An Educational Guidebook

Environmental Management Systems (EMS) For Golf Courses: Educational Guide

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This EMS educational document is a cooperative effort between the University of Georgia and Audubon International.

Why Be Concerned About EMS?

Management of environmental issues at the local site is no longer a choice, but a necessity, whether the local facility is a factory, restaurant, waste-treatment plant, farm operation, or golf course. **The Key Question** is: "what environmental management approach will be used---a strict regulatory model, multiple methods imposed by dealing with each individual environmental issue with a different model, or a comprehensive and holistic approach. In the evolution of environmental regulatory approaches, **Environmental Management System (EMS)** is becoming the primary model on an international basis to manage site-specific environmental issues because the approach is holistic, science-based, and effective. The EPA's December 2005 position statement on EMSs noted: "Recently the EPA reissued its Position Statement on Environmental Management Systems (EMS). The revised Position Statement reaffirms the Agency's long-held opinion that implementing an EMS will enable businesses, agencies, and other institutions to improve their environmental performance and business competitiveness." http://www.epa.gov/ems/index.html.

After years of a regulatory-centered approach for environmental policy (using laws and regulations to dictate business behavior towards the natural environment), the EMS voluntary management approach has been officially accepted by the nation's environmental policy body. It is essential that the golf course industry, as well as all other business enterprises, clearly understand the EMS concept and implications because it will be "their" proactive model for dealing with environmental issues in the 21st Century. To-date EMSs have not been widely used or discussed in the turfgrass industry, but that must change if we are to be proactive and support a sustainable environment and business philosophy.

Purpose of This EMS Guidebook

With increasing focus on EMSs by federal and state environmental regulatory agencies, it is essential that the golf course industry become familiar with the EMS concept and to understand implications relative to the whole club facility. This EMSs guidebook is intended:

- **To be an educational tool for golf course officials.** The intention is to provide an overview of the EMS history, concept, EMS elements, general plan of operation, EMS implications, and key resources. It is not our intention to develop an EMS for the golf industry, but to provide educational information so that the industry can understand this concept.
- **To identify the key or core environmental impact issues** that may occur on a golf club.
- To identify and discuss certain environmental impact areas not currently considered in most golf related environmental assessments **(i.e., to identify environmental impact area gaps**); but that the authors consider will become more important in the future.

Environmental issues are complex; thereby, requiring many diverse factors to be considered in conducting a comprehensive impact assessment for each particular environmental impact area (such as wildlife habitat management or water-use efficiency/conservation) and in developing of a successful management plan for each environmental area. It is beyond the scope of this guidebook to provide detailed site assessment checklists/protocols or to include detailed best management practices (BMPs) strategies and options for each environmental impact area. These will arise from various facets of golf course industry as development of EMSs for individual clubs become more common.

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Section I.

INTRODUCTION TO ENVIRONMENTAL MANAGEMENT SYSTEMS (EMS)

Chapter 1. EMS History and Concepts

Prior to discussing the Environmental Management System (EMS) concept relative to the golf course industry, it is beneficial to understand the basics of this systematic approach to management of environmental issues. Environmental Management System (EMS) is rapidly becoming the accepted systematic approach to identify and manage all environmental issues for all facilities (from manufacturing plants, restaurants, businesses, agricultural facilities, etc.). The EPA's December 2005 position statement on EMSs noted: "Recently the EPA reissued its Position Statement on Environmental Management Systems (EMS). The revised Position Statement reaffirms the Agency's long-held opinion that implementing an EMS will enable businesses, agencies, and other institutions to improve their environmental performance and business competitiveness."(http://www.epa.gov/ems/index.html)

1.1. Definition and Traditional Model (Plan, Do, Check, Act)

An EMS is a proactive approach to environmental stewardship that entails establishing an environmental policy and long-term commitment to environmental management to promote stewardship by a business entity. The most common EMS models are modeled after the International Organization of Standards (ISO), a non-governmental network of national standards institutes from various countries. ISO is the world's largest organization devoted to development of standards, especially technical standards. In 1996 and revision in 2004, the ISO developed a standard for environmental management entitled **"ISO 14001 Environmental Management System"** (http://www.iso.org/iso/en/ISOOnline.frontpage).

The ISO 14001 standard is defined as: "The Environmental Management is the part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing, and maintaining the environment". ISO 14001 (1996) consisted of 5 principal or key components in a cyclic process:

- **Commitment and Policy (**development of an environmental policy by the organization)
- **Planning**
- **Implementation**
- **Measurement and Evaluation** (checking and corrective actions)
- **Review and Improvement** (management review).

The ISO 14001 was, therefore, developed to "standardize" a management approach for entities to manage environmental issues in a systematic manner. The main thrust for its development came as a result of the Rio Summit on the Environment held in 1992.

Since 1996, the ISO 14001 EMS approach has been increasingly adopted in many areas of the world and including the USA, but often with some modification. The USEPA modified the ISO 14001 so that the EPA EMS entails a continual cycle with 4 key components, summarized in a **plan, do, check, act** format (http://www.epa.gov/ems/index.html), where these key components are defined as:

- **Plan** – Planning, including identifying environmental aspects and establishing goals.
- **Do** – Implementing, including training and operational controls.
- **Check** – Checking, including monitoring and corrective action.
- **Act** – Reviewing, including progress reviews and acting to make needed changes to the EMS.

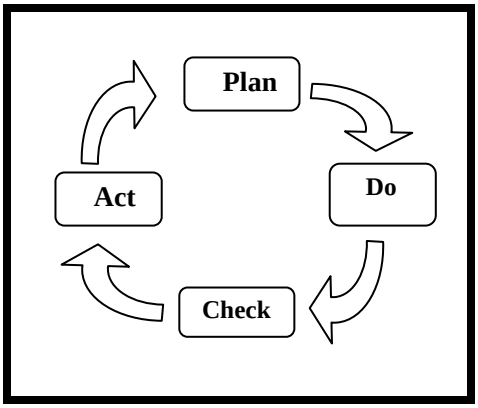


Fig. 1. Key components of USEPA EMS

1.2. Elements of Traditional EMSs

Both the 5 principal components of the ISO 14001 and the 4 basic components (plan, do, check, act) of the US EPA EMSs are normally expanded into 17 key elements or steps related to the development and implementation of an EMS for an entity. The 17 key elements are outlined on the EPA site as (http://www.epa.gov/ems/info/elements.htm):

1. **Environmental policy**
2. **Environmental aspects and impacts**
3. **Legal and other requirements**
4. **Objectives and targets**
5. **Environmental action plans**
6. **Structure and responsibility**
7. **Training, awareness and competence**
8. **Communication**
9. **EMS documentation**
10. **Document control**
11. **Operational control**
12. **Emergency preparedness and response**
13. **Monitoring and measurement**
14. **Nonconformance and corrective and preventive action**
15. **Environmental Records**
16. **EMS audit**
17. **Management review**

A review of the 17 steps reveals three important points. First, a central purpose of the EMS concept is to incorporate environmental management into daily management decision-making at all management levels of a facility. In addition to current parameters that may influence daily management decisions, is added attention to environmental issues at all management levels.

Second, when a facility embarks on development and implementation of the EMS approach, management, training, and communications are significantly affected. As a word of caution, when reading US EPA or other governmental agency materials related to EMSs, most of the material will be related to the areas of management structure, management activities, development of effective communication lines within a facility, and educational needs at various levels. Much of the discussion relates to facilities larger than most golf courses where management structure and

activities, communications, and educational aspects can be integrated into existing management structures with fewer challenges than facilities with more complex management hierarchies. However, when reading these materials, one can easily get "bogged down" in the management emphasis and suggested changes.

Third, in contrast to the extensive materials on management, communications, and education, limited information will be noted relative to **the real "core" of an EMS plan,** which consists of assessment of environmental issues coupled with development/implementation of BMPs for each environmental impact issue. Since the foundational ISO 14001 EMS is really a standardized approach to managing environment issues for all types of entities, their materials emphasis the common areas of management, communications, and education challenges. However, the actual environmental issues that may be present on a facility is very much dependent on the nature of the entity – i.e., environmental issues of a golf course would differ from a manufacturing plant. In the current document, we focus on the core environmental issues as related to golf courses.

1.3. Related Environmental Terms

Terms or programs that may be confused with EMS are Environmental Management Plan (EMP), Environmental Audit (EA), and National Environmental Performance Track (NEPT) program (NEPT, 2007). An EMP is much narrower than an EMS and is generally considered a plan to mitigate and monitor a single environmental issue. A very similar concept is Best Management Plans (BMPs) which are developed to manage a particular environmental issue --- in this document, we use the BMPs terminology (Carrow et al., 2005). Thus, EMPs or BMPs are part of an overall EMS, while the EMS refers to the whole "system" or approach.

An Environmental Audit is a means to determine whether an EMS is effectively implemented or not. As such an EA is a part of the overall EMS – i.e., one of the components. The ISO 14001 definition of an EA is: "An EMS Audit is a systematic and documented verification process of objectively obtaining and evaluating evidence to determine whether an organization's EMS conforms to the EMS audit criteria set by the organization and for communication of the results of this process to management".

The EPA has a National Environmental Performance Track (NEPT 2007) program described as: "Launched in June of 2000, the National Environmental Performance Track ("Performance Track") is a voluntary partnership program that recognizes and rewards private and public facilities that demonstrate strong environmental performance beyond current requirements. Performance Track is designed to augment the existing regulatory system by creating incentives for facilities to achieve environmental results beyond those required by law. *To qualify, applicants must have implemented an independently-assessed environmental management system(i.e., EMS), have a record of sustained compliance with environmental laws and regulations, commit to achieving measurable environmental results that go beyond compliance, and provide information to the local community on their environmental activities.* Members are subject to the same legal requirements as other regulated facilities. In some cases, EPA and states have reduced routine reporting or given some flexibility to program members in how they meet regulatory requirements. This approach is recognized by more than 20 states that have adopted similar performance-based leadership programs". http://www.epa.gov/performancetrack/index.htm. Thus, a facility that has an EMS may wish to participate in the NEPT program as an additional but it is not a part of the EMS. One of the criteria for the NEPT program is to have a comprehensive independent assessment of the organization's EMS.

Chapter 2. EMS and Golf Courses

In the remaining sections and chapters, focus will be on adapting and explaining the various EMS elements in context of golf courses. When developing an EMS document for golf clubs, our approach differs from a traditional EMS in some aspects, such as:

- **We encourage placing less emphasis on "process"**. As noted earlier, a review of EMS documents illustrates that great emphasis is placed on planning process, management structure at various levels, communication/training, structure, etc. While these components are important, our emphasis will be too incorporate these aspects within the normal structure of golf course operations as much as possible.
- EMS documents developed to-date for other industries do not seem to have depth and breadth of content related **to rigorous site assessment; identification of environmental issues; and providing management information/options dealing with any identified issues**. These aspects will be the central core and emphasis of this document while keeping discussion of the "process" components as simple as possible.
- The traditional EMS concept is based on identification and management of environmental aspects that may significantly impact the environment, especially in a negative manner. Some degree of "sustainability" philosophy is inherent in the traditional EMS in the sense of alleviating factors that would degrade the environment. A more aggressive or proactive approach would be to **include environmental enhancement and sustainability of natural resources**. In this document both environmental enhancement and sustainability of natural resources are incorporated and emphasized.
- When developing BMPs for addressing specific environmental issues (example, water-use efficiency/conservation) the focus of traditional EMS has been to identify BMPs to implement; but past and current BMPs and infrastructure improvements to alleviate the specific environmental issue may be overlooked. For each potential environmental issue, the EMS document should **include past and present BMPs already implemented** in terms of management practices and infrastructure improvements.

2.1. Elements or Framework of Golf Course EMS

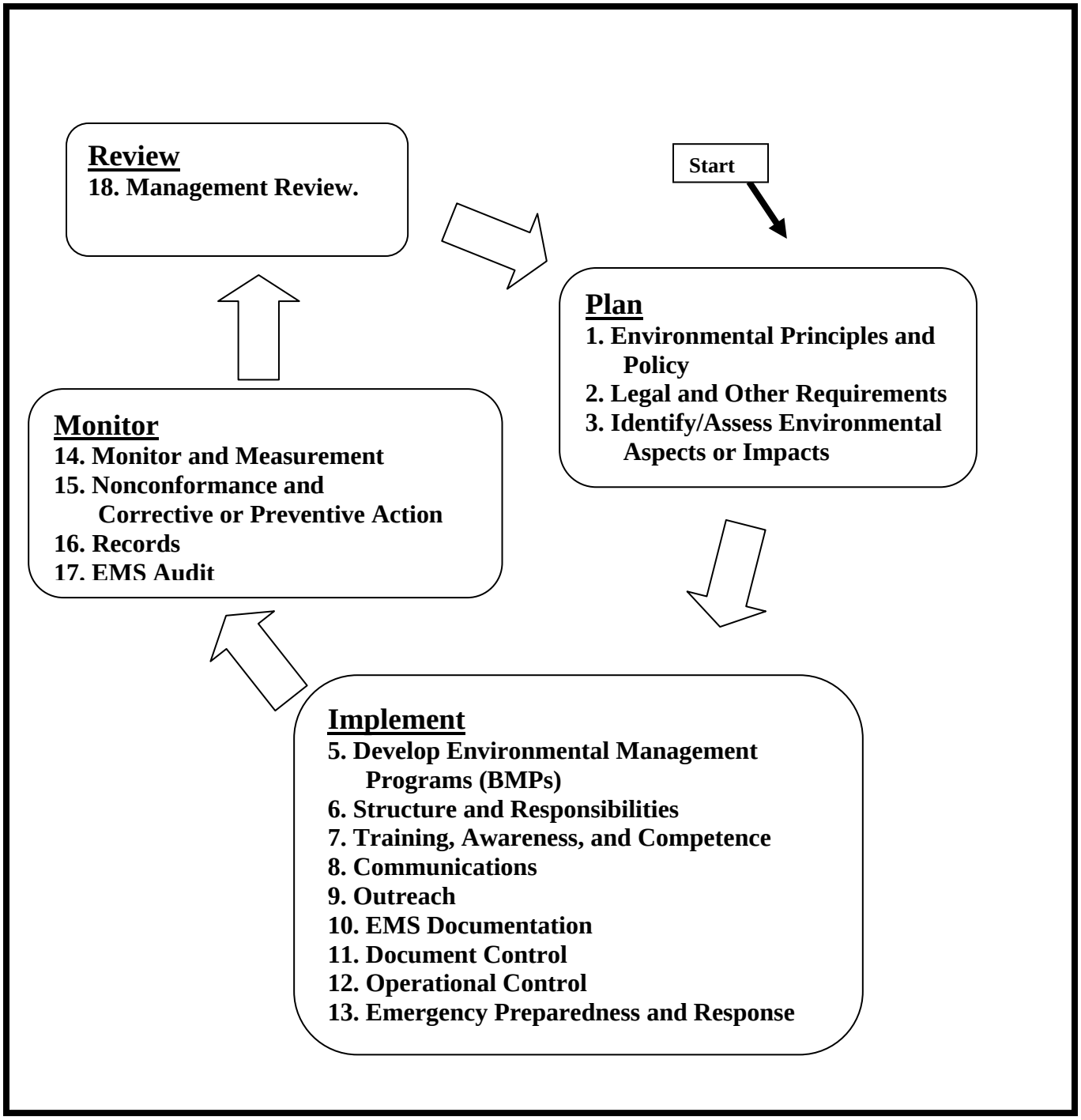
Key EMC components appropriate for golf clubs are suggested as: **Plan, Implement, Monitor, and Review.** These components are the framework for **18 practical steps or elements suggested for developing a golf course EMS plan**, and are illustrated in Figure 2.

As the EMS concept evolves within the golf course industry, the specific 4 key components and 18 steps/elements used in this document may be changed; but, for current educational purposes, these suffice to illustrate the EMS concept in outline form. Each of the 18 steps or elements of an EMS are briefly defined below, with greater detail presented in Section II.

<u>Plan (Initial Planning)</u>

1. **Environmental principles and policy** — Develop a statement of your organization's commitment to the environment. Use this policy as a framework for planning and action.
2. **Legal and other requirements** — Identify and ensure access to relevant laws and regulations, as well as other requirements to which your organization adheres.

Figure 2. Suggested elements or steps in a golf course EMS.



3. **Identity/Assess significant environmental aspects and impacts** — This step is an environmental review to identify environmental attributes of your products, activities and services. Determine those that could have significant impacts on the environment.
4. **Objectives and targets** — Establish environmental goals for your organization, in line with your policy, environmental impacts, the views of interested parties and other factor

Implement

5. **Develop environmental management programs (BMPs)** — For each environmental issue, an action plan (BMPs) is formulated. Plan actions necessary to achieve your objectives and targets. When formulating BMPs for each environmental issue, the club should clearly define past and current BMPs (management practices and structural improvements) they have already implemented as well as new ones planned.
6. **Structure and responsibility** — Establish roles and responsibilities for environmental management and provide appropriate resources.
7. **Training, awareness and competence** — Ensure that your employees are trained and capable of carrying out their environmental responsibilities.
8. **Communication** — Establish processes for internal communications on environmental management issues.
9. **Outreach** --- Establish processes for external communications on environmental management issues, especially in terms of community outreach.
10. **EMS documentation** — Maintain information on your EMS and related documents. This would include BMPs for each environmental impact issue.
11. **Document control** — Ensure effective management of procedures and other system documents.
12. **Operational control** — Identify, plan and manage your operations and activities in line with your policy, objectives and targets.
13. **Emergency preparedness and response** — Identify potential emergencies and develop procedures for preventing and responding to them.

Monitor (see Section IV)

14. **Monitoring and measurement** — Monitor key activities and track performance. Conduct periodic assessments of compliance with legal requirements.
15. **Nonconformance and corrective and preventive action —** Identify and correct problems and prevent their recurrence.
16. **Environmental Records** — Maintain and manage records of EMS performance.
17. **EMS audit** — Periodically verify that your EMS is operating as intended.

Review (see Section V)

18. **Management review** — Periodically review your EMS with an eye to continual improvement**.**

2.2. EMS Related Programs in the Golf Industry

Currently, within the USA there are environmental programs in various venues for golf facilities that contain EMS aspects but are not full EMS programs. Similar movements are occurring in other

countries with the EMS approach becoming widely used by golf clubs in Australia and many areas of the EU (Fletcher, 2006; MacKay 2006). Related programs in the USA and other countries are:

1. Audubon International Programs. Audubon has three programs that are strongly based on the EMS model (http://www.auduboninternational.org/). Their programs illustrate the necessity for flexibility within an approach and for adapting any environmental approach, including the EMS concept, to encompass new developments or additions (planning, construction, long-term management), as well as existing facilities. Recently, Ron Dodson, President and CEO of Audubon International published the book *"Sustainable Golf Courses—A Guide to Environmental Stewardship"* that elaborates on many of the key environmental issues encompassed in the EMS concept when applied to golf facilities (Dodson, 2005).

a) Audubon Cooperative Sanctuary Program which is for existing land use areas and where "Participation helps people plan, organize, implement, and document a comprehensive environmental management program and receive recognition for their efforts." Infrastructure standards are strongly recommended but not required for certification such as those for the maintenance facility. This program incorporates 6 Key Environmental Components with each incorporated into a site assessment and environmental plan. Audubon offers, *"A Guide to Environmental Stewardship on the Golf Course"*, which incorporates the 6 components mentioned below.

- Environmental Planning
- Wildlife and Habitat Management
- Chemical Use Reduction and Safety
- Water Conservation
- Water Quality Management
- Outreach and Education.

b) Audubon Classic Program where "The Classic Program falls between Audubon International's Audubon Cooperative Sanctuary Programs for existing land uses and the Signature Programs (which work with projects in the planning stage of development through construction and long-term management). The Classic Program is based upon Audubon International's experience with the Signature Programs; taking into account that properties in it will already have been developed for certain uses and might to some extent be constrained by the prior development. Like the Signature Programs, the Classic Program takes an approach that is flexible and adaptable to almost any type of property, including redevelopment or restoration projects, in any country."

c) Audubon Signature Program, as noted, relates to projects in the planning stage of development through construction and then into long-term management. They have three program levels with the Gold program exhibiting the most similarity to a comprehensive EMS.

- Audubon Signature Program—Gold. "For landowners and developers who strive to integrate environmental quality, integrity, and sustainability into a new development, Audubon International invites participation in the Gold level. This designation is reserved for members who establish a partnership with Audubon International prior to the siting and design of the project. A team of experts from the Audubon International Environmental Department prepares an Environmental Master Plan for all aspects of the property, including site-specific strategies for natural resource management, architecture, sustainable building and infrastructure, landscaping, and community education. Gold

Program projects involve on-going monitoring and research and require a long-term commitment to showcase principles and practices of environmental sustainability."

- Bronze and Silver member levels are available as well with each involving the Natural Resource Management Plan either developed by the landowner or AI representatives depending upon the level. An on-site audit is required for the Bronze plan where the management plan is completed by the landowner. The silver plan is developed by AI ensuring all the proper elements are included.

2. Environmental Institute of Golf (EIFG) (http://www.eifg.org/). The EIG is a component of Golf Course Superintendents Association of America and their web-site is a portal for considerable environmental information related to golf clubs. The EIFG web portal and environmental assistance tools or programs are evolving and many of these resources have a direct interest to EMS aspects; however there is not specific EMS documentation.

3. The U.S. Air Force's Golf Club Environmental Management (GEM) program. The Air Force mandated that all installations "develop and implement an environmental management system (EMS) to sustain, restore, and modernize natural infrastructure to support mission capability". GEM is an EMS designed for golf facilities situated within the military structure and method of operation. Elements include (http://www.afcee.brooks.af.mil/ec/golf/default.asp):

- Provide a unique approach to melding sound ecosystem-based environmental practices into a comprehensive and holistic approach to golf course management.
- Implement a systematic, process-oriented approach will allow for the utilization of each idea or theory of management as it applies or doesn't apply at each course. The free interchange of ideas is paramount for this concept to succeed.
- Facilitate the creation of an environmentally friendly golf course facility for its customers.
- This EMS utilizes and evaluation process called Golf Course Evaluation Baseline Assessment (GCEBA), documentation, implementation, evaluation, and revision.
- A tool called the Environmental Compatibility Quotient (ECQ) is used for each participating course. This tool uses questions and a rating system for each yes, partial, or no answer. An actual and potential quotient is then provided for each course. Some of the questions, like those related to military operations, may prohibit courses from having a perfect 100 quotient. Therefore, the potential quotient is used in lieu of the percentage like the environmental performance audit uses.

4. The Michigan Turfgrass Environmental Stewardship Program (MTESP): This program is an EMP developed through collaborative efforts of Michigan State University, government agencies, the turfgrass industry, and advocacy groups. It has a defined mission of which one element is: "to advance the environmental stewardship of Michigan's golf industry by increasing the awareness and understanding of Michigan's environmental resources, the potential impacts of golf turf management, and elevate the level of pollution protection."(http://mtesp.org/). The MTESP has elements that an EMS would incorporate, but isn't an EMS or EA.

5. Golf Clubs with an EMS. Some golf facilities have developed an EMS based on the ISO 14001 standard such as Colonial Acres Golf Course (Glenmont, NY), Tan Tara Golf Club (North Tonawanda, NY), and Meadowcreek Golf Course (City of Charlottesville, VA), while others like Old Collier Golf Club of Naples, FL are in the process of developing an EMS.

6. Environmental Business Solution's e-PAR (Australia). The e-PAR program was developed by Terry Muir of EBS Australia in conjunction with the AU EPA and Australian Golf Course Superintendents Association and is the most advanced program applying the EMS concept to golf courses in the world (http://www.epar.com.au/brochure/Default.aspx). Their program is described as: "EBS Australia has developed a software program that simplifies the environmental management process with an innovative program called e-par ®….. Using e-par your portfolio will quickly grow to include:- environmental performance reviews, environmental policy statement, environmental risk assessments and procedures, environmental legal register, environmental objectives register, environmental action plans, your environmental organizational structure, environmental training analysis and register, environmental induction booklet, environmental communications matrix, environmental manual, environmental document control procedures, standard operating procedures for significant activities, environmental emergency response procedures, environmental monitoring register, environmental audits. Your portfolio will be housed electronically within the e-par server and hardcopy documents retained in your e-par folder".

7. Club Managers Association of America's Environmental Performance Audit. The CMAA environmental audit states that it, " is an internal, self-assessment or evaluation that uses standard, widely accepted environmental management practices to measure overall environmental performances."< http://www.cmaa.org/onlinesurveys/environmentalaudits/EAdetail.asp?lngEAID=1>. The EA focuses on six key components including planning and is divided into components of golf facilities such as buildings and sports amenities. It utilizes a rating or scoring system called an index to identify performance based upon points for yes or no answers. A general rating on performance is then given by the percentage of points divided by the total possible points with an on-line tool that is free. This is not an EMS or EMP, but could potentially be used to develop an audit for and EMS, provided it addresses all the audit criteria listed in the EMS.

8. Other. Environmental management on golf facilities is a topic of concern around the globe. MacKay (2006) recently surveyed a number of organization web-sites containing information on some aspects of environmental stewardships on golf courses.

In the USA as the EMS concept becomes more defined and developed, various entities will create tools, programs, literature, and other resources to assist golf clubs in efficiently developing their site-specific EMS or in auditing of EMS. Organizations or groups likely to provide assistance in these endeavors are:

- Audubon International Programs and Resources. To-date, Audubon International has developed the most comprehensive programs and documents that related to golf course environmental management and auditing that could be adapted to the EMS concept. USGA Resources and Programs
- EIG/GCSAA Resources and Programs
- Private Industry Resources and Programs.
- University Resources and Programs
- Golf related organizations

2.3. EMS Benefits and Costs

Since the EMS approach to management of environmental issues is voluntary and integrated into daily management of a facility, the aspects of benefits and costs related to an EMS are important

components in development and implementation of a facility EMS. Implementation of an EMS entails benefits to a business as well as costs. Benefits and costs of EMS in terms of both business and environmental aspects are summarized from the EPA website (http://www.epa.gov/ems/info/costben.htm) and include many of the following:

Benefits to a Business

- Improve overall environmental performance
- Prevent pollution
- Save money on landscape maintenance, energy, materials, etc.
- Enhance existing compliance efforts related to environmental aspects
- Reduce or mitigate risks and liabilities
- Exhibit environmental due diligence
- Increase efficiency
- Reduce costs
- Enhance employee morale and possibly enhance recruitment of new employees
- Achieve/improved employee awareness of environmental issues, responsibilities, and initiatives
- Promote a positive, proactive corporate image related to environmental issues and club achievements with public, regulators, lenders, investors.
- Qualify for recognition/incentive programs such as the EPA Performance Track Program (http://www.epa.gov/performancetrack/)

As noted, development and implementation of an EMS by a golf club demonstrates to the public and regulators a proactive attitude toward environmental stewardship that does enhance the corporate image. However, positive benefits of a golf facility to the community "stakeholders" encompass more than the environmental aspects; and all benefits should be included in the EMS – i.e., job creation, impact on the local economy, recreational goods and services provided, positive environmental contributions. Too often in the past, when discussing a particular environmental issue that may have high visibility among environmental activists or the public, only the negative aspects were included without the counterbalance of benefits or positives (Table 1). The authors recommend that a club include such information in their EMS, perhaps as an appendix document for educational purposes.

A EMS program and associated document, can be valuable tools for planned outreach and educational efforts by a golf course (see Chapter 4, section on Outreach and Education). A good outreach and educational program involving club officials can result in significant benefits at the community level.

Costs to a Business

- An investment of internal resources, including staff/employee time
- Costs for training of personnel
- Costs associated with hiring consulting assistance, if needed
- Costs for technical resources to analyze environmental impacts and improvement options, if needed.

Table 1. Benefits that turfgrass sites contribute (after Beard and Green 1994; Beard, 2006; Butler and Maronek, 2002: Carrow, 2005; Cathy 2002; Gibeault 2002).

Functional/Environmental

Protection or Enhancement of Soil Resources and Quality

- Prevent soil loss from wind erosion---a primary reason turfgrass is used as a groundcover.
- Protect for soil loss by water erosion---a primary reason turfgrass is used as a groundcover.
- Contributes soil organic matter and enhances soil quality/health---physical, chemical, biological/microorganism aspects

Protection and Enhancement of Water Resources.

- Reduce sediment movement into water features---a primary reason turfgrass is used as a groundcover.
- Capture water from runoff for soil moisture recharge
- Entrapment of organic chemical pollutants and enhances degradation
- Many turfgrass sites incorporate wetlands, surface water capture, trees, shrubs, naturalized environmental areas

Climatic Enhancement and Protection

- Reduces/moderates climatic temperatures
- Reduces sod/soil surface temperatures on sports fields and turfgrass areas used for enjoyment
- Reduce air borne dust and associated health problems
- Fire protection by providing a green zone that is not combustible (firewise landscaping)
- Glare reduction
- Air pollution control

Recreational

Integral part of many community, school, professional sports---soccer, golf, football, baseball, lawn bowling, tennis
Enhances youth and adult participation and enjoyment in outdoor activities and sports
Contributes to a safe playing environment for athletes---cushioning and surface stability, smoothness
Contributes to spectator enjoyment
Low cost, living surface that can be self-repairing

Aesthetic

Beauty contributes to quality of life
Feeling of mental well-being---horticultural therapy
Community pride
Ornamental compliment to trees, shrubs, and flowers
Allows individuals to express themselves and influence their surroundings through individualized landscape activities

Economic

Direct revenues, taxes, jobs from sporting events and golfing in the local economy
Enhancement of tourism---in some cases tourism is build around golfing
Parks, sports venues, golf courses, and landscape industry contribute jobs, money and taxes
Suppliers of turfgrass equipment, supplies, and services contribute jobs, money, and taxes in the economy
Enhanced home and properties values and, therefore, greater tax revenues

Contributes to purchase of non-turf items goods and services in the community ---restaurants, dry cleaners, service stations, transportation, hotel and resort accommodations, sports equipment

2.4. Some Key Implications

In reviewing, the previous material related to golf clubs and movement toward an EMS approach to managing environmental issues, several key issues are worth reiterating:

- The EMS concept is promoted by regulatory agencies on an international basis as the best means to mitigate or manage environmental issue for all businesses or entities that have potential environmental impact.
- EMSs are for all facilities of an industry – i.e., all golf clubs will very likely need to develop their own site-specific EMS plan. In contrast, current environmental issues are normally focused on one at a time in separate programs and documents.
- The EMS concept binds together all environmental issues on a facility – i.e., all environmental issues are assessed and management plans developed and implemented for all environmental issues on that facility. In the author's opinion, this is a positive benefit of the golf industry. Currently, when environmental activists or regulatory agencies raise concern related to golf clubs it is normally on a single issue without a holistic consideration of all benefits and costs to all potential stakeholders. An EMS provides a venue to bring these aspects into the discussion, since they are components of what of an holistic EMS.
- The term Environmental Management Systems (EMS) truly reflects the nature of EMSs. For example, an EMS is: a) a new management approach, b) for the whole system, c) for all environmental issues, and d) for daily environmental management decisions at all management levels within an organization to be the normal practice.
- Since EMS is for the whole facility, upper management and organization-wide commitment are necessary. This entails organization-wide training.
- An EMS allows combining together into one system the various BMP for each particular environmental issue. Thus, EMS is based on the BMP model to mitigate and manage environmental concerns – and the BMP model is the "gold standard" developed by the US EPA (Carrow and Duncan, 2007). BMPs arose out of the Clean Water Act of 1977 and, therefore, the concept has had 30 years to be refined. Thus, as the name implies it is the "best management practices" --- an entity cannot be expected to exceed "the best" as a model to deal with environmental issues.

Section II.

PLAN--IMPLEMENT--MONITOR--REVIEW

In this section, each of 18 key elements will be presented in sufficient detail as related to golf clubs to understand the concept. For more detailed EMS information useful to any organization interested in understanding the EMS concept and initiating development of an EMS, the US EPA web-site on "Basic Information" can assist in defining some of the planning issues (USEPA, 2007) http://www.epa.gov/ems/index.html. Additionally, the on-line publication by Stapleton et al. (2001; http://www.epa.gov/OW-OWM.html/iso14001/wm046200.htm) is a good step by step discussion of each element; however, the management and organizational aspects within this document are designed for larger enterprises than golf clubs and may be too detailed and cumbersome for golf clubs. The basic tenets must be adjusted to the size and organizational structure inherent in the specific club. While an EMS should contain the basic structure and elements presented in the above documents, EMS are voluntary and allow flexibility to adapt to various industries, organizations, and entity.

The initial planning phase when developing a golf club EMS will involve: understanding EMS concepts; development of an organizational structure for initial planning of EMS; development of club principles of action for environmental issues; development of an environmental policy statement; becoming familiar with legal/regulatory requirements; planning for site assessment to identify significant environment issues; and establishing targets and goals. Since these considerations are "initial planning", as an EMS progresses it may be necessary to make revisions as the club's knowledge base grows. An EMS is based on making changes as needed.

Initiation of an EMS will influence organizational structure to some extent in the short and long-term. Two components of the organizational structure at the initial phase of EMS development to consider are:

- Club Organizational Structure for EMS planning. Organizational structure would be whatever is deemed appropriate. Since an EMS involves all aspects of a facility and is to be an on-going process, these should be considerations in organizational planning. Critical to the planning process is involvement of top management.
- Resource Advisory Group. Beyond involvement of club officials, an important aspect of EMS is to involve others from the community that are interested in the environment and specialists that can provide technical assistance. The Resource Advisory Group may change overtime, but clubs are encouraged to initiate this group early in the process.

After significant environmental issues are identified (discussed in Section II), then further planning will be required to focus on addressing issues by BMPs, EMS document development, monitoring auditing, and review. At that time, a club may or may not develop a somewhat different organizational structure related to EMS plan implementation/management, monitoring, and reviewing. Since EMS is an on-going, cyclic process with environmental management decisions to be made as a part of routine management, it is important to develop a management structure to facilitate this process. As noted, when reviewing documents written by the EPA or other groups, the organizational structure is often stressed to a greater extent than necessary for clubs; primarily because these documents usually are more

appropriate for traditional business organizations larger than most golf clubs. As a general rule, clubs are encouraged to adopt simple organization structures, at least until there arises a need for more complex ones--- i.e., simplify.

Chapter 3. Plan.

Plan
1. Environmental Principles and Policy
2. Legal and Other Requirements
3. Identify/Assess Environmental Aspects or Impacts
4. Objectives and Targets

3.1. ***ELEMENT 1*. Formalize Sustainable Environmental Principles and a Policy.**

Prior to defining an "Environmental Policy Statement", it is useful to determine a **statement of sustainability/enhancement principles** related to primary environmental management that the facility commits to operate under for issues such as: site assessment; habitat sensitivity, native and naturalized plant use and landscaping when feasible; water conservation; protection of surface and subsurface water quality; water features; irrigation water management; waste management; energy conservation and renewable energy sources; greenspaces and corridors; site design; transportation; building design. Dodson (2005) has an excellent discussion/listing of principles for most of the issues listed above as does Audubon International (2007) http://www.audubonintenational.org/resources/principles.htm. The development and listing of basic "sustainability/enhancement principles" under the above headings is a good means to: a) initiate education of club personnel concerning what environmental issues would be included in an overall EMS; b) clarify the club organizational goals, and c) formalize the foundational principles for on-going decision-making related to the environment management (EMS).

With a solid understanding and adoption by a club of the foundational sustainability/enhancement principals guiding environmental management decisions, a concise **Environmental Policy Statement** can be formulated as the top management's declaration of commitment to the environment. Policy should include four key commitments:

- Commitment to continual improvement.
- Commitment to environmental management to foster sustainability and enhancement of environmental resources.
- Commitment to compliance with relevant laws and regulations.
- Commitment to share information on environmental performance with the community

3.2. ***ELEMENT 2*. Identification of Legal/Regulatory Requirements.**

Developing an EMS is voluntary and does not add new regulations. But, it does bring together management of all environmental issues impacts of a facility; and knowledge of the applicable laws and regulations is necessary to insure compliance. Thus, the initial planning phase, compiling information on laws, regulations, and permitting that must be considered relative to various environmental aspects is an important step. Means of obtaining information on applicable laws and regulations include:

- Commercial services with updates
- GCSAA Compliance web-site for member (http://www.gcsaa.org)
- USEPA web-site **www.epa.gov**
- Consultants and attorneys
- State compliance assistance programs

3.3. ***ELEMENT 3.*** Identification of Significant Environmental Impacts.

Approach. In this step, how the club interacts with the environment is assessed by identifying the clubs environmental aspects and impacts and determining which are significant. Some of the environmental aspects may be regulated, while others may not be. A comprehensive assessment of environmental impacts may require outside assistance and involve considerable effort. However, a comprehensive assessment is normally a one time process. It would involve the whole golf facility – course, other grounds, clubhouse, maintenance, etc.

When reviewing the general information on EMS concepts by the USEPA or other sources, the documents will not contain specific information on this element since the particular environmental impacts are specific to an industry. However, this step is "the key element" in ultimately developing a successful EMS.

During the environmental impact assessment process, information related to other important elements will likely arise. As environmental aspects/impacts are identified and assessed, clubs should identify specific products, operations and activities from which these aspects/impacts arise. Likewise, any monitoring that is performed of these operations or activities for environmental purposes can be noted. For example, if generation of waste products is noted as a significant environmental aspect, it would help to know which operation(s) generate the wastes. It might also help to know whether these are monitored or otherwise measured in some manner. Thus, during the environmental impact assessment, the following information may arise that will assist in later EMS steps.:

- Current management practices to mediate or manage the particular environmental impact.
- Infrastructure improvements that are or have been made to mediate or management the particular environmental impact.
- New or alter practices or infrastructure improvements to improve BMPs for the issue may be identified or become apparent
- Monitoring practices already in process.
- Monitoring practices that will be necessary in the future.

As a reminder of an earlier point, we encourage golf clubs to carefully define what current practices and current/past infrastructure improvements have been made to assist in alleviating or preventing a particular environmental issue. In the later section on Water-Use Efficiency/Conservation, examples are

provided of practices and infrastructure improvements that many clubs have instituted but may not be readily recognized by regulatory agencies, environmental activities, or the general public. A general estimate of costs associated with current practices and infrastructure improvements would be useful in demonstrating the commitment of the club to more sustainable environmental management.

Primary Environmental Issues. The primary environmental issues in the environmental assessment are summarized in the remainder of this section. If after the assessment a particular issue does not reveal an environmental problem or concern, it still should be included in the EMS along with any BMPs and monitoring that is related to the issue. More detail is provided for particular environmental issues which have received less attention in past environmental assessment schemes, while for more recognized issues less detail is provided. For all issues, sufficient detail is given to define the issue. Readers may wish to refer to section 2.2 "EMS Related Programs in the Golf Industry" for various sources of information on environmental issues. Good sources that are more comprehensive are: Audubon International (2007, 2007a), Dodson (2005), and EIFG (2007).

Environmental Planning and Design of New Golf Courses, Additions, or Renovations

In most instances, an EMS will be developed for an existing facility, but sometimes an addition or renovation may be involved at the facility. In other cases, an EMS may be developed as part of a new development and would involve environmental issues from construction to on-going management of the site once construction is completed. In this section "Environmental Design Concepts" that can be applied to additions, renovations, or new courses can be summarized. Since the environmental issues of most concern during construction are discussed in later chapters for existing facilities, we will only highlight the main issues in this section. Dodson (2005) contains considerable related information.

1. Constituents of Surface and Subsurface Drainage. Important constituents that may occur in the water from on-site management (pesticides, nutrients, sediments) or be within the irrigation water (salts) should be considered.
    - Inlet Control Practices.
    - Vegetative Practices
    - Infiltration and Percolation Practices.
    - Drainage Features
    - Restricting Salt Additions
    - Outlet Control

2. Stormwater and Water Management.
3. Open spaces
4. Green Building Concepts.
5. Protection of natural resources/identification of environmental resource areas. Design should consider the impact on any of the natural resources --- soil, water, energy.

Sustainable Maintenance Facility Design

Key principles of sustainable maintenance facility design and operation include several considerations (Dodson, 2005; Audubon International, 2007a http://www.audubonintemational.org/e-Source/pdfs/G-E%20Maintenance%20Facility%20BMP%20Checklist.pdf).

1. Past and Current Activities Related to Environmental Facility Design Aspects.

2. Maintenance Building and Shop Design and Operations for Water and Energy Efficiency
3. Fuel Island and Storage
4. Pesticide Storage and Mixing/Loading
5. Wash Pad
6. Facilities for Disposal of Chemicals—oil, batteries, etc.

Turfgrass and Landscape Plant Selection

In a later section (Wildlife Habitat Management), habitat selection related to wildlife is noted, but here the focus in on turfgrass and landscape plant selection on the playing area of the course. Proper turfgrass and landscape plant selection impacts management to a great extent and particular environmental issues, such as water conservation, nutrient requirements, and pesticide needs. The idea of this section is to illustrate that multiple factors must be considered when choosing plants. A plant adapted to the climate, site use, and soil provide the first line of defense against pests, while the addition of specific pest resistance or tolerance provides additional benefits in terms of reducing pesticide use. However, without abiotic, edaphic, and use-related stress tolerance, the biotic resistance/tolerance is much less effective. Considerations for plant selection include:

a. Climatic Stress Tolerance/Adaptation. Can include water-use efficiency/conservation in this section; high temperature tolerance.
b. Site Use and Use-related Stresses. Include mowing height stress tolerance and traffic tolerances in this section.
c. Soil and Water Quality Stresses. Can include nutrient-use efficiency in this section as well as salt tolerance.
d. Design and Functional Uses.
e. Local/Regional Pest Stress Resistance

Water-Use Efficiency/Conservation

Demonstration and documentation of water-use efficiency/conservation are critical for golf courses and other turfgrass areas since water quantity and quality issues will likely be the most predominant environmental challenges for the golf course industry in the future. Carrow et al. (2007; www.georgiaturf.com) provide a guideline template to determine current and anticipated future water needs as well as numerous BMPs to enhance water-use efficiency/conservation. An important water conservation BMP is to use alternative irrigation water instead of potable water. This aspect is discussed in the next section as a separate issue.

Achieving water-use efficiency/conservation on a golf course is a complex challenge, especially if alternative irrigation water sources are necessary that may be of lower quality compared to potable water. Strategies involved in a comprehensive water-use efficiency/conservation plan include (Carrow et al., 2007):

1. Selection of turfgrasses and other landscape plants for water use efficiency and drought resistance
2. Use of non-potable water sources for irrigation---alternative water sources; water harvesting/reuse.
3. Efficient irrigation system design and devices for water conservation.
4. Efficient irrigation system scheduling/operation. Both irrigation system design and irrigation scheduling in the future will requires much more site-specific information. Sensor technology

integrated into a GPS/GIS approach will assist in development and interpretation of information for improved irrigation systems and scheduling.

5. Golf course design for water conservation.
6. Altering management practices to enhance water-use efficiency---soil amendments; cultivation; mowing; fertilization; etc.
7. Indoor water conservation measures in facility buildings. Conservation strategies for landscape areas other than the golf course and
8. Education. Plan for initial and continuing education on water conservation/management by golf course superintendent, crew, club officials, etc. BMPs for turfgrass water conservation is complex and when poor irrigation water quality is involved the level of costs and complexity greatly increases ---i.e., fertilization, leaching of salts, salt disposal/hydrological issues, complex irrigation systems and scheduling of irrigation, these are some of the complex issues.
9. Development of conservation and contingency plans. A formal BMPs document should be developed and agreed on by all club officials and members so that the golf course superintendent has support for any reasonable science-based measures to be taken. Also, a written plan may be required by regulatory agencies.
10. Monitor and revise plans.

Assessment of water-use efficiency/conservation should be done with attention to the future since it may involve costly and time-consuming challenges related to the various strategies, especially irrigation system design, irrigation system capability for scheduling, landscape design alterations, and changes necessary for use of one or more alternative irrigation water sources. Ultimately the BMPs plan for water conservation within an overall EMS can be no better than the information that goes into the decision-making process. Thus, site assessment in this area is especially important.

In most cases, development of a comprehensive BMPs water-use efficiency/conservation plan for a golf course is a process that is best done over a 1-2 year period, especially if alternative irrigation water sources or poor water quality sources are part of the plan. In other cases where the water supply is known and adequate in quantity and quality, site assessment is somewhat easier. In other instances, the "site assessment" or information gathering process requires contracting companies to do detailed water audits of the existing irrigation system, water source options along with water quality assessment, and other rather complex information gathering tasks. Carrow et al. (2007) presents a detailed discussion of these factors, including irrigation system design. Thus, an initial plan can be made but may change over time as additional information is gained---for example, an anticipated irrigation water source may be deemed unacceptable due to quality or quantity constraints after a more detailed assessment is conducted. Thus, the initial EMS plan may be developed with a central component of the plan consisting of lay out how and when the full site assessment information may be obtained; and then integrated into a future plan. That is the nature of EMS and BMPs --- not all the answers to questions need to be obtained before an initial plan is developed.

Within each of the primary environmental issues that may be evaluated/assessed on a golf course, it is important to determine during the assessment process what has already been accomplished by the course with respect to the issue. This step is essential because:

- Aids in bringing together the whole management team at a club (superintendent, club officials, pro, etc) and club members to better understand various environmental issues and how they have responded.
- Assists in establishing a common understanding of what is involved in development of a BMPs plan for each issue (i.e., scope, terminology, components).

- Clarifies for the club what practices and infrastructure measures are already instituted---these become a benchmark for further improvements in management practices and infrastructure.
- Documents for regulatory agencies that the club is not starting at "ground zero" with respect to water conservation; and that considerable time, effort, and resources have been expended toward water conservation in the past. Many times these past improvements are overlooked by regulatory agencies and even club officials---golf courses may improve environmental programs by new measures, but that does not mean they are just starting in this endeavor or starting from "ground zero".
- Aids in establishing a benchmark for future actions based on past.

As an example to illustrate reporting of past of practices or infrastructure changes related to an environmental issue, a club may have already implemented under their current BMPs for water-use efficiency/conservation such aspects as:

<u>Management, Personnel, and Education Aspects</u>

1. Scouting – costs
2. Hand watering – hours and costs
3. Night watering capability
4. Staffing in irrigation control and irrigation maintenance –Irrigation Assistant
5. Traffic controls and costs
6. Management for water conservation
   a. Height of cut
   b. Soil cultivation to promote root depth
   c. Evapotranspiration utilization for irrigation scheduling
   d. Selection and installation of drought resistant landscape plants
   e. Natural vegetation areas
   f. Fertilization practices to minimize water use.
   g. Pest management – early morning or late evening applications to reduce water loss. Consideration of Integrated Pest Management protocols.
   h. Wetting agent usage.
7. Record keeping and costs
8. Goal setting regarding water-use efficiency/conservation.
9. Education Efforts –Education taken by superintendent or any club official related to water conservation, list benefits of golf courses and turf areas; publish water conservation plans; engage stakeholders (members, patrons, neighbors, general public) with the benefits of water conservation.

<u>Infrastructure Improvements</u>

10. Grass selection and establishment– adapted species and cultivars or climatic/soil conditions. Use of drought resistant grasses, such as bermudagrasses.
11. Rain, leak, etc. loss controls and costs
12. Current irrigation controls and hard costs (parts, power)
13. Irrigation design and control improvements --- zoning of heads into similar water use areas; irrigation system design to take into account factors that influence water-use efficiency (slope, soil type, wind, etc);
14. Possible irrigation methods (plant-based, soil-based, budget approach, deficit, atmosphere based). On-site weather station.
15. Use of alternative (non-potable) irrigation water sources --- reclaimed, water-harvesting from

runoff, stormwater, saline sources, etc.

16. Metering – installation and ongoing calibration and replacement
17. Infrastructure improvements made due to using alternative irrigation water --- water treatment; soil treatments; extra cultivation, drainage, etc.

As the above list illustrates, a club may already be investing considerable efforts into alleviating particular environmental issues. An EMS allows reporting of these activities.

Irrigation Water Quality Management.

As a part of the environmental assessment/information gathering phase in the initial EMS, near-term or long-term changes in irrigation water sources should be reported and how they will impact overall water conservation aspects. Use of alternative irrigation water sources, rather than potable water supplied by a municipal water treatment system, is not a new practice to many golf courses and other large turf areas (Carrow et at., 2007). However, this is now becoming the normal practice in many areas as competition for potable water increases (Snow 1994: Thomas et al. 1997; Huck et al. 2000). Alternative sources of irrigation water include:

- Larger streams, rivers, and flowing watercourses,
- Surface water in natural or constructed lakes, ponds or impoundments fed by streams, springs, or diversion channels from flowing water sources,
- Irrigation or drainage canals,
- High flow (flood) water diversion into storage ponds (type of water harvesting),
- Ponds fed by surface runoff from surrounding terrain during normal rainfall events (type of water harvesting),
- Storm runoff from impervious surfaces captured in retention ponds (type of water harvesting),
- Ground water from deep or shallow wells,
- Ground water from aquifers not suitable for potable purposes due to high salinity, but can be used on salt tolerant grasses,
- Reclaimed water (water reuse, wastewater, effluent) --- tertiary effluent from a sewage treatment plant for reuse in golf course irrigation.
- Recycled water. Examples are: a) water collected from the drainage and/or stormwater lines of a golf course plus associated housing development, treated by a private treatment facility for irrigation quality, and then used for irrigation; or b) wastewater from a golf course plus associated housing development applied to a forested spray field, then wells are used to recover the water for irrigation. In this instance the soil as a filter is the “water treatment”.
- Seawater or seawater blends on salt-tolerant (halophytic) grasses..
- Desalination technologies to remove excess salts from seawater or other highly saline waters.

A feasibility study that analyzes water supply sources usually requires a qualified professional consultant to evaluate all potential sources with respect to supply adequacy, economic viability, engineering considerations, and environmental impacts. Some general considerations that may apply to one or more of the sources are listed below; and much of this information may be reported in the BMPs section of the EMS document.

- Location of the source.
- Development needs, costs, and potential problems relative to a water supply,

- Design and installation costs for wells, ponds, well-field layout, pumping, distribution lines, and other facilities.
- Pond/lake location, construction, and inflow/outflow features.
- Pond/lake seepage control measures.
- On ponds or lakes where water withdrawal may exceed water recharge, especially in the summer, the influence of a drop in water level may have on fish, aquatic plants, and growth of undesirable plants along the exposed shore. When these water features are a part of a housing development, these issues are of concern to these individuals.
- Determination of water rights, competition for a source, permitting, regulatory negotiations,
- Regulatory issues related to maintenance of in-stream flow for aquatic organisms, habitat, dilution needs, or the needs of other users,
- Regulatory issues concerning permitting for use of the water source that is under consideration,
- Investigation of any incentive programs for the use of a particular water source,
- Determination of any regulations requiring use of effluent water,
- Determination of how effluent water will be transported and stored on a site.
- Watershed analyses may be necessary to estimate the potential runoff capture in order to design and locate storage ponds. These analyses should be conducted along with a site assessment for drainage features and any storm water runoff features required on a site.
- Sheet flow of water into ponds can be enhanced by use of uniform turf areas and grass waterways from fairways and rough and non-use areas.
- When considering surface water collection into ponds, appropriate buffer zones should be used to avoid water quality protection.
- Well yield and drawn-down determinations.
- Stream flow during dry periods versus irrigation demand,
- Reliability and water volume both in the long-term and over the seasons of a year for all water sources. Included should be the anticipated effects of any water use restrictions that may apply to a water source during drought periods.
- Investigate any pricing regulations or water price structures.
- Investigate any water rebates or other incentive plans for using water conservation practices or devices.
- Characterization of the underlying aquifer, which is the process of quantifying the physical and chemical features of an aquifer that may influence ground water or the potential for contaminant from an alternative irrigation water source. With more saline irrigation water that requires a leaching program, the potential for contamination of the existing aquifer must be determined. If this potential exists, very careful contouring and sub-surface drainage with an appropriate outlet is necessary (Huck et al. 2000; Carrow and Duncan 1998).
- A complete water quality test for any natural constituents in the water as well as any contaminants. Any permanent grasses must be able to tolerate the salt levels in the water; as well as any overseeding grasses.
- Potential to use an aquifer that is not used for potable purposes, but may be suitable for irrigation.
- Potential for interaction of water removal from a source on wetlands, streams, sink-hole problems, etc.
- Energy costs to move water. This should be for well pumps and for transfer pumping costs --- whether in pipelines or to pump from one pond to another.

- When more than one water source is used, consideration should be given the potential loss of one or more of the sources due to drought, increased costs of maintenance, regulatory, or other reasons; and to the ramifications of losing a source.
- Costs associated with treatment of water prior to irrigation use. In recycling of storm/drainage waters for irrigation, treatment may encompass a typical water treatment facility. For use of desalinized water, the RO or other treatment facility would be a significant cost. The most common water treatment is for irrigation water containing high sodium in conjunction with high bicarbonates that interfere with use of calcium amendments to prevent formation of a sodic soil (Carrow et al.1999).

Determination of the water quality of each irrigation source is essential (Carrow and Duncan, 1998). As the quality of water used for irrigation on many golf clubs, declines in response to switching to nonpotable sources, constituents in some sources may contribute to potential environmental concerns. Thus, a good water quality test should include evaluation for not just the turfgrass but for other potential concerns such as:

- Salinity – impacts on turfgrass, soil, surface and subsurface waters, impact on flora and fauna in lakes and streams, discharge or sequestration of salts, etc.
- Sodic soil impacts --- soil physical properties, plants
- Nutrient/element toxicities – turf and landscape plants
- Nutrient/element influence on fertilization
- Health issues
- Other environmental issues --- eutrophication

Pesticides: Water Quality Management.

The Clean Water Act of 1977 was a Federal initiative to established BMPs to protect water quality and focused on pesticides, nutrients, and sediments as related to water quality protection (Rawson, 1995). Pesticide issues are still a central environmental concern for any entity using pesticides. Audubon International (2007a) fact sheets on "chemical use reduction and safety" as well as "water quality management" are good sources for information related to pesticides (and nutrients and sediment) as well as the GCSAA EIFG (2007) http://www.eifg.org/. Pesticide issues include IPM consideration such as:

a. Volatilization
b. Water solubility
c. Sorption
d. Plant Uptake
e. Degradation
f. Runoff---buffer zones
g. Leaching
h. Biological control
i. Cultural and mechanical practices
j. Pest resistant plants
k. Proper disposal of containers
l. Wash off areas

Nutrients: Water Quality Management.

As another component of concern in the Clean Water Act, nutrient fate is important and issues include:

a. Leaching control/prevention.
b. Runoff management ------ vegetative practices; structural improvements to remove, filter, detain, or reroute nutrients; water management to minimize nutrients.
c. Minimizing use --- soil/tissue testing; precision application of nutrients; spoon-feeding of nutrients; water management; etc.
d. Volatilization
e. Enhancing Nutrient Use Efficiency -- plant selection, plant nutrient-use efficiency, developing deep, viable roots.
f. Fertilizer Storage and Disposal of Containers.

Erosion and Sediment Control: Water Quality Management.

The third primary pollutant considered in the Clean Water Act is sediment and any constituents associated with it. The focus in this issue is on sediment as a pollutant. Sediment related assessment should entail:

a. Construction, Land Renovation, and Normal Sediment Management --- vegetative practices; structural improvements to remove, filter, detain, or reroute sediments; water management to minimize sediments.
b. Pond, lakes, and stream sediment quantification/analysis/management
c. Soil degradation by wind or water erosion (see next section)
d. Soil deposition onto landscape areas.

Soil Sustainability and Quality.

Sustaining/enhancing soil as a natural resource was a major national priority after the dust bowl days in the 1930's. Today it is again becoming a priority, especially in terms of agricultural lands and urban areas; and as following the 1930's, grass plays a key role in soil enhancement and sustainability (CAST, 2002; NRCS, 2007). **Soil quality** is the capacity of soil to function, in a natural or managed ecosystem for the purposes of: a) sustain plant and animal productivity; b) maintain or enhance water and air quality; and c) support human health and habitation. These attributes are expressed in soil as a natural resource through the functions of:

- Regulating water. Soil helps control where rain, snowmelt, and irrigation water goes. Water and dissolved solutes flow over the land or into and through the soil.
- Sustaining plant and animal life. The diversity and productivity of living things depends on soil.
- Filtering potential pollutants. The minerals and microbes in soil are responsible for filtering, buffering, degrading, immobilizing, and detoxifying organic and inorganic materials, including industrial and municipal by-products and atmospheric deposits.
- Cycling nutrients. Carbon, nitrogen, phosphorus, and many other nutrients are stored, transformed, and cycled through soil.
- Supporting structures. Buildings need stable soil for support, and archeological treasures associated with human habitation are protected in soils.

. Degradation of soil quality can occur from (NRCS, 2007):

1. Loss of organic matter.
2. Loss of microorganism/biotic diversity
3. Soil loss by erosion---wind and water.
4. Compaction,
5. Reduced infiltration, percolation, drainage
6. Saltinity or sodic conditions.
7. Soil pH/excessive acidity
8. Acid sulfate soil formation
9. Excessively sandy soil
10. Low water holding capacity.
11. Contamination by organic and inorganic constituents

Assessment related to soil sustainability and quality has not been a common occurrence for turfgrass sites. However, it should be because of possible practices that may degrade soils; but, also because numerous practices and infrastructure improvements routinely used on golf courses sustain and often improve/enhance soil quality. In urban areas, some of the best quality and functioning soils are on golf course sites. Changes in soil quality are reflected in soil properties that can change with management and/or climate. Key indicators of Soil Quality are:

- Soil OM content --- increased OM also means increased sequestration of CO_2 from the atmosphere.
- Soil microbial biomass
- Aerobic vs. anaerobic microorganisms
- C and N cycling
- CEC
- Nutrient status and balances
- Available water holding capacity
- Hydraulic conductivity/infiltration for water collection
- Leaching potential
- Plant and microbial activity/biodiversity
- Physical properties related to plant rooting

A soil sustainability and quality section in an EMS document for a golf club could be developed into two parts, one dealing with soil problems and the other dealing with the many locations on a typical course where soil quality enhancement is occurring. First for the problem areas: a) identify sites that exhibit any of the eleven soil degradation problems, b) develop BMPs for each site situation such as salt-affected soil sites or hydrophobic conditions, and c) state how these will be monitored in the future. By far the most challenging situation is salt-affected sites, usually due to saline and/or sodic irrigation water. This is an area that will require considerable expertise to develop a good site-specific BMP program (Carrow and Duncan, 1998).

Second, for the areas that soil quality enhancement is occurring, these should be high lighted and based on the key indicators of soil quality – remember that OM is a key indicator. At the same time, implementation of BMPs to deal with any soil problems as noted the previous paragraph should be included as additional soil enhancement activities. The grass lands of golf clubs have a good story to tell related to soil – one of our key natural resources.

Stormwater Management

"Stormwater management" has traditionally been confined to flood control and control/prevention of pollutants in the stormwater. With water competition and recognition of the large quantities of stormwater available for reuse, the definition of "stormwater management" is shifting to include water reuse as a conservation measure. In this section the focus in upon "stormwater management" from the standpoint of stormwater reuse, since other aspects are included elsewhere. The reason to separate this section from other alternative irrigation water sources is to highlight its increasing importance. The integration of harvested stormwater, floodwater, saline groundwater, reclaimed water, agriculture recycled water, and coastal water resources will be the future of irrigation on recreational turf (Beltrao et al., 2003; Duncan et al., 2007). Of these sources, stormwater reuse for irrigation will be a significant and important component of turfgrass and landscape irrigation in the future. **Stormwater** is generated by precipitation and runoff from land, pavements, building rooftops and other surfaces. Stormwater runoff accumulates pollutants that may be present such as sediments, oil and grease, chemicals, nutrients, metals, and bacteria as it moves across land and other surfaces. Heavy precipitation or snowmelt can also cause sewer overflows which, in turn, may lead to contamination of water sources with untreated human and industrial waste, toxic materials, and other debris.

Related to the shift in re-defining stormwater management to include reuse is the realization by local to national governmental entities that an integrated approach to urban water management is essential. An integrated approach entails supporting, enhancing, and utilizing the natural neighborhood or urban water cycle to achieve a sustainable urban environment by managing urban water –supply, wastewater, and stormwater. Currently, the primary means of achieving integrated urban water management is by national, state, and local governments to encourage implementation of holistic water-cycle management within new local developments (i.e., neighborhood level) in the North America, Australia, and Europe (Duncan et al., 2007; van Roon, 2006).

Stormwater control aspects are part of the initial course design and include water drainage and storage features. Many golf courses use the stored stormwater for irrigation purposes. Since stormwater may contain a diversity of constituents, information in sections on pesticides, nutrients, sediment, and salts will be relevant. Key considerations in environmental assessment are:

- Water harvesting for irrigation.
- Stormwater recycling for irrigation purposes, wetland development, lake or stream recharge, aquifer recharge.
- Pollutants associated with sediments – nutrients, oil and grease, metals, organics, pesticides, bacteria and viruses, gross pollutants (trash)
- Site Design. Permeable pavements; streets/driveways; parking lots; buildings; landscape areas; other areas to: reduce pollutants, treat pollutants, capture runoff, or store runoff.
- Storage of stormwater.
- Source Control of Pollutants
- Treat Runoff—infiltrate, detention/retention, bio-filter through vegetation.
- Illicit discharge assessment/monitoring/management
- Water quality monitoring
- Detention pond assessment/monitoring/management.
- Stormwater sampler installation

Wildlife Habitat Management

Important considerations during assessment of wildlife habitat are:

- Inventory of resident wildlife and core habitats.
- Develop a wildlife and habitat sustainable and enhancement plan.
- Protect existing habitat and wildlife.
- Enhance/naturalize areas for wildlife habitat, especially unused areas.
- Protect endangered species.
- Establish connecting corridors for wildlife movement.
- Use IPM concepts.
- Does a current naturalization plan exist for establishing, maintaining/protecting, and restoration of wildlife habitat?

Wetland and Stream Mitigation and Management

Wetland and Stream Issues entail assessment related to:

- Maintenance of existing wetlands, swales, streams
- Creation of wetlands.
- Restoration of wetlands.
- Wetlands as bio-filters.
- Dry/wet swales
- Bank stabilization
- Buffer zones – maintenance, installation
- Serial design features leading into wetlands --- multiple pond systems, grasses swales, detention ponds, vegetative filter strips, infiltration trenches
- Wetland and Stream Monitoring

Aquatic Biology and Management of Lakes and Ponds.

Assessment would include lake and pond management practices or situations that would influence pond/lake water quality and function. Examples are:

- Acidity.
- Nutrient loads, eutrophication
- Nuisance algae
- Vascular plants --- weed control in ponds and banks.
- Oxygen depletion/anoxia and related issues
- Surface runoff constituents/sedimentation
- Influence and remediation of saline groundwater movement into ponds
- Fish management
- Monitoring.

Waste Management

Assessment of waste management should involve the whole facility. Factors to consider are:

- Waste reduction practices
- Reuse

- Recycling of wastes and by-products—include use to improve soils
- Composting
- On-site waste treatment
- Waste management policies

Energy Management

As with waste management, energy management should entail the whole facility. Aspects to consider are:

- Irrigation pump system efficiency.
- Well or transfer pumping needs related to irrigation water supply and transport.
- Lightening
- Heating, ventilating, and air conditioning.
- Hot water supply
- Equipment and appliance energy requirements
- Solar energy
- Building design for heating and cooling

Clubhouse and Building EMS Aspects.

In recent years, the “green building” concept has gained wide attention. Audubon International (2007b) has a fact sheet that is a good introduction to this concept. While energy and waste aspects are noted in previous sections, for reporting within an EMS this can be by either means – i.e., by the type of facility (clubhouse, maintenance shop, etc.) or by the environmental issue (energy, waste, etc.). Considerations for the clubhouse are:

- Past, current or planned building design practices consistent with “green building” construction
- Indoor water conservation --- reclaimed water for air conditioning, water saving toilets, shower heads, faucets, dishwashers, clothes washers, etc.
- Energy efficient measures
- Clubhouse waste management practices—disposal, recycling, reuse, etc.

Climatic and Energy Management

While many of the other environmental issue sections deal with some of these aspects, the emphasis in this chapter would be to highlight the "surrounding community or urban area effects” of the golf course and energy efficient practices. In many large urban areas, the green space from golf courses can play a significant role in enhancement of the community. Demonstration of environmental stewardship by a club may include more than the environment on the facility. Assessment aspects to consider include past, current, and future practices that influence the community environment and demonstrate energy efficiency, such as:

- Carbon sequestration
- Community stormwater management
- Community water remediation and conservation.

- Green landscapes for climatic modifications in urban settings --- temperature, air filtering, glare, screening, etc.
- Conserving and revitalizing land areas.
- Firewise landscaping
- Wildlife and Biodiversity.
- Low-Impact Development Design Factors
- Energy efficiency practices – maintenance facility, clubhouse, irrigation system, etc.

3.4. ***Element 4*. Objective and Targets.**

Environmental targets and goals can now be established based on assessment of the environmental issues. Objectives and targets will help a club to **translate purpose into action** by factoring environmental goals into their strategic plans. This can facilitate the integration of environmental management within the organization's other management processes. The club determines what objectives and targets are appropriate for their organization. These goals can be applied organization-wide or to individual units, departments or functions -- depending on where the implementing actions will be needed. This information will help you to determine the relevant levels and functions within the organization for achieving objectives and targets. For example, if an objective is to reduce hazardous waste generation by 10 percent this year, the club also should know which parts of the organization must be involved in order to meet this objective.

Objectives should be consistent with the club's environmental policy. Objectives should give attention to significant **environmental aspects**, applicable **legal and other requirements**, the **views of interested parties**, your **technological options**, and **financial, operational,** and **other organizational consideration.**

Chapter 4. Implement.

Implement
5. Develop Environmental Management Programs (BMPs)
6. Structure and Responsibilities
7. Training, Awareness, and Competence
8. Communications
9. Outreach
10. EMS Documentation
11. Document Control
12. Operational Control
13. Emergency Preparedness and Response

4.1. *ELEMENT 5.* Develop Environmental Management Programs (BMPs)

An important part of the planning effort is defining what your organization intends to achieve in the environmental area. To achieve your objectives and targets, you need an **action plan --** also known as an environmental management program or BMPs (Carrow et al. 2005). Essentially, for each environmental issue identified in section 3.1 "Identify/Assess Environmental Aspects or Impacts", a set of BMPs should be developed that is specific to the issue. The various BMP programs should be **linked directly to your objectives and targets** — that is, the program should describe **how** the organization will **translate its goals and policy commitments into concrete actions** so that environmental objectives and targets are achieved. The BMPs can be combined into the overall EMS. For each environmental issue, the BMPs should entail the following:

- Include all current practices and past infrastructure improvements in the BMP.
- Add additional practices as required.
- Include comments on any infrastructure improvements that are planned that will enhance management of the issue. An EMS is an on-going, cyclic process that allows and encourages improvements over time.

Identification/assessment of environmental issues coupled with the various BMPs to manage these issues is the heart of an overall EMS. As noted, specific information on these two aspects will not be found in general EMS documents. It is beyond the scope of this document to present detailed BMP templates for each environmental issue, but Section 2.2. "EMS Related Programs in the Golf Industry" is a good starting place for information. Relative to the complex issue of BMPs for water-use efficiency/conservation, Carrow et al. (2007) provide an on-line document that is a template for developing a BMP in this area. This document also illustrates the principles of formulating BMPs. Integrated Pest/Plant Management (IPM) programs that detail various practices are another example of BMPs (just under a different terminology).

4.2. ***ELEMENT 6*. Structure and Responsibility.**

For an EMS to be effective, roles and responsibilities must be clearly defined and communicated. The commitment of all employees is needed for an EMS to live up to its full potential. At this stage of EMS development, a club may need to re-evaluate the best organizational structure and responsibility lines of authority to achieve their targets and goals. Since the EMS concept involves management at all levels across the whole facility and is to involve environmental management on a daily basis, these principles should be the basis for making structure and responsibility changes. Club members must be aware of changes and should be involve in any environmental practices that can be delegated to this level.

4.3. *ELEMENT 7.* Training, Awareness, and Competence.

All personnel should receive appropriate training with training **tailored** to the different needs of various levels or functions in the organization. As a first step, train employees on the environmental policy and other elements of the EMS followed by training to promote understanding of the organization's EMS efforts and the progress made to-date. Discuss the environmental impacts of their activities, any new/modified procedures, the organization's objectives and targets, as well as their EMS responsibilities. Training should involve every employee since

- Every employee can have potential **impacts** on the environment,
- Any employee can have **good ideas** about how to improve environmental management efforts.

Each person and function within your organization can play a role in environmental management. For this reason, your training program should cast a wide net including club members. Every employee and manager should be aware of the environmental policy, the significant environmental impacts of their work activities, key EMS roles and responsibilities, procedures that apply to their work and the importance of conformance with EMS requirements. Employees also should understand the **potential consequences** of not following EMS requirements (such as spill, releases, fines or other penalties).

Training is one element of establishing **competence,** which is typically based on a combination of education, training, and experience. For certain jobs (particularly tasks that can cause significant environmental impacts), a club may consider establishing criteria to measure the competence of individuals performing those tasks. Training efforts and costs should be noted in the EMS.

4.4. *ELEMENT 8*. Communication

Effective environmental management requires **effective communications, both internally and externally**. Effective **internal** communication will require mechanisms for information to flow top-down, bottom-up and across functional lines, including on-going communications with club members. Since employees are on the “front lines,” they can be an excellent source of information, issues, concerns and ideas.

Proactive, two-way communication with **external** parties is also important for an effective environmental management system. This should start with the Resource Advisory Group as well as steps to obtain the views of other stakeholders, which can include neighbors, customers, community

groups, and regulators. These stakeholders can also bring important concerns or views related to environmental issues to your attention that should be addressed in your EMS; however, this does not mean you should cede control of your EMS to them. Rather their input can be used to make your EMS stronger and more responsive to community concerns. Doing so will usually provide long-term benefits to the club organization.

4.5. *ELEMENT 9.* Outreach.

In addition to external communication noted in the previous section directed toward EMS improvement, golf clubs should strongly consider becoming an **outreach and education resource for the community**. The community is interested in the environment and may not be very well informed on the environmental sustainability and stewardship activities of a golf course. An EMS provides an excellent vehicle to use in community outreach and education. Audubon International (2007a) has several fact sheets related to this topic. Outreach and education activities will require a plan and commitment such as:

- Identify the key education person on the facility.
- Develop educational tools--- displays, newsletters, brochures, press releases,
- Continuing education plans and activities– turf managers, community, crew, site managers/owners,
- Formal training of turf managers --- environmental turfgrass management or sustainable turfgrass management.
- Site-use for educational activities. Develop educational programs for the community (such as school children, scouts)

4.6. *ELEMENT 10.* EMS Documentation.

To ensure that the course's EMS is well understood and operating as designed, there must be adequate information to the people doing the work. Once roles and responsibilities and initial BMPs are established for the various environmental issues, preparing the EMS manual should be a relatively simple matter. Since external parties and future club officials/members may want to understand how an EMS is designed and implemented, the various processes that make up an EMS should be documented.

The manual should summarize the results of the club efforts to date (that is, it should describe the processes the club have developed, the roles and responsibilities that have been defined, and other EMS elements). It is important to describe the links among system elements and provide direction to other system documents; but keep the manual simple - there is no need to provide great detail on any particular system process.

4.7. *ELEMENT 11.* Documents Control.

People in an organization use various documents (procedures, work instructions, forms, drawings and the like) as they perform their duties. To ensure that personnel are **consistently** performing their jobs in the right way, the organization must provide them with the proper tools. In the context of an EMS, the "tools" needed are correct and up-to-date procedures, instructions, and other documents. Without a mechanism to manage these EMS documents, the organization cannot be sure that people are working with the right tools. Document control should include:

- Where EMS documents are located.
- A system to periodically review documents
- A system to update documents
- Identification of who is responsible for the above activities.

4.8. *ELEMENT 12.* Operational Control.

To ensure that a club achieves their commitments in an environmental policy, certain operations and activities must be controlled. Where operations or activities are complex and/or the potential environmental impacts are significant, controls should include documented procedures. Procedures can help an organization to manage its **significant environmental aspects**, ensure regulatory **compliance** and achieve **environmental objectives**. Procedures can also play a prominent role in employee **training**. To ensure that everyone is working with the proper EMS documents, an organization should have a **procedure** that describes how such documents are controlled (see Section 4.7).

4.9. *ELEMENT 13.* Emergency Preparedness and Response.

Despite an organization's best efforts, the possibility of accidents and other emergency situations still exists. Effective **preparation and response** can reduce injuries, prevent or minimize environmental impacts, protect employees and neighbors, reduce asset losses and minimize downtime. An effective emergency preparedness and response program should include provisions for these situations.

Chapter 5. Monitor.

Monitor
14. Monitor and Measurement
15. Nonconformance and Corrective or Preventive Action
16. Records
17. EMS Audit

5.1. *ELEMENT 14.* Monitor and Measurements

Monitoring environmental management assists in managing an organization better. Pollution prevention and other strategic opportunities are identified more readily when current and reliable data is available. Monitoring and measurement enables an organization to:

- **Evaluate** environmental **performance**;
- **Analyze root causes** of problems;
- **Assess compliance** with legal requirements;
- **Identify** areas requiring **corrective action**,
- **Improve performance** and **increase efficiency**.

Monitoring may be targeted to key environmental impacts such as: water use; irrigation water quality; stream, pond, or lake quality; energy usage; soil testing; chemical inventories and disposal information; wildlife inventories; pesticide usage; or any other factor that may be related to monitoring or measuring the success of BMPs for an individual environmental issue.

5.2. *ELEMENT 15*. Nonconformance and Corrective or Preventative Action.

EMS is to be in the continual process: Plan – Identify/Assess – Implement – Monitor – Review. Thus, with monitoring it may become apparent that an environmental goal is not on track or not in conformance. No EMS is perfect, so once a problem is identified changes should be initiated, either as corrective or preventative measures. In this manner, the club EMS will continue to changes and grow. To deal with system deficiencies, the organization needs a process to ensure that:

- **Problems** (including nonconformities) are **identified** and **investigated**;
- Root **causes** are **identified**;
- Corrective and preventive **actions** are **identified** and **implemented**; and,
- **Actions** are **tracked** and their **effectiveness is verified**.

The amount of planning and documentation necessary for corrective and preventive actions will vary with the **severity** of the problem and its potential environmental **impacts**. Don't go overboard with bureaucracy — simple methods often work quite effectively. Once a problem is documented, the

organization must be committed to **resolving it in a timely manner**. Be sure that your corrective and preventive action process specifies **responsibilities** and **schedules** for completion. Review your **progress** regularly and follow up to ensure that actions taken are effective.

5.3. *ELEMENT 16.* Records.

The value of records management is fairly simple — to **demonstrate** that the organization is actually implementing the EMS as designed. While records have value internally, over time you may need to provide **evidence of EMS implementation to external parties** (such as regulatory agencies or the public). Records management is sometimes seen as bureaucratic, but it is difficult to imagine a system **operating consistently** without accurate records. The basics of records management are straightforward: you need to decide **what** records you will keep, **how** you will keep them and for **how long**. You should also think about how you will **dispose** of records once you no longer need them.

5.4. *ELEMENT 17.* EMS Audit/Certification.

An EMS audit is to verify that the EMS is operating as intended. The simplest audit is an **internal audit** process. Periodic EMS audits will help determine whether all of the requirements of the EMS are being carried out in the specified manner. Internal auditors will need to be selected and trained. Auditors should be independent of the activities of the being audited. Many organizations find it is easier to start with smaller, more frequent audits than to audit the entire EMS at once. These early audits can serve as a learning tool for the auditors. Audit records should be managed in accordance with the records management process. Results of your EMS audits should be linked to the corrective and preventive action process just as the monitoring and measurement aspects are. For your EMS audit program to be effective, you should:

- Develop audit procedures and protocols;
- Determine an appropriate audit frequency;
- Select and train your auditors; and,
- Maintain audit records.

External auditing is also an option and adds a greater degree of accountability and credence to a course EMS. In cases where the EMS is integrated into the National Environmental Performance Track program (NEPT, 2007; http://www.epa.gov/performancetrack/), one of the criteria is an external audit. The NEPT web-site describes the program as: "The National Environmental Performance Track is open to facilities of all types, sizes, and complexity, public or private, manufacturing or service-oriented. Performance Track is designed to recognize facilities that consistently meet their legal requirements and have implemented high-quality environmental management systems. Performance Track encourages facilities to continuously improve their environmental performance and to work closely with their community and employees. Once accepted, members remain in the program for three years, as long as they continue to meet the program criteria. After three years they may reapply. Facilities applying to Performance Track must meet the following criteria:

- **Environmental Management System (EMS)**. Applicants must have an EMS in place for at least one complete cycle. An EMS is a set of processes and practices that enable a facility to reduce its environmental impacts and increase its operating efficiency. A facility must have a comprehensive independent assessment of its EMS.

- **Sustained Compliance**. Performance Track members have a record of compliance with environmental laws and are in compliance with all applicable environmental requirements. They also commit to maintaining the level of compliance needed to qualify for the program.
- **Continuous Improvement**. Applicants must demonstrate past environmental achievements during the current and preceding year. Applicants also commit to four quantitative goals (small businesses commit to two goals) for improving their environmental performance. Commitments range from upstream improvements (such as improving environmental performance of suppliers) to on-site improvements (such as reduce emissions or waste from a facility) to downstream improvements (such as reducing a product's packaging or its lifetime energy use). Commitments are expected to be achieved over the course of the three-year membership.
- **Community Outreach**. Applicants commit to remain involved and active in their community, sharing their accomplishments with the public and addressing any community concerns.
- **Annual Performance Reporting**. Performance Track members must complete an Annual Performance Report for each year of their membership, describing to EPA and the public their environmental accomplishments during the previous year."

As part of several of the Audubon International programs, certification is achieved through an auditing process which they have developed (see Section 2.2. EMS Related Programs in the Golf Industry; Audubon International, 2007c). A similar program could be developed for an EMS since the Audubon International programs are based on EMS principles.

Chapter 6. Review.

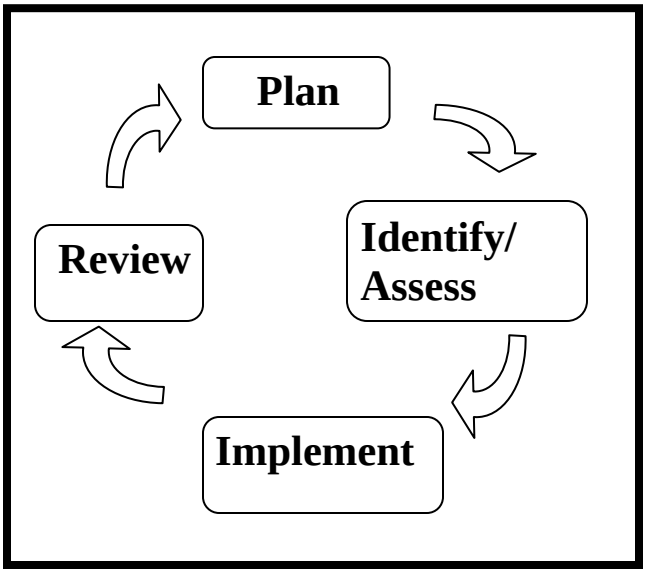
Review
18. Management Review.

6.1. *ELEMENT 18.* Review.

This last element closes the EMS loop. Since this periodic review is conducted with an eye to continual improvement of the overall EMS, it is also the first step in the next EMS cycle. The EMS review in this element is a management review conducted by the top management. Considerations in the review may be:

- Effectiveness of the EMS in terms of managing the key environmental issues.
- EMS process efficiency and cost effectiveness.
- Effectiveness of the organizational structure and responsibilities.
- Effectiveness of EMS procedures.

After this management review, the results are integrated into the next cycle of the **EMS process**—remember that EMS is to integrate environmental management into everyday decision-making at all club levels on a continuous basis.



Section III

IMPLICATIONS OF EMS

Chapter 7. IMPLICATIONS OF EMS.

In section 2.4. "Some Key Implications" directly related to the golf club initiating an EMS were noted. These are again summarized here as well as some additional implications to either a club or components of the turfgrass industry:

- The EMS concept is promoted by regulatory agencies on an international basis as the best means to mitigate or manage environmental issue for all businesses or entities that have potential environmental impact.
- EMSs are for all facilities of an industry – i.e., all golf clubs will very likely need to develop their own site-specific EMS plan.
- The EMS concept binds together all environmental issues on a facility – i.e., all environmental issues are assessed and management plans developed and implemented for all environmental issues on that facility.
- The term Environmental Management Systems (EMS) truly reflects the nature of EMSs. For example, an EMS is: a) a new management approach, b) for the whole system, c) for all environmental issues, and d) for daily environmental management decisions at all management levels within an organization to be the normal practice.
- Since EMS is for the whole facility, upper management and organization-wide commitment are necessary. This entails organization-wide training.
- An EMS allows combining together into one system the various BMP for each particular environmental issue.
- As the EMS evolves there will be a substantial need for: educational materials; site-assessment protocols and tools related to each environmental issue; development of concise BMPs protocols and tools for each environmental issue; auditing and certification protocols and tools; and services to conduct on-site environmental assessments and audits. Organizations, consultants, and associations that can provide these services will arise. Due to the comprehensive nature of EMS, it will be attractive to golf clubs to seek service providers that can provide holistic service packages.
- Related to the previous statement, educational or information "packaging", must become more focused, targeted, and integrated. General information or even specific information in diverse places will not be nearly as useful when so many environmental issues must be addressed in one EMS. The systematic packaging of environmental information may be at various levels of detail depending on the target audience; but for the turf manager, specific detail is necessary.
- As detailed BMPs are developed for each environmental issue, application to specific sites is essential since the very nature of BMPs and environmental issues is site-specific --- one size does not fit all. A comprehensive BMP template must be refined for each site based on site knowledge and science.
- As "environmental management" evolves into the normal day-by-day operations of a facility in addition to the current daily agronomic, personnel, and economic considerations that managers

must consider, environmental staff positions may arise, such as an Assistant Superintendent/Environmental Specialist.

- For complex issues, such as water-use efficiency/conservation, irrigation water quality (when water quality is challenging), and salt-affected turfgrass sites, consultants with in depth understanding of these complexities will be in demand.
- Education of future turf managers must evolve as the EMS concept becomes integrated into all facets of the turf industry (not just golf courses). Students will require: course content to understand the complex issues in much more detail than is the current status; introduction into the terminology, concepts, and management related to each of the environmental issues (depending on the issue, the detail or intensity will vary); and ability to think and manage based on a "systems" approach.

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