



# ***Golf and the Environment: Guidelines for the 21<sup>st</sup> Century***

***The United States Air Force  
Golf course Environmental  
Management (GEM) Handbook***

***January 2008***

**Operations & Maintenance  
Section**

This Handbook is a slightly revised version of the 2006 Comprehensive Golf course Environmental Management (GEM) Planning booklet written and copyrighted by William H. Bushman/Ecodesigns.

**San Antonio, Texas**



*Combine the natural beauty of Kauai with Jack Nicklaus' design expertise and you get the awesome Kiele Course.*

## **Environmental Compatibility Categories**

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) checklists have been compiled from several sources (Audubon International, 2000) (AFCEE, 2001) (Smart, et al, 1999). The ECQ checklists represent the best method currently available to determine the actual relative environmental compatibility of a golf course's management practices. The ECQ checklists can be completed through interviews with the golf manager and the golf course superintendent, a professional examination of the course's golf course management process, and review of the available environmental or planning documents.



*A buffer is used on the out-of-play side of the water feature.*

## **Operations & Maintenance**

Today, operating and maintaining a golf course facility embraces several diverse aspects. Outside of the golf course turf and associated amenities such as water features, bunkers, and forests, there are parking lots, clubhouse, cart storage facility, maintenance complex, service and utility areas, and other landscaped areas that compliment all of the above both functionally and aesthetically.

“In 1754, the Society of St. Andrews Golfers sought special playing privileges, or starting times, at the Old Course. In exchange, they were to supply funds for maintenance of the course. This may be the first historical reference to the actual contemplation of golf course maintenance. The first published scientific papers related to turfgrass research were initiated in 1880 by the renowned botanist Professor William J. Beal of the Michigan Agricultural Experiment Station, East Lansing, Michigan” (Beard, 2002).

As discussed earlier, the primary product of golf course operations and maintenance is quality turfgrass. A large majority of the inputs of the operation are directly related to growing, mowing, and caring for turfgrass. Since most of a golf course’s equipment uses petroleum-based products for fuel and lubrication, potential impacts related to these products are a daily reality. In addition, operating the equipment

creates exhaust emissions. Storing and cleaning the course's equipment contributes other situations where the potential for adverse impacts arises.

"The use of integrated management of turfgrass would be very effective for reducing detrimental non-point source environmental and water quality impacts. These practices would coordinate all management factors required for long-term sustained productivity and quality of turfgrass, golf course profitability, and ecological soundness of selected management options. Critical components of integrated management systems include proper design and construction of golf courses; selection of appropriate turfgrass species and cultivars; soil practices; clipping and cultivation practices; nutrient management; irrigation and drainage management; chemical, biological, and cultural pest management; and soil, water, energy, and natural resource conservation during construction and maintenance of lawns and golf courses" (Balough and Walker, 1992).

### **Operations & maintenance action items**

- Integrate environmental protection into all course management decisions and practices
- Employ the principles of integrated pest management
- Document all activities for future reference
- Further reduce solid waste streams from clubhouse operations
- Increase the use of slow release fertilizers
- Constantly examine management practices to look for improvements
- Insist on a well-trained staff
- Incorporate contour mowing procedures
- Educate employees and 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 Golf course Environmental Management Plan goals
- Create a location to communicate environmental management goals
- Take proper actions after a chemical or fuel spill
- Implement recycling procedures throughout the golf course operation

## Operations & Maintenance Environmental Compatibility Quotient Checklist

<b>Operations &amp; Maintenance</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/or to 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 levels that do not excessively stress important playing surfaces?			
4	Are aeration, topdressing, and drainage improvements regularly implemented to improve soil health and minimize or eliminate use of pesticides or fertilizers?			
5	Have all playing surfaces been inventoried and mapped for soil types including soil structure, nutrient levels, organic content, compaction, and water infiltration?			
6	Are soil tests or plant tissue analysis used to determine turfgrass nutritional requirements?			
7	Are there projects planned and funded for the next year that would increase the compatibility of the course's management methods with 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 a complete examination of all aspects of the operation other than the golf course (snack bar/restaurant, clubhouse, pro shop, pesticide mixing and storage facilities, fuel storage and delivery areas, and maintenance complex) for potential negative environmental impacts?			
10	Are all employees encouraged to apply for education and training opportunities that may increase their awareness of the GEM Plan goals?			

**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 contamination?			
14	Are recycling containers located throughout the facility for use by customers and employees?			
15	Are grass clippings left in place (other than greens) collected, composted, and/or recycled?			
16	Are products that minimize unnecessary packaging purchased for use throughout the facility?			
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	Does the restaurant/snack bar facility utilize at least 90% plates, cups, and utensils that are reusable rather than disposable?			
20	Is the food storage and prep area regularly cleaned to reduce the likelihood of pest infestations and required pesticide applications?			
<b>Totals</b>				

## Environmental Compatibility Quotient Summary & Scoring Scale

<b>ENVIRONMENTAL COMPATIBILITY QUOTIENT SUMMARY</b>			
Environmental Compatibility Category	Yes	Partial	No
<b>Planning &amp; Compliance</b>			
<b>Operations &amp; Maintenance</b>			
<b>Water Resource Management</b>			
<b>Conservation</b>			
<b>Pesticides &amp; Pollution Prevention</b>			
<b>Totals</b>			

- Key to checklist responses

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

<b>ENVIRONMENTAL COMPATIBILITY QUOTIENT SCORING SCALE</b>	
Total Yes or Partial Responses	Environmental Compatibility Level
<b>86-100%</b>	<b>Advanced (Green)</b>
<b>70-85%</b>	<b>Showing progress (Yellow)</b>
<b>69% or less</b>	<b>Just started (Red)</b>



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Please visit our Golf course Environmental Management (GEM) Program website:  
**<http://www.afcee.brooks.af.mil/ec/golf/>**.