DOWNLOAD PDF TURFGRASS AND LANDSCAPE IRRIGATION WATER QUALITY

Chapter 1 : HLA Turf Irrigation Water Quality: A Concise Guide Â» OSU Fact Sheets

The authors discuss irrigation system design when confronted with poor quality water, salt leaching, water acidification, and turfgrass nutritional considerations, and discusses lake, pond, and stream management and other water issues.

Irrigation product suppliers and property owners must partner to drive irrigation efficiency to keep the green industry healthy. Designed and managed landscapes, which typically include in-ground irrigation, are common in many urban and urbanizing areas of the United States. While these landscapes can have aesthetic and other functional benefits, they have also been under scrutiny due to the inputs to maintain these landscapes at a desired level of quality or performance. In particular, water and fertilizer inputs have come under scrutiny due to the demand imposed on municipal water systems where potable water is the source of irrigation for the former and downstream water quality degradation for the latter. This article will focus on the issue of water as an input and some trends that are shaping landscapes of the future. In the past, a number of strategies have been utilized in an attempt to reduce potable irrigation demand on landscapes. Relative to irrigation, the following are somewhat common tools: Some other less common requirements include a required threshold level of distribution uniformity DU and some measure of proper design and installation in the field such as field verification of irrigation install compliance with a design. These strategies have all been used where potable water is used for irrigation. Increasingly, alternative water supplies such as reclaimed wastewater, lower quality surface water or shallow wells are being encouraged. Even these alternate sources, which were once thought to be plentiful if not almost limitless are showing signs that limits might exist with some utilities now volumetrically metering reclaimed wastewater for billing purposes. Landscape techniques aimed at reducing potable water demand include: Reducing potable water use In recent years, tremendous interest has occurred with programs aimed at reducing the amount of water applied to landscapes and in particular when potable water is used. Other programs such as Florida WaterStar http: Rather than a quantitative water budget that can be used in the design process, the designer most pick from a menu of options which are then assigned point values corresponding to the relative potential for water conservation. For example, not irrigating a significant fraction of the landsape would allow for more points than say using pressure regulation in the sprinkler system. A certain number of points in various categories such as percentage of the landscape not irrigated, percentage of the landscape without high volume irrigation, use of a smart controller, leak detection and rainfall harvesting as the irrigation water source WaterStar and limiting turfgrass, use of drought tolerant plants, and reduce irrigation demand by at least 20 percent, LEED for homes are required for certification. The programs described here are voluntary. On the other hand, codes, once adopted by local governing bodies are mandatory. Examples include local building codes and electrical codes. Standards are used in codes such as the Florida Building Code. A building code is a specification intended to protect health, provide safety in the built environment, and addresses the manner in which systems are assembled or constructed in the field. Standards strengthen codes since they function as references for very specific aspects of a code. Characteristics of Landscapes of the Future Use substantially less or possibly no potable water for irrigation. When potable water is used we can expect drastically less sprinkler irrigated area. With many common turfgrass varities, this will necessitate less turfgrass area or new varieties that can exist on only rainfall. Larger amounts of landscaped area will contain microirrigation or a significant amount of the landscape will not be irrigated. Expect to see trials of subsurface drip or buried capillary mats in turfgrass. Dual supply systems will become more common as alternative water supplies e. Smart irrigation controllers will become mainstream so that the efficiency of irrigation scheduling will be maximized. Onsite rainfall capture will increase in popularity. Greywater may be coupled with such a system as yet another way to offset potable water or other sources for irrigation. Standards under development There are currently several ongoing standards development efforts related to landscape irrigation. This standard aims to establish minimum requirements for landscape emission devices to ensure adequate safety and performance through common testing and

specification procedures. Currently testing and specification guidelines vary across the industry for sprinklers and microirrigation. The Landscape Plant Water Requirements standard will establish a common methodology for determining water requirements of landscape plants while maintaining intended function of those plants based on the most current scientific knowledge. Such a standard could be used to define a landscape irrigation budget for either management or how a landscape might be designed. Currently, there are many different ways used to determine landscape water requirements that vary across the county and in some places city by city. The Weather-based Controller standard aims to provide a common testing methodology to characterize an efficiency of these controllers. This standard will build on the existing efforts of the Irrigation Association Smart Water Application Technologies test protocol development http: The Auditing standard is in process of defining minimum requirements for performing a catch can test and is using the Irrigation Association Recommended Audit Guidelines as a starting point. This standard committee is also looking at developing minimum requirements for auditing drip systems as well as performing an audit using a soil moisture sensor because there are also many variations across the country on how to audit a landscape irrigation system. Variation necessarily leads to differences due to the evaluation process itself making it difficult if not impossible to specify minimum performance levels across a broad area. Finally, the Soil Moisture Sensor Controller standard will describe a methodology to test the performance characteristics of soil moisture sensors in various types of soil, salinity levels and temperatures. Common testing, specification and evaluation of landscape irrigation technologies, equipment and systems will lead to an even playing field for the industry while achieving higher levels of water use efficiency. Contact him at mddukes ufl.

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Chapter 2 : Turfgrass Irrigation Water Quality â€" Oklahoma State University Turfgrass Science

Turfgrass and Landscape Irrigation Water Quality: Assessment and Management - Ebook written by Robert N. Carrow, Ronny R. Duncan, Michael T. Huck. Read this book using Google Play Books app on your PC, android, iOS devices.

Yet few turfgrass managers have received formal training in the intricacies of irrigation water. Turfgrass and Landscape Irrigation Water Quality: Assessment and Management provides a comprehensive, science-based review of irrigation water quality. The book examines field problems in a logical manner, provides clear scientific explanations, and offers detailed practical information for resolving each specific problem in an environmentally sustainable manner. Divided into four parts, the book begins with an overview of the assessment of irrigation water. It discusses factors that affect the quality of water, assists readers in understanding irrigation water quality tests, and examines field monitoring. The second part focuses on explaining scientific irrigation water quality situations or challenges associated with various water sources, including saline, seawater, and reclaimed irrigation water, as well as stormwater reuse. The next section explores management options for site-specific problems. The authors discuss irrigation system design when confronted with poor quality water, salt leaching, water acidification, and turfgrass nutritional considerations, and discusses lake, pond, and stream management and other water issues. The book contains several case studies which further clarify the material and provides a comprehensive appendix list of landscape plants and their relative salinity tolerances. The diversity and nature of various water quality related challenges are quite daunting, even for the most seasoned professional. This volume provides a foundation for understanding the complexities of water quality that is certain to lead to science-based management decisions that are environmentally friendly and sustainable for years to come. Read more About the author Robert N. His degrees are from Michigan State University B. He has held research and teaching position in turfgrass science at the University of Massachusetts and University of Georgia present. Carrow has concentrated his research position at the a soil chemical nutrients, acidity, salinity and soil physical compaction, oxygen, drought stresses, and b traffic stresses compaction, wear on turfgrass. He has served in many professional turfgrass manager and scientific society responsibilities. He received his Ph. Following graduation he served for 2 years in the U. Army, and worked in the fertilizer industry for 2 years. He taught and conducted research in turfgrass programs at the University of Massachusetts and at Penn State He continued his activities for several years following retirement. He served as visiting scientist and taught in the turfgrass management program at Mississippi State University during the spring semester in through He has conducted research dealing with soil-related problems on turfgrass areas. Topics included N-source evaluation, soil test calibration, soil modifications and playing surface characteristics of sports fields. His teaching assignments haveincluded courses in beginning soils, soil physics, soil physical properties on turf, turfgrass nutrition, weed control in turf, and turfgrass management. He has served in many turfgrass industry and professional society offices and committees. His contributions have been recognized by various awards and honors including Fellow in the American Society of Agronomy, the Fred V. His degree are Ph. He joined the faculty at M. His research program has concentrated on cultivation, topdressing, and fertilization of turfgrasses. For 20 years he coordinated the turfgrass extension program at M. His teaching included courses in beginning soils, soil management, and turfgrass soil management, the latter having been taught to over students. Rieke has served the turf industry and professional societies in a number of capacities. Among recognitions for Dr.

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Chapter 3 : turf irrigation manual | Download eBook PDF/EPUB

Turfgrass and Landscape Irrigation Water Quality: Assessment and Management provides a comprehensive, science-based review of irrigation water quality. The book examines field problems in a logical manner, provides clear scientific explanations, and offers detailed practical information for resolving each specific problem in an environmentally.

And increasingly, water is becoming an ever more precious resource. However, the landscape industry occupies a unique position where water is concerned. Patterns of rainfall vary considerably from one part of the country to the next. Surface water is separated into watersheds by the topography of the land. Even groundwater belongs to one aquifer or another. The most pressing water issues will vary from region to region, and sometimes from one municipality to the next. However, looking at the biggest water concerns nationwide will reveal the following three at the top of the list: The past 10 years have seen significant drought in many areas of the U. Those of us in the West and Southwest are now living through a millennial drought, with conditions unlike any in recent memory. What is not clear is just how long-term this water shortage is likely to be. While it is logical to assume that drought conditions will always eventually go away, some climate change models predict a more or less permanent shift toward drier conditions in parts of the U. Regardless, every region is bound to experience drought sooner or later, whether short-term or for the duration. Shifting to less water-intensive landscaping practices will not only help relieve the situation now, but also set the stage for greater resilience against low-water conditions in the future. Water quality is a top concern throughout the water-rich Eastern, Great Lakes and Midwest regions of the U. In drought-stricken areas, the effects of drought extend to water quality: On average, municipal water rates in the U. Contributing factors include drought-related shortages; tightened water quality regulations; the rising cost of chemicals and other items necessary for water treatment; and costs associated with maintaining an aging water distribution infrastructure. Challenge â€¦ or opportunity? While water concerns vary by region, the primary overarching water issue of the day is undoubtedly water availability. Globally and in many regions, there is a limited amount of water with a lot of interests seeking to have that water. Naturally, conflicting water interests have given rise to an increasing amount of water use legislation, especially in drought-prone areas. Historically, landscaping has been largely unregulated. However, that is changing rapidly as more and more water regulations come into play. Depending on location, property owners are being asked to restrict water use, replace their turf with less water-intensive landscaping, eliminate runoff and sometimes even stop watering altogether. No one likes forced lifestyle changes. However, in general the public is adapting well to water use restrictions, says John Farmer, government and public affairs director of the Irrigation Association. People want to be water conscious. Of the remainder, 67 percent believe that it will become an issue in their area as drought conditions worsen across the country. Farmer stresses that even though the changes going on in landscape and irrigation regulation may feel uncomfortable, they represent an opportunity for landscape professionals to step up and be seen as a solution to the problem rather than a part of it. He says the drought regulations in his area are encouraging people to move past their comfort zones and take advantage of his expertise. Overall, the trend is toward collaboration between all parties, including programs and incentives that benefit consumers, landscape professionals and communities alike. For example, their Water Smart Landscapes program offers renovation grants to help both commercial and residential property owners in their area finance replacement of turf with desert landscaping. The program increases business for landscape contractors as well as incentivizing long-term savings for the consumer. The utility also offers a no-cost certification program for local landscape contractors. The Water Smart Contractor program trains contractors in water efficiency best practices through free, sponsored workshops. Landscape companies that certify at least half their employees and remain in good standing qualify for Water Smart Contractor status and enjoy promotional privileges. Eighty-nine percent of contractors nationally reported that the majority of their customers were only somewhat or not at all aware of

the importance of proper turf and landscape irrigation. This lack of understanding appears to affect marketing and sales directly: However, almost half of contractors make no proactive effort to educate their clients about the subject. The need for education is not limited to the end consumer. When rating themselves, 38 percent of contractors said they were only somewhat knowledgeable about proper irrigation techniques, and 2 percent admitted that they had no knowledge of the subject. We have a lot of opportunities for keeping contractors at the cutting edge. For example, July is Smart Irrigation Month. One of the most important things we do is educate contractors to educate consumers. The best place is face-to-face interaction. We also partner with the water providers and have them educate customers.

Chapter 4 : The Changing Landscape of Water - Turf

Irrigation water quality is becoming more important for managers of sports turf and grounds. With the demand for potable water increasing, users of irrigation water are considering alternatives sources, such as recycled or effluent water.

Water quality conservation objectives are to design, develop, and test a rechargeable, in-line drainage filter that removes nitrates and phosphates from leachate coming through the drain tile of a sand-based putting green. A schedule of outputs follows. Survey data collected for water conservation website planning; year 1 of the case study completed. Laboratory, greenhouse, and golf course testing of nutrient filter initiated. Irrigation scheduling website launched and user-tested; year 2 of the case study completed. Greenhouse filter testing completed, field testing continues. Irrigation scheduling website development completed and year 3 of the case study completed. Filter improvement for field applicability continues with lab and greenhouse data published. Continued website improvement and peer-reviewed publishing of case study results. Field testing of filter completed and commercialization considered. Project Methods A public-access website will be developed that provides turfgrass-specific water needs based on seven Virginia Tech-managed weather stations around the state. Species-specific evapotranspiration ET needs will be updated daily to encourage landscape irrigators to only apply the amount of water needed for healthy growth. As the website is being developed three case studies will be conducted to compare water consumption when irrigation is scheduled based on an observational approach rather than the weather-station ET approach. Quality as the dependent variable and irrigation applied as the independent variable will be used in correlation and regression analysis to determine if there is a relation between the two variables and how changing irrigation amount over the two summer monitoring periods may affect turfgrass quality. Our hypothesis is that ET-based irrigation will result in less applied water with little to no affect on turfgrass quality. Case study cooperators will provide feedback as to the ease of use and effectiveness of the ET website. At several stages of web site development surveys of numerous potential users will be conducted to inform and refine usefulness and ease of use. Surveys will include Likert-type scale responses to measure responses concerning certain website aspects. Correlation statistics will also be utilized to assess relationships i. A filter consisting of ferrihydrite-coated sand FCS and anion-exchange resins AER will be constructed and tested in lab, greenhouse, and field settings. The ability of the FCS and AER compounds in the filter to capture nitrate-N and phosphate-P during multiple saturated-flow leaching events will be assessed in the lab and then lysimeter greenhouse studies. Lawn care providers, golf course superintendents, sports field managers, and other turfgrass managers primarily in Virginia. Some aspects of this project extend internationally. The Virginia turfgrass irrigation website that was developed as part of this project is no longer operational due to loss of Virginia Tech weather station support. Major delays in the rootzone leachate and nutrient filter project have occurred due to malfunctions of the monitoring equipment installed by BSE department cooperators on the VT and UVA football stadium fields. As a result of major delays in this portion of the project, I initiated and included in this report, a project on water quality monitoring of streams on golf courses within the Chesapeake Bay Watershed. A PhD student has completed 2 years on this project. What opportunities for training and professional development has the project provided? Graudate students were trained as part of this project. How have the results been disseminated to communities of interest? Conference presentations, industry, newsletters, websites, and reviewed publications. What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported Impacts What was accomplished under these goals? A PhD student, Adrienne LaBranche-Tucker, completed her dissertation in that served to accomplish half of the goals of this project Water conservation: ET-based irrigation scheduling website. Numerous conference presentations and industry newsletter articles were delivered by Ervin and LaBranche. The Water Quality portion of this project had three facets: Numerous conference presentations and industry newsletter articles have been delivered by Ervin and Wilson PhD student. Numerous conference

presentations and industry newsletter articles were delivered by Ervin and others as concerns the information in this book. Water quality monitoring on Virginia golf courses. This manual includes sections on BMPs for water conservation and quality that were directly informed by information produced as a result of this project. Information pertinent to the goals of this project were presented this reporting period at educational meetings of various associations of turfgrass professionals including: Co-PI on golf course water quality project. Primary student investigator for golf course water quality project. PI on rootzone leachate and nutrient filter project. Co-PI on rootzone leachate and nutrient filter project. Partner organizations for these projects are the Virginia Agricultural Council funding , the Environmental Institute for Golf funding and professional development , the Virginia Golf Course Superintendents Association funding and professional development. Training and professional development on golf course water quality was given to turfgrass managers who attended talks given by Ervin over the last reporting period at the Virginia Turfgrass Council and Pennsylvania Golf Turf Association annual conferences, and annual meetings of the Greater Washington, Old Dominion, and Shenandoah Valley turfgrass associations. Golf course superintendents nationally are also an audience given that funding is being received by their Environmental Institute for Golf and updates are being published in their professional periodical: Face to face meetings and talks at monthly meetings have been given and are planned to continue to educate them on our water quality findings and to discuss BMP implementation for reducing nutrient movement into streams exiting their courses. Impacts Implementation and ground-truthing of recommended BMPs for conservation and protection of water resources began in the last reporting period with a research project that involves seasonal monitoring of water quality parameters on six golf courses within the Chesapeake Bay Watershed in Virginia. A grant proposal to garner funding to expand this monitoring and BMP implementation project was funded by the Environmental Institute for Golf and a PhD student Chantel Wilson has been working on the project since June, To date, we have reported to stakeholders that nitrogen and phosphorus levels in streams exiting golf courses monitored within the Chesapeake Bay Watershed do not exceed EPA pollution limits. Short-term BMP implementation on one course has resulted in less nutrient loss from a stream exiting one of the monitored courses. Grant funds from the Virginia Agricultural Experiment Station were used this reporting period to continue and expand our research on an in-drain-tile filter system for removing nitrate and phosphate in leachate from sand-based turfgrass systems such as golf greens and athletic fields. Drainage leachate volume is currently being monitored and sampled for nutrients coming out of the football stadium fields at Virginia Tech and the University of Virginia. These background water data will be used in the coming reporting period to design a field-scale filter for effective removal of nitrate and phosphate in the drainage leachate. The manual is currently being reviewed by personnel within affected Virginia regulatory agencies and is scheduled to be published in early The following organizations partnered on this project by providing funding or attending training events associated with the information produced: Nothing significant to report during this reporting period. Impacts Outcomes are unknown and in-progress for the two main components of this project. Implementation and ground-truthing of recommended BMPs for conservation and protection of water resources began this reporting period with a new research project that involves seasonal monitoring of water quality parameters on six golf courses within the Chesapeake Bay Watershed in Virginia. A grant proposal to garner funding to expand this monitoring and BMP implementation project has been submitted to the Environmental Institute for Golf Grant funds from the Virginia Agricultural Experiment Station were received this reporting period to continue and expand our research on an in-drain-tile filter system for removing nitrate and phosphate in leachate from sand-based turfgrass systems such as golf greens and athletic fields. Publications No publications other than grant proposals and a draft BMP manual during this reporting period. Outputs for Turfgrass Irrigation Conservation goals: The website is available at http: Sustained heat and drought stress during summer meant this ET and irrigation scheduling website was an important guide for VA landscape irrigators. Presentations on how to use the website to guide irrigation scheduling to provide healthy turf, while promoting water conservation were given at the VT Turfgrass Short Course Dec 09 in Blacksburg to 45 VA

turfgrass professionals. Outputs for the Water Quality Protection goals: A filter is still in development to place in drainage outlets from sand-based turfgrass rootzones to capture nitrates and phosphates in drainage water and prevent their effects on eutrophication. Lab and greenhouse scale filters have been successfully developed and tested, with an article published in Golf Course Management magazine. Funding to develop and test a field scale filter was pursued and received for to A team of researchers from Virginia Tech and University of Virginia is in the process of installing and testing filter efficacy in the large 24" id main drain tile outlets at their respective university football stadium fields. Impacts The product of the water conservation project-the VA Turfgrass Irrigation Planning website-is being utilized by turfgrass managers to match irrigation amounts applied to actual needs of the turfgrasses in their region. Such use of weather station-based estimates of evapotranspiration ET put science, rather than guesswork, behind how much water to apply, functioning to conserve water. Applying less irrigation to landscapes not only conserves water and money, but should reduce large runoff or leaching events which potentially carry nutrient loads into water bodies. Removing nitrate and phosphate in drain tile leachate. Reclaimed water for turfgrass irrigation. Outputs for the Turfgrass Irrigation Conservation goals: Email notifications to the Virginia Turfgrass Council VTC listserv of approximately as regards this website availability were sent out in Presentations on how to use the website to guide irrigation scheduling to provide healthy turf, while promoting water conservation have been given at the VTC annual educational conference Jan 09 , at the VT Turfgrass Short Course Dec 08 , and at very turf association meetings throughout the year. Virginia Cooperative Extension agents and Master Gardeners have been made aware of website availability via direct communication and email. Adrienne LaBranche received her PhD May 09 for research related to website development and project goals. A filter is being developed to place in drainage outlets from sand-based turfgrass rootzones to capture nitrates and phosphates in drainage water and prevent their effects on eutrophication. Anion exchange resins AER tested provided efficient capture of leached nitrates, but poor capture of phosphate. To improve phosphate capture, glass beads in the filter were replaced with ferrihydrite-coated sand FCS. Ferrihydrite is an amorphous iron oxide that is often found in soils. Phosphate is readily adsorbed to the surface of ferrihydrite; therefore, coating sand particles that have the same size as the glass beads with the ferrihydrite provided a support material that also gave better phosphate capture. Furthermore, additional AER was added to the filter mixture to enhance the capture of nitrate such that leachate levels remained below the EPA maximum contaminant level MCL. US Patent Serial No. Renewable filter materials for capturing leached nutrients, was filed on October 1, by the Virginia Tech Intellectual Property office. Adam Nichols, the M. No talks were given this reporting period as regards this filter project, but a popular press article for Golf Course Management magazine is in preparation for early publication. Upscaling and commercialization of this filter technology for larger drain-pipe systems of athletic fields has been considered but funding has not been found. Water conservation through use of the Virginia Turfgrass Irrigation Planning website was encouraged via extension presentations made at meetings of the following professional associations: Its use was also encouraged in a presentation to participants at the Virginia Tech Turfgrass Short Course. Attempts have not been made to determine website usage or to estimate how use of the website may be conserving water. Resources have been used exclusively to finish the website and to encourage its use at presentations given to VA turfgrass professionals.

Chapter 5 : Water Quality - University of Florida, Institute of Food and Agricultural Sciences

of irrigation water on turf-soil-water relations and on the soil's chemical and physical properties, particularly as these factors relate to turfgrass quality.

Chapter 6 : Landscape Irrigation BMPs

With the increased use of alternative irrigation water sources on turfgrass and landscape sites, their management is

becoming more complex and whole ecosystems-oriented.

Chapter 7 : Turfgrass and Landscape Irrigation Water Quality: Assessment and Management - CRC Press

Because water quality can influence soil quality and turfgrass performance, it is advisable to test irrigation water periodically for factors that can compromise the turf/soil system. Listed in the following paragraphs are some suggested guidelines to follow when interpreting results of irrigation water analyses.

Chapter 8 : Irrigation Trends Shaping Our Landscapes - Turf

Water quality is a top concern throughout the water-rich Eastern, Great Lakes and Midwest regions of the U.S., with much attention being placed on the use of potable water for irrigation, and on controlling runoff in order to limit the amount of pollutants released into surface water.