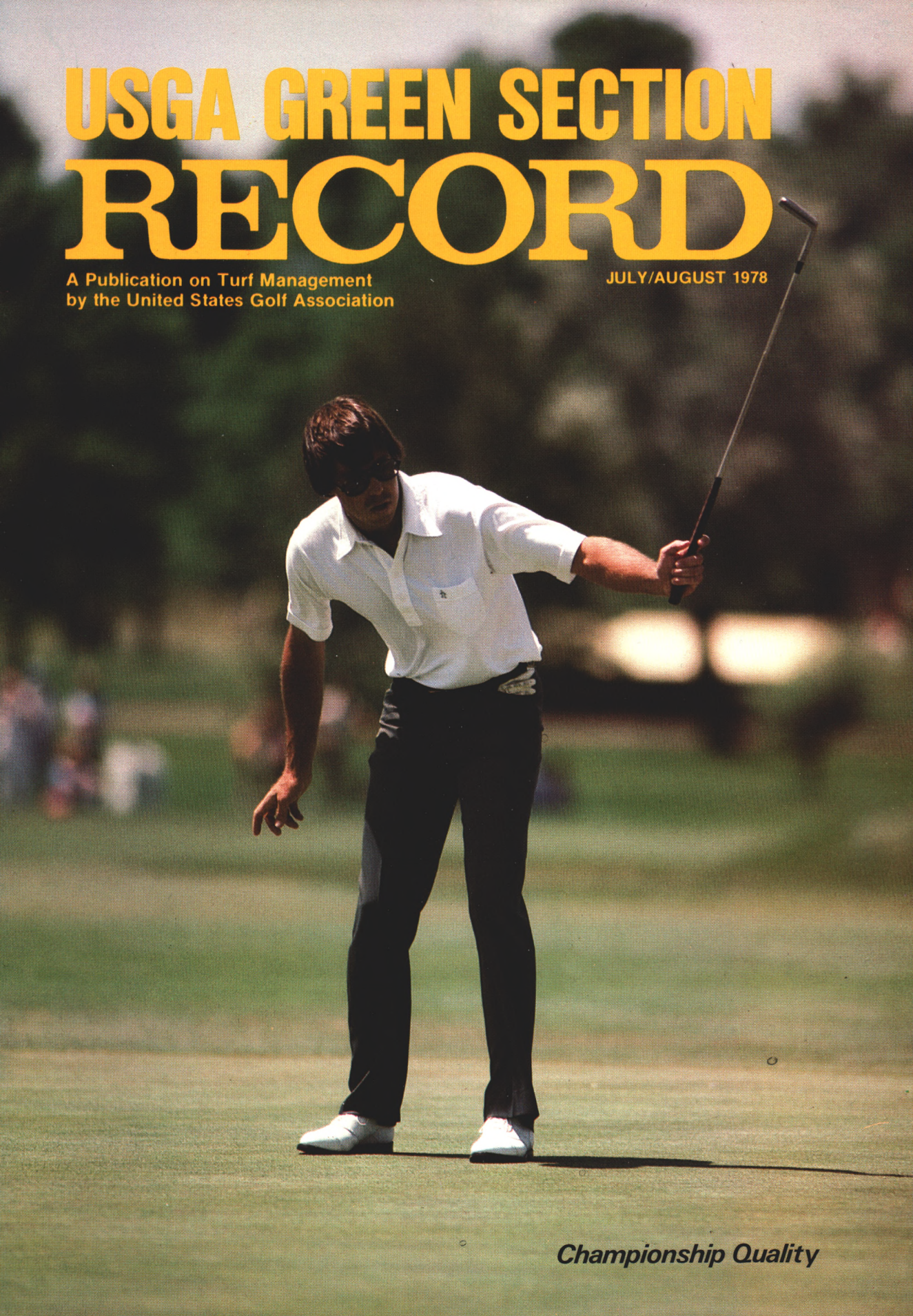
USGA GREEN SECTION RECORD

A Publication on Turf Management
by the United States Golf Association

JULY/AUGUST 1978



Championship Quality

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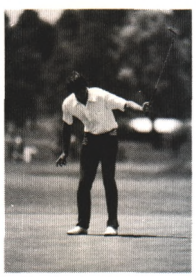

COVER PHOTO: Maintenance is responsible for the Championship quality of greens at the U.S. Open. Billy Kratzert at Cherry Hills Country Club.
Photo by KELLY/RUSSELL

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Overwatering is not helping the turf quality but will make the green hold the shot.

THE GOLF COURSE SUPERINTENDENT

The Man Who Maintains Turfgrass Standards

by WM. G. BUCHANAN, Director, USGA Green Section Mid-Atlantic Region

SINCE 1894, the USGA has been concerned with preserving the integrity of golf; the Rules, amateur status, implements and ball, handicapping, and conducting 10 national championships. In addition, the USGA is also very much involved in contributing to golf course maintenance standards and providing quality playing surfaces for the game. The Green Section agronomists work closely with golf course superintendents to provide service and assistance with course maintenance operations. However, the superintendent is the one person in the day-to-day operation of the golf course who can realistically maintain standards that place demands on the golfers that can make the game of golf such a great game.

The superintendent can exert a tremendous amount of influence on the game strictly by his philosophy of golf course maintenance. If he is sincerely interested in maintaining a playing surface for the game itself, inherently, the members at the club will accept the conditions and become relatively proficient at the game. However, if the superintendent is of the philosophy that "green is good — dark green is great," and that every inch of the golf course has to be a soft, lush turf, the membership will also adopt this philosophy. In all the comments heard at these courses about how great the golf course *looks*, you seldom hear any mention of playing conditions. Because of the potential influence on the game that the super-

intendent exerts, whether it be intentional or unintentional, he should have extensive knowledge of the game. He need not be an expert, but he should have a knowledge of the Rules of Golf, what is required to play a good shot (whether he is an accomplished golfer or not) and what the golf course is supposed to represent. If it is to be a good golf course, its playing surface should place certain demands on the golfer. It must require the player to execute shots with accuracy and finesse; possess a steady hand on the putting surfaces; and require the golfer to think about the play of the course, not just see how far he can hit the ball.

The past 20 years have provided a tremendous amount of technological advances in golf course maintenance. However, it seems that in the past 10 to 15 years the overall quality of playing surfaces has sometimes been diminished by the misuse of some of these advances. There are probably fewer than several hundred golf courses in the country today that provide a truly fine playing surface day to day. Too many clubs have become victims of the advances made by the irrigation industry. Too many clubs have fallen into dependence on the use of too many chemicals. Although the chemicals are used according to label recommendations, when they are used in combination or at the same time they actually have a detrimental affect on the quality of the playing surface. It appears that golf course maintenance is going the route of the great American philosophy that if a large number of people cannot meet current standards without having to work or practice, then the standards should be lowered.

It appears that, although we are more sophisticated in the maintenance of the golf course today, fairways are becoming wider and are being mowed higher (so that they are prettier); the roughs are becoming shorter (because of the very weak excuse that the ball is easier to find and, therefore, will help speed play) and that the greens are becoming softer (because it is no longer the responsibility of the golfer to execute the shot properly with a proper amount of spin so that the ball will hold the green). It is now almost a requirement that the green should hold the ball on its impact alone!

Strangely enough, despite all the advancements in new, stronger turf providing year 'round playing surfaces, and, with more and more money being spent on golf course maintenance, some golfers believe they must still have the right to improve their lie before every fairway shot. This is the same golfer who expects the greens to be soft. If the ball is teed high, there is a tendency to pick the ball and not put backspin on it. When it hits the green, it will bounce and roll farther than if it had spin. But our golfer believes he has hit a perfect shot, and the green did not hold the ball!

Technological advances and superintendents must not bear the full brunt of the decline of overall quality of playing surfaces. Club members have brought a tremendous amount of pressure on the superintendent to make the course easier. Some

Practice putting green at Merion Golf Club. A high standard of maintenance is responsible for a quality playing surface.

(Above) Herbicide control is essential until the bermuda becomes established. Pre-emergence crabgrass control at this time could result in damage to the permanent grasses.

(Left) Water control will yield a strong root system as well as a better playing surface.

believe this is justified because of increased play and time factor involved in playing a round of golf. Therefore, in the interest of self-preservation, the golf course maintenance program has frequently been altered to make the members happy and, hopefully, keep his job.

The manicured approach to golf course maintenance is causing a number of severe problems in turfgrass management. We are no longer conditioning grasses to withstand stress; rather we are forcing them into an unusual growth pattern which makes them more susceptible to stress from weather, traffic and wear and tear. When our maintenance programs reach a point where we are forcing grass growth, we artificially create more problems than we would have under natural conditions.

The maintenance of the cool season grasses, especially on putting greens, is severely affected

by autumn and spring maintenance programs. We constantly hear of programs being altered because XYZ groups are coming in to play, or that the 10th mixed fourball of the year is scheduled. Because of ever increasing traffic on our courses, it is necessary to follow proper maintenance schedules. It is essential that certain operations be performed to prepare the golf course for its peak and heavy play months. Some of the most important operations are the most basic and time-consuming ones:

1) Aeration — By either removing the cores or a spiking procedure, aeration is basic to good turfgrass management. The grass plant needs air in the soil to provide for strong growth. Without mechanically renovating the surface, it is absolutely impossible to maintain a good soil-air supply. Compaction from cart traffic, mowing equipment, and foot traffic has a tremendous affect on the soil. This applies not only to greens and tees, but fairways as well.

2) Vertical Mowing — Vertical mowing has a tremendous benefit for grasses and golf in removing the dead and decaying organic material that accumulates as a thatch layer on the soil surface. By a regularly scheduled vertical mowing operation, control of this thatch layer will be achieved mechanically and will prevent the grasses from becoming puffy or spongy. Whether in the fairways or on the greens, grasses that become puffy are most difficult to maintain as quality playing surfaces.

3) A Regularly Scheduled Top-dressing Program — This will encourage the grass to develop a strong, upright growth. The top-dressing of greens is of tremendous assistance in providing a smooth surface so that the ball, when properly struck, will roll with a good pace along its intended line. Top-dressing operations on tees are beneficial as well to smooth the surface and fill the divot scars. With few exceptions, it is not practical to top-dress fairway areas.

By following these three basic programs, turf for golf will be tremendously benefitted.

The overuse of chemicals, such as fertilizers and herbicides, soften grass growth and weaken its performance in stress periods. The philosophy that "it has to be green to be good" has caused heavier applications of fertilizers to be made earlier in the spring. By stimulating the grasses at an early date and trying to get mid-summer color by the end of April, serious problems could develop during the summer. An application of fertilizer in the early part of the spring causes the grass blade to become wide and the growth soft. This makes it more susceptible to traffic injury, it will require more water and it becomes more susceptible to diseases. By controlling nitrogen in the spring and waiting for normal initial greenup, the plant can maintain a thin upright posture and be able to condition itself to the stresses of the coming months.

Putting surfaces are the one place on the golf course where absolute control over the growth rate of the grass is necessary. Ideally, on a bentgrass putting surface the grasses will only be growing fast enough to recover from the traffic injury that is received from day-to-day play. It is not a contest on the putting surface to see how fast you can get the grass growing, but how fast you can get the ball rolling. It is most difficult to maintain a quality putting surface when the grasses have a rapid and soft growth rate.

As a result of overstimulation of turfgrasses in the spring, it becomes necessary to apply water on a more frequent basis. The growth rate demands it. Once we start applying too much water, soil compaction is increased. Air spaces in the soil are greatly reduced. This starts a vicious cycle of having to apply more and more water to keep the grasses growing in order to survive the stress they are being placed under.

Once the soil is saturated, disease susceptibility increases, especially to pythium. Because the pythium fungus needs warm weather and moisture to be active, we are artificially creating a condition that provides excellent growing conditions for it. Frequently, if the areas are kept drier, grasses could survive and the natural climatic conditions would not exist long enough for pythium to have a detrimental effect on them.

Overwatering also provides an excellent climate for the growth and development of crabgrass. Crabgrass moves into an area when overall turfgrass conditions become weak. We then start using a tremendous amount of herbicide to control crabgrass. Of course, the use of these herbicides is not compatible with the basic aeration procedures mentioned earlier. Once the herbicide is used, aeration should not take place because it will reduce the effectiveness of the pre-emergence material. Therefore, the overall desirable turfgrass population decreases and crabgrass or *Poa annua* moves in.

It is not hard to see how golf courses can find themselves in a program of lowered standards. The vicious cycle begins with the misuse of turf management techniques. Mismanaged techniques will cause more problems than are normally caused naturally.

Not only have cool season grasses had problems because of overmanagement. Bermudagrasses have run into essentially the same problems when pre-emergence crabgrass controls have been applied before the seedling bermudagrass is fully established. Bermudagrasses have been forced into overstimulation too late in the fall in order to keep the fairways green. They go into winter in a soft condition without hardening off and are, therefore, more susceptible to winter injury. Further, they are often mechanically injured when fairway overseeding is accomplished too late in the year.

As we look ahead, let us hope that golf course maintenance programs will be directed more toward quality playing surfaces than toward aesthetics. This will call for a greater understanding and appreciation of golf on the part of most club members and the golf course superintendent.

Current Review of Sewage Effluent for Irrigation Use

by A. E. DUDECK, Ornamental Horticulture, IFAS,
University of Florida, Gainesville, Florida

IN ATTEMPTING TO review the vast amount of literature dealing with the characteristics and use of sewage sludge and effluent, along with all of their ramifications and impacts on agriculture and the environment, I thought that perhaps a better title would be "Don't Waste the Waste!" However, I came across a title suggested by Whetstone[9] which I think you will agree is perhaps more appropriate: "The 21st Century — an Effluent Society." It is Whetstone's contention, supported by many authorities in this field, that recycled water will be routine in 50 years. One need only to look at the Colorado River system to realize that, in fact, we are doing this today.

Two major forces will be responsible for this development:

(1) improvement in sewage treatment, and
(2) water economics.

Modern developments in the area of improved sewage treatment have been hastened by the Federal Water Pollution Control Act Amendments of 1972. This Act set a goal to eliminate discharge of pollutants into navigable waters by 1985.

In addition to this Federal mandate, water economics are such that growing demands on an essentially constant supply of water can only be relieved by recycling. Whetstone[9] says, "The luxury of discharging once-used water will become a bitter memory of ancestral squandering." McGauhey[7] presents an even stronger case for recycling water: "If sewage were discharged without any treatment whatsoever, we should be sending a 2,000-ton train of water, on which we lately spent a great deal of money in purifying, to transport a single ton of organic solids. Worse yet, in the more common case of well-treated sewage, one good burro could carry all that is required of

this half million gallons of water. Furthermore, we throw away the train at the end of a single trip. It is in line with our heritage of waste, but it is without parallel in the history of transportation."

It stands to reason that increased population demands on this water lead to increased waste problems. Each resident of a community usually contributes 70 to 100 gallons of wastewater per day, resulting in the production of one-quarter pound of sludge per day.[5] In the past, the nation's rivers, streams, lakes, and oceans have been used to dilute these wastewaters, but now the steadily increasing volume of waste is exceeding the dilution ability of our waters. Thus, increased nutrient levels of the water result in excessive algae and aquatic weed problems which upset the ecology of the system, not to mention obvious health hazards.

At present, most sewage waste is disposed of in landfills, lagoons, and the ocean, by incineration, and by application to the land. Because of environmental and economic considerations, application of sewage waste to the land appears to be by far the most feasible method of disposal. Benefits in using the land as a living filter are as follows:

1. The nutrient concentration in wastewater would be reduced by the biological, chemical, and physical processes in the soil.
2. The nutrients would be available for plant utilization and growth.
3. Renovated water would recharge the groundwater.

How then is this wastewater being applied to the land? Several approaches are currently being used:

1. Irrigation.
2. Overland flow.
3. Infiltration — Percolation.
4. Deep well injection.

IRRIGATION

Irrigation may be defined as a controlled discharge of effluent by spraying onto the land to support plant growth. Wastewater is thereby utilized by (1) plant uptake, (2) evapotranspiration into the air, and (3) percolation into the groundwater. The benefits from wastewater irrigation are many:

1. Inexpensive source of water,
2. Economic savings of potable water which could be used for purposes other than irrigation,
3. The utilization of green belt areas for recreation purposes in urban and suburban areas,
4. Economic return on the sale of crops, and
5. It is a positive alternative to advanced waste treatment and/or surface water discharge.

OVERLAND FLOW

Overland flow is a controlled discharge onto the land with a large portion of the wastewater appearing as runoff. It can then be recycled for other uses. As of 1973 this approach has not been used in the United States although it is used in Australia.[6]

INFILTRATION — PERCOLATION

Basically a flooding technique where heavy loading rates infiltrate and percolate into the soil with relatively small losses to evaporation. This process has been developed primarily for groundwater recharge.

DEEP WELL INJECTION

This approach is considered to be a disposal method rather than a wastewater treatment. It is one alternative along the coast to holding ponds on the surface during periods of rainy weather. This approach is currently being used in California, New Jersey, and Florida.

CHARACTERISTICS OF WASTEWATER

Wastewater may be quite variable as its composition depends on the following:

1. The domestic water system itself, including
   (a) water supply source,
   (b) treatment, and
   (c) conveyance system;
2. Inorganic and organic compounds in both industrial and domestic wastewaters;
3. Inflow and infiltration into the wastewater collection systems.

The greater the industrial base the wider the variation in its wastewater effluent. Table 1 illustrates a comparison between a residential vs. an industrial sewage sludge.

TABLE 1

Characteristics of Two Municipal Sewage Sludges

	Municipality	
Characteristics	**Residential**	**Industrial**
solids %	23.2	20.5
pH	5.4	5.6
N%	2.5	2.3
P%	1.3	0.8
K%	0.07	0.12
Ca%	1.6	1.1
Mg%	0.1	0.1
Cd ppm	18	165
Cr ppm	358	1754
Cu ppm	352	636
Mn ppm	372	890
Pb ppm	447	2748
Zn ppm	7915	11,812

After Burns & Boswell. 1975.

Note that there are no appreciable differences in the first seven characteristics, most of which are essential plant nutrients, but that the primary differences are in the heavy metal content. Note further that these high concentrations of heavy metals are found in sewage sludge — not sewage effluent. There is a difference between the two. Sewage sludge contains most of the organic solids

which are separated out during processing and contain little water, whereas sewage effluent is the liquid outflow from the sewage treatment processes and contains 99.9985% water.[6] Table 2 illustrates two effluent sources which likewise vary due to industrial inputs, but note the relatively low concentrations of metals in the effluent fraction compared to the sludge.

Note that a number of metals in both states but especially in Michigan exceed the recommended drinking water standards, while conversely those in the low range are well below the water quality limits. It should be apparent, therefore, that plant growth problems are more apt to be associated with the sludge fraction rather than the effluent fraction. There is concern, nevertheless, that continued use of effluent over a long period of time may cause metal build-up to the point of plant toxicity. Burns and Boswell[2] found that the high metal content of the industrial sludge seriously affected rooting in bermudagrass and centipedegrass. Centipedegrass was more seriously affected by the industrial metals than was bermudagrass.

TABLE 3

Performance of Bermudagrass and Centipedegrass Cuttings in Sewage Sludge from Two Sources

	Bermudagrass		Centipedegrass	
Characteristics	**Res.**	**Ind.**	**Res.**	**Ind.**
Total root length mm/cutting	55	12	40	3.5
% cuttings with roots	100	93	100	25

After Burns & Boswell. 1975.

In addition to the heavy metals, the salt content and the biological composition affect the quality of wastewater.

Recently we sampled one treatment plant located close to the shore in Florida and were surprised to find the effluent analyzed 2,000 parts per million of total salts. Apparently the influent lines were allowing saltwater to leak into the system, causing a problem with high soluble salts.

The biological agents associated with wastewater are of great concern to the public health officials as well as to the general public. In general, three groups of organisms are involved: (1) bacteria, (2) parasites, and (3) virus. It is generally assumed that disinfection of secondary treated effluent eliminates the potential hazards associated with the bacteria as well as the parasites, but the control of viral organisms is a moot question, primarily because of the difficulty associated with studying virus. Recently, however, with the completion of St. Petersburg's Southwest Plant, we now have a sewage treatment plant which produces an effluent in which the virus is non-detectable.

The Southwest wastewater treatment project, in St. Petersburg, was selected by the National Society of Professional Engineers as one of its "Ten Outstanding Engineering Achievements of 1976." All the wastewater from this plant is recycled for turf irrigation. Approximately 8,000 acres are expected to be irrigated by 1980. During periods of heavy rainfall, the effluent is injected into deep wells. Thus zero discharge to surface waters ensures complete elimination of pollution problems. This is the first major regional wastewater treatment system in the nation to achieve zero discharge.

In Table 4, Baldwin presents some interesting economic considerations relative to effluent treatment, disposal, and utilization. He presents a number of probably acceptable disposal alternatives if wastewater is treated to minimum levels. Note that all treatment levels are adequate for utilization of this wastewater on turf facilities if health considerations are followed. Treatment B is the current treatment level of the new St. Petersburg plant. Relative costs for these different levels of treatment are presented by Baldwin[1] in Table 5. It can be seen that treatment costs may more than double our current expenditures to meet new Federal standards of zero discharge by 1985. The St. Petersburg plant (treatment B) by using turf for its disposal has been able to reduce the costs involved.

TABLE 2

Range of Concentration of Metals in Wastewater

	Conc. Range mg/L		Rcm'd. Drinking Water Std's.
Metal	**Cal[1]**	**Mich[2]**	**mg/L**
Cadmium	< 0.005-0.22	< 0.008-0.142	0.01
Chromium	—	< 0.02-0.70	0.05
Copper	< 0.006-0.053	< 0.02-3.36	1.00
Mercury	0.0002-0.001	< 0.0002-0.044	0.002
Nickel	0.003-0.60	< 0.002-880	no std.
Lead	0.003-0.35	< 0.050-1.27	0.05
Zinc	0.004-0.35	< 0.03-8.31	5.0

[1] After Chang and Page. 1977.
[2] After Cohen. 1977.

TABLE 5

Relative Sewage Treatment Costs

	Level	¢/1000 Gal (5-10MGD Plant)
	Raw Sewage	—
A.	Secondary & chlorination	20
B.	"A" + filtration + flash chlorination	30
C.	"A" + N removal to < 10 ppm N	30
D.	"A" + filtration + P removal to < 1 ppm	40
E.	"D" + N removal to Grizzle-Wilson Std.	47

After Baldwin. 1975.

Turf is a natural for sewage effluent disposal for the following reasons:

1. Use of nutrient constituents, primarily nitrogen and phosphorus, on an annual per unit area basis is high and should minimize groundwater contamination by these elements. This is especially true in Florida where we have a year-round growing season — thus we have year-round utilization;
2. Turf is perennial. Use continuity is year-round and not interrupted by cultivation, seeding, or harvesting operations that are common to other forms of agriculture;
3. Turf has a high water requirement throughout the growing season;
4. The use is in close proximity to the source thereby minimizing transmission expenses.

The economic savings on the fertilizer value alone from sewage effluent are presented in Table 6.

Certainly sewage effluent is not going to solve all of our nutrient and water requirements — in fact it undoubtedly will cause other unknown problems, but it is a resource which at this state of the art bears serious consideration for utilization on turf facilities.

Currently our turf research program is involved in one aspect of sewage effluent utilization for turf purposes. This work is supported in part by the American Society of Golf Course Architects Foundation through the United States Golf Association Green Section Research and Education Fund, Inc. Our concern relates to the heavy metal content of effluent and, although found in relatively small amounts, what their ultimate effects might be on bermudagrass and St. Augustinegrass.

Our first effort was to contact those people who are currently using effluent for turf purposes in Florida. Apparently because of the psychological concerns of the public over the use of effluent, and because of the present as well as future legal restrictions, no one would admit he was using effluent. After many phone calls, letters, and personal visits, we were able to contact a few people who were willing to cooperate. We are currently working with them.

TABLE 4

Treated Sewage Effluent Disposal Alternatives
Yes — Probably Acceptable

Level of Treatment		Inland Waters	Estuaries and Bays	Gulf of Mexico	Deep Wells Inland	Deep Wells Coastal	Deep Ocean	Percolation Ponds	Parks and Golf Courses	Hay and Other Forage Crops	Fruits and Vegetables
A.	Secondary Plus Chlorination	No	No	No	No	Yes	Yes	No	Yes[1]	Yes	No
B.	Secondary Plus Filtration Plus Flash Chlorination	No	No	No	No	Yes	Yes	No	Yes[2]	Yes	No[3]
C.	"A" Plus N Removal To <10 ppm	No	No	No	Yes	Yes	Yes	Yes	Yes[1]	Yes	No
D.	"A" Plus Filtration Plus P. Removal To < 1 ppm	No	No	No	No	Yes	Yes	No	Yes[2]	Yes	No[3]
E.	"D" Plus N Removal P < 1 ppm N < 3 ppm SS < 3 ppm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes[2]	Yes	Yes[3]

1. Where access would be restricted following irrigation.
2. Assuming virus free effluent.
3. Presently unacceptable. Certain crops, such as citrus, may utilize virus free effluent under a strict monitoring program.

After Baldwin. Personal Communication. 1975.

Our field work involves gathering samples of the effluent currently being used. In those cases where it has been utilized for a long period, detailed soil samples have been gathered, along with plant tissue samples. The soil and plant analyses are incomplete at this time, but the effluent analyses are summarized in Table 7. In all cases, the concentration of the five metals we are studying was well below the recommended drinking water standards. Note especially in Table 7 most effluent samples were taken directly from the sewage treatment plant. We do not anticipate phytotoxicity problems from the continued utilization of these sewage effluents.

Miss Cindi Donoho is responsible for the conduct of this study. Cindi is currently attempting to establish phytotoxic levels of cadmium, lead, zinc, copper, and nickel on bermudagrass and St. Augustinegrass. We anxiously await her results so that sound judgments can be made on the future use of sewage effluent of varying quality for turf purposes. My current feelings are that sewage effluent is a tremendously valuable resource and should be utilized to its fullest.

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TABLE 6

Value of Nutrients Applied with Typical Secondary Sewage Effluent at 1 Million Gallons/Day for 1 Year

Nutrient	Amount in* Effluent ppm	Amount in 1 Million Gallons Pounds	Applied in 1 Year Pounds	Unit Value (Applied) $/#	Value Per Year $
N	30	250	91,250	19¢	17,338
P	10	83	30,295	7¢	2,120
K	6	50	18,250	75¢	1,369
Ca	32	267	97,455	2¢	1,949
					TOTAL 22,776

*These concentrations are variable from different treatment plants.

TABLE 7

Heavy Metal Content of Florida Effluent Direct from Treatment Plants and Currently Utilized for Turf Irrigation

Source	Range	Parts Per Billion Cd	Cu	Ni	Pb	Zn
Treat. Plants	L	.05	1.5	.5	.5	10
(10)	H	40.00	6.0	25.0	2.0	70
Golf course (6)	L	.05	1.5	ND	ND	5
Not diluted	H	.15	18.5	1.0	6.0	350
Golf course (5)	L	.50	1.0	ND	1.5	3
Diluted	H	3.00	150.0	.5	8.0	61

ND = Not detectable

New Zealand

Turfgrass Management in An Incredible Land

by WM. H. BENGEYFIELD

"HAERE MAI" they call, and you are welcomed to New Zealand!

When you disembark the 14-hour flight from Los Angeles and arrive in Auckland, you are not only in another day and another season, but also in another world. New Zealand is a land of unbelievable beauty and its 3½ million people are sports enthusiasts, participants and doers. Someone will soon tell you there are also 60 million "four-legged greenkeepers"; this an affectionate referral to their most important agricultural commodity — sheep!

Through the invitation of President Stewart Robinson of The New Zealand Turf Culture Institute, the opportunity to tour, lecture, listen and learn of the turf culture practices in this incredible country was extended last February. The true value of sharing ideas and information was re-emphasized and reinforced. It is undeniable that turfgrass management today is a world-wide profession.

No turfgrass agronomist will visit New Zealand without soon learning that there are two schools of thought regarding soil pH levels. The "acid era" still has its adherents. They believe a pH range between 4.1 and 5.0 is right and proper for putting greens and similar areas.

Then there are others who feel, just as strongly, that the range should be at least over 5.0 and preferably nearer 6.5. We in the United States passed through the so-called "acid era" in the 1930's and, since that time, have generally agreed to pH ranges above 6.0 as acceptable.

Who is right? Convincing arguments can be presented by both sides. Those believing in lower pH ranges point proudly (and correctly) to a marked absence of *Poa annua* in their New Zealand browntop bentgrass greens. There are fewer problems from earthworms as well. In fact, many New Zealand browntop bentgrass greens are remarkable for their tight, wear-resistant turf, narrow-bladed grass with exceptional putting qualities!

To the contrary, those believing in higher pH values point proudly (and correctly) to the fact that thatch accumulation is far less a problem, water infiltration greatly improved and turf is, overall, greener, healthier and far more able to survive droughty, adverse weather conditions!

Is there some middle ground in this argument of soil pH levels? Perhaps our New Zealand friends, in their dedication to agricultural fundamentals, have something for us to ponder. Perhaps a soil pH range between 5.5 and 6.0 is of considerable benefit to bentgrass production when compared with *Poa annua* development (assuming other nutritional needs are in adequate supply). Dr. Roy Goss, Washington State University, has recently shown the value of sulfur applications in reducing *Poa annua* invasion in bentgrass turf (March, 1978, issue of the *Record*). Retired Superintendent Art Anderson, Brae Burn Country Club, Massachusetts, has long advocated such a pH range for greens. With modern equipment and modern chemicals, the old problems of thatch, insects, weeds and disease may be more easily tolerated at the 5.5 to 6.0 pH range today. It is something for us to think about.

RESEARCH IN NEW ZEALAND

Whether in their country or ours, meaningful research remains at the heart of all progress in turfgrass management. There is no substitute for it!

At the Department of Scientific & Industrial Research (DSIR) in Palmerston North, Dr. Peter Evans heads up a most capable turfgrass research team. This governmental agency works closely

(Above) A typical countryside golf club. Fence protects greens from four-legged greenkeepers.

(Left) Cotula was once a weed. Now it's used on bowling greens.

with Stewart Robinson and the staff of The New Zealand Turf Culture Institute (a non-profit and non-governmental agency). The Institute staff visits all sports turf interests (golf, lawn bowling, cricket, football, rugby, croquet, etc.) who support The Institute through annual subscriptions. A high level of scientific extension teaching and research is thereby developed and maintained.

One of the most exciting DSIR research efforts lies in the selection and breeding of New Zealand browntop *(Agrostis tenuis)* now underway. This grass is naturally found over the hills, fields and fence lines of New Zealand. Potential for improvement seems unlimited and, if three or four good adaptable, seeded varieties become commercially available (as with creeping bentgrasses in the United States), the entire turfgrass world may one day beat a path to the South Pacific and New Zealand's front door.

Other research is underway with soil pH values, various grass species, nutritional requirements, physical properties of sand and soils, and *Poa annua* and other weed controls.

To bring new research and to share improved cultural practices with those in the field, The New Zealand Turf Culture Institute maintains a staff of seven extension agronomists. They visit and send reports to supporting clubs similar to USGA Green Section agronomists. Their financial base is supplied by golf, bowling and other sports turf interests. Each club contributes according to the number of members on its roll.

New Zealand is a nation having more golf courses per capita than any other country in the world. While visiting Otago Golf Club in Dunnedin, I had the great pleasure of meeting Greenkeeper John Dickson and one of the senior members of his club at Otago, a Mr. McClintock. Otago Golf Club incidentally is the second oldest club in New Zealand. It crowned its first champion in 1872. McClintock recalled an old Scottish story relating

to finances. "In this world," he said, "You get nothing for nothing — and very little for sixpence!" The New Zealanders are investing in better turf through their Turf Culture Institute.

GOLF — A WINTER SPORT?

It may be difficult for an American to understand, but golf in New Zealand is considered a "winter sport!" Someone said it is traditional. But winter is also the time of rains and, until recently, the brown, dry fairways of summer were of little concern to most golfers. Times are changing. Irrigation improvements are being made and there are now perhaps six courses with fully automatic irrigation systems and ever increasing numbers of quick-coupler installations especially for greens and tees.

Improved golf course irrigation is essential; it is the first step toward improving year-round turfgrass quality. In fact, if one had to predict the future for golf turf in New Zealand, it would have to be an improved and extended irrigation system. But the New Zealanders know how to manage what irrigation they presently have. February is summertime below the equator, and I never saw a wet green or a wet golf course during the entire trip!

MONEY, MANPOWER & EQUIPMENT

New Zealand was settled largely by Scots during the mid 1880s, and thriftiness, even today, is not unknown. Annual golf club membership dues are generally under $100, with the most exclusive clubs charging no more than $150 a year! Clubhouses are not ornate palaces, nor are they heavily staffed with employees. There is always the Club Secretary and one, perhaps two or three others involved in the kitchen, bar or elsewhere in the entire clubhouse. Not every golf club employs a full-time golf professional. But the clubhouse traditionally has a picture window view of the final hole and is comfortable, functional and clean. Most memberships willingly accept many of the responsibilities we delegate to hired hands. For example, if a country golf club is holding a weekend tournament, the ladies will prepare and furnish the food. Golfing memberships are comprised mostly of those who enjoy playing the game; other social considerations seem less important.

Because of low dues structures, manpower and equipment on the golf course is considerably less than in the United States. Nevertheless, the more experienced golf course superintendents receive good salaries, which are far above the national norm. The average number of golf course workers is perhaps two or three for an 18-hole course. The highest number was eight! Super grooming and super mowing practices are not always found. Indeed, if there is one turf management requirement which would materially improve playing qualities, it would be increased mowing schedules. If overall maintenance and course conditioning is to improve, the golfing membership must be willing to accept higher dues for larger staffs for golf course maintenance.

Because it is an island and is basically an agricultural nation, New Zealand's import duties on golf course maintenance equipment are high. For example, a triplex putting green mower manufactured in the United States will cost $12,000! As a result, the New Zealand greenkeeper (the title he prefers) has become a tremendously resourceful and inventive fellow. Since his club cannot always afford the equipment he needs, more than likely he invents or builds his own; shades of our country 30 years ago! I saw some very good homemade triplex putting green mowers, direct hydraulic drive fairway mowers, scooters, sprayers, topdressers, etc. Necessity, it seems, is still the mother of invention.

OTHER TURFGRASS INTERESTS

New Zealand golfers are not alone in their interest in better sports playing grounds. Never have we seen a more enthusiastic fraternity of sportsmen than the lawn bowlers of New Zealand! All ages are represented, and their spirit toward this game is infectious. Women are active bowlers through the summer days while the men, when work is over, drop by their club for a few games usually before but sometimes after dinner. Annual dues for bowling club membership ranges from $12 to $20 a year and there are thousands of bowlers throughout New Zealand.

The lawn bowler is interested, even to a greater degree than golfers, in fast, hard-playing surfaces. Turfgrasses do not always provide ideal bowling conditions, and over 25 years ago, bowlers on the South Island found a strange weed invading some of their greens. It was a low-growing, broadleaf native plant called Cotula and proved to be excellent for bowling purposes. Several other Cotula varieties have been found over the years and are preferred by many bowlers today. Indeed, Cotula is "a weed that has found its place!"

The cricket and rugby fields of New Zealand are usually shared, and their seasons overlap (not unlike baseball and football in the United States). The two games have entirely different playing requirements, and yet the turfgrass manager is expected to affect the change almost overnight. He strives mightily usually, I think, successfully, but it is a difficult assignment. More research and implementation of sound turf management procedures in irrigation, fertilization, soil studies, etc. will surely help.

A FINAL THOUGHT

Americans and New Zealanders have a natural bond, not only in language and history, but also in an attraction to all outdoor sports. The New Zealanders are exceptional agriculturists and grow very good turf for sports use. Furthermore, they are interested in growing it better. These are wonderfully friendly people living in an incredible land. And once you have traveled and seen their remarkable country, their expression "Good as Gold" will take on new meaning and forever remind you of the wonders of New Zealand.

News Notes for JULY/AUGUST

Dr. Douglas Hawes becomes Mid-Continent Director of Green Section.

Dr. Douglas T. Hawes was appointed USGA Green Section Director for the new Mid-Continent Region, effective May 22, 1978. Dr. Hawes will serve Green Section subscribers in Idaho, Utah, Arizona, New Mexico, Colorado, Wyoming, Montana, North and South Dakota, Nebraska, Kansas, Oklahoma and Texas from his new office at 17360 Coit Road, Dallas, Texas. This is the first step in our expanding nationwide Green Section effort to serve more clubs more effectively.

Dr. Hawes has been on the teaching and turfgrass research staff of the University of Maryland for the past 12 years.

Doug Hawes

Donald Hoos becomes Western Director as Bill Bengeyfield resigns from the Green Section.

After 26 years on the Green Section staff, Bill Bengeyfield resigned as Western Director and Publications Editor, effective July 15, 1978. He plans to continue his turf management with a new golf course and recreational facility in Southern California.

Donald D. Hoos was appointed Western Director from his previous Green Section post as Southeastern Region agronomist. Mr. Hoos has been a member of the staff since January, 1978, after completing his Masters Degree at Oklahoma State University. He previously served as a captain with the United States Army, spending two years in Germany.

Bill Bengeyfield and Don Hoos

Stimpmeters Delivered

Green Section Stimpmeters have been mailed to all USGA Green Section Turfgrass subscribing clubs. This instrument is designed to assist golf course superintendents and green committees in measuring the speed of greens and developing greater uniformity from one green to another.

A limited supply of Stimpmeters is available to non-Green Section subscribers at a cost of $15 each. Write to Golf House, Far Hills, New Jersey 07931, for further details.

Poa annua Bulletin published.

The *Poa annua* Bulletin, "Annual Bluegrass (*Poa annua* L.) Description Adaptation, Culture and Control," is now available after an extended delay. This publication was prepared by Drs. Beard, Rieke, Turgeon and Vargas of Michigan State University and is MSU Farm Science Research Report No. 352.

The USGA Green Section Research and Education Fund supported a major portion of this study. Two copies of this Bulletin have been mailed to every USGA Member Club.

Correction for "Poa annua — It Won't Go Away!"

Dr. Roy L. Goss, Washington State University and author of "*Poa annua* — It Won't Go Away!" (March, 1978, *Green Section Record*) has called our attention to a typographical error in that article. The error occurs in the second paragraph on page 29 and states, "it involves using endothal and DSMA." It should read, "endothal and bensulide."

Dr. Goss tells us that his research has never used endothal and DSMA in combination, and he would have no idea what the effect might be on turf. Our thanks to Dr. Goss for the correction and our apologies for the original error.

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TURF TWISTERS

A PLACE FOR STIMPMETER

Question: We recently received our Stimpmeter and the directions indicated that when not in use, it should be stored safely to avoid damaging the instrument. Do you have any suggestions for storage and transportation? (Wisconsin)

Answer: Yes. By storing the Stimpmeter in a piece of plastic irrigation pipe one meter in length, it is possible to avoid damaging, scratching or denting the instrument. It is important that one end of the irrigation tube be capped.

A PLACE FOR CUPS

Question: Is there a place where I can show my Golf Committee and the members of the club the guidelines for cup locations on greens? (Maryland)

Answer: Yes, the USGA Golf Handbook has a section for the Golf Committee. In this section, pages 6 and 7 explain the guidelines for pin placement. The USGA Handbook can be purchased from Golf House, Far Hills, New Jersey 07931, for $5.

A PLACE FOR DISEASE

Question: Positively diagnosing turfgrass diseases has always been somewhat of a problem for me. I was wondering, are there any sources of information on the microscopic identification of turf diseases? Perhaps by looking at my turf through a microscope I can do a better job of diagnosing what is weakening my grass this summer and thus be more effective in my control procedures. (New Jersey)

Answer: We have recently seen a publication entitled "A Turf Manager's Guide: Microscopic Identification of Common Turfgrass Pathogens." It was prepared by Patricia Sanders, Research Assistant, Department of Plant Pathology, Pennsylvania State University. Inquiries on this manual should be addressed to:

Pennsylvania Turfgrass Council Inc.
16 Tyson Building
University Park, PA 16802