Water Conservation on Agricultural Lands

Report produced as a part of Central Florida Water Initiative – Agricultural Water Conservation Sub-Team

Draft – 4/20/2017

UF/IFAS Photo by Marisol Amador

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We appreciate the feedback provided by the anonymous reviewers from SFWMD

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List of Acronyms

AGI – Adjusted Gross Income
AWS – Alternative Water Supply
BMP – best management practice
CFP – Cooperative Funding Program
CFWI – Central Florida Water Initiative
CUP – consumptive use permit
EQIP – Environmental Quality Incentives Program
FARMS – Facilitated Agricultural Resource Management Systems
FDACS – Florida Department of Agriculture and Consumer Services
FDEP – Florida Department of Environmental Protection
gpd – gallon per day
IWM – Irrigation Water Management
mgd – million gallons per day
MIL – Mobile Irrigation Laboratory
MOC – Management Oversight Committee
NRCS – US Natural Resources Conservation Service
RWSP – Regional Water Supply Plan
SJRWMD – St. Johns River Florida Water Management District
SFWMD – South Florida Water Management District
SWCD – Soil and Water Conservation District
SWFWMD – Southwest Florida Water Management District
USDA – U.S. Department of Agriculture
WMD – Water Management District

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Executive summary

In support of the Central Florida Water Initiative (CFWI) 2020 Guiding Document, regional, state, and federal agencies worked collaboratively with stakeholders to develop a framework for more effective water resource planning and management in Central Florida. The new approach is aimed at coordinated water resource and supply development and management to protect, conserve, and restore water resources while meeting water demands for urban, agricultural, and other needs. This report summarizes current results of the Agriculture sub-team's work. It presents an overview of ongoing funding programs supporting agricultural water conservation BMP implementation, water conservation achieved in 2010 – 2016, and BMPs that can be implemented to achieve additional water conservation outcomes.

By 2035, total water demand in central Florida is projected to increase significantly. Traditional groundwater sources will not be sufficient to meet the future water demands without unacceptable impacts. Water conservation is identified as a top priority with an overall water conservation goal set at a minimum of 37 million gallons per day (mgd). The water conservation goal for agriculture is a minimum of 4.3 mgd. The Agriculture Conservation sub-team of CFWI Conservation Team performed an in-depth assessment of the water conservation practices that were implemented in the CFWI planning area from 2010 to 2016. Estimated water conservation achieved from 2010 to 2016 is summarized in Table 1. Overall, 3.05 mgd, or 78% of the minimum reduction goal of 4.3 mgd has been attained from 2010 to 2016. Furthermore, a draft repository of potential and actual water conservation best management practices (BMPs), cross-referenced with implementation costs, has been developed with input from agencies and stakeholders.

Table 1. The progress toward water conservation goal made in 2010-2016

Agencies administering water conservation programs	Region within CFWI	Agricultural Water Conservation Achieved in 2010-2016 (mgd)
NRCS	Orange and Lake Counties	0.79[z]
NRCS and FDACS partnership	Osceola County	0.43[y]
SJRWMD[x]	SJRWMD jurisdiction	0.61
SWFWMD	SWFWMD jurisdiction	1.01
Other	Lake and Orange Counties	0.21[w]
TOTAL		***3.05***

[z]This estimate include cooling pads retrofit only. Water conservation estimates for the irrigation retrofit projects implemented with NRCS support are not available.
[y] These estimates include installations of water control structures only. Estimates for other projects are not available.
[x] Projects implemented with SJRWMD funding, along with one project implemented with farmer's funding without funding support by the agency.
[w] Verified estimates provided by mobile irrigation lab program.

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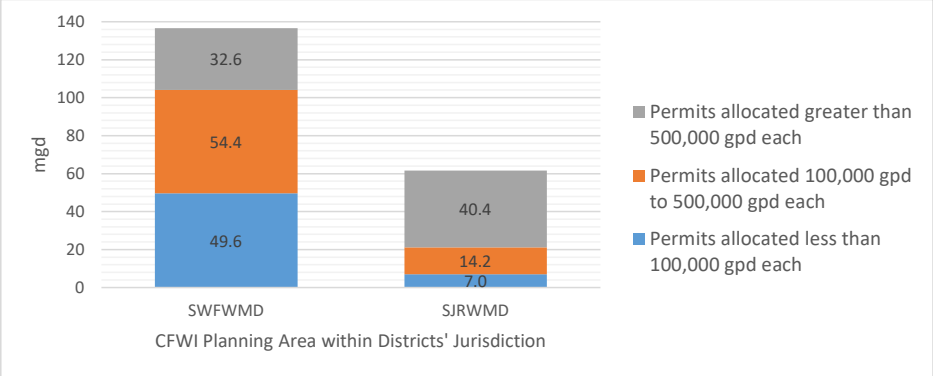
Significant challenges for developing and implementing a comprehensive water conservation strategy that require additional collaborative work were identified:

- Lack of financial resources impedes the ability of agricultural producers to implement additional water conservation practices, especially those practices that require significant up-front costs. ~~Unlike public utilities, agricultural landowners lack levying powers to raise funds for BMP implementation.~~
- Special attention should be paid to small-size agricultural operations holding consumptive use permits (CUPs) for the withdrawal of <100,000 gallons per day (gpd). Such operations account for the majority of permit holders in CFWI planning area, and significant water allocations (Figure 1). Water conservation projects on such operations may not meet the cost-effectiveness criteria set by funding agencies, making the projects ineligible for existing cost-share programs.

Figure 1. Total volume of water allocated to different categories of CUPs (as of July 2016)



Several **priority areas** need to be addressed as agricultural areas in CFWI planning area continues to make the progress toward meeting and exceeding the goal of savings of 4.3 mgd.

- Dedicated cost share funding source provided by the SFWMD, SJRWMD, and SWFWMD (Districts) and FDACS for the CFWI planning area
- Additional information should be collected to access and quantify saving for BMP implemented, especially for operations holding CUPs allocated <100,000 gpd each
- Additional Mobile Irrigation Labs (MILs) evaluations
- Farm demonstrations
- BMP cost effectiveness matrix tool for producers and agencies to evaluate water conservation strategies for the CFWI planning area

In addition to government cost-share programs, other strategies to encourage water conservation can be considered, such as banking of water use credits, of private-public partnerships.

Commented [SKB2]: OUC: PWS utilities are typically enterprise funds and have no authority to raise taxes. Money to pay for conservation BMP implementation from the PWS sector would come from customers, just as it would for the Ag sector in the form of increased prices for commodities Consider removing

Commented [SKB3]: Consider including the number of permittees

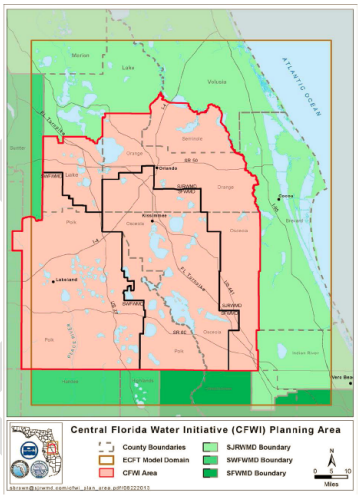
Commented [SKB4]: Consider providing information on why pursuing the larger users, which account for about 60% of allocations is not being done; perhaps focus on less than 100K for in SWFWMD and larger users in the other two districts

Commented [SKB5]: What about SF?

Commented [SKB6]: PWS subteam is looking into quantifying savings for BMPs, both those that have been implemented and those that haven't been; should consider also looking at BMPs that haven't been implemented yet

1. Central Florida Water Initiative: An Overview

Figure 2. Central Florida Water Supply Initiative Planning Area (Source: CFWI 2015a)



The Central Florida Water Initiative (CFWI) is a collaborative water supply planning effort among the state's three largest water management districts, the Florida Department of Environmental Protection (FDEP), the Florida Department of Agriculture and Consumer Services (FDACS) and water utilities, environmental groups, business organizations, agricultural communities and other stakeholders (see more in CFWI, 2017). The CFWI planning area includes approximately 5,300 square miles in Orange, Osceola, Seminole, and Polk counties and southern Lake County (Figure 1). By 2035, total water demands in the area are projected to increase from an average of approximately 800 mgd to almost 1,100 mgd.[1] It is estimated that the traditional groundwater sources will not be sufficient to meet the future water demands without unacceptable impacts. Water conservation is identified as one of the top priorities. It is estimated that at least 37 mgd could be saved with increased conservation efforts in various water demand sectors. ***For the agricultural sector, the specific strategic water conservation goal is a minimum 4.3 mgd reduction by the year 2035.*** This goal was established through the findings in the 2015 CFWI Regional Water Supply Plan (RWSP) and further refined with the Solutions Planning Team, which determined that projected demand in 2035 could be reduced through implementation of enhanced conservation over and above current conservation efforts.

The current CFWI partnership structure includes a Steering Committee that oversees the CFWI process and provides guidance to the technical teams, and the Management Oversight Committee (MOC) that oversees teams working on specific issues (including Conservation). The MOC ensures coordination among the teams, and identifies policy issues that need to be evaluated by the Steering Committee (Figure 3).

The Conservation team is further divided into Agriculture and Public Supply sub-teams. The primary goal for the Agriculture sub-team is identifying and evaluating options for water conservation projects and programs on agricultural lands that would reduce future water demands by a minimum of 4.3 mgd, as identified in the 2015 CFWI RWSP.

[1] The water demand projections represent those reasonable-beneficial uses of water that are anticipated through the year 2035. Average condition (5-in-10 year) and drought condition (1-in-10 year) demands have been estimated in five-year intervals from 2010 to 2035 for each category.

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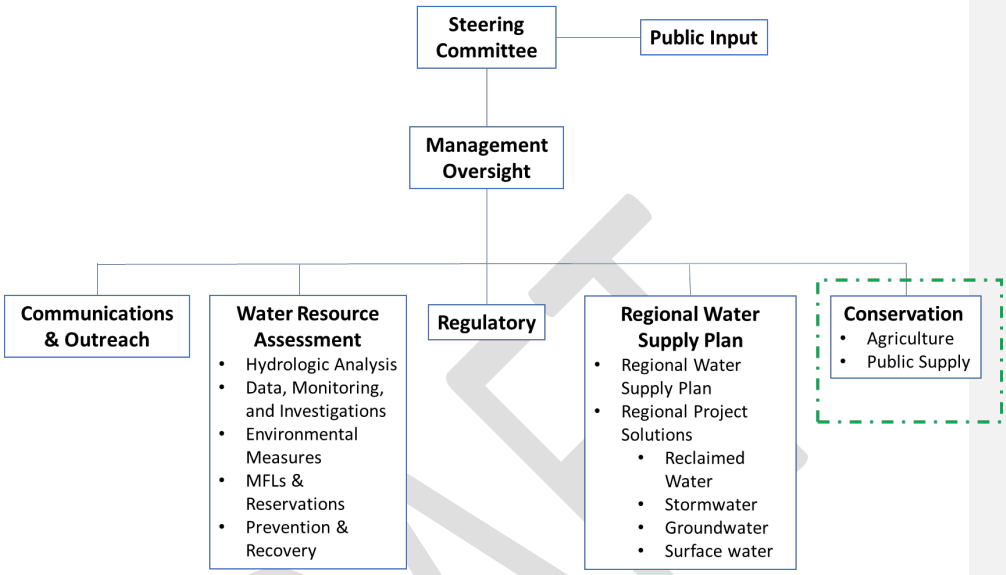
Figure 3. CFWI: Governance and Organizational Structure, with Water Conservation team and sub-teams highlighted (Source: based on CFWI 2020: Guiding Document).



To develop an Implementation Strategy to achieve the water conservation goal, the Agriculture sub-team is charged with the following tasks:

- Identify ongoing funding programs that support BMP implementation, and options for increasing the effectiveness of the existing programs. Information should be gathered from water users/suppliers, agency funding programs, etc. (defined as Task A.2 in 2015 CFWI RWSP)
- Conduct an assessment of the existing status of the implementation of BMPs identified in the RWSP and the remaining potential for BMP implementation. Information should be gathered from water users/suppliers, agency funding programs, existing water conservation-related data bases, etc. (defined as Task A.1 in 2015 CFWI RWSP)

The deadlines for completing these tasks are presented in Appendix A.

This report summarizes current results of the Agriculture sub-team's work. It presents an overview of ongoing funding programs supporting agricultural water conservation BMP implementation, water conservation achieved in 2010 – 2016, and priority BMPs that can be implemented to achieve additional water conservation outcomes.

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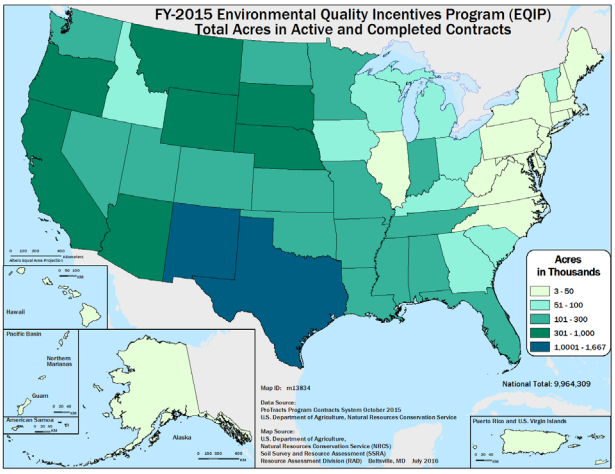
2. Existing Agricultural Best Management Practice Programs

Technical and financial assistance for implementation of agricultural water conservation practices and projects is provided by agencies on federal (United States Department of Agriculture Natural Resources Conservation Service (USDA/NRCS)), state (FDACS), regional (Florida's WMDs), and local levels (counties' Soil and Water Conservation Districts). The agencies often coordinate their activities and programs. Listed below, are the main programs offered in CFWI planning area.

Federal agricultural cost-share programs

Figure 4. USDA/NRCS Environmental Quality Incentives Program (EQIP): 2015 Total Acres in Active and Completed Contracts, some of which result in water conservation, while others focus on water quality benefits (Source: NRCS, https://www.nrcs.usda.gov/Internet/NRCS_RCA/maps/cp_eqip_maps.html)



Several programs offered by the USDA reward agricultural producers and landowners practicing environmental stewardship. These programs are administered by the USDA/NRCS, and they focus on voluntary implementation of practices that protect soil, water, air, wildlife habitats, and related natural resources. The programs include Environmental Quality Incentive Program (EQIP), Agricultural Conservation Easement Program, and Conservation Stewardship Program (see UF/IFAS extension publication by Mylavarapu *et al*. 2014).

The program that is the most relevant to the CFWI agricultural water conservation efforts is EQIP (Figure 4), with water conservation practices supported by this program including:

- Cooling Pad System Retrofits;
- Irrigation System, Micro-irrigation (conversion from a less efficient system);
- Irrigation Water Management;
- Drainage Water Management;
- Irrigation Land Leveling;
- Structure for Water Control;
- Irrigation Reservoir;
- Water Harvesting Catchment;
- Water Well Decommissioning; and
- Well Plugging.

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EQIP programs are available for owners and operators of agricultural lands (including cropland, rangeland, pastureland, non-industrial private forestland, and other farm or ranch lands). Eligible applicants must comply with adjusted gross income (less than $900,000), they must be in compliance with the highly erodible land and wetland conservation requirements; and they must develop an NRCS EQIP plan of operations that addresses at least one natural resource concern.

Payment rates are offered for eligible practices, and the payments are based on modeled cost of the practices (that can be higher or lower than the actual cost encountered by producers in specific geographic regions). For more information about the program, see https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/.

NRCS evaluates practices' cost-effectiveness considering the magnitude of environmental benefits (defined based on National Priorities and the priority natural resource concerns (see https://directives.sc.egov.usda.gov/viewerFS.aspx?hid=21402). However, the evaluation does not involve quantitative estimation of water conservation potential. Hence, limited information is available about water conservation benefits achieved by NRCS programs in Florida.

Florida Department of Agriculture and Consumer Services Program

FDACS defines BMPs as "individual or combined practices determined through research, field testing, and expert review to be the most effective and practicable means for improving water quality, taking into account economic and technological considerations" (source: FDACS, "Agriculture and Water Quality" brochure, http://www.freshfromflorida.com/content/download/33106/813038/BMP_Backgrounder.pdf).

Figure 5. Examples of FDACS' BMP manuals (Source: Rance Ellis, FDACS OAWP; copied from http://nwdistrict.ifas.ufl.edu/phag/files/2012/08/bmp-manuals.jpg)

The BMPs are divided into management and structural categories. The majority of practices are management BMPs, such as nutrient management and irrigation management (i.e., adjustments in irrigation schedules). Structural BMPs include water control structures, fencing, tailwater recovery systems, and other projects involving installing structures on land.

BMP manuals for specific crops are developed with the input from various stakeholder groups, and they are adopted by rule by FDACS. The manuals "contain BMPs that producers reasonably can be expected to implement at little to no cost. Most of the manuals also contain a few practices that may not be economically feasible without cost share, many of which are structural BMPs. Examples are soil-moisture-sensor technology;… advanced irrigation controllers; center-pivot retrofits; variable-rate irrigation; … and structural improvements that require engineering and dedicated treatment systems (i.e., taking land out of

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production), such as … retention/detention ponds, and tailwater recovery systems." (Source: FDACS, "Agriculture and Water Quality" brochure, http://www.freshfromflorida.com/content/download/33106/813038/BMP_Backgrounder.pdf).

Although several BMPs included in FDACS' manuals have both water quality and water conservation benefits, the primary focus of the FDACS' BMP program is water quality protection and improvement. The water conservation benefits achieved through the FDACS program have not yet been assessed, and they are not accounted for in this report.

South Florida Water Management District's Cost-Share Program

Agricultural water conservation, alternative water supply, and stormwater BMP projects are eligible for cost-share funding through the District's Cooperative Funding Program (CFP)[2]. Established in 2016, the CFP combined decades-old individual funding programs for these three project types into one streamlined program to provide partnership opportunities and financial incentives to implement local projects that complement regional flood control, restoration, water quality and water supply efforts. Examples of potential water conservation and alternative water supply project BMPs include:

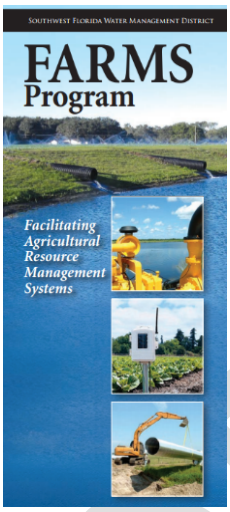
- Conservation
  - Irrigation system retrofits
  - Soil moisture and climate sensor telemetry
  - Subirrigation drain tiles
  - Rainwater harvesting/cisterns
  - Other water conservation measures that increase irrigation efficiency
- Alternative Water Supply
  - Tailwater recovery systems
  - Aboveground impoundment (Surface/ Stormwater or Stormwater/ Irrigation runoff)
  - Used of reclaimed water and other alternative water sources

Over the past two decades, the SFWMD has funded over 680 alternative water supply (AWS) and water conservation projects; however, very few ~~projects from~~ agricultural water users have ~~been proposed and funded~~applied for project funding, and hence, they are not discussed in this report.

[2] SFWMD also offers Dispersed Water Management/Water Farming program to incentivize projects for storing excess surface water on agricultural lands to manage the volume of water flowing into the Lake Okeechobee and Caloosahatchee and St. Lucie estuaries. The program has been recognized on the national level; however such public-private partnerships are outside the scope of this report, since they focus on water storage rather than water conservation.

Southwest Florida Water Management District's Cost-Share Program

Figure 6. FARMS program brochure (see SWFWMD FARMS webpage at https://www.swfwmd.state.fl.us/agriculture/farms/)



SWFWMD's FARMS (Facilitated Agricultural Resource Management Systems) program is a partnership developed by the SWFWMD and the FDACS. It provides agricultural cost-share reimbursement for practices specifically aimed at reducing groundwater withdrawals from the Upper Floridan aquifer. Examples of commonly used BMPs include:

- Irrigation retrofit,
- Soil moisture and weather station climate sensor telemetry,
- Tailwater recovery/surface water pond irrigation pump stations and filtration,
- Water control structures,
- Electronic controls including remote irrigation zone and start/stop controls, and
- Cold and frost/freeze protection BMPs (in the Dover/Plant City Water Use Caution Area).

Growers manage their projects and they are reimbursed for approved expenses. The reimbursement is up to 75 percent of total project costs if BMP provides both water quality and groundwater quantity savings; and up to 50 percent for BMP with either water quality or groundwater quantity savings. In the CFWI planning area, the projects generally focus on water conservation only, and they are eligible for cost-share of up to 50 percent of total project costs. More information about the program is at https://www.swfwmd.state.fl.us/agriculture/farms/.[3]

Potential FARMS project cooperators are required to submit a cost estimate for the proposed project. This estimate is then compared to the estimated reduction in groundwater demand accomplished by the project. A formula is used to calculate a cost per thousand gallons saved over the life of the project and this cost-benefit estimate is included in the information used to approve a project. These cost-benefit estimates are compared to models researched and revised every few years to keep a check on project costs.

Projects funded by SWFWMD are required to install flow meters in association with their projects. The cooperators are required to report water use each month. At the onset of a FARMS

[3] For small-size operations of 100 acres or less, mini-FARMS program provides cost share for water conservation and water quality improvement/protection practices. The cost-share rate is 75 percent of growers' project cost, not to exceed $5,000 per project, which often is not sufficient to implement structural water conservation practices. The program is implemented in partnership with FDACS, it provides an incentive for enrollment in the FDACS-adopted agricultural BMPs program, through a Notice of Intent (NOI).

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conservation project, a benchmark is established and the monthly water use is compared to the established benchmark to determine actual water savings.

Because the goal of FARMS is to reduce Upper Floridan groundwater use, switching water sources and the use of alternative water supplies (e.g. tailwater reservoirs or reclaimed water) is a large component of the groundwater savings. In addition, increased water use efficiency is mainly accomplished through precision irrigation with pump automation and irrigation conversion. Increased water use efficiency projects tend to have lower costs, but also lower benefits in terms of groundwater demand reduction, as compared with the projects focused on replacing groundwater with surface water sources. Both project categories (i.e., increased water use efficiency and tailwater reservoirs/ surficial water sources) are summarized in this report.

St. Johns River Water Management District's Cost-Share Program

A cost-share program to support agricultural conservation practices in SJRWMD jurisdiction was initiated in 2015. Projects eligible for funding include:

- Irrigation system retrofits,
- Soil moisture and climate sensor telemetry,
- Rainwater harvesting,
- Subirrigation drain tile,
- Tailwater recovery and reuse,
- Other water conservation and pollution runoff reduction practices

Figure 7. Installing subsurface irrigation drain tile to replace less efficient seepage irrigation (Source: SJRWMD, http://www.sjrwmd.com/permitting/regulatorynews/archive/2016-04/)

The cost-share funding offered is up to 75 percent of the cost of the project (approved design, construction, and implementation cost; with the maximum of $250,000 annually. Mobile Irrigation Lab (MIL) evaluation is recommended as a part of the application process. The recipient of the cost-share funding should be willing to aknowledge the water savings achieved and have their CUPs modified (the SJRWMD will keep backup allocation for a minimum of five years to allow the water use of the cost-shared project be evaluated). To promote conservation, the SJRWMD may issue a longer-duration permit to those who demonstrated water conservation (for more information, see SJRWMD website "Cost-share opportunities for growers" at http://www.sjrwmd.com/agriculture/costshare.html).

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Submitted proposals are ranked based on the potential to both conserve water and reduce and prevent water pollution. Once or twice a year, SJRWMD issues a call for proposed projects and a panel of experts evaluates the submitted project ideas. Evaluation is based on the projects' water resource benefits, likelihood of timely and successful completion, and cost-effectiveness scores. The summary available for each project also includes the type of project, crops produced, and acreage on which the project is implemented.

Nineteen projects were evaluated in 2015 and 28 projects were evaluated in 2016. Seventeen projects proposed for the CFWI planning area are summarized in this report.

Local Programs: Florida's Soil and Water Conservation Districts

The mission of SWCDs is: "to coordinate assistance from all available sources—public and private, local, state, and federal—to develop locally-driven solutions to natural resources concerns" (National Association of Conservation Districts, 2017). These available assistance and funding sources include state and federal cost-share for environmental practices, emergency watershed projects, and federal disaster relief.

SWCDs are involved in such activities as implementing agricultural practices to protect soils, water, air, and wildlife; protect and restore water resources; work with developers to protect natural resources during construction stage; and implement outreach activities. Specifically, SWCDs may conduct research, teach best management practices for soil and water conservation, and develop comprehensive plans for soil erosion control and flood prevention.

Since SWCDs coordinate their activities with other agencies, water conservation outcomes achieved with their participation are not identified as a separate category, but instead are discussed in various categories and sections of this report.

Cost-Share Programs Implemented through Agency Partnerships

Agencies often collaborate to support implementation of water resource practices by producers. Examples of such collaborations include:

- FARMS program implemented in partnership between SWFWMD and FDACS (as described above);
- Joint funding of water control structures on agricultural lands implemented jointly by NRCS and FDACS in Osceola County (see Table 1);
- Joint support for MILs provided by WMDs, FDACS, NRCS, as well as selected counties. MILs are employed to determine current irrigation conditions and if water use efficiency can be increased. MILs can also measure how effective producers are at improving efficiency for definitive points in time (with baseline and follow up evaluations done for water conservation projects). On the statewide level, MILs have proven to be a tool to help increase efficiency of agricultural

Figure 8. Mobile Irrigation Lab: Measuring sprinkler pressure (Source: SWFWMD, https://www.swfwmd.state.fl.us/agriculture/mobile.html)

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operations' water use. From 2009 to 2015, statewide there were 5,060 evaluations conducted resulting in actual savings of 19 mgd based on implemented conservation measures. In other words, the 5060 evaluations saved on average 0.00375 mgd per evaluation (FDACS personal communication 2016).

Developing partnerships among agencies in the future can results in increased funding available for producers, and potentially, improved effectiveness of the cost-share programs. Public-private partnerships can also create financial incentives for water resource protection.

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Overall, several cost-share programs are available for agricultural producers who are interested in improving water use efficiency and water conservation in the CFWI planning area. Below, the agricultural water conservation sub-team analyze the information assembled by the programs to estimate water conservation outcomes achieved in 2010 – 2016, and assemble a list of priority BMPs that can be employed to achieve additional water conservation by 2035.

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3. Agricultural Water Conservation Outcomes for 2010 – 2016

Commented [SKB8]: Consider breaking it up, i.e., 2010-2015, 2016-2019 (or 2016-2017, if that is how far your data goes)

Agricultural producers have implemented a variety of water conservation practices. Estimated water conservation reported in this section relies on information from the cost-shared programs offered by government agencies (see the sections above).

The 2015 CFWI RWSP addressed agricultural water conservation on a programmatic basis based on the potential water savings estimated by the MILs throughout the state. Although the MIL estimates were a good starting point to determine potential water conservation estimates on agricultural lands, the sub team sought to further refine the estimate with actual participation rates of agricultural producers. The agricultural sub-team has performed an in-depth assessment of the best management practices that have been implemented in the CFWI planning area for the years of 2010-2016 with strong emphasis placed on the highly successful cost sharing programs implemented by the SWFWMD, SJRWMD, and the USDA-NRCS.

Commented [SKB9]: Initially used MILs, but the FARMS program was used to estimate the ag savings on a programmatic basis in the solution phase

A summary of estimated water conservation is summarized in Table 1. Overall, 71% of the minimum reduction goal set by the RWSP for agriculture (4.3 mgd) has been achieved in 2010 – 2016. The programs implemented by specific agencies are described in details in the following sections.[4]

Table 1. The progress toward water conservation goal made in the 2010 – 2016 period

Agencies administering water conservation programs	Region within CFWI	Agricultural Water Conservation Achieved in 2010-2016 (mgd)
NRCS	Orange and Lake Counties	0.79[z]
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[x] projects implemented with SJRWMD funding, along with one project implemented with farmer's funding without funding support by the agency
[w] Verified estimates provided by mobile irrigation lab program.

[4] The agricultural water conservation sub-team attempted to estimate water conservation achieved by practices implemented at producers' expense (i.e., with no government cost-share support). However, the information about such practices is very limited. Furthermore, it is important to note that the effect of land use change on water demand is outside the scope of this report, and hence, the analysis did not account for potential decrease or increase in water demand due to land use conversion among various agricultural crops, and between agriculture and other land uses. The analysis also focused on the costs eligible for cost-share programs (usually, project design and implementation), with no estimates of maintenance cost, the cost of land potentially taken out of production, or estimates of benefits provided by water conservation practices to the producers.

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Federal USDA/NRCS Cost-Share Program

EQIP has been in existence since 1999, and over that time, significant agricultural acreage has been enrolled into the program, resulting in water conservation benefits. This acreage may be representative of operations that have had participation in the past and are still managing and maintaining their water quantity related conservation practices.

Note that while NRCS routinely collects data on the adoption of various practices, the water conservation benefits resulting from the practice adoption have been evaluated for a small sub-set of practices only. A summary of information collected for NRCS agricultural cost-share programs is provided in Table 5.

*Table 2. Summary of NRCS Cost-Share program activity in CFWI Planning Area**

Practice Name	Period	Results
Irrigation systems	2010-2016	Practice adopted on 31.6 acres **
Cooling pads retrofit	2010-2016	Water conservation: 0.79 mgd***

* In addition, EQIP practice "Structures for Water Control" can provide water conservation benefits but only when it is used in conjunction with other practices in a suite such as Irrigation Land Leveling. In 2010 – 2016, two Structures for Water Control were installed Orange County; however, this practice will not be included in the analysis since the practice was not a part of the suite.
** Data provided by Jessica Bertine, NRCS-Gainesville; see the description below.
*** Data provided by NRCS engineer in the Region 3, personal communications.

Commented [SKB10]: Confused how this is 31.6 acres and below it mentions 102.6 acres

Within the program parameters, practice "Irrigation System, Microirrigation" (practice code 441) is only installed when an existing, lesser efficient irrigation system is in place. EQIP does not allow new non-irrigated acres into production, only those that are existing and can be converted to a more efficient irrigation system. EQIP practice "The Irrigation System, Microirrigation" includes several different types of systems, but only a microjet conversions were installed within the CWFI planning area during 2010 – 2016. In total, 102.6 acres of Irrigation System, Microirrigation conservation practices were installed (Tables 3 and 4).

Table 3. USDA/NRCS Conservation Practice "Irrigation System, Microirrigation" (Practice Code 441) Installed in the CWFI Planning Area in 2010 - 2016

County	Unit	Contracted Amount
POLK	Acre	20.0
POLK	Acre	20.0
POLK	Acre	9.0
POLK	Acre	22.0
POLK	Acre	31.6
Total	Acre	102.6

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Table 4. Estimated Total and Unit Costs of "441 Irrigation System, Microirrigation" Conservation Practice Installed within the CWFI Planning Area.

Practice Code	Practice Name	Scenario	Unit	Quantity	Estimated Total Cost	Unit Cost
441	Irrigation System, Microirrigation	Microjet	Acre	102.6	$288,586.10	$2,812.73

Federal and State Agency Partnership for Water Resource Protection

A partnership between NRCS and FDACS involved co-funding for water structure projects in Osceola County, resulting in 0.43 mgd water saving (based on personal communication with the NRCS District Conservationist, Osceola County).

St. Johns River Water Management District's Jurisdiction

Since the inception of the SJRWMD Agricultural Cost Share Program in 2015, producers have implemented a variety of strategies to increase irrigation efficiency within the SJRWMD portion of the CFWI planning area. These strategies have included rainwater harvesting from greenhouse rooftops coupled with ebb and flood benches, irrigation conversions from less efficient methods such as seepage to overhead systems, precision irrigation BMPs and irrigation retrofits to update existing systems to the most efficient emitters currently available. The estimated conservation and estimated farmer funding along with actual SJRWMD funding is reported in Table 5.

Table 5. Water Conservation Results: CFWI planning area in SJRWMD jurisdiction

Ag Type	Annual Average Daily Permitted (gpd)	Estimated Groundwater Reduction (gpd)	Project Type	Total Project Cost	SJRWMD Cost	Project Acres	Year of Approval
Row Crop	153,789	32,986	Irrigation Conversion	$150,000 (estimate)	$0 (farmer funded)	99	2011
Greenhouse	17,250	17,250	Rainwater capture	$350,000	$300,000	15	2015
Citrus/Small Fruits	30,700	10,940	Irrigation Conversion	$176,434	$158,791	19	2015
Sod	146,710	80,690	Irrigation Conversion	$161,571	$64,740	75	2015
Nursery	1,415,000	288,124	Irrigation Conversion	$422,703	$300,000	694	2016
Sod	219,000	177,340	Irrigation Conversion	$383,105	$287,329	75	2016
Totals	**1,982,449**	**607,330**		**$1,643,813**	**$1,110,860**	**977**	

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Southwest Florida Water Management District's Jurisdiction

In 2003, SWFWMD started FARMS program to assist with the implementation of BMPs related to reducing Upper Floridan groundwater demand in agricultural areas. The FARMS program has, historically funded three types of projects:

- Irrigation water conservation through precision irrigation including pump automation and decision support with soil moisture sensor or weather station;
- Irrigation system conversion to increase irrigation efficiency; and
- Alternative water supply (including expansion of existing water features, excavated ponds, and reclaimed water supply) to replace the demand of Upper Floridan groundwater quantities with a different source of water.

Since 2003 the FARMS program has funded 183 projects throughout the SWFWMD, investing a total of $65.7 million with an estimated reduction of 27 mgd of Upper Floridan groundwater. Since 2010, within the CFWI, the SWFWMD has funded 17 projects (Table 6). These projects result in 1.01 mgd of water conservation or Upper Floridan groundwater offsets.

Table 6. FARMS projects funded within the CFWI (2010 – 2016)

Ag Type	Annual Average Daily Permitted (gpd)	Estimated Groundwater Reduction (gpd)	Project Type	Total Project Cost	SWFWMD Cost	Project Acres	Year of Approval
Blueberry	36,300	21,000	Alternative Water Supply	$277,670	$63,762	20	2010
Citrus	350,200	7,000	Precision Irrigation	$9,087	$ 4,370	448	2010
Blueberry	28,700	10,045	Irrigation Conversion	$77,967	$23,000	20	2011
Blueberry	567,700	40,000	Irrigation Conversion	$161,571	$64,740	20	2011
Citrus	52,400	10,000	Irrigation Conversion	$43,808	$21,904	20	2011
Citrus	35,200	29,775	Alternative Water Supply	$25,128	$18,846	41	2011
Citrus	196,000	58,800	Irrigation Conversion	$304,320	$116,548	192	2011
Blueberry	39,000	29,250	Alternative Water Supply	$138,836	$90,174	20	2012
Blueberry	25,600	19,200	Alternative Water Supply	$96,120	$ 44,962	13	2012
Blueberry	15,800	10,270	Alternative Water Supply	$46,190	$34,611	8	2012
Blueberry	176,200	112,340	Alternative Water Supply	$376,460	$266,980	80	2012
Blueberry	34,500	10,350	Irrigation Conversion	$90,151	$32,500	24	2012
Nursery	461,300	89,900	Alternative Water Supply	$490,247	$200,000	84	2012
Citrus	43,900	11,300	Alternative Water Supply	$17,460	$8,730	36	2013
Blueberry	908,200	520,000	Alternative Water Supply	$1,007,922	$670,105	414	2014

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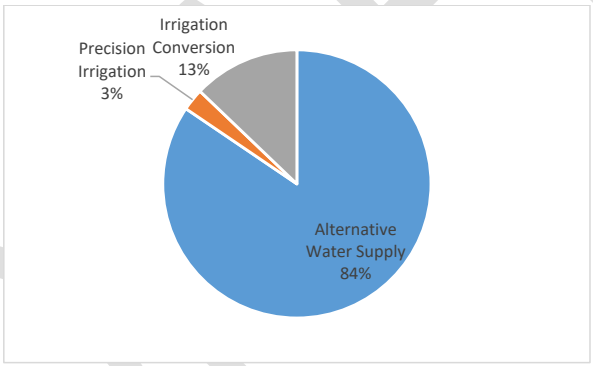
Ag Type	Annual Average Daily Permitted (gpd)	Estimated Groundwater Reduction (gpd)	Project Type	Total Project Cost	SWFWMD Cost	Project Acres	Year of Approval
Blueberry	201,100	6,000	Alternative Water Supply	$35,488	$17,744	12	2015
Citrus	551,000	19,800	Precision Irrigation	$109,600	$54,800	483	2016
Totals	**3,723,100**	**1,005,030**		**3,308,024**	**1,733,776**	**1,935**	

Because the goal of FARMS is to reduce Upper Floridan groundwater use, AWS projects, such as tailwater reservoirs or other surficial water sources, is a large component of the groundwater savings (Fig. 10). ~~Within the CFWI, conservation would then mainly be accomplished through water supply from sources other than Upper Floridan Aquifer, conservation through precision irrigation with pump automation or irrigation conversion. Conservation projects tend to have lower costs, but also lower benefits to groundwater use reduction.~~

Figure 9. ~~Water Conservation Savings~~FARMS groundwater savings in SWFWMD Jurisdiction, 2010 – 2016: distribution of savings among project types



Other Water Conservation Outcomes

In addition, verified MIL results are available from Lake County Soil and Water Conservation District, with the estimated water conservations of 0.21 mgd for Orange and Lake Counties.

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4. Additional Water Conservation Potential

Matrix of BMPs

A draft repository of potential and actual BMPs, cross referenced with implementation costs, has been developed by the ag sub-team with input from agencies and stakeholders, and using data from the existing agricultural cost-share programs.

To use this information and estimate water conservation potential for agricultural areas in the CFWI planning area, important steps should include assessment of (1) baseline level of adoption of different practices for various agricultural crops grown in the CFWI planning area ; and (2) potential limitations on the practice adoption (such as physiographic soil types). This information will allow identification of acreage that is available for implementation of conservation practices identified in the matrix.

Table 7. Matrix of conservation practices and AWS for which cost and benefit information is available (arranged by cost-effectiveness score; color-coded to highlight categories of practices). Relevance of practices to crops and soils in each Districts' jurisdiction is based on preliminary expert opinions and ranked from V= very relevant, to S=somewhat relevant, and N=not relevant; NA – expert opinion is not available

Category	Project type	Crops	Cost-effectiveness ($/kgal)**	Cost per unit**	Units	Information source	Relevance to CFWI		
							SJRWMD	SWFWMD	SFWMD
Water Conservation	**Soil and Moisture Sensor (SMS)**	Sod/Pasture	**$0.04**	$1,947	$/System	SWFWMD	V	V	NA
Water Conservation	**SMS**	Row crops	**$0.05**	$1,947	$/System	SWFWMD	V	S	NA
Water Conservation	**SMS**	Perennial	**$0.08**	$1,947	$/System	SWFWMD	V	V	NA
Water Conservation	**Weather Station**	Sod/Pasture	**$0.08**	$3,515	$/System	SWFWMD	V	V	NA
Water Conservation	**SMS**	Container Nurseries	**$0.09**	$1,947	$/System	SWFWMD	V	V	NA
Water Conservation	**Weather Station**	Row crops	**$0.10**	$3,515	$/System	SWFWMD	V	S	NA
Alternative Water Supply	**Reclaimed water supply**	Container Nurseries	**$0.15**	$47,245	$/System	SWFWMD	S	S	NA
Water Conservation	**Weather Station**	Perennial	**$0.17**	$3,515	$/System	SWFWMD	V	V	NA
Water Conservation	**Weather Station**	Container Nurseries	**$0.17**	$3,515	$/System	SWFWMD	V	S	NA
Alternative Water Supply	**Reclaimed water supply**	Sod/Pasture	**$0.19**	$97,248	$/System	SWFWMD	N	V	NA
Alternative Water Supply	**Reclaimed water supply**	Row crops	**$0.20**	$95,280	$/System	SWFWMD	N	N	NA
Alternative Water Supply	**Reclaimed water supply**	Perennial	**$0.23**	$70,702	$/System	SWFWMD	S	N	NA
Alternative Water Supply	**Tailwater recovery with irrigation retrofit**	Sod	**$0.39**	$3,700.50	$/acre	SJRWMD	S	V	NA
Water Conservation	**Irrigation system automation (SMS)**	Sod/Pasture	**$0.44**	$23,078	$/System	SWFWMD	S	V	NA
Water Conservation	**Irrigation system automation (weather station)**	Sod/Pasture	**$0.47**	$24,647	$/System	SWFWMD	S	V	NA
Irrigation Conversion	**Overhead to micro irrigation**	Container Nurseries	**$0.54**	$3,288	$/Acre	SWFWMD	V	V	NA
Water Conservation	**Irrigation system automation (SMS)**	Row crops	**$0.55**	$23,078	$/System	SWFWMD	S	S	NA

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Commented [SKB12]: Clarification on meaning of "relevance of practices"

Commented [SKB14]: Clarification on meaning of "relevance to CFWI"; As an example, SW indicates they paid for a project using reclaimed water on row crops but they have an N for CFWI relevance.

Commented [SKB13]: how were these numbers derived? Are they averages of funded projects? Just one District or average of all projects regardless of funding?

Category	Project type	Crops	Cost-effectiveness ($/kgal)**	Cost per unit**	Units	Information source	Relevance to CFWI		
							SJRWMD	SWFWMD	SFWMD
Water Conservation	**Irrigation system automation (weather station)**	Row crops	**$0.59**	$24,647	$/System	SWFWMD	**S**	**S**	NA
Irrigation Conversion	**Seepage to tile drain**	Row crops	**$0.66**	$4,441.70	$/Acre	SJRWMD	**S**	**N**	NA
Irrigation Conversion	**Overhead to drip**	Perennial Crops	**$0.79**	$2,133	$/Acre	SWFWMD	V	V	NA
Water Conservation	**Irrigation system automation (SMS)**	Perennial	**$0.87**	$23,078	$/System	SWFWMD	V	V	NA
Irrigation Conversion	**Seepage to drip**	Row Crops	**$0.88**	$2,133	$/Acre	SWFWMD	**S**	**N**	NA
Alternative Water Supply	**Existing feature expansion**	Sod/Pasture	**$0.90**	$416,500	$/System	SWFWMD	**S**	V	NA
Water Conservation	**Irrigation system automation (SMS)**	Container Nurseries	**$0.91**	$23,078	$/System	SWFWMD	V	V	NA
Alternative Water Supply	**Existing feature expansion**	Row crops	**$0.91**	$392,460	$/System	SWFWMD	**S**	**S**	NA
Water Conservation	**Irrigation system automation (weather station)**	Perennial	**$0.93**	$24,647	$/System	SWFWMD	V	V	NA
Water Conservation	**Irrigation system automation (weather station)**	Container Nurseries	**$0.97**	$24,647	$/System	SWFWMD	V	V	NA
Irrigation Conversion	**Seepage to tile drain**	Row crops	**$1.00**	$3,686.70	$/Acre	SJRWMD	**N**	**N**	NA
Alternative Water Supply	**Existing feature expansion**	Perennial	**$1.11**	$258,439	$/System	SWFWMD	V	V	NA
Irrigation Conversion	**Overhead to micro spray**	Perennial Crops	**$1.25**	$3,032	$/Acre	SWFWMD	**S**	V	NA
Irrigation Conversion	**Seepage to Center pivot**	Row crop	**$1.44**	$1,750	$/Acre	SWFWMD	**N**	V	NA
Irrigation Conversion	**Seepage to Center pivot**	Sod/Pasture	**$1.49**	$1,750	$/Acre	SWFWMD	**S**	V	NA
Alternative Water Supply	**Existing feature expansion**	Container Nurseries	**$1.61**	$167,807	$/System	SWFWMD	**S**	**S**	NA
Irrigation Conversion	**Seepage to subsurface drip**	Sod/Pasture	**$2.26**	$2,657	$/Acre	SWFWMD	**N**	**S**	NA
Irrigation Conversion	**Center Pivot to sub-surface drip**	Row crop	**$3.34**	$2,657	$/Acre	SWFWMD	**N**	**N**	NA
Irrigation Conversion	**Center Pivot to sub-surface drip**	Sod/Pasture	**$3.34**	$2,657	$/Acre	SWFWMD	**N**	**N**	NA
Alternative Water Supply	**Excavated pond**	Row crops	**$0.79 - $1.05**	$451,985 - $532,643	$/System	SWFWMD	**N**	**N**	NA
Alternative Water Supply	**Excavated pond**	Sod/Pasture	**$0.80 - $1.05**	$485,267 - $575,280	$/System	SWFWMD	**S**	V	NA
Alternative Water Supply	**Excavated pond**	Perennial	**$0.91 - $1.23**	$286,105 - $330,450	$/System	SWFWMD	V	V	NA
Irrigation Conversion	**Retrofit of sprinkler systems**	Env. Horticulture	**$0.98***	$1,838.3*	$/Acre	SJRWMD	V	**N**	NA
Alternative Water Supply	**Excavated pond**	Container Nurseries	**$1.22 - $1.71**	$178,701 - $198,627	$/System	SWFWMD	**S**	**S**	NA

* use with caution, since the estimate is based on a variety of practices, with a large range of costs and benefits.
** note that the cost includes installation cost only (annualized based on the estimate life span of the project); maintenance costs or changes in producers' yields and profits were not accounted for. Furthermore, variability in

Commented [SKB14]: Clarification on meaning of "relevance to CFWI"; As an example, SW indicates they paid for a project using reclaimed water on row crops but they have an N for CFWI relevance.

Commented [SKB13]: how were these numbers derived? Are they averages of funded projects? Just one District or average of all projects regardless of funding?

Category	Project type	Crops	Cost-effectiveness ($/kgal)**	Cost per unit**	Units	Information source	Relevance to CFWI		
							SJRWMD	SWFWMD	SFWMD

the cost among the sites and farm sizes is not accounted for. For the practices for which a range of cost is available (i.e., practices funded by SJRWMD), median estimate is used.

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Commented [SKB13]: how were these numbers derived? Are they averages of funded projects? Just one District or average of all projects regardless of funding?

In addition, for several practices that are expected to provide water conservation benefits, Florida-specific reliable estimates of cost-benefit ratio estimates were not found. These practices are summarized in Table 8, and a recommendation is made to collect more data on the practices' water conservation potential and cost.

Table 8. Additional conservation and AWS practices for which additional cost and benefit information should be collected; color-coded to highlight categories of practices). Relevance of practices to crops and soils in the CFWI planning area is based on preliminary expert opinions and ranked from V= very relevant, to S=somewhat relevant, and N=not relevant

Category	Project type	Land use	Information source	Relevance to CFWI planning area
Alternative Water Supply	Tailwater recovery for microjets irrigation	Perennial	SJRWMD	S
Alternative Water Supply	Tailwater recovery with decision support	Perennial	SJRWMD	S
Alternative Water Supply	Tailwater recovery with hydroponics	Perennial	SJRWMD	V
Alternative Water Supply	Tailwater recovery	Mixed	SJRWMD	S
Alternative Water Supply	Rainwater harvesting	Hydroponics	SJRWMD	V
Alternative Water Supply	Reservoir to store groundwater and reclaimed water	Mixed	SJRWMD	S
Alternative Water Supply	Horizontal well	Mixed	SJRWMD	N
Alternative Water Supply	Irrigation Reservoir: Embankment Dam with On-Site Borrow	Variety	NRCS	V
Alternative Water Supply	Irrigation Reservoir: Embankment Reservoir = 30 Acre-Feet	Variety	NRCS	V
Alternative Water Supply	Irrigation Reservoir: Steel Tank	Variety	NRCS	S
Alternative Water Supply	Irrigation Reservoir: Plastic Tank	Variety	NRCS	S
Alternative Water Supply	Irrigation Reservoir: Fiberglass Tank	Variety	NRCS	S
Alternative Water Supply	Irrigation Reservoir: Excavated Pit	Variety	NRCS	V
Alternative Water Supply	Irrigation water management	Variety	NRCS	V
Alternative Water Supply	Irrigation land leveling	Variety	NRCS	V
Conservation	Well decommissioning (shallow well)	Variety	NRCS	V
Conservation	Well decommissioning (drilled well)	Variety	NRCS	V
Conservation	Well decommissioning (small drilled well)	Variety	NRCS	V
Conservation	Artesian Well Cappinig	Variety	NRCS	S
Conservation	Well Plug	Variety	NRCS	V
Irrigation Conversion	Seepage to linear overhead	Field crops	SJRWMD	S
Irrigation Conversion	Seepage to center pivot	Vegetables, other crops	SJRWMD	S
Irrigation Conversion	Traveling gun to center pivot	Variety of crops	SJRWMD	S
Irrigation Conversion	Overhead to microspray	Perennial	SJRWMD	V

Category	Project type	Land use	Information source	Relevance to CFWI planning area
Irrigation Conversion	Overhead to drip	Perennial	SJRWMD	S
Irrigation Conversion	Drip to hydroponics	Env. horticulture	SJRWMD	S
Other	Drainage Water Management	Variety	NRCS	V
Other	Structure for Water Control: Flashboard Riser, Metal	Variety	NRCS	V
Other	Structure for Water Control: Commercial Inline Flashboard Riser	Variety	NRCS	V
Other	Structure for Water Control: Culvert	Variety	NRCS	V
Other	Structure for Water Control: Pipe Drop Structure	Variety	NRCS	V
Other	Structure for Water Control: Slide Gate	Variety	NRCS	V
Other	Structure for Water Control: Flap Gate	Variety	NRCS	V

Commented [SKB15]: Should the irrigation conversion projects be considered very important? Should they be labeled as conservation?

***

While the draft matrix of water conservation BMPs provides information about practices and their costs, it does not allow estimating the additional water conservation outcomes that can be achieved with the implementation of these practices in CFWI planning area. The sections below are intended to shed the light on the extent of these practices implementation and resulting water conservation outcomes in SWFWMD's and SJRWMD's jurisdictions given the existing Districts' cost-share programs. A similar assessment of the water conservation potential for SFWMD maybe conducted in future. In addition to WMD's programs, NRCS programs can also lead to increase in the acreage of water conservation BMPs, as discussed below.

Water Conservation Potential: SJRWMD

Since the inception of the SJRWMD Agricultural Cost Share Program in 2015, producers have implemented a variety of strategies to increase irrigation efficiency within the SJRWMD portion of the CFWI planning area.

All growers are eligible for SJRWMD Agricultural Cost Share, but typically those producers with CUP allocations for greater than 100,000 gpd are most likely to participate. These same growers are also most likely to implement projects at their own expense.

The majority of growers are currently using the most efficient irrigation system available for their crop type, so conservation is primarily expected to come from implementation of decision support systems such as weather stations, soil moisture sensors and automated pump stations.

Based on an analysis of the current SJRWMD CUPs, 30% of the total number of permits are Tier 1 or 2, with allocations greater than 100,000 gpd. Of these, 36% have not reported any water use within the past two or more years, primarily due to grove decline from the effects of greening. An additional 13% are already using a lower quality water source for irrigation.

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Twenty-seven farms are considered as meeting the criteria for future expected irrigation efficiency improvement projects (Table 9).

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Table 9. Potential for Water Conservation Projects that can be implemented in the SJRWMD portion of CFWI planning area

Crop	# Farms	Type of Project	Reduction potential (mgd)*	Anticipated Project Cost*
Blueberry	3	Decision support and automation	0.028	$98,588
Citrus	11	Decision support and automation	0.233	$553,872
Citrus	5	Decision support and automation plus irrigation retrofit	0.142	$361,736
Nursery	7	Decision support and automation	0.029	$147,882
Row crop	1	Irrigation conversion from seepage to overhead	0.033	$212,613
Totals	**27**		**0.465**	**$1,374,691**

* Estimates for conservation potential and cost were derived from the SWFWMD Model Farms Economic Study based on years of data collected from the FARMS program.

Barrier to participation within the SJRWMD portion of the CFWI planning area

Almost half of the Tier 1 and 2 CUPs are for citrus which has been adversely affected by greening. Many growers are waiting for a solution to the problem and may be unwilling to invest in efficiency upgrades with an uncertain future for their commodity.

Water Conservation Potential: SWFWMD

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Agricultural water conservation within the SWFWMD is typically accomplished through three BMPs categories:

- Use of AWS
- Reduction of water use through Precision Irrigation
- Reduction of water use through irrigation conversion

Conservation potential for each of these categories is discussed below.

SWFWMD: Conservation through Alternative Water Supply

AWS can include tailwater recovery ponds, reclaimed water sources, and other surficial aquifer sources. The CFWI planning area has some unique physiographic areas that limit the effectiveness and practicality of AWS as a means to reduce Upper Floridan groundwater use. Within Polk county there are four sand ridges:

- Lake Wales Ridge
- Lake Henry Ridge
- Lakeland Ridge
- Winter Haven Ridge

Within these ridge areas, AWS is difficult to maintain because the hydrology does not tend to support surface water reservoirs. Out of more than 1,900 water use permits issued by SWFWMD

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in the CFWI planning area, more than 60% of those permits fall within a ridge physiographic province and therefore are not practical for an AWS type project.

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SWFWMD: Conservation through Precision Irrigation

Precision irrigation BMPs generally include pump auto starts and auto stops as well as soil moisture sensors and / or weather stations to help a grower decide when to turn pumps on and off. The costs for pump start and stop automation are similar for each pumping station, whether that station serves 10 acres or 40 acres. Based on project experience and research done to support the FARMS program, water conservation benefits are generally limited to about 5 to 7 per cent of permitted quantities. Based on a typical pump automation project cost, and because of the limitation in potential for ground water conservation, FARMS funding for automation projects is generally limited to permits with allocations greater than 100,000 gpd.

Commented [SKB21]: SWFWMD, is this correct?

Using these parameters and the permitted quantities, the following table details the potential for conservation through precision automation and potential costs within the SWFWMD portion of the CFWI planning area and the potential savings at various participation rates (Table 10). Note that the range in funding needed is dependent on the mix of projects. AWS projects cost much more than conservation projects.

Table 10. Potential for ~~Upper Floridan Groundwater Conservation~~Programmatic Savings in SWFWMD portion of the CFWI Planning Area

	Precision Irrigation Conservation	**AWS in Valleys and Uplands**	**Total Potential Participation**	**50%**	**30%**	**10%**
Number of Permits Above Cost Benefit Threshold using at least 10% of permitted quantity	175	17	192	96	58	19
Potential Reduction in GW Use (mgd)	3.22	2.05	5.27	2.64	27.84	0.527
Potential Funding Needed	$1,750,000	$ 4,800,000	$6,550,000	$3,275,000	$ 1,749,000	$655,000

SWFWMD: Conservation through Irrigation Conversions

The other main BMP used to conserve groundwater for agricultural irrigation is the conversion of an irrigation system from one of a lower efficiency to one of high efficiency. Table 11 shows the types of irrigation systems permitted within the SWFWMD section of CFWI planning area, and the total quantities associated with each type.

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Table 11. Potential for ~~Upper Floridan Groundwater~~ Conservation through Irrigation Conversion in the SWFWMD portion of the CFWI Planning Area

Irrigation System	Percent permits within CFWI	Associated Permitted Quantity (mgd)	Potential Savings for conversion to 80% Efficient (mgd)	Approximate Average Irrigation Efficiency
Micro spray	79.21%	103.39	0	80%
Sprinkler over plant or / Travelling Gun	12.53%	10.78	1.62	65%
Drip irrigation (with and without plastic)	6.64%	10.68	0	85%
Seepage	1.35% s	2.27	0.68	50%
Center Pivot	0.27%	1.95	0.09	75%
Totals	**100%**	**129.07**	**2.39**	

This analysis shows that 86% of irrigation systems used in the SWFWMD's portion of CFWI planning area are at least 75% efficient. This does not necessarily mean the systems have been operated and maintained to maximize efficiency, but the basic systems permitted are the more efficient systems available. This limits the SWFWMD's ability to make significant gains in conservation through irrigation efficiency improvements or irrigation conversions.

Using the average cost for previously funded irrigation conversions and a 10% decrease in water demand, the permitted quantity would need to be at least 230,000 gpd to get sufficient savings to justify the cost of a typical project. Out of the 1,990 permits in the CFWI planning area, only 100 would meet the cost benefit criteria. Of the 100 permits that have sufficient quantities to justify the cost of an irrigation conversion, the majority are citrus permits of which the majority are groves that use low volume spray type irrigation systems. Within the current guidelines for the SWFWMD funding programs, irrigation conversion within the CFWI planning area will likely not provide significant savings towards the agricultural conservation goal.

Barriers to participation in water conservation programs within the SWFWMD portion of the CFWI planning area

Listed below are the main barriers to participation in the FARMS program in the CFWI:

- For AWS projects the main barrier is the geology of the CFWI planning area which doesn't lend itself to tailwater recovery or surface water impoundments.
- For precision irrigation projects, the primary barrier to FARMS funding is sufficient permitted quantity to justify a full pump automation project.
- For Irrigation conversion projects, the main barrier is the vast majority of permits that are already using relatively efficient irrigation systems.

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Commented [SKB23]: Should this analysis be done on the quantities under each permit based on irrigation type?

Commented [SKB24]: What about savings potential outside of the funding programs?

Commented [SKB25]: What about other barriers to conservation outside of the funding programs?

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Water Conservation Potential: USDA/NRCS

Two NRCS practices were identified as keys to water conservation in the CFWI planning area. First, "The Irrigation System, Microirrigation" was the typical NRCS practice adopted in the CWFI planning area. Microirrigation is a more efficient irrigation system than others, with an approximate increase in efficiency of up to 90%. However, how the system is managed effects the amount of overall efficiency achieved.

Second, the conservation practice "Irrigation Water Management (IWM)" includes analyzing the crop requirements as well as the efficiency of the irrigation system (i.e. blocked nozzles, broken appurtenances). In some areas IWM plans are developed by MILs that provide this information to the landowner.

Commented [SKB26]: Is this O & M or having an inspection program to detect and repair?

NRCS relies on state resource assessment to evaluate the work load for the coming years. This assessment is intended to account for past participation trend, and the cost-share programs implemented by other agencies. Based on this assessment, acres perceived to require NRCS service in the future can be evaluated (Table 12).

Table 12. Estimated Future NRCS Participation for Water Conservation Practices within the CWFI Planning Area

	Potential Area to be Serviced by NRCS (Acres)	Assuming 50% Participation (Acres)	Assuming 25% Participation (Acres)
Number of Potential Acres	3,000*	1,500	750

**Potential Acres based upon USDA - NRCS State Resource Assessment*

Barriers to Participation in USDA-NRCS programs

Listed below are the main barriers to participation in the EQIP. Though most funding allocated to the program in Florida is spent within the fiscal year, there are still sectors that may not participate in USDA/NRCS financial and technical assistance programs, which include the following:

- A primary barrier to participation in the USDA–NRCS EQIP is awareness. Though USDA/NRCS does promote themselves and their programs, there are numerous agricultural operations/operators that are not aware of the cost-share opportunities for the implementation of conservation practices. Novice farmers (or agricultural operators) may fall into this category.
- A secondary barrier would be resistance to participate, or work with, a federal agency (i.e., averse to government assistance, distrust of government agencies).
- A third barrier would be directly related to programmatic restrictions (most notably the Adjusted Gross Income (AGI) restriction of less than $900,000 for participation in EQIP). However, this AGI requirement would only restrict larger operations (note that federally recognized Native American Indian Tribes are exempt from the AGI payment restrictions).

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5. Next Steps

Challenges for implementing a comprehensive water conservation strategy were identified, and the need for future collaborative work to address these challenges is emphasized:

- Lack of financial resources impedes the ability of agricultural producers to implement additional water conservation practices, especially those practices that require significant up-front costs. Unlike public utilities, agricultural landowners lack levying powers to raise funds for BMP project implementation.
- Special attention should be paid to small-size agricultural operations holding CUPs for withdrawal of <100,000 gallons per day. Such operations account for the majority of permit holders in CFWI planning area. These operations account for 11.4% of total water demand in SJRWMD portion of CFWI planning area (7.0 mgd), and 36.3% of total water demand in SWFWMD portion of CFWI planning area (49.6 mgd) (Figure 1). They often face higher per-acre implementation costs for water conservation projects (due to the effect of scale that increases per acre or per gallon implementation costs for smaller structural projects). Due to the higher costs, water conservation projects on such operations may not meet the cost-effectiveness criteria set by funding agencies, making the projects ineligible for existing cost-share programs. Small-size agricultural operations also face additional barriers on financing and borrowing. At the same time, these operations, as a group, are managing significant volumes of water; and they can potentially make a significant contribution to the water conservation goals for the CFWI planning area.

As noted previously, there are several **priority areas** that need to be considered as we identify ways to reduce agricultural demands by at least 4.3 MGD by the year 2035.

- **Dedicated cost share funding source provided by the Districts and FDACS for the CFWI planning area**
  Many (1,973) CUPs in the CFWI planning area have water withdrawal allocations below 100,000 gpd (Fig. 1). Water conservation projects for many of these CUPs do not reach cost benefit thresholds, and existing cost-share funding is allocated to larger permittees. An example a solution to this challenge is SJRWMD program, which is using 50% of provided cost-share funds for the Tri County Agricultural area in north central Florida (St. John's, Putnam and Flagler Counties). Agricultural water conservation sub-team believes that it would be appropriate to further explore this model and create dedicated cost-share funds for the CFWI planning area.
- **Additional information should be collected to access and quantify the savings for BMPs implemented in the CFWI planning area, especially for operations holding CUPs allocated <100,000 gpd each**

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Overall, the group of holders of "small" (<100,000 gpd) permits is allocated significant volumes of water for withdrawal (56.6 mgd, or 28.6% of volume of water currently allocated for SJRWMD and SWFWMD portions of CFWI planning area). BMPs implemented by these holders may lead to significant water conservation results. However, currently, pumpage reporting is not required on these individual CUPs. In an effort to advance conservation beyond the 4.3 mgd previously identified, there is a need to account for water use and water conservation strategies implemented by such permit holders, as well as to encourage additional water conservation. For example, survey of these CUP holders can be conducted to ascertain maintenance and management of current systems, and quantify water conservation potential for this group of permit holders.

Commented [SKB27]: Can you expand on what you mean by this?

- **Additional Mobile Irrigation Labs (MIL) evaluations**
  MILs are employed to determine current irrigation conditions and if water use efficiency can be increased. MILs can also measure how effective producers are at improving efficiency for definitive points in time (with baseline and follow up evaluations done for water conservation projects). On the statewide level, MILs have proven to be a tool to help increase efficiency of agricultural operations' water use. From 2009 to 2015, statewide, there were 5,060 evaluations conducted resulting in actual savings of 19 mgd based on implemented conservation measures. In other words, the 5,060 evaluations saved on average 0.004 mgd per evaluation (FDACS, personal communication 2016).

Commented [SKB28]: Do we know how many MILs were done in the CFWI region and how much was saved over what period of time?

- **Farm demonstrations**
  Producers like to see demonstration programs and to interact with leading farmers who have implemented successful water saving efforts. Effective strategies should be developed to reach the agricultural land owners and operators with technical information and financial incentives. The number of land owners and operators in the CFWI planning area is so large that traditional strategies and programs may not be effective.

Commented [SKB29]: Would you like to see more of them done?

- **BMP cost effectiveness matrix tool for producers and agencies to evaluate water conservation strategies for the CFWI planning area**
  A variety of water conservation strategies are available to producers (and additional practices are being developed), and a menu of practices applicable to different crops and soil characteristics should be developed to aid the choices of producers and agencies (see specific suggestions in Appendix C). For each practice, ranges of water conservation potential and the costs of the practices should be provided. In this report, draft cost-effectiveness matrix is presented; in future, the draft should be expanded. Gathering this information would assist with the development of a statewide clearinghouse as a repository for agricultural conservation data, publications, and goal-based planning tools to optimize future conservation programs and promote consistency.

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Appendix A. Tasks Identified for the Agricultural Conservation Sub Team

Task A. Using the analysis and options from the Sub-teams, the Conservation Team will develop an Implementation Strategy to achieve the projected savings identified in the 2015 CFWI RWSP. Specifically, the following steps should be completed:

Commented [SKB30]: Tasks should be changed per the revisions to the scope of work

- Task A.1. Conduct an assessment of the **existing status** of the implementation of BMPs identified in the 2015 CFWI RWSP, and the remaining potential for BMP implementation. Information will be gathered from water users/suppliers, agency funding programs, existing water conservation-related data bases, etc.

- Task A.2. Identify **ongoing funding programs** that support additional BMP implementation, and options for increasing the effectiveness of the existing programs. Information will be gathered from water users/suppliers, agency funding programs, etc.

Table A1. Deadlines for Completing the Major Tasks

Tasks	Sub-Tasks	Due Date
Intermediate progress report for the Steering Committee	Information collected from sub-teams	Dec. 2, 2015
	Information sent to Management & Oversight Committee	Dec. 16, 2015
	Report presentation to the Steering Committee	Jan. 13, 2016
*Task A.1: Assessment of **existing status** of implementation of BMPs identified in RWSP and remaining potential*		*Jan. 2016*
Assessment of existing status of Regional Water Supply Plan best management practices (BMPs)	Regional Water Supply Plan Team determines baseline for calculating water savings (i.e., the start date for measuring conservation outcomes)	Dec. 29, 2016
	Public Water Supply sub-team completes survey of water utilities and summarizes results	Jan. 20, 2016
	Assessment prepared by Agricultural Water Conservation sub-team (including BMP matrix, water conservation results achieved, and remaining challenges)	Jan. 20, 2016
	Complete report to be sent to the overall Conservation Team	Jan. 20, 2016
Assessment of remaining potential for BMP implementation	Public Water Supply sub-team come up with estimate from the survey of water utilities	Jan. 31, 2016
*Task A.2: Identify ongoing **funding programs** and options for increasing effectiveness of existing programs*		*Dec. 2016*
Identify ongoing funding programs	Reports completed by St. Johns River and Southwest Florida Water Management Districts	Dec. 2, 2016
	Report completed by Public Water Supply sub-team (based on utilities survey results)	Dec. 29, 2016
Options for increasing existing funding programs	On-going discussion	Jan. 20, 2017
Next Steps:		
	Implementation Strategy Drafts from Sub-teams	April 2017
	Complete draft options for implementation strategies to achieve 37 mgd of water savings identified in 2015 CFWI Regional Water Supply Plan (to be submitted to Management & Oversight Committee for consideration)	June 2017
	Complete draft options for actions/programs to increase water savings beyond 37 mgd in 2015 CFWI RWSP	TBD

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Appendix B. Next steps to further refine the BMP Matrix

- Crops grown and irrigation practices utilized in the CFWI planning area are diverse, and there is significant variability in soil types. This diversity should be accounted for when effectiveness of various agricultural BMPs is assessed. Innovative strategies are required to prioritize water conservation investments and increase cost-share programs' cost-effectiveness.
- A strategy should be developed for estimating water conservation in the link with the land use change analysis. This report focused on a seven-year time horizon (2010 – 2016), and did not assess changes in water demand associated with changes in area devoted to various crops. However, developing long-term scenarios of water demand and conservation requires accounting for land use changes.
- The need to evaluate the baseline level of adoption of agricultural practices is identified as the first priority for data collection. Additional information should be collected about water conservation practices implemented at producers' expense.
- Future collection efforts should focus on improving the assessment of the maintenance cost of water conservation practices, changes in returns due to taking the land out of production (for structural practices), economic benefits provided by the practices, variation in costs and benefits depending on the sizes of farms, market conditions, and weather effects on water demand and water conservation potential. In the future, it will also be important to address the question about BMP stacking (i.e., additionality of costs and benefits if two or more BMPs are implemented on the same acre of land).
- This report relies on information about water conservation practices provided by various government agencies. Additional information should be collected about water conservation practices implemented at producers' own expenses.

It is also important to note that this report focuses on agricultural ~~water conservation practices~~programmatic efforts to help address the gap between the projected water demands and limited groundwater resources. However, the gap could also be addressed by encouraging agricultural practices that increase groundwater recharge. These additional benefits should be accounted for in the future.

Commented [SKB31]: Should this be more of a demands subgroup task?

Commented [SKB32]: Would this be related to MILs?

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