

# The Whys and Hows of Revising the USGA Green Construction Recommendations

by JAMES T. SNOW

National Director, USGA Green Section

FOR MORE than 30 years the USGA recommendations for green construction have been the most widely used method for green construction throughout the United States and in other parts of the world. When built and maintained properly, USGA greens have provided consistently good results for golf courses over a period of many years.

In response to industry concerns about soil laboratory inconsistencies, the scientific validity of certain specifications, and other perceived problems, the USGA decided in 1991 to make a thorough scientific review of its specifications and, if needed, to publish an updated and revised version after the study was complete.

Plans for the project solidified when Dr. Norman Hummel, associate professor of turfgrass science at Cornell University and an expert in soils and soil testing, agreed to spend his year on sabbatical leave with the Green Section and lead a review of the green construction specifications. Among his objectives was to determine the reasons for

laboratory inconsistencies and to update and standardize the recommended laboratory procedures. Also, he proposed to complete a thorough review of the scientific literature pertaining to green construction and sand-based root zone mixtures, recommend needed modifications to the current specifications, recommend quality control procedures for checking, sampling, and testing materials during construction, and identify needs for future research concerning green construction.

In following through with the review, the Green Section had several goals in mind:

1. To increase confidence in the specifications by providing a sound scientific rationale, establishing standardized lab procedures to help minimize the inconsistencies experienced in the past, and providing quality control guidelines to help ensure the best possible results during construction.

2. To reduce the cost of building USGA greens by taking whatever scientifically valid steps can be taken to provide greater

flexibility, incorporate results of recent research and new technologies, and remove any unnecessary steps.

3. To provide the golf industry with the best possible green construction recommendations, given the current state of our scientific knowledge and experience, for the benefit of golfers who enjoy the game worldwide.

4. To identify weaknesses in our knowledge base and encourage scientists to pursue answers to the questions that could lead to even better quality, less costly, easier-to-maintain greens in the future.

To help ensure that a broad base of scientific knowledge was considered in revising the recommendations, an advisory committee (see inside front cover) was formed to serve as a sounding board for Dr. Hummel's work. The committee was very helpful in providing sources of information for the literature review, and in reviewing the proposed laboratory procedures and the new recommendations.

Dr. Hummel officially began his work on July 1, 1991, and his first order of business was to initiate the revision of the laboratory procedures. The original procedures were published by Dr. Marvin Ferguson in 1960, and no updating had been done by the USGA since then. For more than 20 years there had been little reason to modify the laboratory procedures, since there were just one or two laboratories providing testing services during most of that time. The golf boom of the 1980s, though, saw a large increase in the number of laboratories offering these services, and it wasn't long before inconsistencies began to appear. People who sent samples of the same material to several laboratories sometimes received greatly varying results.

It was clear from Dr. Hummel's survey of the laboratories that establishing new laboratory standards would greatly improve consistency from lab to lab (see "Why We Need Soil Testing Laboratory Standards for Root Zone Mixes" later in this issue). With the help of the Advisory Committee and with the cooperation of personnel at all of the soil testing laboratories, Dr. Hummel developed the new standards that were hoped for. These procedures have been submitted

*USGA Recommendations — what most golf courses turn to the second time around.*



*The USGA extends warm thanks to the many people who gave freely of their expertise in the 1993 revision of the USGA Green Construction Recommendations.*

#### ADVISORY COMMITTEE

**Dr. Stephen Baker**  
Sports Turf Research Institute, UK

**Dr. Norman Hummel**  
Cornell University

**Mr. James Latham**  
USGA

**Mr. James Snow**  
USGA

**Dr. Donald Waddington**  
Penn State University

**Dr. Kirk Brown**  
Texas A&M University

**Dr. Wayne Kussow**  
University of Wisconsin

**Dr. Edward McCoy**  
Ohio State University

**Dr. L. Art Spomer**  
University of Illinois

#### REVIEW PANEL

##### United States

Mr. Jeff Brauer  
Mr. Chuck Dixon  
Mr. Mark Flock  
Mr. Powell Gaines  
Ms. Judith Gockel  
Mr. Leon Howard  
Mr. Rees Jones

Mr. Don Knott  
Dr. Charles Peacock  
Mr. Ron Pritchard  
Dr. Paul Rieke  
Mr. Brian Silva  
Mr. James Thomas  
Dr. James Watson

##### International

Mr. Ian McIver, Australian Turf Research Institute  
Dr. Murray Wallace, Australian Turf Research Institute  
Mr. David Gourley, Canada  
Ms. Barbara Gourley, Canada  
Mr. James Arthur, England  
Dr. Yoshisuke Maki, Japan  
Mr. Keith McAuliffe, New Zealand Turf Culture Institute  
Mr. Richard Gibbs, New Zealand Turf Culture Institute  
Mr. David Howard, New Zealand Turf Culture Institute

##### Green Section Staff

Mr. Robert Brame  
Mr. James Connolly  
Dr. Kimberly Erusha  
Mr. John Foy  
Mr. Chuck Gast  
Mr. Larry Gilhuly  
Mr. Patrick Gross  
Mr. James Latham  
Mr. George Manuel

Mr. James Moore  
Mr. David Oatis  
Mr. Patrick O'Brien  
Mr. James Skorulski  
Mr. James Snow  
Mr. Robert Vavrek  
Mr. Paul Vermeulen  
Mr. Stanley Zontek

to the American Society of Testing and Materials (ASTM), and will undergo a thorough scientific review in hopes of having the procedures adopted by ASTM as national standards. In the future, only laboratories that agree to follow the new standards and to report the information called for in these procedures will be included on the list of laboratories that accompanies the USGA's green construction booklet.

Following the development of the new laboratory procedures, Dr. Hummel completed a thorough literature review to serve as a basis for prospective changes to the specifications. Upon completion of the review, and with input from the Advisory Committee and others, he recommended changes in adherence with the goals mentioned previously. After a thorough review of these recommendations by an international panel (see inside front cover) of knowledgeable scientists, architects, agronomists, industry personnel, and soil laboratory personnel, the 1993 version of the USGA Recommendations for a Method of Putting Green Construction was adopted by the Green Section staff.

As expected, there was some disagreement about some of the finer details of the proposed changes, but there was surprising agreement among the world's experts on the major points, and it is fair to say that the 1993 version of the USGA recommendations for green construction represents as much of a consensus as could ever be expected from such a broad-ranging group of experts.

Unquestionably the most prominent change is the option of eliminating the intermediate layer in the USGA green profile *if* the appropriate gravel can be found. Selection of the gravel is based on the particle size distribution of the root zone mix.

The use of the intermediate layer in a USGA green always has been one of the most contentious parts of the recommendations, and it simply has been left out by many contractors, architects, or superintendents for the sake of economy. Sometimes these greens worked very well, but in many other instances the lack of an intermediate layer resulted in disaster. In anticipating this revision of the recommendations, the Green Section staff decided that if a scientifically valid method could be identified to determine when the intermediate layer is not needed, it should be included in the recommendations. Doing



*Dr. Norm Hummel checks cores from a green built many years ago according to USGA standards.*

*Good root zone physical properties equate to good roots and healthy turf.*



so would save many courses tens of thousands of dollars in not having to purchase and install the intermediate layer material.

Fortunately, from information supplied by two of our reviewers, an engineering textbook was located that described an extensively researched method for evaluating the need for filter materials in layered profiles. It fits our purpose very well, and is described in the following sections of this issue of the *Green Section Record*.

Another change that could save many thousands of dollars, depending on location, is the broadening of the particle size distribution for the intermediate layer, where the use of the layer is necessary. This change will make available many less-expensive materials for use as the intermediate layer, and there is no sacrifice in the way they function in the profile.

There are many other minor changes throughout the recommendations, including several to the physical properties of the root zone mix. The particle size range has been expanded to allow for more fine sand, but less very fine sand, allowing greater availability of acceptable sands in some parts of the country. Also, the test for saturated conductivity (infiltration rate) has been added, after having been left out of the recommendations in the 1989 version. See Table 1 for a summary of all the significant changes.

It should be emphasized that despite the changes that have been made, the underlying principles associated with USGA greens since 1960 have not been altered. They include the necessity of a drainage system to move excess water quickly away from the site, a gravel blanket to allow excess water to move quickly to the drainage system, a layered profile to create a perched water table for the conservation of moisture and nutrients in the root zone, and laboratory testing to ensure that the root zone mix and other components of the profile meet the required standards.

In the pages of this issue of the *Green Section Record* are the results of nearly two years of work by dozens of people. The USGA extends special thanks to Dr. Norm Hummel, who with patience and thoroughness steered the project to a successful end. Thanks also to members of the Advisory Committee and the Review Panel, and to countless others who offered constructive advice and moral support to those of us involved in the revision of the USGA's recommendations for putting green construction.