribute positively to the overall quality of the course and the golf course environmental management capabilities.



*Just a matter of time before all of the cottonwoods go to that “old nursery in the sky”.*

## TREE MANAGEMENT & LANDSCAPE DEVELOPMENT

Probably the most disconcerting and most incongruous design aspect of the Muroc Lake Golf Course is the use of soldier-like cottonwood trees along almost every fairway. These may be the largest water guzzling varieties of all time. They love water so much that the only place they occur naturally in the

largely arid west is riparian areas where water flows regularly or constantly. Unless the cottonwood roots can find groundwater, they will not survive very long as eventually it is impossible to irrigate them sufficiently. Since the cottonwood is a fast grower they area also brittle and short-lived. There are numerous trees that have already succumbed with many more to follow. It is time to set priorities to remove high risk trees and begin programming to have the remainder of the cottonwood trees removed.

A sound redesign of the course landscape to fit the extreme climatic conditions at Edwards AFB that eliminates unnecessary turfgrass while preserving playability is paramount to the long-term economic viability of the operation while improving aesthetics and customer satisfaction.

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**<http://www.afcee.brooks.af.mil/ec/golf/>**