Georgia=s Agricultural Water Use Metering Program: Using Results To Benefit Farmers And The State

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Abstract

In their adoption of HB 579, the apparent legislative intent was to A...to obtain clear and accurate information on the patterns and amounts of such use, which information is essential to proper management of water resources by the state and useful to farmers for improving efficiency and effectiveness of their use of water...@[1] As a part of their charge to implement this program of measuring agricultural water use, GSWCC is required to read metering devices annually, and to compile and report findings.

This paper suggests approaches that might be used by the GSWCC in responding to these legislative mandates. Using data drawn from meters installed during the meter installation program=s first year -- 2004 -- examples are given for types of summary statistics that might serve the GSWCC=s interests in using metering data for purposes that support their more general mission of assisting farmers in their efforts to improve the management and conservation of land and water resources. We also suggest the structure of an analytical model that can be used to several important purposes, most important among which are to explore primary determinants of water use in the agricultural sector, and to assess the effectiveness of public policies in improving water use efficiency. While the peculiarities of hydrological conditions in 2004, coupled with expected data problems during the meter installation program=s initial year of operation, does not allow for meaningful applications of the model when 2004 data are used, we suggest that it will play its intended role for data analyses in future years as improved data become available from the metering program.

Finally, we describe a program that we are in the process of developing that will carry results from the metering program directly to the farmer in ways that should be useful to him or her in efforts to optimally manage land and water resources. This program will involve making available to farmers a secure, on-line means for accessing data, and an ability to compare their individual performance (in terms of such measures as yields and water use) with average performance measures from farms with similar characteristics.

[1] Georgia Code 12-5-31(m.1)(1).

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I. Introduction

As mandated by the Georgia legislature in 2003,[2] Georgia=s Soil and Water Conservation Commission (hereafter, GSWCC) is charged with the installation of meters on all agricultural withdrawal points operating under water use permits issued by the Georgia Environmental Protection Division (EPD) **C** more than 20,000 meters. The rationale for this program wherein the State purchases and installs meters at all agricultural withdrawal points operating under an EPD water use permit is A...to obtain clear and accurate information on the patterns and amounts of such use, which information is essential to proper management of water resources by the state and useful to farmers for improving efficiency and effectiveness of their use of water...@[3] As a part of their charge to implement this program of measuring agricultural water use, GSWCC is required to read metering devices annually, and to compile and report findings.[4]

The purpose of this paper is to describe methods developed thus far to assist the GSWCC in the analysis and reporting of data from the metering devices and to demonstrate, with preliminary data, some of the uses of the information. These findings will be reported in two general classes of Areports@ that provide a comprehensive response to the ends sought by the legislature in adopting H.B. 579.

The first class of reports will provide the State in general, and the GSWCC in particular,

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[2] H.B. 579, amending Georgia Code '2-6-27.

[3] Georgia Code 12-5-31(m.1)(1).

[4] *Ibid.*

with summary statistics that allows it to identify farms that might benefit from GSWCC assistance. This summary section will describe the range and variations in such measures as water use/acre and yields. The second section of this report will provide analyses of metering data that can provide insights as to variations in water use across individual farms and *why* such variations are observed -- i.e., analyses that Aexplain@ water use for irrigation of any crop, soil, water source, or water management practice. These analyses can provide the GSWCC with Asignals@ as to how policies might be designed that will assist farmers in the process of using water more efficiently.

The second class of reports will focus on data that are of direct use for farmers, such as average water use and crop yields among similar types of farms. Such information, if provided in a manner easily accessed by the farmer, will be useful in allowing the farmer to compare his/her performance (in terms of water use, yields, and other information) with those of similar farms. Such comparisons might indicate to the farmer a need to re-examine his/her irrigation and land management practices. These comparisons could also signal the GSWCC as to which farms might benefit from their programs designed to assist farmers in land and water management practices.

A brief overview of the installation of meters is as follows. The process of installing meters was initiated in 2004. By design, the installation program had a modest beginning in 2004. 156[5] meters were installed in the Ichawaynochaway sub-basin of the Flint River Basin during 2004; see Figure 1. Referring to Figure 2, 24 meters were installed at withdrawal points

[5] 139 meters were standard, flow-measuring meters; 17 meters were connected to a telemetry system which allowed for instantaneous measures of water use, rainfall, and other variables. Due to technical problems, however, usable data were obtained from loggers at only 6 of the 17 telemetry sites.

Figure 1 : Metering locations in the Itchawaynochaway Sub-basin (2004)

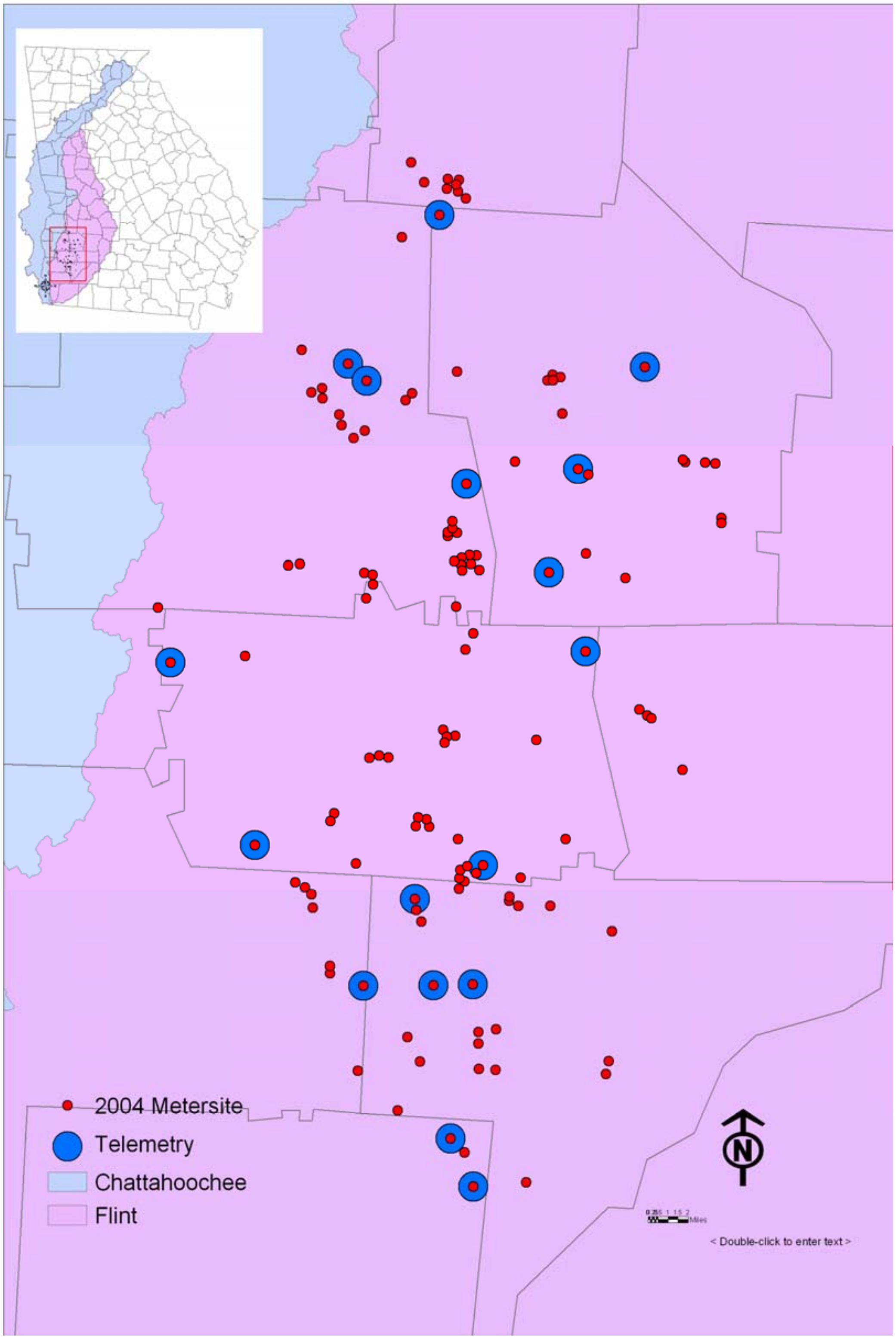
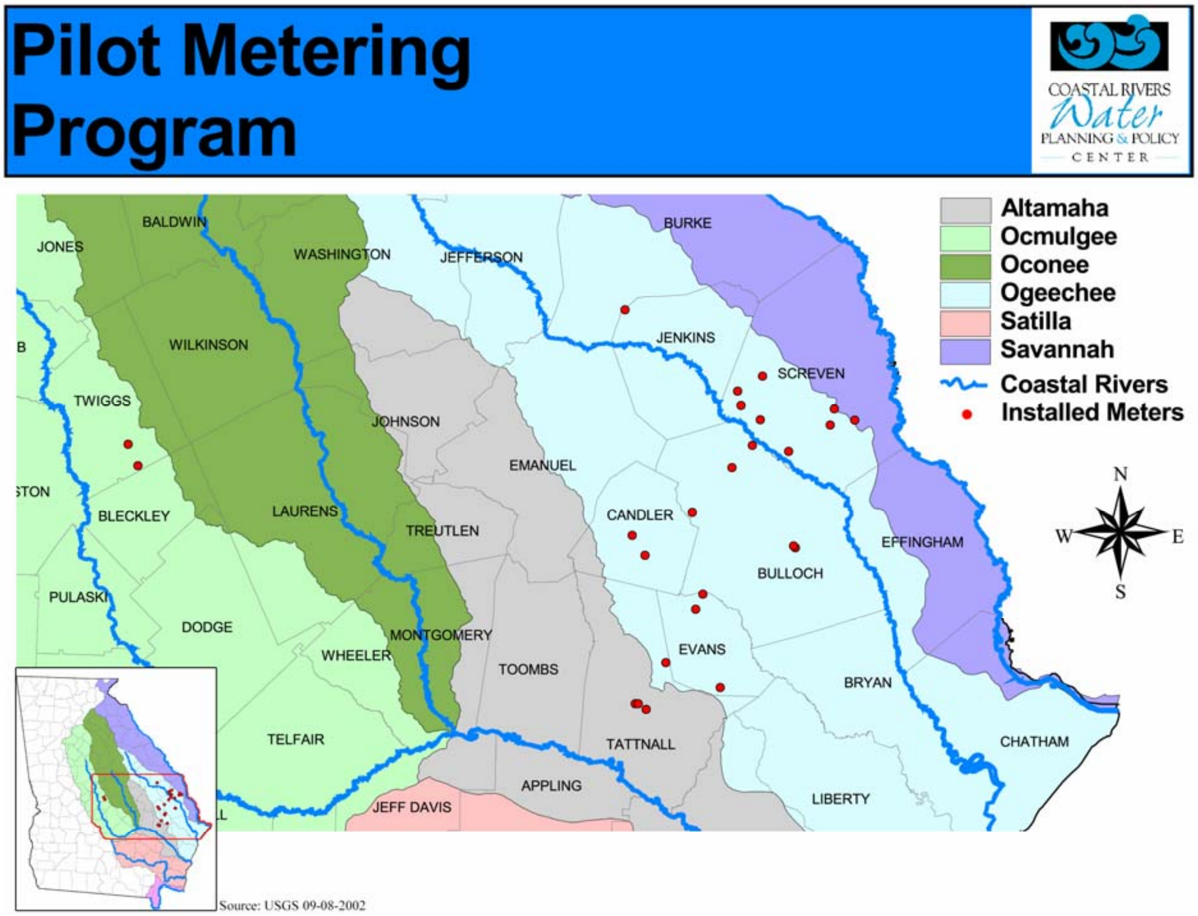


Figure 2: Meters in coastal area



in seven counties in Coastal and Middle Georgia[6] by the Coastal Rivers Water Planning and Policy Center. Ownership of these 24 meters was ceded by the Center to GSWCC; during 2004, however, GSWCC assigned to the Center the task of reading these 24 meters. The GSWCC=s installation process will accelerate rapidly in future years, however, with some 1,500 meters scheduled for installation in 2005, and about 5,000 in 2006. The installation program is required to be completed (for all 20,000-plus withdrawal points) by July 1, 2009 (provided that adequate funding is received[7]

In section II, we present information relevant for the first class of reports: summary statistics and an analytical model that we have developed for the purpose of analyzing annual data from the reading of meters at agricultural withdrawal points **C** analyses that attempt to Aexplain@ patterns of water use. This model was estimated using data from meters installed during 2004 to *demonstrate* the *potential* usefulness of that model.

Emphasis is given to Ademonstrate@ to alert the reader to the many data problems encountered during this first year of the programs operation, problems that severely limit our ability to analyze 2004 data in any substantive manner. More important among these problems are the following. The year 2004 was an extraordinarily wet year; measured rainfall exceeded eight inches in June at some (of our admittedly "spotty") sites. There was exceptional variability in rainfall during July, with some sites receiving less than one inch of rain, while other sites received almost five inches. In September, some sites reported rainfall in excess of 14 inches. As a result, a good many farms did not irrigate during the 2004 season, and one finds enormous

[6] Bulloch, Candler, Evans, Jenkins, Screven, Tattnall, and Twiggs counties.

[7] Georgia Code 12-5-31(m.1)(2)(C).

variation in water use among sites reflecting these differences in microclimates. This latter issue would present no problem to our model if we had site-specific rainfall measures for each metered site. Unfortunately, such data were not available to us this year. Plans are being made to improve the availability of more appropriate rainfall measures for metered sites for the 2005 season.

Finally, meters were, of course, installed and became operative in the study area at different times. Thus, some meters measure water use from April or May through the growing season, while others did not become operable until later dates, extending through the month of June. In general, our seasonal water use measures are then not totally comparable across metered sites. Moreover, *monthly* reading of meters was conducted only for the 24 sites in Coastal Georgia. For all of the metered withdrawal points in Southwest Georgia the only measures of water use available were for the period between when the meter became operable and the time that the meter was read (mostly in October and November, 2004). Our hope is that the GSWCC will provide for monthly reading of a sample of meters during the 2005 growing season.

Thus, data available from the program's first year of operation, perhaps not surprisingly, have limited uses from the standpoint of analysis. This situation will improve each year, however, as more and more meters become installed; confidence in metering readings is understandably limited until a meter has been in operation for at least one year. We look forward to a very productive year in 2005.

In section III, the 2004 data are presented more fully. In section IV we briefly describe a program that we hope to implement during 2005; this will provide the second class of reports described above -- information that is of direct importance for the farmer. Here we focus on means by which two important tasks might be accomplished: enhance the data collection process, such as measuring site-specific yields and rainfall; and provide reports that make *useful* data easily available to farmer with an on-line system. Concluding remarks are offered in section V.

II. Reports that directly serve interests of the State and the GSWCC.

A. Summary statistics. In addition to providing, as required by H.B. 579, Aclear and accurate information on the patterns and amounts...@ of water use in the agricultural sector, the GSWCC has responsibilities that extend to assisting Georgia=s farmers in their efforts to implement practices designed to conserve land and water resources. In these regards, the metering program can provide data to indicate farms that might welcome the GSWCC=s assistance in reviewing their land/water conservation efforts.

Consider the data given below in Table 1. These data are meant to simply *exemplify* the kinds of data that can be made available from the metering program. The number of observations given for each crop in Table 1 is purposefully small -- we have simply taken a few observations at random. Also, the reader must note that, first, rainfall data are *not* field-specific (as they should be), and the irrigation water use measure applies to the May-August growing season as opposed to disaggregated monthly data which would enhance the usefulness of the data. We hope to mitigate, if not eliminate, these weakness in future years. The Astandard deviation@ number reported for each variable for each crop is a way to describe the variability of that measure. A standard deviation that is large relative to the average value indicates that the sample average value does not accurately describe most of the measurements in the sample. For example, for corn crops, the average irrigation water use per acre is 8.2 inches, but the standard deviation is 6 inches. If you look at the individual values of irrigation water use per acre, you can see that they vary between 3.3 inches per acre and nearly 17 inches per acre – a degree of variability that does not invite confidence in average values! While data in Table 1 are taken from actual fields including in the metering program, the identification of individual farms is

Table 1
Summary Statistics For Individual (ananomous) Farms -- An Example

Crop	***Acres***	**Irr. Water Use/acre (ac. In)**	***Rain + Water use Per acre (ac. In)***	***Crop Yield***		Yield per ac. In. Irr. Water	Yield per ac. In. Total Water
Corn	25	4.9	37.3	115	bu	23.4	3.1
Corn	90	3.3	24.1	150	bu	45.2	6.2
Corn	80	7.7	28.5	190	bu	24.6	6.7
Corn	77	16.9	44.1	220	bu	13.0	5.0
Average		**8.21**	**33.49**	**168.75**		**26.6**	**5.2**
Standard deviation		**6.07**	**8.92**	**45.89**		**13.5**	**1.6**
Cotton	70	7.1	27.9	480	lbs	67.5	17.2
Cotton	70	1.6	22.4	550	lbs	346.2	24.6
Cotton	90	3.2	24.0	650	lbs	201.9	27.1
Cotton	2	5.0	24.7	719	lbs	142.6	29.1
Cotton	130	0.7	21.5	800	lbs	1207.9	37.3
Cotton	100	4.4	25.2	800	lbs	179.8	31.7
Cotton	55	5.8	38.2	960	lbs	166.6	25.2
Cotton	90	5.8	31.7	1,000	lbs	173.6	31.6
Cotton	158	7.3	33.3	1,200	lbs	163.5	36.1
Cotton	50	23.8	44.6	1,200	lbs	50.3	26.9
Cotton	76	16.9	44.1	1,232	lbs	72.9	28.0
Average		**7.43**	**30.68**	**871.91**		**252.1**	**28.6**
Standard deviation		**6.91**	**8.42**	**266.33**		**327.2**	**5.6**
Peanut	35	15.4	36.2	2,900	lbs	188.7	80.2
Peanuts	25	1.6	22.4	3,000	lbs	1888.3	134.1
Peanut	40	9.9	30.7	3,400	lbs	343.9	110.8
Peanuts	95	5.0	24.7	3,600	lbs	714.2	145.6
Peanuts	70	7.7	28.5	3,800	lbs	492.1	133.3
Peanut	50	11.8	32.6	3,800	lbs	322.0	116.6
Peanuts	65	6.3	38.7	3,900	lbs	619.4	100.8
Peanut	70	8.6	29.4	4,700	lbs	543.7	159.7
Average		**8.29**	**30.40**	**3637.50**		**639.0**	**122.6**
Standard deviation		**4.22**	**5.45**	**568.05**		**532.9**	**25.6**
Soybeans	45	0.6	21.4	38	bu	60.3	1.8
Soybeans	70	6.3	38.7	43	bu	6.8	1.1
Soybeans	5	21.9	42.7	45	bu	2.1	1.1
Average		**9.62**	**34.28**	**42.00**		**23.0**	**1.3**
Standard deviation		**11.03**	**11.32**	**3.61**		**32.3**	**0.4**

excluded for obvious reasons.

The potential usefulness of data displayed in Table 1 for the GSWCC is immediately obvious. Looking, e.g., at corn, two farmers apply irrigation water at levels that are almost half of the average, with yield/acre lower than average yields. It may be the case that the GSWCC may want to discuss irrigation strategies with these farmers. Why are water application rates so low **C** would water use efficiency dictate higher rates (note here the importance of rainfall data **C** we don=t really know, at this point, rainfall amounts received at these farmer=s fields). Similar questions arise when considering the two farms with the highest yields (190 and 220 bu/acre). The field with yields of 190 bu/acre obtains yields that are 86% of the higher yield, but with only 46% of the water used by the higher-yield farm **C** yield/acre inch of water use is almost double that for the farm with the higher absolute yield. What accounts for these differences (aside from water use, e.g., one would want to consider other inputs -- e.g. fertilizers -- and management practices)? Would the higher yielding farm benefit from using less water (with corresponding lower costs) at the cost of somewhat lower yields?

Similar questions are *suggested* by examining yield and water use data for fields planted in other crops. The peanut field with the lowest yield (2,900 lbs) has a yield that is only 61% of the highest yield, but also used <u>79% more water</u> than the field with the highest yield! Information of this type (<u>with</u> reliable rainfall data and, perhaps, data for monthly water use) provides the GSWCC with invaluable Asignals@ as to those areas in which its efforts to promote soil and water conservation might be most productive.

<u>B. An analytical model for assessing water use.</u> The statistical model that we propose to use in analyzing data from the metering program could be used for two related purposes. First, it

can be used to relate water use to farm and crop characteristics that explain changes in usage. Secondly, if the model successfully captures the primary determinants of irrigation water use, it can be used to *predict* levels of water use. Thus, the model might be used to predict the effects on water use of changes in policy or measure the effectiveness of existing policies (e.g., the GSWCC's ongoing water audit program that focuses on the uniformity of water application under center pivot systems). The structure of the model will probably change over time as information and data become available suggesting the possible relevance of variables not currently included in the model. The structure of the model that we are presently using is given in equation (1).

$$W = \alpha_o + \alpha_1 CN + \alpha_2 CT + \alpha_3 P + \alpha_4 O + \sum_{i=5,..8} \alpha_i S_i + \alpha_9 R_{ps} + \sum_{j=10..13} R_j + \alpha_{14} GS + \alpha_{15} CP + \alpha_{16} A + \xi \qquad (1)$$

W = total metered water use (in acre inches)
CN = acres of corn
CT = acres of cotton
P = acres of peanuts
O = acres of other crops
S_i = soil texture: clay ($i = 5$); sandy ($i = 6$); sandy-loam ($i = 7$), and loamy sand ($i = 8$)
R_{ps} = pre-season rainfall, in inches (January through April)
R_j = monthly rainfall (inches) in the months of May ($j = 10$), June ($j = 11$), July ($j = 12$), and August ($j = 13$)
GS = source of irrigation water, a zero-one variable (1 if surface water; 0 if ground water)
CP = irrigation system used, a zero-one variable (1 if center pivot; 0 if other)
A = metered field has had a GSWCC audit, <u>and</u> state funds were expended to replace faulty sprinkler heads or for other system improvements
ξ = error term, captures unobservable and unmeasurable fluctuations in water use.

The rationale for most variables included in (1) is immediately obvious. Source of water (ground or surface water, GS) is included reflecting the fact that pump costs are typically higher for ground water use and costs of accessing water for use in irrigation can be expected to affect the level of use. The only policy variable included in the model at present is A: whether or not the central pivot system at a metered site has benefitted from the GSWCC's ongoing water audit program. This program involves the known expenditure of state funds to improve the uniformity of water applications from the center pivot system. Other policy variables and variables reflecting non-water related management practices may be included in future years as they are initiated. An example could include whether or not the farmer has accessed the data information system described in the following section. We also plan to explore the possible relevance for explaining water use of other non-policy variables. Examples include crop yield and source of energy used by the farmer (electricity or diesel).

Ultimately, our interest is in the values for the coefficients α associated with each variable. Their interpretations are as follows. Coefficients for CN, CT, P, and O would measure the increase in water use if one additional acre of a crop were to be added **C** they then measure, at the margin, average water use per acre associated with any of these crops. The coefficients associated with the R variables measure the effect of an additional inch of rainfall on irrigation water use **C** one would expect that these coefficients would have a negative value, meaning that an additional inch of rain *reduces* irrigation water use. The coefficient associated with GS measures the change in water use associated with an incremental change in the number of acres that rely on ground water, and the coefficient associated with CP measure the same effect associated with an incremental change in the number of fields making use of center pivots. The coefficient associated with A measures the effect on total irrigation water use associated with an additional farm receiving funds from GSWCC for the enhancement of the farm's center pivot irrigation system. One would expect this coefficient to have a negative sign **C** such expenditure of state funds has the effect of *reducing* total water use. Finally, we reiterate that the availability of monthly water use would enhance the value of the model results.

III. Applications to *demonstrate* the potential uses of the analytical model

General statistics derived from the 2004 reading of 154 meters are given in Table 2. Data from the 17 telemetry sites are excluded due to lack of data from 11 sites, and incompatible data from the other six. Data from nine farms that did not irrigate during the 2004 growing season are also excluded.

Referring to Table 1, the unusually wet 2004 season referred to in section I is obviated by rainfall measures, as is the issue of extreme variance in rainfall across the region. Thus, while *average* monthly rainfall was 3.4, 4.1, and 4.1 inches in June, July, and August, respectively, the reported rainfall ranged from .26" to 8.13", .47" to 8.13", and .24 to 11.62 inches, respectively. Given that meters installed during 2004 were concentrated in a single sub-basin, data are not representative of average conditions in the Flint River Basin, as can be seen from the acres in major crops C corn, cotton, and peanuts C in fields where water use was measured in 2004. Both cotton and corn are under-represented in this sub-basin relative to the pattern of irrigation in Southwest Georgia, and both of these crops are more water-intensive than peanuts. Most (96%) of the metered sites used center pivots, and ground water was the source of water for 51% of the sites (a lower proportion than in the Basin as a whole which is closer to 60%). None of the metered sites have benefited from GSWCC expenditures for the improvement of irrigation systems.

Table 2
2004 Metering Data C Summary Statistics

	Corn (acres)	Cotton (acres)	Peanuts (acres)	Other (acres)	Total acres	Rainfall June	Rainfall July	Rainfall August)	A (S&W audit)	Ground water (%)	Center Pivot (%)
	2,672	7,213	6,112	2,318	18,491	3.4"	4.1"	4.1"	0	51%	96%
Range						.26- 8.13"	.47- 8.13"	.24- 11.62"			
Percent of total	15%	39%	33%	13%	100%						

Unfortunately, as mentioned above, the 2004 data set is not well-suited for econometric model-fitting according to equation (1) in the previous section. As noted in section I, meters were not operating over the same period of time (and data are not dated as with telemetry data C if such data were available), our rainfall data is much too coarse for these purposes, and, as one would expect when meters are concentrated in a single sub-basin, there is little in the way of variation among metered fields in soil quality and/or irrigation methods used (center pivot vs. others).

Thus, after repeated runs of the model using various combinations of variables, usable results (Ausable@ in the statistical sense) obtain only from a much reduced version of the full model given in (1): one which includes only the crop variables and total rainfall. However, our results are not Ausable@ in any practical sense due, primarily, to the many data problems to which reference has been made earlier. This point is clarified below.

The results below show the estimated coefficient for each crop variable, and the coefficient for total rain. The numbers in parentheses indicate the >t-statistic= associated with each variable. The t-statistic measures the statistical significance of the coefficient; roughly speaking values of t greater than 1.8 denote statistical significance, meaning that it is quite unlikely the variable has *no* effect of total water use.

One could, for example, interpret these results as meaning that a farmer who plants an additional acre of land in cotton will use an additional 3.2 acre/inches of water over the growing season. A farmer who takes an acre of land away from the cultivation of peanuts and plants corn

Coefficient on:	Coefficient value
Acres of corn	2.7
	(3.8)
Acres of cotton	3.2
	(7.8)
Acres of Peanuts	3.8
	(7.4)
Total rainfall	9.7
	(1.4)

instead will reduce his seasonal water use by just over an inch. Of course, such relative values do not square with what one would reasonably expect. One would expect that corn would require more, not less, water than, e.g., peanuts. Especially important, among the many possible causes for the distorted relative relationship between crop water use coefficients derived from the model, of course, is our lack of site-specific rainfall measures.

The coefficient on rainfall also does not make good sense inasmuch as it has a *positive* number (surely increases in rainfall have the effect of reducing, not increasing, the need for irrigation water use). Notice however that the t-statistic is small, only 1.4. This indicates that the effect of this variable on total water use is not measured with any accuracy. We note that in the overall sample, total water use and total rainfall are positively correlated. Because we don't believe that farmers ran out and turned on the irrigation systems every time it rained, we believe this anomalous result reflects the poor measurement of rainfall during the 2004 growing season.

The R^2 value for this regression **C** which, roughly speaking, measures the proportion of variation in total water use in the sample that is Aexplained@ by the included variables **C** is not high, only .42.[8] This is not surprising given that we were not able to use many of the other variables that are expected to play a role in explaining total water use.

The results, however limited, are promising in terms of the likely effectiveness of the model is providing information that we want in future years when consistent data are available (beginning in 2005). The coefficients on corn, cotton, and peanuts are not inconsistent with average water use that characterizes irrigation in Georgia during wet years **C** under 4 inches per acre. As more meters are installed in more heterogenous areas, in terms of soil type, types of irrigation systems used, and farms benefitting from GSWCC water audit programs, we have every reason to expect that our model will allow for analyses of the effects of these variables on water use.

[8]Note that this regression was run with 150 observations, four observations were dropped in the analysis because the total water use reported from these meters was very, very high relative to other farms. We suspect these numbers are not meaningful.

IV. Methods for making metering data Auser friendly@ for farmers

We are in the process of establishing a means for responding to H.B.579's mandate for providing water use and related data that can be A...useful to farmers for improving the efficiency and effectiveness of their use of water....@ This process will involve a *secure* system accessible by all farmers on-line, with provided user names and passwords, which accomplishes two, related, ends. First, the farmer is asked to provide information (that is, by state law, treated confidentially) related to such things as yield, rainfall, and perhaps other information.[9] Once these data are entered, a report something along the lines of that exemplified in Table 3 is available to the farmer (we again note the advantages of having access to monthly data).

Referring to data in Table 3, this information allows the farmer to compare his/her water use and yields with those obtained in farms with characteristics similar to his/her farm **C** similar size, soil type, rainfall, etc.. In this example, Farmer A=s corn yields are a bit lower than the average, but his water applications are *much* lower than the average, possibly raising questions as to the effectiveness of his/her irrigation strategy. In this example, similar questions are suggested by comparisons of Farmer A=s water use and yield for other crops.

Expected input from farmers will undoubtedly result in changes in the range of data that will be accessible *via* this system. The end sought, of course, is to maximize the value of data collected through the metering program for assisting farmers in their management of water resources. Over time, changes will be made as they are required to better meet the farmer=s needs in these regards.

[9] We hope to be able to allow the farmer to see information in the data file that relates to his permits in order that he/she can advise us of any corrections that should be made. This process could dramatically reduce the costs of verifying information in the data file entered as a part of the meter installation process as well as the meter reading process.

Table 3
On-line accessible data for Farmer A C An example drawn from 2004 metering data

Crop	Farmer A=s yield per acre	Farmer A=s water use/acre	Average water use/acre - similar farms (acre inch)	Range of water use (ac. in./ac)	Average yield/ac - similar farms	unit	Range of yield (per acre)	Yield per ac. in. of applied waster	Range of yield per acre inch
corn	150	3.3	8.2	3.3 - 16.9	169	bu	115 - 220	27	13 - 45
cotton	719	4.4	7.4	0.7 - 23.8	872	lbs	480- 1,232	252	50- 1,208
peanuts	3,600	5.0	8.3	1.6 - 15.4	3,638	lbs	2,900 - 4,700	639	188 - 1,888
soybeans	38	6.3	9.6	0.6 - 21.9	42	bu	38 - 45	23	2 - 60

V. Concluding Remarks

In their adoption of HB 579, the apparent legislative intent was to A...to obtain clear and accurate information on the patterns and amounts of such use, which information is essential to proper management of water resources by the state and useful to farmers for improving efficiency and effectiveness of their use of water...@[10] As a part of their charge to implement this program of measuring agricultural water use, GSWCC is required to read metering devices annually, and to compile and report findings. This paper suggests approaches that might be used by the GSWCC in responding to these legislative mandates.

Examples are given for types of summary statistics that might serve the GSWCC=s interests in using metering data for purposes that support their more general mission of assisting farmers in their efforts to improve the management and conservation of land and water resources. We also suggest the structure of an analytical model that can be used to several important purposes, most important among which are to explore primary determinants of water use in the agricultural sector, and to assess the effectiveness of public policies in improving water use efficiency. While the peculiarities of hydrological conditions in 2004, coupled with expected data problems during the meter installation program=s initial year of operation, does not allow for meaningful applications of the model when 2004 data are used, we suggest that it will play its intended role for data analyses in future years as improved data become available from the metering program.

[10] Georgia Code 12-5-31(m.1)(1).