



_____ **Golf Course**
Environmental Management Plan
_____ AFB, State March 08





Suggested
_____ Golf Course
Environmental Policy

**In concert with the
_____ 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 constantly reevaluate our processes
to achieve the highest standards
of environmental excellence.**

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 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 installation mission. AFI 32-7064 requires a GEM Plan as part of the Integrated Natural Resources Management Plan (INRMP).

The primary tenets of the GEM Program are to minimize or eliminate potential negative environmental impacts, maintain daily compliance with all appropriate regulations, and constantly examine 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



Environmental Compatibility Quotient

Actual ECQ	61
Potential ECQ	80

Final environmental challenges

The following environmental challenges were identified during the GEM Plan process:

- Environmental challenge

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/>).

Analysis

Course details

- Architect
- Year constructed
- Climate
- Average annual rainfall
- Average growing season
- Winds/Prevailing Direction
- Total Facility Acreage
- Par
- Yardage/Rating/Slope

- Turfgrass
- Tees-
- Fairways-
- Greens
- Roughs-
- Irrigation water source



Willow Lakes Course Layout

Course description

At 7174 yards from the back tees, Willow Lakes Golf Course is one of the most challenging of U.S. Air Force links. The course features heavily treed, rolling terrain with several ponds and streams that must be negotiated. This makes the Director of Golf's course tough for all levels of golfers - no matter which tee they choose to play.

Although the greens are in dire need of a major overhaul, Willow Lakes is still fun and rewarding for the avid player. The Superintendent does the best that can be expected considering he only has a 3-person staff.

If the Army decides to continue with Willow Lakes as part of the new Fort Bragg and they implement a few improvements, the Willow Lakes Golf Course should provide a phenomenal recreational resource and a steady income for a long time.

Insert aerial photo here.

_____ **Golf Course Aerial Photo**

Determining the Baseline (ECQ)

The following is a brief compilation of some of the responses in each of the ten Environmental Compatibility Quotient (ECQ) categories obtained in an interview with the superintendent and the manager conducted during the site visit.

ECQ Categories

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

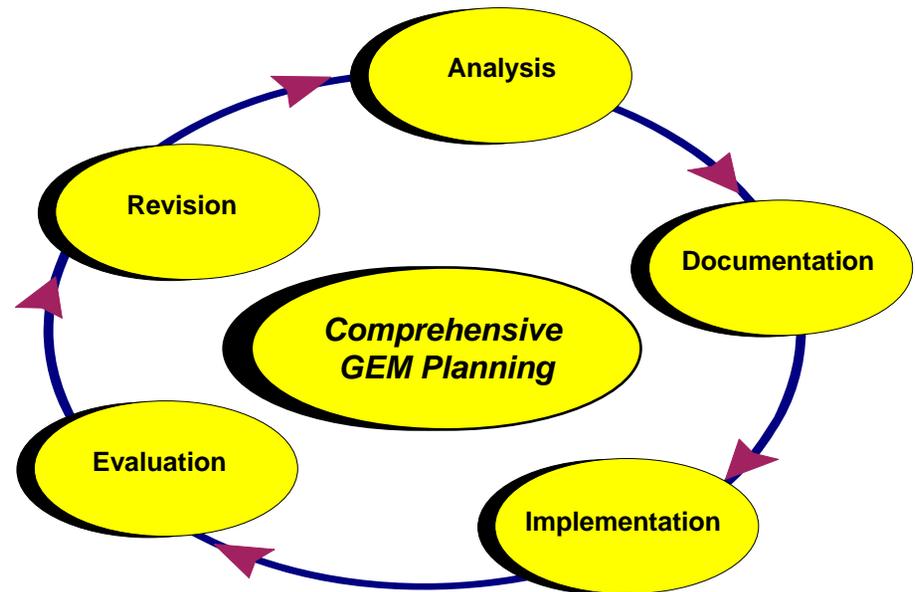
Key to checklist responses

- **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 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)



The GEM Planning process.

Interpreting the 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)



Many impoundment devices and bridges are in need of replacement.



The Willow Lakes Golf Course is a challenge for all ability levels.

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	Are environmental challenges and their approved and implemented management practices, objectives, and targets evaluated at least annually, and are they regularly communicated to employees, customers, management, and the local community?			
6	Are there signs appropriately located to warn golfers of hazards of drinking reclaimed or otherwise non-potable water?			
7	Are there signs posted that highlight key habitats or have appropriate areas been designated “Environmentally Sensitive Zones” per The Rules of Golf?			
8	Is there a general understanding by the entire course management staff of how their practices may potentially adversely impact the environment?			
9	Are the environmental impacts of pest control measures considered as part of the comprehensive GEM planning process?			
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 (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	<i>Does the superintendent document the actual amount of each pesticide or fertilizer annually used on each major golf course feature (greens, tees, fairways, roughs, water features, and natural areas)?</i>			
14	<i>Has the course attained full certification in the Audubon Cooperative Sanctuary Program or similarly recognized environmental management program?</i>			
15	Are all 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	<i>Are there documented aesthetic or functional thresholds integrated into the pest control decisions?</i>			
18	<i>Is there a written and regularly updated Integrated Pest Management Plan for the entire golf course property?</i>			
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	Has course management comprehensively examined the course to determine the activities that have a potential to negatively impact an identified environmental challenge?			
	Totals			

Operations & Maintenance				
#	Environmental Compatibility Indicator	Yes	Partial	No
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 (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 considered prior to purchasing 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?			
	Totals			

Water Resource Management				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Are written records of water quality monitoring activities, results, and pollution control measures readily available?			
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	Is the irrigation system utilized solely based on the specifically calculated local daily evapotranspiration rate?			
4	Are outdoor irrigation of non-golf course areas and indoor plumbing regularly monitored and maintained for leaks?			
5	Have low-flow water saving devices been installed wherever possible?			
6	Are recycled or other non-potable water supplies being used to irrigate at least 65% of the golf course property?			
7	Are there projects planned that should 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	Is runoff from parking lots cleansed by control measures such as vegetative or drainage filters prior to leaving the golf course property?			
10	Are there procedures for reporting water quality problems to supervisors (as required) for appropriate action?			

Water Resource Management (continued)				
#	Environmental Compatibility Indicator	Yes	Partial	No
11	Is the irrigation pumping station and associated equipment regularly checked for proper operation and leaks?			
12	Has the irrigation system or its components recently been upgraded to reduce inefficiency, malfunction, and overall water use and are flow meters used to monitor water use and detect potential waste?			
13	Is there a map of the watershed in which the golf course property resides and location(s) of floodplains and stormwater drainage exist on the property?			
14	Is the quality of the water entering and leaving the property tested regularly for contaminants, pH, dissolved oxygen, and nutrients?			
15	Is water quality data collected to establish baseline conditions for all water features on the property?			
16	Are settling ponds and/or detention ponds used to effectively remove sediments and pollutants from water features?			
17	Are biological processes such as the addition of grass carp or white amur used to control unwanted aquatic vegetation in water features?			
18	Is there a written Water Resources Management Plan that delineates the care of the course's water features?			
19	Has the property been examined for potentially significant wetlands or associated sensitive water-based habitats?			
20	Has the property's water features been studied to determine the aquatic and amphibious species population?			
	Totals			

Conservation				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Is all motorized golf course equipment checked regularly for 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	Have all potentially significant wildlife habitats and their maintenance practices been coordinated with local natural resource manager, the Fish & Wildlife Service, or other appropriate local or regional regulatory agency?			
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?			
6	If applicable, have all necessary permits been 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 or exotic species on or near the course?			
9	Is there a readily available Drought Management Plan for the entire golf course facility?			
10	Is there at least one project planned and funded that is expected to minimize or eliminate the course's potentially existing negative environmental impacts?			

Conservation (continued)				
#	Environmental Compatibility Indicator	Yes	Partial	No
11	Is stormwater collected for supplementing irrigation water supplies for use on the course or golf course facility grounds?			
12	Are a majority of plants used in landscaped areas drought-tolerant native trees, shrubs, groundcovers, or their cultivars?			
13	Have local wildlife species and their habitats been documented and mapped?			
14	Does the course have a Tree Management Plan complete with planting plan and maintenance schedule?			
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 degraded habitats due to construction or maintenance of the course been fully restored or improved?			
19	Has the entire property been examined for archaeological, cultural, or historical resources?			
20	Are customers and employees regularly informed/trained on the golf course's conservation practices?			
	Totals			

Pesticides & Pollution Prevention				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Are there minimally maintained, natural areas, no spray zones, and buffer areas around water features or sensitive landscapes and have they been communicated to equipment operators and pesticide applicators?			
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	Are equipment or vehicle wash and wastewater kept from making direct contact with surface water?			
7	Is equipment cleaned with compressed air on part of the course instead of or prior to washing at a designated wash rack where pollution prevention measures are employed?			
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/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?			

Pesticides & Pollution Prevention (continued)				
#	Environmental Compatibility Indicator	Yes	Partial	No
11	Is there a map of the course's "hot spots" that may require special care or attention?			
12	Are there trained scouts on staff other than the superintendent to monitor turf and plant health and pest problems?			
13	Are there scouting forms utilized and are they collected and organized into a report or guide for use in future pest control decisions?			
14	Is there an established aesthetic or functional threshold for insects, fungal diseases, and weeds for all managed areas that may possibly reduce pesticide and fertilizer inputs?			
15	Are current copies of all Material Safety Data Sheets (MSDS) for all chemicals used anywhere on the golf course property maintained and readily available?			
16	Are chemical applicator(s) encouraged to apply for regular training to maintain currency?			
17	Is the chemical storage structure/area locked, well-ventilated, fire resistant and is access limited to appropriate personnel?			
18	Are records of pest treatments and their effectiveness maintained and used to guide future pest control decisions?			
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			

ECQ Summary

#	Environmental Compatibility Quotient Category	Yes	Partial	No
1	Planning & Compliance			
2	Operations & Maintenance			
3	Water Resource Management			
4	Conservation			
5	Pesticides & Pollution Prevention			
	Composite point totals/response percentage			

Month Year - _____ Golf Course, Installation AFB, State

- Actual ECQ (# of “Yes”) = 61 (“Red”)

- Potential ECQ (Actual ECQ plus “Partial”) = 80 (“Yellow”)

* = Category requires improvement or attention

Environmental challenges

One of the important results of the GCEBA process is the identification of potential environmental challenges to be addressed in the long-term GEM Planning process. After determining the relative significance and validation of each potential environmental challenge, the installation golf and environmental staffs should determine the set of final challenges that will be actively managed in the GEM Plan. Armed with the list of final environmental challenges, the golf staff should determine the best management approach that satisfies the goals of the golf facility from the course playability and customer satisfaction perspectives. Then the golf staff's preferred management approach should be coordinated with the installation's environmental staff for refinement, coordination, and approval.

Ultimately, the combined environmental and golf staff team should proceed toward finalizing the GEM Plan. The entire process can be viewed at the AFCEE GEM website (<http://www.afcee.brooks.af.mil/ec/golf/>). The following potential environmental challenges were identified during the GCEBA or Draft GEM Plan process:

- Environmental challenge



Willow Creek Golf Course has numerous water resource management-related environmental challenges.

FINAL ENVIRONMENTAL CHALLENGES

The following final environmental challenges were identified during the GEM Plan process:

- Environmental challenge

**Insert env challenges
map here.**

_____ **Golf Course Environmental Challenges**

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.

MANAGEMENT APPROACH

A course's approach to managing environmental challenges in accordance with the driver or requirement, environmental policy (see page 2), and established objectives and targets is the heart of the GEM Plan.

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.

TARGET

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



Canada geese are Willow Lakes' primary BASH concern.



Many of the streams and ponds at Willow Creek are full of sediment.

Environmental Challenge # 1

(Description)

Driver/requirement

-

Management approach

-

Objective

Target



Water features may be an attractant to Canada geese but they utilize the entire course to feed and nest.



Many of the streams and ponds at Willow Creek are full of sediment.

Environmental Challenge # 2

(Description)

Driver/requirement

-

Management approach

-

Objective

Target



Water features may be an attractant to Canada geese but they utilize the entire course to feed and nest.



Many of the streams and ponds at Willow Creek are full of sediment.

Environmental Challenge # 3

(Description)

Driver/requirement

-

Management approach

-

Objective

Target



Water features may be an attractant to Canada geese but they utilize the entire course to feed and nest.



Many of the streams and ponds at Willow Creek are full of sediment.

Environmental Challenge # 4

(Description)

Driver/requirement

-

Management approach

-

Objective

Target



Water features may be an attractant to Canada geese but they utilize the entire course to feed and nest.



Many of the streams and ponds at Willow Creek are full of sediment.

Environmental Challenge # 5

(Description)

Driver/requirement

-

Management approach

-

Objective

Target



Water features may be an attractant to Canada geese but they utilize the entire course to feed and nest.

GEM Plan goals & objectives

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

- Determined by installation GEM team
-
-

Please see the AFCEE GEM program website (<http://www.afcee.brooks.af.mil/ec/golf/>) for more information.)

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

- Determined by installation GEM team
-
-

GEM Plan best practices

Best practices are defined as any action, method, practice, or result that has proven its value and worth over time. The GEM program has been designed to create a body of scientific data to share with all U.S. Air Force installation golf and environmental staff members. The following best practices are currently in use:

- Determined by installation GEM team
-
-

Please see the AFCEE GEM program website (<http://www.afcee.brooks.af.mil/ec/golf/>) for more information.



Conclusion

The Civil Engineering Squadron's unit environmental coordinator program should provide the key oversight to assist in improving the quality of the golf and environmental together to better support the installation. In addition, conserving precious water supplies through the application of science, engineering, and demonstrated environmental stewardship may be the only other major issue facing the environmental and golf staff members.

sample

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.

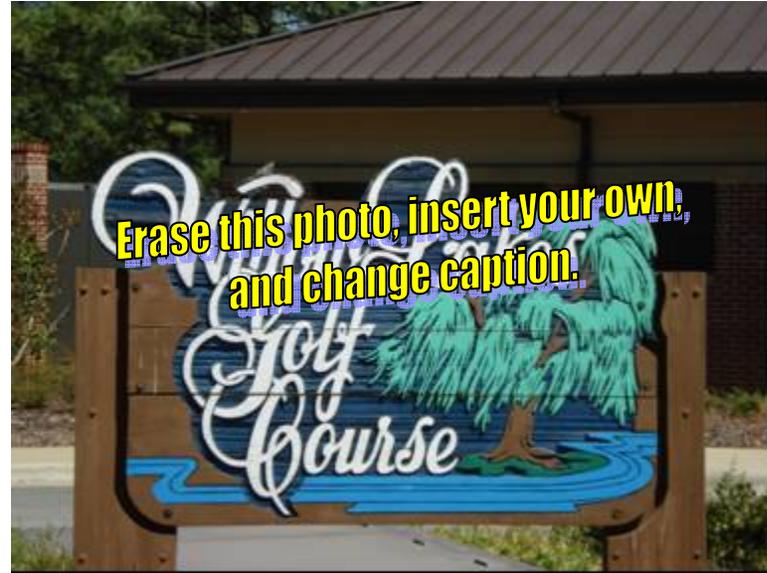


Photo caption.



The Willow Lake clubhouse is relatively new and well-appointed.



Delineated wetlands occur alongside Willow Lakes GC.



The 4th green is hiding behind the vegetation lining one of many ponds.



Much of the stream beds are within dense natural areas.



Azaleas provide aesthetic relief on the 18th hole.



Trees are a major component of the Willow Lakes golfing experience.



Sink holes in the 10th fairway are caused by failed storm drain.



Sediment from Fort Bragg has nearly filled this creek on the 2nd hole.



Bibliography

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Bushman, William H., *A Process to Quantify the Environmental Compatibility of Golf Course Management Practices*, University of Texas at San Antonio, Thesis, The University Of Texas At San Antonio, College of Sciences, Department of Earth and Environmental Sciences, May 2003.

Bushman, William H., *Comprehensive Golf Course Environmental Management Planning*, Golf Course Superintendents Association of America, Atlanta, GA, February 2006.

Add sources used to research this GEM Plan to this list. Sources above must remain in the final report.



Pope AFB · North Carolina



**Air Force Center for Engineering & the Environment
Technical Directorate
Natural Infrastructure Division**

For additional assistance or more information, please contact:
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Please visit our Golf course Environmental Management (GEM) Program website:
<http://www.afcee.brooks.af.mil/ec/golf/>