

Conserve Florida Water Conservation Clearinghouse

Applied Research Agenda March 2008

**Prepared for
Conserve Florida Water***

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Executive Summary

Conserve Florida Water was established to provide information and tools to improve water conservation through the development of utility-specific, goal-based water conservation programs. The Clearinghouse coordinated the development of an applied research agenda that prioritizes applied research needed to further the state of knowledge regarding effective water conservation programs and practices in Florida. The applied research agenda is the result of a process that included a review of key documents, a research agenda planning task group and a collaborative workshop that included participants from Utilities, Water Management Districts (WMDs), University of Florida (UF), Florida Department of Environmental Protection (FDEP) and consultants. The most critical needs identified at this stage focused on Water Efficient Landscapes and Utility Management Efficiency and Optimization. Since the Alliance for Water Use Efficiency (AWE) Testimony on Efficiency Research Funding¹ addresses research priorities for indoor water use and general applications (meaning?) across the country well it was decided that there is not a need to repeat this in the CFW priorities.

2008 Priority Research Topics for Conserve Florida Water Conservation Clearinghouse identified through the process include:

1. Identification of barriers to behavioral change and methods to affect behavioral practices impacting water conservation by homeowners, homeowner associations, developers, corporation, green industry.
2. Pricing and Water Rates – evaluation of the potential for rate levels, rate standards, tiered rates, and impact fees to increase water conservation.
3. Design of water conservation incentive programs that are effective for different groups (people, builders, government, utilities, developers) including more creative strategies for conservation as a planning tool (i.e., capacity buy-back²)

¹ (Statement of Mary Ann Dickinson, Executive Director, Alliance for Water Efficiency Regarding, Water Efficiency Research Needs, For the Record of the Hearing of October 30, 2007 on H.R. 3957, Subcommittee on Energy and Environment, House Science Committee, November 13, 2008 (available on line - <http://www.allianceforwaterefficiency.org/resourcelibrary.html>)

² Capacity buy-back is a concept already in use by the power industry. A supplier-public water utility determines the marginal cost of the next increment in supply and then provides demand-side project funds to existing customers, to install efficiency at a cost less than the anticipated cost of building new capacity. For example: Say a public water supplier needs to meet future demand, and the only source is desalination. At \$2-3 per kgals, the cost of this new

4. Quantification of Low Impact Development (LID) water savings- environmental savings, benefits of LID for delaying the need for capital improvements, impact of use of ‘pattern book’³ for new development landscaping.
5. Benchmarks for minimum achievable water use standards for buildings (retro and new building, efficacy of LID certifications, use of “pattern book”).
6. Benchmarks for minimum water required for residential landscaping. Relationship between the volume of water usage and quality of landscape.

In the next year of the Conserve Florida Water Conservation Clearinghouse (CFWCC) project (2008-09), the Clearinghouse will focus on the first two of the top key priority areas to provide further synthesis and document state of the art research, research gaps, and recommended studies.

Introduction

In February 2004, stakeholders signed the “Joint Statement of Commitment for the Development and Implementation of a Statewide Comprehensive Water Conservation Program for Public Water Supply.” Signatories to this important agreement were the Florida Department of Environmental Protection, the South Florida Water Management District, the St. Johns River Water Management District, the Southwest Florida

capacity is high. It would be in the utility’s best financial interest to pay their customers to retrofit, say showerheads (or some other water conservation BMP) at < than \$1 per kgals.

³ Pattern books are devices that planners and architects use to create a sense of what the theme of community can be, that is, how the neighborhood will look and feel. It is vehicle to integrate the results of recommendations steering toward good practices in a comprehensive holistic fashion and provides the earliest point at which information can get to the developers and development teams for all large residential development. Dr. Pierce Jones, at the University of Florida, has suggested developing a “model pattern book” emphasizing water efficient, drought tolerant landscaping and irrigation management in the community as well as appropriate practices to be considered early in the design phase. The use of ‘pattern books’ will provide an opportunity to put water conservation and efficiency practices in the context of a style of presentation and language that developers use. It helps water efficient landscape practices in a relevant context. Refer to an example: Patterns of the Past, a foundation for the future. A guide for place making. Oakland Park, Florida. Castle and Cooke. 2005.

Water Management District, the Northwest Florida Water Management District, the Suwannee River Water Management District, the Florida Public Service Commission, the Utility Council of the American Water Works Association (Florida Section), the Utility Council of the Florida Water Environment Association, and the Florida Rural Water Association. That collaborative effort was the basis for the 2004 enactment of Section [373.227, F.S.](#) The law states that the overall water conservation goal of the State is “to prevent and reduce wasteful, uneconomical, impractical, or unreasonable use of water resources.” To achieve these conservation objectives, the legislation emphasized “goal-based, accountable, tailored, and measurable water conservation programs for public water supply.” The legislation directed the Florida Department of Environmental Protection, in cooperation with the water management districts and the other stakeholders, to develop a statewide water conservation program for public water supply utilities.

In 2001-2002, the SIGNATORIES to this Joint Statement, in collaboration with many other stakeholders, participated in the Florida Water Conservation Initiative. All water uses were addressed in this wide-ranging process and the participants collectively recommended many conservation tools in the April 2002 Report from the Water Conservation Initiative. One of several mandates was to “Enhance Assistance and Information Sharing Regarding Water Conservation Programs,” with among several others, the following statements:

- Establish a water conservation clearinghouse to include an accessible, integrated database for information collection, evaluation of conservation effectiveness, and distribution of qualitative and quantitative information on water conservation programs and practices.
- Explore opportunities for research to support refinement of water conservation practices and development of utility-specific programs.

Conserve Florida Water Conservation Clearinghouse

Conserve Florida Water was established to provide information and tools to improve water conservation through the development of utility-specific, goal-based water conservation programs. Through this effort, a water conservation Clearinghouse was established. In March 2006, Conserve Florida Water selected the University of Florida to house, manage, and expand the operation and functions of the water conservation Clearinghouse. The Clearinghouse’s mission is to collect, analyze and make available reliable information and technical assistance to public water supply utilities and water managers for use in developing effective and efficient water conservation programs. One of the key objectives of the Clearinghouse is to “Coordinate and

maintain oversight of an applied research agenda to help develop innovative water conservation programs and practices.”

Core Service 5: Applied Research Agenda/Program

The Clearinghouse will coordinate and maintain an applied research agenda that identifies and prioritizes applied research needed to further the state of knowledge regarding effective water conservation programs and practices in Florida. The research agenda will be developed, and periodically updated, in coordination with the Conserve Florida Water participants, with input from appropriate sources including related UF programs.

Developing an Applied Research Agenda

The applied research agenda is the result of a process facilitated by the Clearinghouse that took place over several months. It included a review of key documents, a research agenda planning task group and a collaborative workshop that included participants from Utilities, WMDs, UF, FDEP and consultants (see *Appendix 1* for Workshop Report). The resultant applied Research Agenda focuses on key research needed by public water supply utilities in Florida to help develop innovative water conservation programs and practices.

Defining Research Focus and Priorities

At the September 18, 2007 Conserve Florida Water meeting a task group was established to work with the Clearinghouse on defining the research agenda. See *Appendix 1* for task group members. This task group met several times to clarify the focus of an applied research agenda, as well as establish the objectives for, and design of research agenda workshop.

The task group included:

- Dave Bracciano, Demand Management Coordinator, Tampa Bay Water
- Norm Davis, Water Conservation Program Technical Director, Hillsborough County Water Resource Services
- Deborah Green, President, Water Media Services
- Steve Moser, Environmental Compliance Group, JEA

- Melissa Musicaro, Staff Water Conservation Analyst, Resource Conservation & Development Department, Southwest Florida Water Management District, SWFWMD
- Lois Sorenson, Demand Management Coordinator & Supervisor, Regulation Performance Management Department, Permit Data Section, SWFWMD
- Wendy Graham, Carl S. Swisher Chair in Water Resources, Director UF Water Institute, University of Florida
- Jim Heaney, Professor and Chair, Department of Environmental Engineering Sciences, University of Florida
- Lisette Staal, Research Coordinator, UF Water Institute, University of Florida

Initially, many potential research questions were compiled for consideration from a variety of sources, including the appendix in the Florida Water Conservation Initiative (2002) called “Preliminary Topics of a Research Agenda”, comments made by the Conserve Florida Water landscape irrigation subgroup during discussions leading up to the drought smart document , and comments made at several Conserve Florida Water meetings.

Reference Documents included:

- Florida Department of Environmental Protection Florida Water Conservation initiative – April 2002, Appendix J: Preliminary Topics of a Research Agenda
- BMPs and Measures FROM WEB BASED Conserve Florida Conservation Clearinghouse GUIDE
- Statement of Mary Ann Dickinson, Executive Director, Alliance for Water Efficiency Regarding, Water Efficiency Research Needs, For the Record of the Hearing of October 30, 2007 on H.R. 3957, Subcommittee on Energy and Environment, House Science Committee, November 13, 2008 (available on line - <http://www.allianceforwaterefficiency.org/resourcelibrary.html>)
- comments made by the Conserve Florida Water landscape irrigation subgroup during discussions leading up to the drought smart document
- Database of issues and research compiled as part of the process (UF research and Extension Programs)
- comments made at several Conserve Florida Water meetings
- Implementing the “Drought Smart” Report, FDEP, July 20, 2007
- Landscape Irrigation and Florida Friendly Design Standards, FDEP, December 2006
- Work Plan to Implement Section 373.227, F.S. (*SECTION 8 OF HOUSE BILL 293*)

- The Joint Statement of Commitment for the Development and Implementation of a Statewide Comprehensive Water Conservation Program for Public Water Supply.
- Hazen and Sawyer Environmental Engineers and Scientists, Potable Water Conservation Best Management Practices for the Tampa Bay Region, Tampa Bay Water, Sept 2003

The task group agreed that a well grounded applied research program that addresses the needs of the CFW and that will have benefits for stakeholders is needed. It established that the CFWCC Applied Research Agenda should focus on applied research to help public water supply utilities to 1) identify tools and approaches to address existing and projected water use and potential for conservation, and 2) identify practices that utilities can implement that will show quantifiable results toward addressing water efficiency and conservation. The applied research should contribute to improving the Guide (support existing measures and BMPs as well contribute to new and improved BMPs for the long term that will impact water use), water use regulation, utility management and water shortage management.

The task group also noted that opportunities to connect the Florida Research Agenda to the research interests of the National Alliance for Water Efficiency should be explored. The AWE Testimony on Efficiency Research Funding ⁴ was presented briefly during the introductory section of the workshop was provided to the workshop participants in advance for their reference. Both the CFW and the AWE research agenda clarify focus, are applied, and recognize the importance of tracking progress as well as documenting measurable results. The AWE research needs are divided into four groups, indoor plumbing, outdoor water use management, integrative research and innovation in green building. The AWE research needs document addresses indoor water use and national applications well and there is not a need to repeat this in the CFW agenda. Rather, the group agreed that the CFW Research Agenda should address the water conservation topics of potential greatest significance in Florida and to address regional differences in Florida, particularly in outdoor water use.

Applied Research Agenda Planning Workshop

The Conserve Florida Conservation Clearinghouse Research Agenda Workshop was held on November 30, 2007, 9:00 am – 4:00 pm, in the Terrace Room, Norman Hall, UF, Gainesville. Over 35 people attended representing WMDs, Utilities, UF, FDEP and other. The workshop was designed to be participatory and to bring Conserve Florida Members and UF Faculty together to articulate an applied research agenda for Conserve Florida to support current Clearinghouse efforts and beyond. This helped to ensure that the research agenda

⁴ (available on line - <http://www.allianceforwaterefficiency.org/resourcelibrary.html>)

reflects the interests of Conserve Florida Water and will support the Clearinghouse efforts. The workshop focused on research to support refinement of water conservation practices and development of utility-specific programs.

The Research Agenda task group initially identified several areas in which applied research is needed to further the state of knowledge regarding effective water conservation programs and practices in Florida. Several theme areas were identified and the Research Workshop was designed to address each of the following:

- Water Efficient Landscapes – Residential Irrigation
- Water Efficient Landscapes – Sustainable Building/New Development
- Residential Indoor Use
- Industrial-Commercial-Institutional Use
- Utility Management Efficiency and Optimization.

Criteria for prioritizing research was also suggested by the Research Agenda task group and was incorporated into the Workshop. These criteria included 1) relevance and fundability, 2) ease of implementation, and 3) research impacts. *For more details on the criteria, see Appendix 1, Workshop Report.*

The output of the workshop has provided input for this applied research agenda. During the workshop all participants were able to address all of the themes. The participants were exposed to what is already being done and considered what still needs to be done, identified priority research needs relevant to Florida water sector, and decided on where priority research efforts should be focused. They worked in groups to identify needs and in plenary to refine those to approximately five per theme area. After presenting each group's top needs, in a plenary session the participants consolidated those considered of key interest narrowing the number to no more than five per group. The top needs identified for each theme included:

A. RESIDENTIAL IRRIGATION - WATER EFFICIENT LANDSCAPES

1. Identification of barriers to behavioral change, behavioral practices (homeowners, homeowner associations, developers, corporations, green industry)
2. Quantification of the minimum amount of water required for landscaping, and the relationship between water volume used and quality of landscape.
3. Big picture cost savings - Relationship between water conservation, energy conservation, biofuels, CO2 emissions, and Carbon sequestration.
4. Reduction of peak demand due to irrigation/landscape changes.

B. SUSTAINABLE BUILDING/NEW DEVELOPMENT - WATER EFFICIENT LANDSCAPES

1. Quantification of Low Impact Development (LID) water savings- environmental savings, benefits of LID for delaying the need for capital improvements, impact of use of “pattern book” for new development landscaping.
2. The impact of using/offering incentives and credits for LID, not mandates and understanding for who and how to offer.
3. What are models for making incentives work for different groups (people, builders, government, utilities, developers)? Design of water conservation incentive programs that are effective for different groups (people, builders, government, utilities, developers)
4. Benchmarks for minimum achievable water use standards for buildings (retro and new building), efficacy of LID certifications), use of pattern books
5. Quantifying the relationship between greenhouse gas emission and water use

C. RESIDENTIAL INDOOR USE

1. Billing Data Analysis - cost analysis for all customers for profiling, targeting conservation programs (leak detection, centralized meter reading).
2. Take advantage of existing other sources of research – including AMR (automatic meter reading).
3. Effects of use of residential softners, etc. on water treatment.

D. INDUSTRIAL-COMMERCIAL-INSTITUTIONAL (ICI)

1. Inventory of equipment, including cooling towers throughout all industries for knowing types and water use, and potential efficiencies between industries.
2. Identify inefficiencies in ICI water usage as a basis for developing new BMPs - through understanding potential for common uses, and the barriers to efficiencies.
3. Link between spent water and water treatment facilities to help identify incentives for common uses.

E. UTILITY MANAGEMENT EFFICIENCY AND OPTIMIZATION

1. Pricing and Water Rates – evaluation of the potential for rate levels, rate standards, tiered rates (and impact fees to increase water conservation
2. Quantify full opportunity costs of water use (including environmental costs).
3. Identify constraints, barriers and benefits to use of reclaimed water.
4. Understand price/cost relationships (should not always just look at averages, should be a better way to reflect the relationships of price and cost across users)
5. More creative strategies for conservation as a planning tool (refer to capacity buy back)

During the final session of the workshop, the participants individually ranked the importance of the needs including all the theme areas. Each participant ranked their top 5 issues. Results were totaled by all participants and by the type of institution that the participant represented (university, utility, water management district, and other).

Research Priorities

The most critical needs identified at the November 30, 2007 workshop focused on Water Efficient Landscapes and Utility Management Efficiency and Optimization. It was the consensus that since the AWE research needs document addresses indoor water use research needs which are generally applicable (is this the right meaning?)

across the country well there is not a need to repeat indoor water use research needs in the CFW priorities. It was determined by the group that the CFW Research Agenda should address the water conservation topics of potential greatest significance in Florida and address regional differences in Florida, particularly in outdoor water use. The research priorities identified in this agenda fall into two key areas of applied research that will help public water supply utilities to:

- ✓ Identify practices, including programs, incentives and pricing strategies that utilities can implement that will show quantifiable results toward addressing water efficiency and conservation (*Understanding people's practices and creating methods and strategies that are effective in impacting water conservation*), and
- ✓ Identify tools and approaches to address issues of existing and projected water use.

See Appendix 1, the Workshop Report, for additional details on priority ranking. Building on the workshop output the following Priority Research Topics have been identified for the Research Agenda:

1. Identification of barriers to behavioral change and methods to affect behavioral practices impacting water conservation by homeowners, homeowner associations, developers, corporation, green industry.
2. Pricing and Water Rates – evaluation of the potential for rate levels, rate standards, tiered rates, and impact fees to increase water conservation.
3. Design of water conservation incentive programs that are effective for different groups (people, builders, government, utilities, developers) including more creative strategies for conservation as a planning tool (i.e., capacity buy-back⁵)

⁵ Capacity buy-back is a concept already in use by the power industry. A supplier-public water utility determines the marginal cost of the next increment in supply and then provides demand-side project funds to existing customers, to install efficiency at a cost less than the anticipated cost of building new capacity. For example: Say a public water supplier needs to meet future demand, and the only source is desalination. At \$2-3 per kgals, the cost of this new capacity is high. It would be in the utility's best financial interest to pay their customers to retrofit, say showerheads (or some other water conservation BMP) at < than \$1 per kgals.

4. Quantification of Low Impact Development (LID) water savings- environmental savings, benefits of LID for delaying the need for capital improvements, impact of use of ‘pattern book’⁶ for new development landscaping.
5. Benchmarks for minimum achievable water use standards for buildings (retro and new building, efficacy of LID certifications, use of “pattern book”).
6. Benchmarks for minimum water required for residential landscaping. Relationship between the volume of water usage and quality of landscape.

Furthering the Research Agenda

In the next year of the CFWCC project (2008-09), the Clearinghouse will focus on two of the top key priority areas to provide further synthesis and document state of the art research, research gaps, and recommended studies. These activities, as possible, will be linked with ongoing national programs such as AwwaRF, the California Urban Water Conservation Council, and the Alliance for Water Efficiency. The two areas are:

1. Identification of barriers to behavioral change and methods to affect behavioral practices impacting water conservation by homeowners, homeowner associations, developers, corporation, green industry

Research in this area may include understanding current knowledge and use of irrigation technologies (sensors, scheduling, etc., effectiveness of education and demonstrations, identification of high water users). In addition, understanding barriers to installing water conserving landscapes as a component of Low Impact Development, LID ordinances, use of pattern books, integrating water conserving practices into HOA documents; implementation of Water Star at the development level. In addition it could include looking at the impact of

⁶ Pattern books are devices that planners and architects use to create a sense of what the theme of community can be, that is, how the neighborhood will look and feel. It is vehicle to integrate the results of recommendations steering toward good practices in a comprehensive holistic fashion and provides the earliest point at which information can get to the developers and development teams for all large residential development. Dr. Pierce Jones, at the University of Florida, has suggested developing a “model pattern book” emphasizing water efficient, drought tolerant landscaping and irrigation management in the community as well as appropriate practices to be considered early in the design phase. The use of ‘pattern books’ will provide an opportunity to put water conservation and efficiency practices in the context of a style of presentation and language that developers use. It helps water efficient landscape practices in a relevant context. Refer to an example: Patterns of the Past, a foundation for the future. A guide for place making. Oakland Park, Florida. Castle and Cooke. 2005.

incentives or other creative strategies encouraging water saving practices, effective regulatory/incentive practices, effectiveness of irrigation ordinances, and specific types of incentive programs that should be encouraged for implementation by local governments.

2. Pricing and Water Rates

Research may include looking at rate levels, rate standards, drought rates, tiered rates, and impact fees. Who is using pricing strategies, do they work?, Do they save water?, Does cost make a difference in water efficiency and conservation? What is the potential for using rate structures to fund conservation programs?

The applied research priority list will be maintained by the Water Institute. It will be posted on the Clearinghouse website and information on research and extension in the priority areas will be accessible through the digital library. It will be periodically updated in coordination with the Conserve Florida Water participants and input from appropriate sources including related UF programs. We anticipate that this research agenda will help provide some insight for Conserve Florida Water stakeholders and other partners in formulating and supporting projects that will support the Conserve Florida objectives. Conserve Florida stakeholders may choose to pursue research priorities that reflect their specific interests and the priority research identified in the agenda may be funded in a variety of ways.

The Clearinghouse team and other stakeholders will proactively solicit funding from other sources and coordinate proposal preparation to conduct priority research as appropriate.



WORKSHOP REPORT

Conserve Florida Conservation Clearinghouse Research Agenda Workshop

November 30, 2007, 9:00 am – 4:00 pm
Terrace Room, Norman Hall, UF, Gainesville

Prepared by:
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Prepared in partial fulfillment of DEP Contract No.WM925
Conserve Florida Water Clearinghouse

WORKSHOP REPORT

The Conserve Florida Conservation Clearinghouse Research Agenda workshop provided significant input for the CFWCC Research Agenda in fulfillment of *Core Service 5: Applied Research Agenda/Program- The Clearinghouse will coordinate and maintain an applied research agenda that identifies and prioritizes applied research needed to further the state of knowledge regarding effective water conservation programs and practices in Florida. The research agenda will be developed, and periodically updated, in coordination with the Conserve Florida Water participants, with input from appropriate sources including related UF programs.* The goal of the workshop was to bring Conserve Florida Members and UF Faculty together to articulate an applied research agenda for Conserve Florida to support current Clearinghouse efforts and beyond. The helped the research agenda to reflect the interests of Conserve Florida Water and supports the Clearinghouse efforts. During the workshop the participants 1) discussed major problems/research needs relevant to Florida water sector, 2) were exposed to research already being done in theme areas, 3) determined what still needs to be done in the theme areas, and 3) prioritized where priority research efforts should be focused.

Planning for the workshop: The planning of the Research Agenda workshop took place over several months. It included the efforts of research agenda planning task group, a review of key documents and multiple discussions considering overall needs. At the September 18, 2007 Conserve Florida Water meeting a task group was established to work with the Clearinghouse on defining the research agenda. Task group members included:

Conserve Florida Water

- Dave Bracciano, Demand Management Coordinator, Tampa Bay Water
- Norm Davis, Water Conservation Program Technical Director, Hillsborough County Water Resource Services
- Deborah Green, President, Water Media Services
- Steve Moser, Environmental Compliance Group, JEA
- Melissa Musicaro, Staff Water Conservation Analyst, Resource Conservation & Development Department, Southwest Florida Water Management District, SWFWMD
- Lois Sorenson, Demand Management Coordinator & Supervisor, Regulation Performance Management Department, Permit Data Section, SWFWMD

University of Florida

- Wendy Graham, Carl S. Swisher Chair in Water Resources, Director UF Water Institute, University of Florida
- Jim Heaney, Professor and Chair, Department of Environmental Engineering Sciences, University of Florida
- Lisette Staal, Research Coordinator, UF Water Institute, University of Florida

The task group met several times to clarify the focus of an applied research agenda, as well as establish the objectives for, and design of research agenda workshop. The Task group established that the CFWCC Applied Research Agenda should focus on applied research to help public water supply utilities to 1) identify tools and approaches to address issues of existing and projected water use, and 2) identify practices that utilities can implement that will show quantifiable results toward addressing water efficiency and conservation. The applied research should contribute to improving the Guide (support existing measures and BMPs as well contribute to new and improved BMPs for the long term that will impact water use), water use regulation, utility management and water shortage management. Reference materials included a variety of sources:

- Florida Department of Environmental Protection Florida Water Conservation initiative – April 2002, Appendix J: Preliminary Topics of a Research Agenda
- BMPs and Measures FROM WEB BASED Conserve Florida Conservation Clearinghouse GUIDE
- *Statement of Mary Ann Dickinson, Executive Director, Alliance for Water Efficiency Regarding, Water Efficiency Research Needs, For the Record of the Hearing of October 30, 2007 on H.R. 3957, Subcommittee on Energy and Environment, House Science Committee, November 13, 2008 (available on line - <http://www.allianceforwaterefficiency.org/resourcelibrary.html>)*
- comments made by the Conserve Florida Water landscape irrigation subgroup during discussions leading up to the drought smart document
- Database of issues and research compiled as part of the process (UF research and Extension Programs)
- comments made at several Conserve Florida Water meetings
- Implementing the “Drought Smart” Report, FDEP, July 20, 2007
- Landscape Irrigation and Florida Friendly Design Standards, FDEP, December 2006
- WORK PLAN TO IMPLEMENT SECTION 373.227, F.S. (SECTION 8 OF HOUSE BILL 293)
- AND THE JOINT STATEMENT OF COMMITMENT FOR THE DEVELOPMENT AND IMPLEMENTATION OF A STATEWIDE COMPREHENSIVE WATER CONSERVATION PROGRAM FOR PUBLIC WATER SUPPLY
- Hazen and Sawyer Environmental Engineers and Scientists, Potable Water Conservation Best Management Practices for the Tampa Bay Region, Tampa Bay Water, Sept 2003

Applied Research Agenda Planning Workshop: The Research Agenda Workshop was held on November 30, 2007 from 9:00 am to 4:00 pm in the Terrace Room at Norman Hall on the University of Florida campus in Gainesville. Over 35 people attended representing WMDs, Utilities, UF, FDEP and private organizations. The workshop was designed to be participatory and to bring Conserve Florida Members and UF Faculty together to articulate an applied research agenda for Conserve Florida to support current Clearinghouse efforts and beyond. This helped to ensure that the research agenda reflects the interests of Conserve Florida Water and will support the Clearinghouse efforts. The workshop focused on research to support refinement of water conservation practices and development of utility-specific programs. See *appendix 1* for Workshop Agenda, *Appendix 2* for List of Participants, and *Appendix 3* for Participant Expectations.

The Research Workshop was designed to address each of the following themes:

- Water Efficient Landscapes – Residential Irrigation

- Water Efficient Landscapes – Sustainable Building/New Development
- Residential Indoor Use
- Industrial-Commercial-Institutional Use
- Utility Management Efficiency and Optimization.

During the workshop all participants were able to address each of the themes. The participants were exposed to what is already being done and considered what still needs to be done, identified priority research needs relevant to Florida water sector, and decided on where priority research efforts should be focused. They worked in groups to identify needs and in plenary to refine those to approximately five per theme area. Then, at the end of the workshop, as a large group, they individually ranked the importance of the needs including all the theme areas. Each participant could rank their top 5 issues. Results were totaled by all, and by type of institution that the participant represented (university, utility, water management district, and other).

Criteria for prioritizing research that was developed by the Research Agenda task group was incorporated into the Workshop. These criteria included 1) relevance and fundability, 2) ease of implementation, and 3) research impacts. Details of the questions helping to determine priorities are attached in *Appendix 3*.

Workshop output: Workshop Results of Participant Priority Ranking Exercise

Participants worked in mixed groups (to include all institutional affiliations) to identify needs and in plenary to refine those to approximately five per theme area. In plenary, the top needs were identified for all groups working in one theme. Workshop participants were then given 5 different colored dots to rank the top 5 of their most important needs. They were also asked to identify on the colored dot to which institutional affiliation they belonged. The results of the voting showed clear emphasis on at least two areas, and significant interest in several others.

1. Top 7 Priority Research Needs Identified by Workshop Participant Ranking

- 1. Identification of barriers and methods to address to behavioral change, behavioral practices** (homeowners, Home owner associations, developers, corporations, green industry) – (*Utility Management efficiency and optimization*) Observation: This need rated as highest in both number of votes and value of votes for both the WMD participants and the UF participants. It was in the middle for UTILITIES and did not rate at all for OTHER.
- 2. Pricing and water rates– looking at rate levels, rate standard, tiers to savings, impact fees** (take advantage of the Whitcomb study) – (*Residential Indoor Water Use*) Observation: This need rated low for WMD, rated second highest in number of votes and tied for highest in value of votes for UF participants, and although rated 4th overall for Utilities, each of the votes received was for the highest priority .
- 3. What are models for making incentives work for different groups (people, builders, government, utilities, developers)?** (*Water Efficient Landscapes – Sustainable Building/New Development*) Observation: This need tied as highest in number of votes but with less total value for WMD participants, was in the middle for UF, and 2nd highest in both number and value of votes for UTILITY and OTHER.

4. **Benchmarks for minimum volume of water standards for building (retro and new building, efficacy of certifications, pattern book as reference.** (*Water Efficient Landscapes – Sustainable Building/New Development*) Observation: This need did not register at all for WMD, was in the middle for UF, was rated as highest in both number of votes and value of votes for UTILITY, and was in the middle for OTHER.
5. **Quantification of Low Impact Development (LID) and water savings- environmental saving and comparisons to other, effect of delaying capital improvements, impact of use of “pattern book” for new development landscaping.** (*Water Efficient Landscapes – Sustainable Building/New Development*) Observation: This need tied at 2nd for WMD, at 3rd for UF, low for UTILITY and did not register for OTHER.
6. **What is the minimum amount of water required for landscaping? Relationship between water amount and quality of landscape?** (*Water Efficient Landscapes – Residential Irrigation*) Observation: This need tied at 3rd for WMD, was 3rd for UF, rated low by UTILITY, and did not register for OTHER.
7. **More creative strategies for conservation as a planning tool (refer to capacity buy-back, including Pierce’s trading- need specific reference for this.** (*Water Efficient Landscapes – Sustainable Building/New Development*) Observation: This need was in the middle for WMD, rated as 3rd for UTILITY, low for UF and did not register for OTHER.

2. Top needs identified in plenary for each theme.

The following needs were identified in plenary session through discussion and consolidated from each of the theme groups’ highest priorities.

F. RESIDENTIAL IRRIGATION - WATER EFFICIENT LANDSCAPES

5. Identification of barriers to behavioral change, behavioral practices (homeowners, Home owner associations, developers, corporations, green industry
6. What is the minimum amount of water required for landscaping? Relationship between water amount and quality of landscape?
7. Big picture cost savings - Energy, CO2, Carbon, Homeowner and others
8. Reduction of peak demand due to irrigation/landscape changes.

G. SUSTAINABLE BUILDING/NEW DEVELOPMENT - WATER EFFICIENT LANDSCAPES

1. Quantification of Low Impact Development (LID) and water savings- environmental saving and comparisons to other, effect of delaying capital improvements, impact of use of “pattern book” for new development landscaping.
2. The impact of using/offering incentives and credits for LID, not mandates and understanding for who and how to offer (for example the rain sensors experience as an example (*need specific information on this reference.*)
3. What are models for making incentives work for different groups (people, builders, government, utilities, developers)?
4. Benchmarks for minimum volume of water standards for building (retro and new building, efficacy of certifications, pattern book as reference.

5. Greenhouse gas emission and water use

H. RESIDENTIAL INDOOR USE

4. Billing Data Analysis - cost analysis for all customers for profiling, targeting conservation programs (leak detection, centralized meter reading).
5. Take advantage of existing other sources of research – including AMR,.... Most thoroughly quantified water savings is available for indoor water conservation devices
6. Effects of residential water treatment, including water softeners ...

I. INDUSTRIAL-COMMERCIAL-INSTITUTIONAL (ICI)

4. Inventory of equipment, including cooling towers throughout all industries
5. Identify inefficiencies as a basis for developing new BMPs - through understanding potential for common uses, and the barriers to efficiencies.
6. Link between spent water and water treatment facilities to help identify incentives.

J. UTILITY MANAGEMENT EFFICIENCY AND OPTIMIZATION

1. Pricing and water rates– looking at rate levels, rate standard, tiers to savings, impact fees (take advantage of the Whitcomb study) Observation –
2. Costs as related to stakeholders, decision makers - including the full opportunity costs (including environmental)
3. Identifying constraints, barriers and benefits to use of reclaimed water.
4. Understanding price/cost relationships (not always just looking at the average...)
5. More creative strategies for conservation as a planning tool (refer to capacity buy –back, including Pierce’s trading- *need specific reference for this.*)

3. Needs Identified by Theme Discussion Groups

Each Theme was discussed by several groups with a focus on identifying key needs based on previous presentations and documentation provided. The following shows the results of those initial group discussions.

Residential Irrigation - WATER EFFICIENT LANDSCAPES

Group 1

- Why do people do what they do (understanding behavior, actions, practice)? How to change behavior and identify barriers to change (involve behavioral scientists (groups, homeowners, developer, corporations, Home owners associations, landscape/green industry, political, legislature.
- How much water is required (i.e. minimum amount) - different based on site conditions, quality (visual and quantitative), how much to keep landscapes “alive”, Landscape design for no irrigation, what to do if it dies, translation of known research to actual landscapes. Assume water cut due to stress but can different types of irrigation reduced water use. Role of education?
- Big Picture cost savings (energy, Co2, Carbon footprint, Infrastructure, statewide irrigation efficiency potential for savings translate to public understanding, common database, institutionally why does Mobil Irrigation Lab not compiled statewide- statewide practical things we can do.
- Reducing Peak demand due to irrigation? Storm water reuse and reclaimed compaction? Rainwater harvesting?

Group 2

- Understand people's (developers, homeowners associations, homeowners) behavior/preferences and design educational/policy price structures to have an effect. Plant needs are not driving water use--- people preferences and practice do. What are the most effective educational programs to change behavior.
- How to reduce peak demand due to irrigation by reuse and harvesting. How does irrigation affect peak demand? How does this influence utilities investment in new infrastructure and cost of producing water.
- Effects of water conservation landscaping on home value and saleability
- Inventory of savings (\$, environmental, energy....) and costs of various technology and programs
- Quantify energy savings, Greenhouse gas, carbon footprint, other environmental benefits associated with water savings.
- *Evaluate landscape needs in replications of actual residential settings (change in canopy cover, soils, including compacted soils, etc.) effect on water demand.*
- *Statewide implementation of promising conservation practices during some time period.*

Group 3

- How to increase number of users of reclaimed water?
- Behavior change of homeowner with regard to irrigation.
- Measure effectiveness of water restrictions and their use and consistency
- Minimum amount of water to keep turf/landscape healthy
- Cost benefit analysis of traditional landscapes vs. Waterwise landscapes
- Developer incentives.

Sustainable Building/New Development -WATER EFFICIENT LANDSCAPES

Group 1

- Knowing who are the decision makers – builders influence metrics, contractors – ok at design, Certification, Certification of irrigation land landscapes – who and how)
- Landscape Design (low or non- irrigated) Retro and existing homes, Economic evaluation/incentives,
- Effects of variability in landscape, Statewide evaluation of irrigation efficiency, Temporary irrigation systems (establishment)
- Water Application Budget based on known Crop/plant coefficient/ Alive vs. Stressed vs. Acceptable quality
- Behavior/education/marketing- Home owner Association Police
- Urban wildlife interaction

Group 2

- Gather information on landscape irrigation (on capital and other costs and efficiencies) between actions Xeriscape vs. Typical. For example delaying utility capital costs – economic benefits.
- Is there an environmental difference between xeriscape/ and Florida Friendly (cost, energy, habitat)?
- Government incentives for LID conservation practices (storm water and Landscape)
- Education – Education and demonstration of alternatives. This is all clear to us... why not everyone else (public, developers?) If LID was easier, /i.e. a choice for the public, maybe they would do it.
- *What percentage of homeowners association fees and home maintenance association fees are associated with landscape maintenance/ Existing vs. new sites-developments how to convert/Cleared site doesn't*

“look good” for five years/ Why are we doing now what seems obviously wrong?/ Adding Organic Material? Is the science available on this? Can we evaluate the cost/benefit of organic addition? /How to create C.C.R. to ensure LID, Florida Friendly, etc. performance./ What are other utilities doing and how much did they save?/ Enhance communication between utility and permitting , How can utility have an impact in the process? / Educating planners

Group 3

- Greenhouse gas and water use research (\$\$funding)
- LID research, practice by practice
- Benchmarks for minimum standards for an efficient community.
- Innovative irrigation controller that tie run time to gallons used to \$\$
- Research organics in new development.
- Water savings in developments where efficiency is achieved through ordinances vrs. Voluntary participation - what is the balance?

RESIDENTIAL INDOOR USE -

Group 1

- Water softener (rinsate quantity/# of units)
- Geothermal heat pumps
- Participate in national research

Group 2

- Most thoroughly quantified water savings is available for indoor water conservation devices
- Cost analysis (including environmental) of water saving equipment practices.
- Develop statistical algorithms to detect leaks for billing data
- Educational programs for homeowners to detect leaks from meters

Group 3

- Clarify and disseminate laws on use of grey water/sullage
- Feasibility of sullage in Florida
- Cisterns – feasibility study (financial, water quality, space, quantity)
- Feasibility of washing machine rebates (efficient)

INDUSTRIAL – COMMERCIAL – INSTITUTIONAL USES

Group 1

- Cooling towers - # of towers/ water use inventory
- Inventory of industrial water use and equipment
- Water use and classifications systems (NAICS,SIC)

Group 2

- Inventory water using equipment for I.C.I and water reduction methods for particular equipment.
- Identify common water using equipment across industries.
- Methodologies for profiling ICI customers to target conservation programs.
- Link to P2 program/industrial pre-treatment.
- Cost analysis (including environmental) of water saving equipment practices.
- Develop statistical algorithms to detect leaks for billing data
- Education incentive program for water conservation in restaurants.

Group 3

- Evaluate need and feasibility of widespread use of BMP's for ICI uses.
- Quantify existing cooling towers and water waste.

UTILITY MANAGEMENT EFFICIENCY AND OPTIMIZATION

Group one

- Pricing –
 - how does it affect outside, other peak-impacting system demand (including difference)
 - optimizing frequency, relative amount of rate changes (how often should we update?)
 - to develop a BMP (establish tiers based on quantity used for inverted rates, educated decision makers, create \$ for next increment of supply, to “sell” to the customers based on social issues and use facts, full cost accounting for education and selling of potable and alternative sources-RCW,etc.
- Demand planning/forecasting (outdoor use, peak as well as average, inventory methodology for established green space- irrigated area)
- Utility system audit (pick a formula /mutodo-WIP, follow-up)
- Reclaimed Water – optimize use via volumetric rates, better estimate of generation vs use, offset – storage—cost and efficiency (6:1?, goal?)

Group 2

- Research methods to price water according to highest use. Price water according to price needed to meet peak demand for that user. Study to determine how high water must be priced to induce conservation. How can private utilities charge enough to induce conservation? Identify “real” cost of potable water and reuse water (opportunity cost, environmental costs, operational costs, and cost of ageing infrastructure)
- Identify barriers to accurately pricing water—strategies to overcome (severance tax, trust funds, peak demand rates)
- Identify local regulatory constraints to water reuse strategies for removing. Identify public perception barriers to water reuse and education programs to overcome.
- Evaluate impact fee structure (are users using more than developer paid for?)
- Identify opportunities for more efficient water use as infrastructure needs to be replaced.
- *Evaluate conservation benefits of informational billing. What information works?*

Group 3

- Develop framework for analyzing cost effectiveness of supply alternatives (including conservation)
- Pre and post billing evaluation of water use for BMPs
 - Drought rate analysis
- Implement “trade paradigm” (re: Pierce Jones).

Group Discussion Group Participants

GROUP 1	GROUP 2	GROUP 3
Dave Bracciano (Utility)	Wendy Graham (Academic)	Dierdra Irwin (WMD)
Howard Beck (Academic)	Camilo Cornejo (Academic)	Norm Davis WMD)
Charles Wright (Utility)	Jorge Patino (WMD)	Pierce Jones (Academic)
Suzanne Goss (Utility)	Bob McVay (Utility)	Tom Swihart (State-FDEP)
Melissa Musicaro (WMD)	Liz Block (Utility)	Sandy Berg (Academic)
Lois Sorenson (WMD)	Don Brandes (WMD)	Wayne Williams (Utility)
Haley Baum (Academic)	Glen Acomb (Academic)	Jim Heaney (Academic)
Liz Krentz (Consultant)	Ben Koopman (Academic)	Tom Olmsted (Academic)
Barbara Larson (Academic)	Richard Beeson (Academic)	Deborah Green (County)
Lukasz Ziemba (Academic)		

Workshop Follow-up: Results of the workshop and analysis of votes on priorities were tallied and incorporated and shared with the task group for comment on February 12th and presented to the CFWCC meeting on February 19th. A draft of the Research Agenda was also sent to the Task Group on February 12th for comment. We anticipate that this research agenda will help provide some insight for Conserve Florida stakeholders and other partners in formulating and supporting projects that will support the conserve Florida objectives. In the next year of the CFWCC project (2008-09), the Clearinghouse will focus on two of the top key priority areas to provide further synthesis and document state of the art research, research gaps, and recommended studies. These two areas will be identified soon.



Conserve Florida Conservation Clearinghouse Research Agenda Workshop

November 30, 2007, 9:00 am – 4:00 pm, Terrace Room, Norman Hall, UF, Gainesville

Goal: To bring Conserve Florida Members and UF Faculty together to articulate an applied research agenda for Conserve Florida to support current Clearinghouse efforts and beyond. The research agenda will reflect the interests of Conserve Florida Water and will support the Clearinghouse efforts.

Objective: During the workshop we will:

- Identify major problems/research needs relevant to Florida water sector.
- Know what research is already being done and determine what still needs to be done
- Decide on where priority research efforts should be focused.
- Consider who might fund the research and who might do it

Output: Input for a document that lists key research topics (rationale, current state of the art research in each of the topic areas, needs/questions relevant to Florida water sector, and an initial ranking of priority for Conserve Florida).

9:00 – 9:35 – Introductions, workshop schedule and CFW Research Agenda Planning Process

9:35 – 9:50 Research Agenda Themes and Criteria

9:50 – 10:00 Introduce AWE research efforts: Testimony on Water Efficiency Research needs (Jim Heaney)

10:00 – 10:15 BREAK

10:15 – 12:15 **WATER EFFICIENT LANDSCAPES**

10:15 – 11:15 Landscape Irrigation/Outdoor Water Use (Mike Dukes, Norm Davis)

11:15 – 12:15 Sustainable Building/New Development-Growth (Pierce Jones, Dave Bracciano)

12:15 – 1:15 LUNCH (provided)

1:15 – 2:15 **RESIDENTIAL – INDOOR WATER AND INDUSTRIAL- COMMERCIAL-INSTITUTIONAL**

(Jim Heaney, Maribel Balbin, Wayne West)

2:15 – 3:15 **UTILITY MANAGEMENT (EFFICIENCY AND OPTIMIZATION)**

(Sandy Berg, Lois Sorensen, Ben Koopman, Kathy Scott)

3:15 – 3:45 Determining Priorities and Funding opportunities

Conserve Florida Water Conservation Clearinghouse

Research Agenda, March 2008

UF Water Institute

**APPENDIX 2 - Conserve Florida Water Conservation Clearinghouse LIST OF PARTICIPANTS -RESEARCH AGENDA
WORKSHOP November 30, 2007 University of Florida, Gainesville, FL**

Last	First	Affiliation/ UF Department	Type	CFW or UF	email
Acomb	Glen	Architecture	Faculty	CFW	acomb@ufl.edu
Balbin	Maribel	Miami-Dade Water and	Utility	CFW	Balbin@miamidade.gov
Baum	Melissa	Agricultural and Biological	Graduate Student	UF	MsHMbaum@juno.com
Beck	Howard	Agricultural and Biological Engineering	Faculty	UF	hwb@ufl.edu
Beeson	Richard	Environmental Horticulture	Faculty	UF	rbeeson@ufl.edu
Berg	Sandy	Economics	Faculty	UF	sberg@ufl.edu
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Bracciano	Dave	Tampa Bay Water	Utility	CFW	DBracciano@tampabaywater.org
Brandes	Don	SJWMD	WMD	CFW	dbrandes@sjrwmd.com
Brown	Mark	Environmental Engineering	Faculty	UF	mtb@ufl.edu
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Dukes	Mike	Agricultural and Biological Engineering	Faculty	UF	mddukes@ufl.edu
Goss	Suzanne	JEA	Utility	CFW	GossSE@jea.com
Graham	Wendy	Water Institute Director	Faculty	UF	wgraham@ufl.edu
Green	Deborah	Water Authority of Volusia	Utility	CFW	dgreen@wavh2o.com
Heaney	Jim	Environmental Engineering Sciences	Faculty	UF	heaney@eng.ufl.edu
Hicks	Henry	FWEA Ocala	Utility	CFW	HHicks@Ocalafl.org
Irwin	Deirdre	SJWMD	WMD	CFW	dirwin@sjrwmd.com
Jamison	Mark	Economics and PURC	Faculty	UF	jamisoma@ufl.edu
Jones	Pierce	Agricultural and Biological	Faculty	UF	pjones10@ufl.edu
Koopman	Ben	Environmental Engineering	Faculty	UF	bkoop2gmail.com
Krentz	Lisa	Hazen and Sawyer	Consulting	CFW	lkrentz@hazendandsawyer.com
Larson	Barbara	Environmental Horticulture	Faculty	UF	bcl@ufl.edu
Lindner	Angela	Environmental Engineering	Faculty	UF	ALIND@eng.ufl.edu
McVay	Bob	Florida Rural Water	Utility	CFW	Robert.McVay@frwa.net
Musicaro	Melissa	SWFMD	WMD	CFW	Melissa.Musicaro@swfwmd.state.fl.us
Olmsted	Tom	Agricultural and Biological	Graduate Student	UF	olmsted@ufl.edu
Patino	Jorge	SFWMD	WMD	CFW	jpatino@sfwmd.gov
Scott	Kathy	SWFMD	WMD	CFW	Kathy.Scott@SWFWMD.STATE.FL.US
Sorensen	Lois	SWFMD	WMD	CFW	Lois.Sorensen@swfwmd.state.fl.us
Staal	Lisette	Water Institute Research	Staff	UF	lstaal@ufl.edu
Swihart	Tom	FDEP	State	CFW	Tom.Swihart@dep.state.fl.us
West	Wayne	Pinellas County Utilities	Utility	CFW	wwest@co.pinellas.fl.us
Wright	Charles	Orlando Regional Utilities	Utility	CFW	Charles_Wright@ouc.com
Ziemia	Lukasz	Agricultural and Biological	Graduate Student	UF	uki@ufl.edu

Appendix 3 – Participant Expectations

Utility participants

- I expect that public attitudes towards water use will be focused on and that priorities will be placed on that
- Evaluate and identify critical factors that significantly influence a component important to society.
- Research agenda that identifies specific concepts that need to be funded. These concepts can and will affect potable water use in Florida
- Utilities main interest are: 1) documented BMP in the distribution of water to end users minimal losses and maximizing long term infrastructure; 2) end use BMPs (water savings) documented best BMPs –cost effective incentive for domestic irrigation and residential commercial
- Identify most effective methods for alternative water supply including disposal options associated with any by products,
- Practical!

Water Management Districts participants (yellow)

- To learn of any research that is presently being conducted or has been completed that the district is not aware of.
- Identify data gaps, prioritize them, identify plan of action and tentative schedule.
- Concrete plans for needed research relating to water savings in yards using efficient irrigations systems and Florida friendly yards.

University of Florida participants (blue)

- Prioritized list of important knowledge gaps along with potential partners to execute and fund research.
- Prioritization of research – to know future funding and real water conservation contacts,.
- Quality data collection representative of focus point with clear opportunity of how determinations can be facilitated (what we are looking for, how we will find it, what we will do with it, how it benefits goal)
- Essentially what, when, where and how much will it cost?
- Specific priorities for research needs and plan to fund and implement in order of priorities. Identify gaps in research knowledge and connections among disciplinary programs.
- The research agenda specifies and prioritizes issues of concern in a defined topical areas, established a strategic plan to address issue in priority order.
- Data knowledge sharing and integration via IT Infrastructures. Beck)
- Understand problem, funding source, potential collaborators, and past research – what is the state of the art?
- Collaboration opportunities, avoid duplication of efforts and storing information,
- To quantify a question that illuminates and informs.
- Direction as to what research is needed. State of knowledge in this area, and representing different viewpoints from my own.
- Identify projects with high economic/ecological payoff and answer important scientific questions. Syh

Other participants

- A very credible and almost self-convincing coordinated program of integrating current information and describing new research topics.
- Identify research opportunities that investigate/improve strategies used by water professionals/water industry.

SUGGESTED CRITERIA FOR DETERMINING PRIORITIES
CFW Conservation Clearinghouse Research Agenda Planning

CRITERIA 1: RELEVANCE AND FUNDABILITY

- Fundability? Are the projects fundable? Do we think that WMD's, water utilities, the state, private entities like FNGLA or others might want to fund the research specifically?,
- Relevance to subscribers? How relevant is the issue to the subscriber base? Who is most interested in the results? Is CFW well positioned to address the issue? Is it appropriate for another water research organization or utility sector to take the lead? How broadly and deeply does the issue affect subscribers? Is it widely cross-cutting or confined to particular region or subset of subscribers? Is the issue being raised often? Is it being identified by a broad cross-section of stakeholders.
- Urgency of need? Is the research already being done by someone? Is the driver for the issue time-critical, eg. a pending regulation. Can research deliver timely results to subscribers? What are the potential impacts if the issue is not addressed?

CRITERIA 2: EASE OF IMPLEMENTATION or RESEARCH CONSTRAINTS

- Potential for collaboration? Does the issue have a high potential for leveraging of funds and knowledge through partnering with another organization?
- Status of ongoing work? Is there ongoing work that should be substantially completed before additional work is undertaken? Is this work being done by another organization?
- Availability of data? Is data available, is it currently being accessed or used to its' best advantage?

CRITERIA 3: RESEARCH IMPACTS

- What impact will the research have on water use and water sectors?
- Potential to save water ? Will the research provide sufficient information to estimate water savings) Savings potential on a regional or larger geographic basis (i.e., savings not just applicable to only a small geographic area).
- Potential transformational effect? Will the research contribute to making water use more efficient? Will the research contribute to reducing water usage?

Appendix 5 – Ranking results of priorities

	B	C	H	I	P	Q	Z	AA	AE	AF	AJ	AK	AL	AM
1														
2														
3			Water Management District	Utility	University of Florida	Other	No designation	ALL COMBINED						
4	Research Theme	ISSUE - Priority Need	Total # of votes	Total value of votes	Total # of votes	Total value of votes	Total # of votes	Total value of votes	Total # of votes	Total value of votes	Total # of votes	Total value of votes	Total # of votes	Total value of votes
5	Residential Irrigation	Identification of barriers to and methods to affect behavioral change, behavioral practices (homeowners, Home owner associations, developers, corporations, green industry)	3	13	2	5	7	23	0	0	1	1	13	42
6	Utility Management (efficiency and optimization)	Pricing and water rates– looking at rate levels, rate standard, tiers to savings, impact fees (take advantage of the Whitcomb study)	1	5	2	10	6	23	1	4	0	0	10	42
7	Sustainable Building-New Development	What are models for making incentives work for different groups (people, builders, government, utilities, developers?)	3	5	4	15	4	11	1	2	2	4	14	37
8	Sustainable Building-New Development	Benchmarks for minimum volume of water standards for building (retro and new building, efficacy of certifications, patternbook as reference	0	0	5	19	3	13	1	2	0	0	9	34
9	Sustainable Building-New Development	Quantification of Low Impact Development (LID) and water savings- environmental saving and comparisons to other, effect of delaying capital improvements, impact of use of "pattern book" for new development landscaping.	2	5	2	5	4	15	0	0	2	8	10	33
10	Residential Irrigation	What is the minimum amount of water required for landscaping? Relationship between water amount and quality of landscape?	2	5	4	10	3	8	0	0	0	0	9	23
11	Utility Management (efficiency and optimization)	More creative strategies for conservation as a planning tool (refer to capacity buy –back, including Pierce’s trading- need specific reference for this.)	0	0	4	12	3	6	0	0	2	5	9	23
12	Residential Irrigation	Big picture cost savings - Energy, CO2, Carbon, Homeowner and others	1	4	3	11	1	3	0	0	0	0	5	18
13	Industrial-Commercial-institutional Use	Inventory of equipment, including cooling towers throughout all industries	0	0	3	10	1	3	1	1	1	4	6	18
14	Industrial-Commercial-institutional Use	Identify inefficiencies as a basis for developing new BMPs - through understanding potential for common uses, and the barriers to efficiencies.	1	4	3	8	3	6	0	0	0	0	7	18

Appendix 2 - Related research done at UF over the last 5 years in the priority need areas

UF Current Research related to Priority Areas

Priority Areas 2008

Identification of barriers to behavioral change and methods to affect practices impacting water conservation by homeowners, homeowner associations(HOA), developers, corporations, and green industries

ACOMB G A	UF	CASE STUDIES IN SUSTAINABLE LANDSCAPE ARCHITECTURE	WATER MANAGEMENT DISTRICTS
Baum Haley, Melissa	UF	Irrigation Savings: Tips for Water conservation	SJRWMD
Baum Haley, Melissa	UF	Residential Irrigation Water Use in the Central Florida Ridge	SJRWMD
Baum Haley, Melissa	UF	Evaluation of Sensor Based Residential irrigation Water Application	Pinellas County
Baum Haley, Melissa	UF	Residential irrigation water application influenced by socio-economic parameters	
Cardenas-Lailhacar,	UF	Sensor-Based Automation of Residential	SWFWMD, UF-IFAS, Pinellas County
DUKES M D	UF	"EVALUATION OF SOIL MOISTURE BASED ON-DEMAND IRRIGATION CONTROLLERS, PHASE 11	WATER MANAGEMENT DISTRICTS
DUKES M D	UF	EVALUATION AND DEMONSTRATION OF SOIL MOISTURE BASED ON DEMAND IRRIGATION CONTROLLERS FOR VEGETABLE PRODUCTION(B228)	WATER MANAGEMENT DISTRICTS
DUKES M D	UF	EVALUATION OF WATER USA AND NUTRIENT LEACHING WITH HIGH FREQUENCY IRRIGATION FOR USE IN BEST MANAGEMENT PRACTICES	U S DEPT OF THE INTERIOR
DUKES M D	UF	RESIDENTIAL IRRIGATION EFFICIENCY ASSESSMENT MONITORING	WATER MANAGEMENT DISTRICTS
DUKES M D	UF	IRRIGATION EFFICIENCY CONSULTATION	WATER MANAGEMENT DISTRICTS
DUKES M D	UF	RESIDENTIAL IRRIGATION EFFICIENCY	WATER MANAGEMENT DISTRICTS

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Priority Areas 2008

DUKES M D	UF	EDUCATION OF EFFICIENT IRRIGATION SYSTEM DESIGN	WATER MANAGEMENT DISTRICTS
Haman	UF	Reducing Barriers to Adoption of Microirrigation	
HAMAN D Z	UF	CONTROLLING IRRIGATION WITH TIME DOMAIN REFLECTOMETRY (TDR) PROBES	NATL FOLIAGE
HEANEY J	UF	CONSERVATION FLORIDA CLEARINGHOUSE	DEPT OF ENVIRONMENTAL PROTECT
KNOX G W	UF	FL YARDS & NEIGHBORHOODS PRGM TO PROTECT WATER QUALITY FROM NONPOINT SOURCE POLLUTION (STATEWIDE COORDINATION)	DEPT OF ENVIRONMENTAL PROTECT
KNOX G W	UF	CONTINUED EXPANSION & SUSTAINABILITY OF THE FLORIDA YARDS & NEIGHBORBORHOODS PROGRAM TO PROTECT WATER QUALITY FROM	DEPT OF ENVIRONMENTAL PROTECT
KNOX G W	UF	FL YARDS & NEIGHBORHOODS PRGM TO PROTECT WATER QUALITY FROM NONPOINT SOURCE POLLUTION (STATEWIDE COORDINATION)	DEPT OF ENVIRONMENTAL PROTECT
Lang-Josan, Sylvia	UF	Green Roofs: An Urban Stormwater BMP for Water Quantity and Quality in the Subtropics	
Olmsted, Tom	UF	Understanding Urban Outdoor Water Use	

Pricing and Water rates - evaluation of the potential for rate levels, rate standards, rate tiers, and impact fees to increase water conservatio

HEANEY J	UF	CONSERVATION FLORIDA CLEARINGHOUSE	DEPT OF ENVIRONMENTAL PROTECT
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Design of incentive programs that are effective for different groups (people, builders, government, utilities, developers) including more creative strategies for conservation as a planning tool

HEANEY J	UF	CONSERVATION FLORIDA CLEARINGHOUSE	DEPT OF ENVIRONMENTAL PROTECT
Jones, Pierce	UF	Baldwin Park - best design and management mpractices to minimize phosphate nutrient	Glatting Jackson planning firm
Jones, Pierce	UF	Madera Community - Applied building sciences research	GreenTrust, LLC

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Quantification of Low Impact Development (LID) water savings- environmental savings, effect of delaying capital improvements, impact of use of "pattern book" for new development landscaping

BERG S V	UF	Water Utility Benchmarking Survey	World Bank
COHEN M J	UF	SEED FUNDS - DEV A PROPOSAL TO AMERICAN WATER WORKS ASSOC ONA WATER SUPPLY DECISION SUPPORT SYS FOR LOWER EAST COAST FLA	"POST, BUCKLEY, SCHUH & JERNIGA"
DUKES M D	UF	DETERMINE REASONABLENESS OF DISTRICT PERMIT AMOUNTS FOR MICRO IRRIGATED RIDGE CITRUS IN HIGHLANDS COUNTY	WATER MANAGEMENT DISTRICTS
HEANEY J	UF	DECENTRALIZED STORMWATER CONTROLS FOR URBAN RETROFIT AND COMBINED SEWER OVERFLOW	LOW IMPACT DEVELOPMENT CENTER
HEANEY J	UF	UPDATE REUSE FEASIBILITY STUDY GUIDELINES	DEPT OF ENVIRONMENTAL PROTECT
HEANEY J	UF	CONSERVATION FLORIDA CLEARINGHOUSE	DEPT OF ENVIRONMENTAL PROTECT
MAZYCK D W	UF	SUCCEED: MULTIDISCIPLINARY DESIGN OF A POTABLE WATER TREATMENT PLANT	NATIONAL SCIENCE FOUNDATION
MAZYCK D W	UF	SUCCEED: MULTIDISCIPLINARY DESIGN OF A POTABLE WATER TREATMENT PLANT	NATIONAL SCIENCE FOUNDATION
ROMEIJN H E	UF	DEVELOPMENT OF A WATER SUPPLY OPERATION MANAGEMENT SYSTEM FOR THE CITY OF COCOA WATER RESOURCE DEPARTMENT	WATER MANAGEMENT DISTRICTS

Benchmarks for minimum achievable water use standards for building (retro and new building, efficacy of certifications, use of pattern books

ACOMB G A	UF	MADERA MODEL CASE STUDY: DOCUMENTING RESOURCE EFFICIENT SITE DESIGN TECHNIQUES	WATER MANAGEMENT DISTRICTS
BROWN M T	UF	"LANDSCAPE DEVELOPMENT INTENSITY COEFFICIENT FOR LITTLE BAYOUMETRO, ARKANSAS "	STATE OF ARKANSAS
HEANEY J	UF	"LOW IMPACT DEVELOPMENT ANALYSIS OF TUMBLIN CREEK WATERSHED GAINESVILLE, FLORIDA "	"JONES, EDMUNDS & ASSOCIATES "

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Priority Areas 2008

HEANEY J	UF	DEVELOPMENT OF A LOW IMPACT DEVELOPMENT DESIGN AND CONSTRUCTION MANUAL FOR TRANSPORTATION SYSTEMS	OREGON STATE UNIVERSITY
HEANEY J	UF	CONSERVATION FLORIDA CLEARINGHOUSE	DEPT OF ENVIRONMENTAL PROTECT
LINDNER A S	UF	DEVELOPMENT OF THE FLORIDA GREEN ENGINEERING EDUCATION(FGEE)PROGRAM: NETWORK OF FL UNIV THROUGH DISTANCE LEARNING	DEPT OF ENVIRONMENTAL PROTECT
Shedd,Mary	UF	Soil Moisture-based Irrigation Control on St. Augustinegrass	

Benchmarks for minimum water required for residential landscaping. Relationship between water amount and quality of landscape

BEESON JR R C	UF	DEVELOPMENT OF IRRIGATION SCHEDULES AND CROP COEFFICIENTS FOR TREES FROM SEEDLINGS TO FIVE-INCH CALIPERS - PHASE II	WATER MANAGEMENT DISTRICTS
BEESON JR R C	UF	DEVELOPMENT OF IRRIGATION SCHEDULES AND CROP COEFFICIENTS FOR TREES FROM SEEDLINGS TO FIVE-INCH CALIPERS	WATER MANAGEMENT DISTRICTS
BEESON JR R C	UF	EVALUATION AND DEVELOPMENT OF A REFERENCE EVAPOTRANSPIRATION MODEL FOR IRRIGATION OF WOODY ORNAMENTALS	WATER MANAGEMENT DISTRICTS
BEESON JR R C	UF	COMPARISON OF IRRIGATION METHODS IN LANDSCAPE CONTAINER PLANT PRODUCTION PHASE II	LAVAL UNIVERSITY
BEESON JR R C	UF	DETERMINING WATER REQUIREMENTS OF SELECT TROPICAL FOLIAGE PLANTS DURING PRODUCTION	WATER MANAGEMENT DISTRICTS
Beeson, Richard	UF	APPLYING KNOWLEDGE OF WOODY ORNAMENTAL PLANT PHYSIOLOGY TO ENHANCE PRODUCTION AND LANDSCAPE ESTABLIS	
Beeson, Richard	UF	Quantifying and Qualifying Water Use in Ornamental Plant Production	
BOMAN B J	UF	TREASURE COAST CONTAINER NURSERY BMP IMPLEMENTATION	DEPT OF AGRICUL & CONSUMER SER

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Cardenas-Lailhacar,	UF	Expanding Disk Rain Sensor Performance and Potential Irrigation Water Savings	SWFWMD, UF-IFAS, Pinellas County
Cardenas-Lailhacar,	UF	Sensor-Based Control of Irrigation in	SWFWMD, UF-IFAS, Pinellas County
Cardenas-Lailhacar,	UF	Soil moisture sensor performance on turfgrass under wet conditions	SWFWMD, UF-IFAS, Pinellas County
Cardenas-	UF	Water Conservation Potential and Performance of Soil Moisture Sensor Irrigation Controllers	
Cardenas-	UF	Sensor-Based Automation of Irrigation of Bermudagrass	SWFWMD, UF-IFAS, Pinellas County
Cisar, John	UF	Environmental Nutrient Management and Enhancement of Water Use Efficiency for	
Davis, Stacia	UF	Evaluation and Demonstration of Evapotranspiration-Based Irrigation Controllers	DACs, UF-IFAS, Hillsborough County
Davis, Stacia	UF	Water Conservation in Landscape Irrigation Using ET Controllers	
DUKES M D	UF	UPDATE ON THE AFSIRS CROP WATER USE SIMULATION MODEL- AMENDMENT #3	WATER MANAGEMENT DISTRICTS
DUKES M D	UF	MAINTAINING OPTIMAL SOIL MOISTURE IN PEANUTS WITH VARIABLE- RATE IRRIGATION	FL PEANUT PRODUCERS ASSN
DUKES M D	UF	EVALUATION AND DEMONSTRATION OF EVAPOTRANSPIRATION-BASED CONTROLLERS	DEPT OF AGRICUL & CONSUMER SER
DUKES M D	UF	UPDATE ON THE AFSIRS CROP WATER USE SIMULATION MODEL- AMENDMENT #3	WATER MANAGEMENT DISTRICTS
DUKES M D	UF	INVESTIGATION AND DEVELOPMENT OF METHODS TO DETERMINE URBAN LANDSCAPE IRRIGATION FOR PLANNING AND PERMITTING.....	WATER MANAGEMENT DISTRICTS
DUKES M D	UF	REVISION AND UPDATE OF THE AFSIRS CROP WATER USE SIMULATION MODEL	WATER MANAGEMENT DISTRICTS

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DUKES M D	UF	SUPPLEMENT FOR RESIDENTIAL IRRIGATION EFFICIENCY - YEAR 3	WATER MANAGEMENT DISTRICTS
Dukes, Michael	UF	Soil Moisture Based Irrigation Study	SWFWMD, UF-IFAS, Pinellas County
Dukes, Michael	UF	Sprinkler Irrigation and Soil moisture Uniformity	SJRWMD
Dukes, Michael	UF	Residential Irrigation Based on Soil Moisture	SWFWMD, UF-IFAS, Pinellas County
Gilman, Edward	UF	Protocol for water needs of shrubs during establishment	
HAMAN D Z	UF	REAL-TIME IRRIGATION SCHEDULING FOR ORNAMENTAL PLANT PRODUCTION USING ECHO MOISTURE SENSORS	HORTICULTURAL RESEARCH INST
HAMAN D Z	UF	DEMONSTRATION OF EBB AND FLOW WATER APPLICATION SYSTEM FOR OUTDOOR CONTAINERIZED PLANT PRODUCTION IN FLORIDA(DACS MATCH)	DEPT OF ENVIRONMENTAL PROTECT
HAMAN D Z	UF	DEMONSTRATION OF MULTIPOT BOXES FOR CONTAINER NURSERY	DEPT OF ENVIRONMENTAL PROTECT
Haman, Dorota	UF	Reducing Water Needs and Environmental Impact of Vegetable/Turf Production Using Improved Irrigation Scheduling and Irrigation	
HEANEY J	UF	CONSERVATION FLORIDA CLEARINGHOUSE	DEPT OF ENVIRONMENTAL PROTECT
Miller, Grady	UF	Improve Turfgrass Management as Related to Environmental Parameters	
Million, Jeff	UF	Resource Management Tool for Container	
OBREZA T A	UF	INCREASE IRRIGATION EFFICIENCY AND WATER CONSERVATION THROUGH PREVENTION OF MICRO-IRRIGATION EMITTER PLUGGING(B040	WATER MANAGEMENT DISTRICTS
Parsons, Larry	UF	Microirrigation Technologies for Protection of Natural Resources and Optimum Production	

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Sartain, Jerry	UF	Turfgrass Fertility Management and Environmental Impact	
Scheiber, Sloane	UF	Evaluation of Management Practices to Reduce Inputs for Herbaceous Landscape Ornamentals in Florida	
Sharma, Jyotsna	UF	Production, Transition Handling, and Reestablishment of Perennial Nursery Stock	
Shedd, Mary	UF	SMS & ET Controller combined preliminary results 2006	SWFWMD, UF-IFAS, Pinellas County
STANLEY C D	UF	SOD IRRIGATION ON-FARM DEMONSTRATION PROJECT (B107)	WATER MANAGEMENT DISTRICTS
X none			
BERG S V	UF	INTERNATIONAL TRAINING COURSE FOR UTILITY REGULATORS	WORLD BANK
BERG S V	UF	PILOT CERTIFICATION EXAM FOR REGULATORY PROFESSIONALS	WORLD BANK
BROWN M T	UF	"STORMWATER AND WETLANDS MONITORING, MANAGEMENT AND EDUCATIONAT OAK HAMMOCK "	OAK HAMMOCK AT THE UNIV OF FLA
JAMISON M A	UF	BODY OF KNOWLEDGE FOR REGULATORY PROFESSIONALS	WORLD BANK
JONES J W	UF	AGRICULTURAL APPLICATION OF CLIMATE INFORMATION SYSTEM FOR AGRICULTURE AND WATER RESOURCE MANAGEMENT IN THE SE USA	NOAA
KNOX G W	UF	PRODUCTION PROTOCOLS AND GARNED/LANDSCAPE PERFORMANCE TO EXPAND AVAILABILITY AND USE OF FOUR FLORIDA NATIVE WILDFLOWERS	FL WILDFLOWER FOUNDATION
McLarty, Rebecca	UF	Toilet End Use Evaluation Methodology for Single-Family Residences in Tampa, FLA	

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Appendix 3 – Some research questions identified throughout planning related to priorities Priority Area 2008

Identification of barriers to behavioral change and methods to affect practices impacting water conservation by homeowners, homeowner associations(HOA), developers, corporations, and green industries

- What is the impact of the human/cultural preferences for landscape, and subsequent behavior, on water conservation?
- Identify high water users from property appraisers and billing information to measure actual home irrigation usage.
- Defining proper operation, installation, calibration, etc. of soil moisture sensors that will go into a
- How to get alternative groundcovers into a market or develop demand?
- Determination of water use in landscapes. How to determine if someone has an irrigation system and if they are using it.
- Conduct research on what outreach works best and the barriers/benefits to instructing homeowners to follow a set schedule in terms of minutes/irrigation event on their clock versus understanding visual symptoms enough to adequately know when to water
- What is the effectiveness of on-line education demonstrations for home irrigation technologies?
- Improvements in mobile irrigation labs. Standardization for the labs and the tie between lab evaluation in rebates and documented savings. Irrigation evaluations are questionable
- Can tools be developed for the homeowner to manage lawn irrigation using FAWN weather data?

Pricing and Water rates - evaluation of the potential for rate levels, rate standards, rate tiers, and impact fees to increase water conservation

- Charlotte and Hernando Counties have implemented “drought rates.” Who else is using drought rates? Does it work? Does it save water? Does cost make a difference?
- Use models for utilizing upper tiers of water conservation rates to fund water conservation efforts.
- Guide Measure - 14 - Conservation rate structures quantifying cost effectiveness and water savings
- Develop methodologies to accurately project changes in demand and revenues from changes in rate
- Evaluate and post information on drought rate structures

Design of incentive programs that are effective for different groups (people, builders, government, utilities, developers) including more creative strategies for conservation as a planning tool

- How should landscape systems with soil moisture sensors and/or ET-based controllers be managed during a water shortage?
- Can you actually quantify actual savings in terms of \$ and water for different incentive programs, etc. Quantification of actual savings established BMP. Could use some research after implementation.
- Independent testing of performance of irrigation hardware.
- Do irrigation restrictions actually save water? What caveats are being put on restrictions. Restrictions are not a current BMP.
- How well do implemented and enforced irrigation design standards work? Case studies of successfully implemented and enforced irrigation requirements
- Guide BMP 2 - Non-potable irrigation resource rebates - what does the data provided to the clearinghouse indicate?
- How can St. Augustine sod farmers transition to lower water demand ground covers that are

Quantification of Low Impact Development (LID) water savings- environmental savings, effect of delaying capital improvements, impact of use of “pattern book” for new development landscaping

- Guide Measure - 8 - Source water metering

- What is the reliability of the sources of water for harvesting of water resources through green roofs, application of residential cisterns, re-use of stored stormwater for irrigation, etc?
- Develop improved methods of estimating water withdrawn from private wells that are not required to report water use.

Benchmarks for minimum achievable water use standards for building (retro and new building, efficacy of certifications, use of pattern books

- Cost/benefit analysis comparing typically irrigated traditional landscaping with efficiently irrigated landscaping and Xeriscaping and Florida Friendly landscaping. Data gathering.

Benchmarks for minimum water required for residential landscaping. Relationship between water amount and quality of landscape

- What are the minimum water requirements of the various turf species for appropriate developing irrigation recommendations ? How do you apply minimum water requirements to supplemental application of irrigation?
- Matching of soil type, including typical fill dirt, with appropriate turf type.
- Use of sewage sludge as a soil amendment- used in Colorado, any potential here?
- Improvement in technology for functional and inexpensive soil moisture sensors
- Frequency of irrigation needed during the various seasons
- Water needs of typical landscape bed plants, for example ligustrum, liriopse, inon hawthorn and recommendation for how much/how often to water beds.
- Evaluate cost effectiveness and effect on behavior of education and outreach programs.
- Evaluate the feasibility of using brackish water for irrigating turf and landscape plants.
- Develop more efficient automatic irrigation systems based on the water needs of plants and turf, and by using soil moisture sensors or other technology
- Breeding of drought tolerant landscape plants and turf
- What is the water need of different grass, shrubs and trees (greenhouse and field)
- What are the minimum amounts of water needed to keep the turf healthy?
- What outdoor water use technologies should be required for new building/development?
- What would be the savings by having sensible site plan review requirements preserving existing native vegetation to the reasonable extent possible?
- What are the cost savings associated with sustainable landscapes result in compared to traditional landscapes, at the homeowner (builder) and community (developer) level
- Determining the establishment periods for new lawns and landscapes - to target specific BMPs/projects or monitoring
- Testing and/or development of more drought tolerant turf varieties.
- Development of Plant Palettes and Appropriate Replacement Plants (similar growth needs) that will save on water.
- LI-7: Evaluate the use of water budgeting as an effective water conservation practice (From Florida Water Conservation Initiative Recommendations – April 2002
- Development of telemetry and evapotranspiration-based control of irrigation

