GUIDELINE FOR EVALUATION OF IRRIGATION USE PERMITS

Resource Planning Department
Central and Southern Florida Flood Control District

August, 1975

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

GUIDELINE FOR EVALUATION OF IRRIGATION USE PERMITS

INTRODUCTION

The purpose of this set of guidelines is to set forth the basis for procedures involved in evaluating applications for withdrawal of water to be used for supplemental irrigation from either surface water or shallow groundwater sources. Portions of these criteria are not applicable to domestic and municipal use, to withdrawals from deeper artesian aquifers, or to cases wherein impoundment areas or reservoirs are incorporated within the water management system being evaluated.

The basic premise underlying the criteria developed is that each land holder in a given service area is entitled to use an equal share on a unit area basis of usable water generated within the service area and an equitable portion of project storage if this storage is available for reasonable and beneficial uses. This does not imply consent by the District of the right to buy or sell water rights by the landholder.

The criteria for determining the amount of usable water generated within a service area is based on analysis of historical records to determine the amount of water available for use without creating a long-term deficit between supply and use. This figure is then corrected for the maintenance of downstream flows and a reservation for contingencies. An additional constraint of reasonable beneficial use is imposed to insure that water is not wasted and excess water can be used at a future date or in other service areas.

The allocation amount on the face of the permit will represent the amount of water available for supplemental use in a normal year. This is

not to be confused with a pumping rate or a withdrawal rate. Supplemental use, in this context, refers to that portion of the irrigation water applied that is lost from the system by such processes as direct evaporation, transpiration by plants, evaporation from the soil surface, and excess water applied which is transferred out of the service area or whose quality has degraded to the extent that it is no longer economically usable. It does not include excess water which re-enters the surface water or groundwater systems at such time or in such manner as to make its reuse within the service area possible.

The value allocated is for a normal year. During drier than normal periods more supplemental water withdrawal and use than is allocated by the permit is likely to occur. This is not expected to present a problem because periods more wet than normal will make up the deficit on a long-term basis, and the establishment by the District of minimum surface and groundwater stages will be sufficient to protect the resource on a seasonal and short-term basis, since when those stages are reached water use will be restricted.

It is recognized that the meaning of the allocation amount may be difficult for the user to comprehend. Conceivably, it could also be difficult to interpret in terms of permit enforcement. This is because the allocation amount is a value which represents use, rather than withdrawal from the water source, and use is not easily measured in direct fashion. Even in normal years it is probable that more irrigation water will be withdrawn than is used in a consumptive sense (dependent, for example, on irrigation method) and, as noted above, in dry periods both withdrawal and use will exceed the normal year's values.

In order that the permit document express a water quantity value in terms more readily understandable to the user a maximum monthly quantity which may be withdrawn (by pumping or gravity) will be specified as a special condition of the permit. In order to also take into account increased water needs during dry periods, this figure will be based on drought conditions rather than the normal or average year.

For the purposes of enforcement of permit conditions, another set of guidelines will be issued as an aid in interpreting this quantity within the scope of various cultural practices, hydrological conditions and geophysical characteristics of the area.

The recommendations contained in this set of guidelines are not intended to cover all possible situations nor are they necessarily in final form. Judgment in evaluation of permits is still required. Furthermore, acquisition and analysis of additional data is likely to result in periodic revision of these guidelines.

DERIVATION OF VALUES

Water Crop

Water Crop is defined as the maximum quantity of water available for supplemental use, on a unit area basis, which will not create a long-term deficit between water inputs and use.

For areas in which Project storage is not available this reduces to the basin yield. Basin yield is basically precipitation minus evapotranspiration, a value which, on a long-term basis, is expressed by basin discharge or runoff. To determine basin yields for the District areas two methods have, to date, been used. For certain water supply, or water service areas basin yield has been calculated as the volume of

water discharged from the service area on a unit area basis which was exceeded 50% of the time, after adjustment of historical records to account for development of supplemental water use, e.g., estimated supplemental water use due to irrigation was added to flow volume to determine the water crop. A further adjustment was made in order to reserve a given volume for maintenance of minimum flows, minimum stages and contingencies.

In the case where project storage is available, those users with access to this storage are assigned a portion of this storage in addition to the basin yield for computation of the water crop.

In the Indian Prairie Area, a portion of the volume of storage above a selected minimum elevation in Lake Istokpoga is added to the basin yield to determine the value of the water crop. Since definitive studies on the volume of water available in Lake Okeechobee have not been completed, an interim procedure is used for areas which have access to storage from this source. In the Lake Okeechobee service area, the portion available from the lake is tentatively being considered as the difference between the normal year water use requirements and the adjusted basin yield.

This method was used for the following areas:

Indian Prairie - Lake Istokpoga Area

St. Lucie County Area

Caloosahatchee River Area

Everglades Agricultural Area

Fisheating Creek Area

Taylor Creek Area

For the first three areas listed the derivation of the adjusted basin yield values based on basin discharge analysis is set out in the "Memorandum Report on Surface Water Availability" for each of those areas. Technical Publication #74-4 of the District is the source of the values to be used in the Everglades Agricultural area; the values having been derived from data analyzed for preparation of that report but not included in that report in the form of basin yield. The values of basin yield for the Fisheating Creek and Taylor Creek Areas have been derived directly from basin discharge data published by the USGS; these values having been adjusted only for tentative minimum flow requirements and not for estimated water use in the basins over the record period of discharge measurements as in the other cases.

The second method is somewhat less precise but is nevertheless based upon available published data derived from long-term observations of precipitation and basin discharges. The data source is Florida Geological Survey Map Series No. 32 which gives in isocontour form the difference between rainfall and potential lake evaporation. Since "potential lake evaporation" represents the maximum water loss to evaporation or evapotranspiration the Map Series values have been adjusted on the basis of the difference between this maximum and probable evapotranspiration, using considerations of topography and soil conditions and exercising engineering judgment. The basin yield values derived in this fashion are at present to be used for all areas of the District other than those listed in the preceding paragraph. As more detailed analyses of basin yield are made in other areas these tentative values will be revised, as necessary.

The water crop values derived as described above are shown on Figure 1.

Average Supplemental Water Use

Average Supplemental Water Use is an estimate of the evapotranspiration requirements of various crops for near optimum production which is not satisfied by rainfall in a normal year.

These values are presently being derived on the basis of the Modified Blaney-Criddle method as presented in SCS Publication TR 21 "Irrigation Water Requirements", 1967 and "Procedure for Estimating Evapotranspiration and Irrigation Requirements for Major Crops in Florida", University of Florida, IFAS, 1974. The District regularly receives and analyzes water use data from local and national sources which may result in slight modifications in procedures or in the values derived from the analysis.

An estimate of the amount of water used by the crop and the wetted soil near the plant in evaporation, transpiration from the plant surfaces, and retention in the plant tissues under conditions where water is not limited to plant growth is made on the basis of the available data. This quantity is referred to as potential evapotranspiration or simply as evapotranspiration or ET. This figure represents the total amount of water used in the growth process of the plants on an average monthly and annual basis. It is presently derived from the IFAS publication referenced above which uses the SCS publication (also referenced) as a base.

In order to determine the supplemental water use it is necessary to determine how much of total demand represented by the ET value is supplied by rainfall. Not all of the rain which falls is available for utilization in this process because a part of this rainfall percolates beyond the

rootzone of the crop, runs off the surface of the land, or flows underground to a point where it is no longer directly available. The portion of the available rainfall which may be utilized varies with such factors as the time distribution of rainfall, moisture holding characteristics of the soil, the depth and extent of the plant root system, and drainage criteria.

The amount of rainfall that is effective in satisfying plant requirements is presently estimated from the mean monthly rainfall at a neighboring station after applying corrections in accordance with a procedure detailed in the SCS publication TR 21. Typical values of average supplemental consumptive use are shown in Table 1.

It is recognized that as a matter of course and of economic necessity more water than is consumed in the evapotranspiration process is applied to the crop. Some of this excess water is consumptively used either by degradation of quality or by transfer out of the basin. One notable example of transfer out of the basin is illustrated by the application of an excessive amount of irrigation water near the end of the dry season. If we assume that all of the excess water will eventually return to the project canal from which it was withdrawn, a portion of the returning water will still be lost because it returns at a time when discharges of excess water are being made. This additional consumptive use has not been considered in the present analysis.

Maximum Monthly Pumping Rate

A Maximum Monthly Pumping Rate is established primarily to indicate a maximum withdrawal which will be considered acceptable subject to the availability of water in the basin. This is not to be considered as any type of allocation. It is strictly an indicator of the maximum range of

withdrawals that the District will accept as reasonable. Under normal conditions it is not expected that the maximum monthly withdrawals will approach this value. Furthermore, under extreme drought conditions the average monthly withdrawal during the irrigation season should be considerably below this figure.

The maximum monthly pumping rate represents a quantity of water which is sufficient to supply crop needs during the month of highest irrigation demand in 8 out of 10 years. In addition, an allowance of 20% for inefficiencies in the irrigation system and for deep percolation is included.

This value is calculated on the basis of a procedure detailed in "Irrigation Water Requirements", TR 21, SCS, 1967. The monthly ET requirements are found as described in the previous section labeled "Average Supplemental Water Use". On the assumption that the ET requirements under drought conditions are the same as under average conditions, the effective rainfall is reduced to a level commensurate with a desired probability of occurrence (80% exceedence level in this case). The total annual rainfall is used as an additional scaling parameter. The maximum value of monthly ET minus effective rainfall is selected as the maximum drought requirement. This value is then divided by an irrigation efficiency which has been tentatively set at 80% to obtain the amount that may be diverted or pumped into the farm delivery system during the month of maximum demand.

Table 2 presents typical values of this parameter for several crops and locations.

For the Everglades Agricultural Area a maximum monthly withdrawal rate of 7.5 acre-inches per acre is, at this time, to be used. The establishment of this value for this area is based on the findings and conclusions of the District's Technical Publication #74-4.

EVALUATION PROCEDURE

The evaluation will start with the determination of the water crop value for the area or basin from which water for the requested use is to be withdrawn (the source being either surface water or the water table aquifer). The water crop will be either the adjusted basin yield, or the adjusted basin yield plus a Project storage component in those cases in which the applicant has access to Project storage. In either case the water crop value is the maximum permissible allocation since it represents the best current determination of the maximum amount of water physically available on a long-term average basis for beneficial use by application of the unit land area formula. The unit water crop value is to be applied to the total contiguous land area under the user's ownership or legal control.

The evaluation will, in addition, include a determination of average crop supplemental water requirement using the applicable tables contained in these guidelines. In several areas it is noted that the water crop exceeds the average supplemental water requirements for certain crops. In those instances the crop requirement becomes the determinant of the showing of reasonable beneficial use. That is, if the crop water requirement is less than the water crop allocation, the water crop amount is not justified. Its allocation would be reasonable with respect to the water resource but it would not be reasonable with respect to the proposed use. The crop supplemental water requirement unit value is to be applied to the area actually irrigated.

The evaluation process, insofar as the technical aspects of supply/demand are concerned, is to be concluded with a comparison of these values: water crop, crop supplemental water requirement, and the applicant's requested allocation. The lowest of these three values is to be recommended as the allocation amount for which the permit is to be issued. It is conceivable in certain cases that an applicant will request less water than is potentially allocable based on either the water crop or supplemental crop requirement. There is no compulsion, of course, for the District to make a water use allocation in excess of the allocation requested.

As noted earlier herein, each irrigation water use permit is to contain a special condition specifying a maximum monthly withdrawal value. These values are to be derived from the appropriate tables contained in these guidelines, and as described in the section "Maximum Monthly Pumping Rate". The maximum allowable monthly withdrawal amount is to be based on the actual area irrigated rather than on the total contiguous land area under the user's ownership or legal control.

TABLE 1

AVERAGE SUPPLEMENTAL WATER USE REQUIREMENTS IN INCHES

	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	YEAR
CITRUS													
Lake Alfred	1.03	0.83	1.28	2.21	2.66	1.10	1.78	1.83	0.78	2.50	1.89	1.20	19.09
Titusville	0.83	0.90	1.35	2.16	2.73	1.56	1.45	1.68	0.40	0.52	1.47	0.80	15.85
Ft. Pierce	0.87	0.95	1.54	2.10	2.79	2.04	2.56	2.49	0.47	0.40	1.30	1.14	18.65
Ft. Myers	1.33	1.38	2.10	2.75	2.83	0.67	1.18	1.33	0.67	2.06	2.28	1.72	20.31
PASTURE													
Lake Alfred	0.56	0.46	1.54	3.01	3.93	2.42	3.12	3.12	1.63	3.04	1.89	0.84	25.57
Titusville	0.46	0.62	1.53	2.97	3.93	2.84	2.76	2.89	1.28	1.00	1.47	0.52	22.27
Ft. Pierce	0.41	0.58	1.81	2.90	3.99	3.37	4.21	3.85	1.31	0.87	1.30	0.86	25.46
Belle Glade	0.87	1.16	1.93	3.18	3.72	1.93	2.80	2.48	1.33	1.92	1.92	1.24	24.48
Ft. Myers	0.86	1.01	2.29	3.58	4.04	1.86	2.47	2.58	1.64	2.67	2.28	1.34	26.62
Homestead	1.06	1.39	2.65	3.52	2.86	0.02	3.43	2.91	0.78	1.16	2.37	1.75	23.90
VEGETABLES													
Lake Alfred	0.56	1.28	1.63	1.85	-	-	-	-	0.00	2.77	2.56	1.12	11.77
Titusville	-	0.16	1.53	2.79	2.22	-	-	-	0.00	0.76	2.03	0.80	10.29
Ft. Pierce	0.41	1.41	1.90	1.74	-	-	-	-	0.00	0.63	1.94	1.14	9.17
Belle Glade	0.78	2.00	2.21	2.02	-	-	-	-	0.00	1.67	2.58	1.53	12.79
Ft. Myers	0.77	1.85	2.57	2.39	-	-	-	-	0.00	2.41	2.95	1.63	14.57
Homestead	0.78	2.05	2.65	2.59	-	-	-	-	0.00	0.85	2.85	1.85	13.62
SUGAR CANE													
Belle Glade	0.21	0.31	0.20	1.20	1.42	0.13	2.21	1.90	0.68	2.74	3.14	2.10	16.24
Moore Haven	0.38	0.29	0.43	1.31	1.33	0.75	2.36	2.58	1.23	3.33	3.49	2.36	19.85
TURF													
Ft. Myers	1.05	1.38	2.29	3.03	2.83	0.00	0.29	0.43	0.00	1.35	1.80	1.15	15.60
Belle Glade	1.06	1.53	1.93	2.65	2.54	0.00	0.57	0.35	0.00	0.67	1.46	1.06	13.82
SUBTROPICAL FRUITS (AVOCADOS)													
Homestead	0.12	0.73	1.90	3.23	2.14	0.00	2.67	0.00	0.00	2.38	1.23	0.69	16.49

TABLE 2

2 IN 10 YEAR IRRIGATION REQUIREMENTS IN INCHES @ 80% EFFICIENCY

	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
CITRUS												
Lake Alfred	1.51	1.33	1.96	3.10	3.80*	2.26	3.04	3.05	1.09	3.44	2.53	1.71
Titusville	1.24	1.35	1.99	3.00	3.84*	2.69	2.63	2.84	1.31	1.24	2.05	1.23
Ft. Pierce	1.32	1.44	2.22	2.96	3.93*	3.21	3.82	3.71	1.31	1.17	1.89	1.63
Ft. Myers	1.85	1.94	2.85	3.70	3.95*	1.72	2.32	2.46	1.61	2.97	2.99	2.30
PASTURE												
Lake Alfred	0.91	0.86	2.29	4.12	5.43*	3.98	4.80	4.74	2.81	4.13	2.53	1.27
Titusville	0.77	1.00	2.22	4.03	5.38*	4.37	4.35	4.42	2.46	1.86	2.05	0.87
Ft. Pierce	0.74	0.97	2.60	3.98	5.46	4.94	5.91*	5.47	2.41	1.78	1.89	1.27
Belle Glade	1.27	1.63	2.78	4.31	5.15*	3.37	4.38	4.00	2.55	2.94	2.61	1.72
Ft. Myers	1.26	1.47	3.09	4.74	5.50*	3.29	4.02	4.10	2.88	3.75	2.99	1.83
Homestead	1.49	1.90	3.52	4.61	4.18	1.21	5.00*	4.38	1.89	2.09	3.11	2.29
VEGETABLES												
Lake Alfred	0.91	1.90	2.41	2.64	-	-	-	-	0.53	3.79*	3.38	1.62
Titusville	-	0.42	2.22	3.80*	3.19	-	-	-	0.53	1.55	2.76	1.23
Ft. Pierce	0.74	2.02	2.67	2.50	-	-	-	-	0.49	1.46	2.70*	1.63
Belle Glade	1.15	2.69	3.06	2.84	-	-	-	-	0.54	2.62	3.44*	2.08
Ft. Myers	1.14	2.53	3.45	3.23	-	-	-	-	0.54	3.41	3.84*	2.19
Homestead	1.14	2.73	3.52	3.43	-	-	-	-	0.50	1.69	3.72*	2.42
SUGAR CANE												
Belle Glade	0.44	0.56	0.51	1.80	2.21	1.05	3.60	3.23	1.69	4.00	4.15*	2.80
Moore Haven	0.63	0.55	0.78	1.94	2.14	1.78	3.82	4.02	2.34	4.66*	4.53	3.09
TURF												
Ft. Myers	1.50	1.94	3.09	4.04*	3.95	0.75	1.15	1.28	0.68	2.06	2.39	1.59
Belle Glade	1.51	2.10	2.70	3.64*	3.64	0.75	1.45	1.20	0.68	1.33	2.02	1.49
SUBTROPICAL FRUITS (AVOCADOS)												
Homestead	0.31	1.36	2.57	4.23*	3.25	1.04	3.98	2.37	1.94	3.16	1.68	0.96

*Maximum Monthly Withdrawal

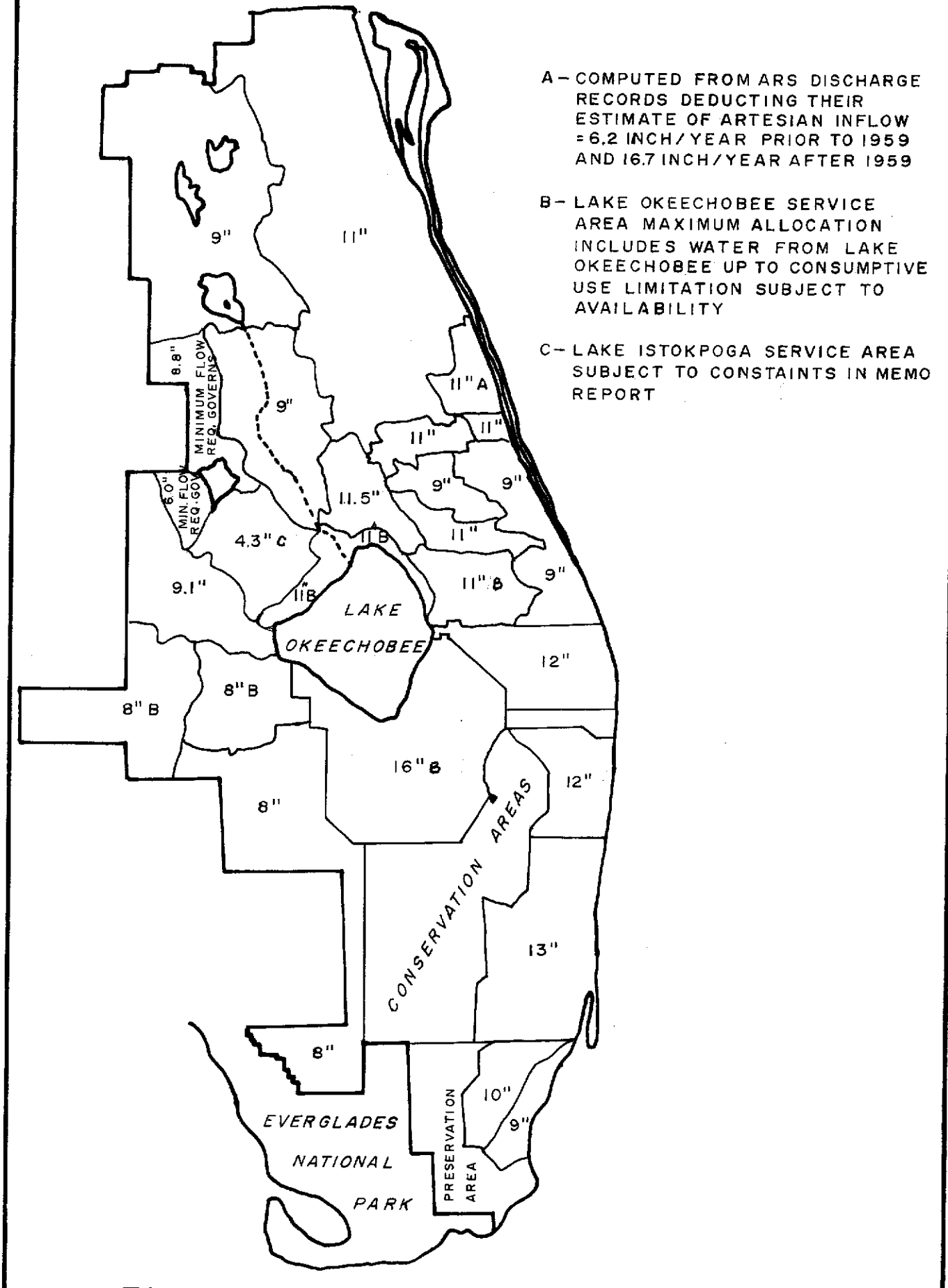

Figure 1 WATER CROP