CHAPTER 40E-63
EVERGLADES PROGRAM

PART I EVERGLADES REGULATORY PROGRAM: EVERGLADES AGRICULTURAL AREA (EAA) BASIN

40E-63.091 Publications Incorporated by Reference.

(1) "Appendix A1 – Description: Regulated Portion of Everglades Agricultural Area ~~S-5A, S-6, S-7 and S-8~~ Basins Palm Beach, Broward and Hendry Counties", dated [to be determined] ~~January 2001,~~ [HYPERLINK].

(2) "Appendix A2 – No Change.

(3) "Appendix A3 – EAA Basin Compliance", dated [to be determined] ~~January 2001~~, [HYPERLINK], and setting forth the procedures the District will follow to determine whether the entire EAA Basin has met the applicable total Phosphorus reduction goals based upon mathematical data analysis.

(4) "Appendix A3.1 – FORTRAN Program for Calculating EAA Basin Flows and Phosphorus Loads", dated [to be determined] ~~January 2001,~~ [HYPERLINK].

(5) "Appendix A3.2 – Flow Computation Methods Used to Calculate EAA Basin Flows", dated [to be determined] ~~January 2001~~, [HYPERLINK], providing applicable mathematical formulas for calculating flow rates through water management structures.

(6) "Appendix A4 – EAA Basin Farm Scale Allocation", dated [to be determined] ~~January 2001~~, [HYPERLINK], setting forth the procedure the District will follow to regulate total Phosphorus loads from individual farms when the EAA Basin has been determined to be not in compliance with applicable requirements.

(7) "Appendix A5 – No Change.

(8) "Appendix A6 – No Change.

(9) South Florida Water Management District Form 0779, dated January 2001, entitled "Application for a Works of the District Permit".

(10) "South Florida Water Management District Guidance for Preparing an application for "A Works of the District" Permit in the Everglades Pursuant to Chapter 40E-63, F.A.C." – No Change.

(11) The documents listed in subsections (1) through (10) are ~~hereby~~ incorporated by reference herein~~, are published by the District~~ and are available at no cost by contacting the South Florida Water Management District Clerk, ~~on the District's website (sfwmd.gov) or from the District at~~ 3301 Gun Club Road, West Palm Beach, FL 33406, (800) 432-2045, ext. 6805 or (561) 682-6805 ~~686-8800, upon request~~.

Rulemaking Authority 373.044, 373.113 FS. Law Implemented 373.016, 373.451, 373.453, 373.4592 FS. History–New 7-3-01, Amended __________.

40E-63.104 EAA Basin Boundaries.

(1) The Everglades Protection Area is generally described as: Water Conservation Areas 1, 2A, 2B, 3A and 3B, the Arthur R. Marshall Loxahatchee National Wildlife Refuge, and the Everglades National Park. It is depicted on maps and legally described in "Appendix A1," which is incorporated by reference in Rule 40E-63.091, F.A.C. ~~of Chapter 40E-63, F.A.C., which is published by reference and incorporated into this chapter~~.

(2) The EAA is generally described as:

(a) the area including, but not limited to, the drainage basins of S-2, S-3, S-5A, S-6, S-7, S-8 and S-150. The EAA is depicted on maps and legally described in "Appendix A1," which is incorporated by reference in Rule 40E-63.091, F.A.C.; and ~~of Chapter 40E-63, F.A.C.~~

(b) The Everglades Construction Project diversion basins, consisting of the areas within the boundaries of the South Florida Conservancy District, South Shore Drainage District, East Shore Water Control District, East Beach Water Control District, and Closter Farms (also known as 715 Farms or the lessee of agricultural lease number 3420). These basins previously released stormwater to Lake Okeechobee, but stormwater was redirected as new releases to Works of the District within the Everglades under Rule 40E-63.108, F.A.C., when the diversion projects were completed. The Everglades Construction Project Diversion Basins are depicted on maps and legally described in "Appendix A1," which is incorporated by reference in Rule 40E-63.091, F.A.C.

(3) The areas described in subparagraphs (2) (a) and (b) are regulated under Part I of this Chapter and are included in calculating phosphorus load reductions as set forth in "Appendix A3" and "Appendix A4," which are incorporated by reference in Rule 40E-63.091, F.A.C.

Rulemaking Authority 373.044, 373.113 FS. Law Implemented 373.016, 373.085, 373.086, 373.451, 373.453, 373.4592 FS. History–New 1-22-92, Amended 7-3-01,________.

40E-63.106 Works of the District within the Everglades.

The ~~following~~ Works of The District within the Everglades Agricultural Area Basin include ~~are or have been used for calculating compliance with the phosphorus load reduction objectives of the Everglades program~~: S-2, S-3, S-5A, S-6, S-7, S-8, S-150, G-88, G-136, G-200, G-344A, G-344B, G-344C, G-344D, G-349B, G-350B, G-357, G-404, G-410, G-402-A, G-402-B, G-402-C, G-402-D, G-605, G-606, Miami Canal, North New River Canal, Hillsboro Canal, C-51 (at both current and ultimate discharge locations into the Everglades Protection Area), and their open channel connections. The Works of the District and other structures which are or have been used for calculating compliance with the phosphorus load reduction objectives of the Everglades program are set forth in "Appendix A3," which is incorporated by reference in Rule 40E-63.091, F.A.C.

Rulemaking Authority 373.044, 373.113 FS. Law Implemented 373.016, 373.085, 373.086, 373.451, 373.453, 373.4592 FS. History–New 1-22-92, Amended 7-3-01,________.

APPENDIX A1
DESCRIPTION

REGULATED PORTION OF EVERGLADES AGRICULTURAL AREA
~~S-5A, S-6, S-7 AND S-8~~ BASINS
PALM BEACH, BROWARD AND HENDRY COUNTIES

[Amendments to this appendix are under development]

APPENDIX A3
EAA BASIN COMPLIANCE

INTRODUCTION

This Appendix sets forth the procedures the District shall ~~will~~ follow ~~in the future~~ to determine whether the entire EAA Basin has met the goal of reducing total phosphorus (TP) discharged by 25 percent, under any set of hydrologic conditions that could arise, after implementation ~~installation~~ of ~~farm-level~~ BMPs as described in Part I of Chapter 40E-63, F.A.C., The first determination was for the period, May 1, 1995 through April 30, 1996, and annually thereafter. The annual determination requires calculation of ~~future~~ TP load leaving the structures from the EAA (location shown in Figure A4 and listed in Table A1). The load calculation must ~~will~~ ~~also~~ include phosphorus carried into Lake Okeechobee through backpumping ~~when this occurs. It also~~ ~~requires the~~ and adjust~~ment~~ for pass-through flows released from Lake Okeechobee and other sources to Stormwater Treatment Areas, the Holey Land, Water Conservation Areas and the Lower East Coast.

Load is the amount of phosphorus carried past a monitoring point by the movement of water. Data on water quality concentration and water quantity (flow) are required to calculate the phosphorus load discharged from a monitoring point. Data on water quality and quantity at the EAA structures are available from several sources – the District, the U. S. Army Corps of Engineers, and the U.S. Geological Service. Several methods of collecting the data are also used. Accordingly, the best method of data collection and source of data to use in a load calculation must be identified.

The water quality and quantity collection sources and methods currently available are described below. ~~The~~ M~~m~~ethods are improved ~~continuously~~ as new equipment becomes available and technology changes ~~improves. However, existing methods of data collection are continued concurrently with the new methods for a substantial period of time~~. Annually, wW~~W~~hen the District reports the results of the determination of whether the EAA Basin has reduced total phosphorus load by 25% for the period of May 1 through - April 30, ~~annually beginning in 1996,~~ the sources and methods of data collection used in the calculation must ~~will~~ be described and available for inspection. Any changes in methods from the prior year must ~~will~~ be specified. Substantially affected persons will have an opportunity to request an administrative hearing. The District shall incorporate permanent changes in methods into this Appendix periodically through Chapter 120, Florida Statutes, rulemaking proceedings.

The load calculations involve detailed procedures, which have been automated by a computer program in FORTRAN language. A flow chart of the program is shown in Figure A3. The methods and equations used in the program are outlined in Appendix A3.1: FORTRAN Program for Calculating EAA Basin Flows and Phosphorus Loads (EAA Basin Compliance model), which is published by reference and incorporated into this Chapter. These methods and equations ~~They~~ are also available electronically ~~on diskette~~.

DATA COLLECTION SOURCES AND METHODS

Water Quantity – Flows

The South Florida Water Management District and the U.S. Geological Survey (USGS) compute flow at all the major water control structures in the Everglades Agricultural Area. Water control structures include pumps, gated spillways, and gated culverts. Pump stations S-2, S-3, and S-6 allow water to flow in the opposite direction of pumping by siphoning. All pump stations except S-6 have an adjacent gated spillway.

The SFWMD uses various methods to compute flow at control structures. Flow at pump stations is calculated using discharge rating equations provided by the pump manufacturer and calibrated by discharge measurements. Flow at gated spillways is calculated using formulae derived by the Corps of Engineers from the Bernoulli equation. Discharge through culverts is calculated using standard equations for weir flow, orifice flow, pipe flow, and open channel flow. Flow computation methods are outlined in Appendix A3.2, which is published by reference and incorporated into this Chapter.

The SFWMD obtains field measurements of stage and control operations through various means. Real-time stage and control operations data are collected via the telemetry system. Analog data is obtained from chart recorders. Digital data are provided by punch tapes and solid state data loggers. Pump station operators log readings of stage and control operations hourly during pumping operations. In addition, staff gauge readings, gate opening measurements, and flashboard elevation measurements are conducted by field personnel who routinely visit unmanned structures.

The SFWMD's hydrologic database stores multiple flow data sets at each structure. Each flow data set is created using a unique combination of sources of stage and control operations data. The USGS publishes one set of flow data for each structure. If convenient, the USGS presents combined flow data from different locations. The SFWMD uses the USGS's data as well as its own data to perform water budget analyses and estimation techniques to obtain a "preferred" flow data set at each structure. Table A1 shows all the flow data sets available in the SFWMD's hydrologic database (DBHYDRO).

Water Quality

A water sample collected in the field is called a "raw water sample", in differentiation with a "water sample" used in the chemistry laboratory. Current raw water sample collecting methods at different structures are listed in Table A2. All raw water samples collected in the EAA ~~in the future~~ for compliance must ~~will~~ be collected by automatic sampler. Automatic samplers must ~~will~~ be programmed to take flow proportional composite samples. Where on-site real-time flow computation is impossible, time proportional composite samples will be taken. Grab samples must ~~will~~ also be continued until the relationships between results from automatic and manual methods has been sufficiently established. After that time, grab samples must ~~will~~ be taken when autosamplers are not functioning, or when necessary for other purposes.

Only a portion of a well-mixed raw water sample is used as a water sample in actual quantitative analysis of a given water quality parameter. The chemical analysis is performed by a certified laboratory using accepted standard methods. In case of change of laboratories or analytical methods, concurrent analyses shall be done until correlation between them can be established. Water quality parameters are identified by structure and collection site, project code, sample date, and serial number of the sample. The data are stored in ~~data base WQDMAIN~~ DBHYDRO.

Rainfall

EAA rainfall is calculated from measurements at representative rainfall gauges. Rainfall gauges provide an estimate of rainfall at a "point" location. Since rainfall is expected to vary in intensity and duration over an area, rainfall data from representative gauges are area-weighted using the Thiessen Polygon Method. Nine rainfall gauges have historically been used to estimate EAA rainfall. Daily rainfall data for each rainfall gauge are stored in the DBHYDRO database. The rainfall gauge station names, DBHYDRO identifiers and area-weights corresponding to each rainfall gauge station are listed in Table A3. EAA rainfall for the May 1 through April 30 period is calculated as the area-weighted sum of the daily rainfall measurements at each rainfall gauge.

Data Upgrades

There are three ways in which the quality and reliability of District flow data are being improved: (1) establishment of single time series of flow for each station from multiple sources of stage and control operations data, (2) verification and calibration of flow equations through intensified discharge measurements at all major EAA structures, and (3) calibration of AVM systems for future use as an additional source of flow data.
~~Efforts are currently under way to establish a single time series of flow data calculated at each flow station.~~ A prioritized list of sources of stage and control operations data must ~~will~~ be established for each flow station. Flow must ~~will~~ be computed from the highest ranking sources. When the highest ranking source of data is missing, the next highest source must ~~will~~ be used, and so on. This method ~~will~~ ensures the calculation of the best flow values from all sources and ~~will~~ minimizes missing data.

Stream gauging is being intensified to provide discharge measurements at all major EAA structures. Statistical analyses are conducted ~~under way~~ to verify or calibrate the discharge rating equations. The upgrading of stream gauging equipment, including a portable acoustic low velocity meter, as well as improved measuring techniques ~~will~~ ensures valuable field measurements. Statistical analysis and calibration of rating equations will continue to increase the accuracy of the calculated flow values.

AVM systems are in place at most major EAA structures. Calibration of these systems is being performed by the USGS. When these systems are satisfactorily calibrated, the data are ~~will be~~ used to verify the District's flow computations. If these systems prove to be highly reliable and accurate, they may provide the highest ranking source of flow data for the prioritization of single time series.

If any upgrades in water quality sampling are undertaken in the future, concurrent samples must ~~will~~ be taken by the existing methods to maintain data continuity, at least until the upgraded methods have been tested and documented as reliable.

DETERMINATION OF COMPLIANCE WITH 25% REDUCTION OF TOTAL PHOSPHORUS LOAD

~~The future~~ TP load must ~~will~~ be evaluated for compliance with the 25% TP load reduction requirement yearly as of April 30, a date which corresponds generally with the change from the dry to the wet rainfall periods. Hydrology, that is, discharge and rainfall, are dominant factors when computing TP loads. Because rainfall and stream flow are subject to large temporal and spatial variation in south Florida, the evaluation for compliance adjusts the TP load for hydrologic variability. Otherwise, the hydrologic variability could be large enough to obscure the effectiveness of BMPs to reduce TP loadings.

The adjustment for hydrologic variability includes two components:

1. A model to estimate future TP loads. The model estimates a future TP load of the EAA Basin by substituting future hydrologic conditions for the conditions that occurred during a base- period (~~water years~~ 1978 - 1988). The estimation is based on hydrologic data collected from a~~ny~~ future time period of May 1 - April 30. The estimation incorporates a calculation for the required 25% TP load reduction.

2. Accommodation for possible statistical error. This ~~in the model~~ is accomplished by specifying a required level of statistical confidence in the prediction of the long-term average TP load. The 90th percentile confidence level is ~~was~~ selected as reasonable.

Evaluation of the EAA Basin for compliance with the 25% TP load reduction requirement must ~~will~~ be based upon the following:

1. If the actual measured TP loading from the EAA Basin (Actual TP Loading) in a future May 1 - April 30 period is less than the model TP load estimate (Target TP Loading), then the EAA Basin will be determined to be "In Compliance," that is, to have met the 25% TP load reduction requirement. After completion of the STAs or other regional projects, the actual percentage of the base period TP load which must be met to be determined "In Compliance" must ~~will~~ be reduced to reflect land converted to STAs or regional projects no longer using the Works of the District within the EAA ~~taken out of agricultural production~~. However, the average unit area reduction required will be the same, both pre- and post-regional project ~~STA~~ completion.

2. If the Actual TP Loading ~~actual measured TP loading~~ from the EAA Basin exceeds the model TP load estimate (Target) in 3 or more consecutive May 1 - April 30 periods, then the EAA Basin will be determined to be "Not In Compliance" – that is, it will not have met the 25% load reduction requirement. If the Target is exceeded in a May 1 - April 30 period, and the District determines that the adjusted rainfall for the period exceeds 63.76 inches, the Target will be suspended for the EAA Basin will not be determined to be "Not In Compliance" for that period only. Any periods in which the Target is suspended must ~~will~~ be excluded from the determination of whether the Target has been exceeded in 3 or more consecutive May 1 - April 30 periods, that is, the EAA Basin will be determined to be "Not In Compliance" when the Target is exceeded for 3 May 1 - April 30 periods, without an intervening May 1 - April 30 period in which the EAA Basin has been determined to be "In Compliance," even though the three periods may be interrupted by periods of suspension.

3. If the Actual TP Loading ~~actual measured TP loading~~ from the EAA Basin exceeds the "upper 90% confidence limit of the Target" (Limit), in any May 1-April 30 period, the EAA Basin will be determined to be "Not in Compliance," that is, it will not have met the 25% load reduction requirement. If the Limit is exceeded in a May 1 - April 30 period, and the District determines that the adjusted rainfall for the period exceeds 63.76 inches, the Limit must ~~will~~ be suspended and the EAA Basin will not be determined to be "Not In Compliance" for that period only.

4. A determination of suspension under paragraphs 2 and 3 above determined, and a Notice of Rights to petition for a hearing under Section 120.57, Florida Statutes, and Section 373.114, Florida Statutes, shall be published in the Florida Administrative Weekly.

5. The Target and Limit must ~~will~~ be calculated according to the following equations and explanation:

To reflect the required 25% reduction, POR TP loads are multiplied by 0.75 before performing the following regression:

$$1n(L) = -7.998 + 2.868\ X + 3.020\ C - 0.3355\ S$$

[Explained Variance = 90.8%, Standard Error of Estimate = .183]

Predictors (X, C, S) are calculated from the first three moments (m_1,m_2,m_3) of the 12 monthly rainfall totals (r_i, i=1,12, inches) for the current year:

$$m_1 = \text{Sum}\ [\ r_i\ ]\ /\ 12$$

$$m_2 = \text{Sum}\ [\ r_i - m_1\ ]^2\ /\ 12$$

$$m_3 = \text{Sum}\ [\ r_i - m_1\ ]^3\ /\ 12$$
$$X = 1n\ (12\ m_1)$$

$$C = [\ (12/11)\ m_2]^{.5}/m_1$$

$$S = (12/11)\ m_3\ /\ m_2^{\ 1.5}$$

where,

L = 12-month load attributed to EAA Runoff, reduced by 25% (metric tons)

X = natural logarithm of 12-month total rainfall (inches)

C = coefficient of variation calculated from 12 monthly rainfall totals

S = skewness coefficient calculated from 12 monthly rainfall totals

The first predictor (X) indicates that load increases approximately with the cube of total annual rainfall. The second and third predictors (C & S) indicate that the load resulting from a given annual rainfall is higher when the distribution of monthly rainfall has higher variance or lower skewness. For a given annual rainfall, the lowest load occurs when rainfall is evenly distributed across months and the highest load occurs when all of the rain falls in one month. Real cases fall in between.

Compliance must ~~will~~ be tracked by comparing the measured EAA Load with:

$$\text{Target} = \exp\ [\ -7.998 + 2.868\ X + 3.020\ C - 0.3355\ S\ ]$$

$$\text{Limit} = \text{Target}\ \exp\ (1.476\ SE\ F)$$

SE = $.1833 [1 + 1/9 + 5.125 (X-X_m)^2 + 17.613 (C-C_m)^2 + 0.5309 (S-S_m)^2 + 8.439 (X-X_m) (C-C_m) - 1.284 (X-X_m) (S-S_m) - 3.058 (C-C_m) (S-S_m)]^{.5}$

where,

$_m$ = subscript denoting average value of predictor in base period ($X_m = 3.866$, $C_m = 0.7205$, $S_m = 0.7339$)

Target = predicted load for future rainfall conditions (metric tons/yr)

Limit = upper 90% confidence limit for Target (metric tons/yr)

SE = standard error of predicted 1n(L) for May-April interval

F = factor to reflect variations in model standard error as a function of month (last in 12-month interval), calculated from base period:

Month:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
F:	1.975	1.609	1.346	1.000	1.440	1.238	1.321	2.045	2.669	2.474	2.420	2.216

July 13, 2017, Governing Board DRAFT

Figure A3

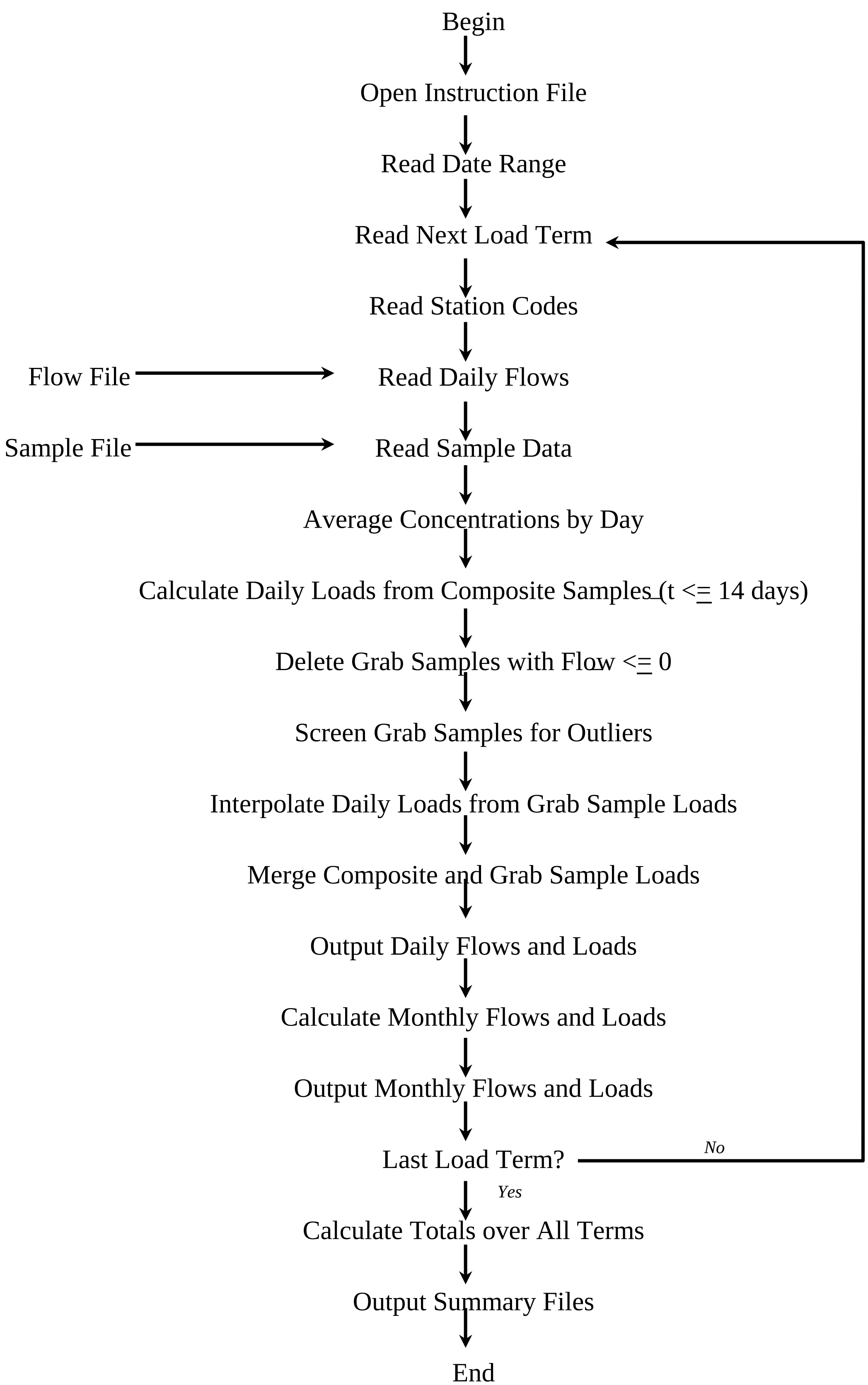

TABLE A1
EAA BASIN DRAINAGE STRUCTURES
DATABASE KEYS TO FLOW DATA TIME SERIES

Structure	Preferred[1]	Effective Date[2]	Inactive Date[3] (if applicable)
S-352 Complex	15068	Base Period	
S-2 Complex	15021	Base Period	
S-3 Complex	15018	Base Period	
S-5A Complex	15031	Base Period	
S-6	15034	Base Period	
S-7	15037	Base Period	01/08/2005
S-150	15041	Base Period	01/08/2005
S-8	15040	Base Period	01/08/2005
G-88	15196	Base Period	06/30/2000
G-136	15195	Base Period	
G-200	15736	10/28/1991	01/08/2005
G-250	16222	01/25/1994	07/10/1999

Structure	Preferred[1]	Effective Date[2]	Inactive Date[3] (if applicable)
G-600	GG955	03/06/1997	04/30/2005
G-605	H3143	11/24/1997	06/30/2000
G-606	HD889	11/24/1997	06/30/2000
G-328	J0718	04/01/2000	
G-344A	J0719	10/01/1999	07/22/2005
G-344B	J0720	10/01/1999	07/22/2005
G-344C	J0721	10/01/1999	07/22/2005
G-344D	J0722	10/01/1999	07/22/2005
G-349B	JA353	10/01/1999	07/22/2005
G-350B	JA352	10/01/1999	07/22/2005
G-410	LX270	07/17/2001	07/22/2005
G-402A	LX264	07/17/2001	01/08/2005
G-402B	LX265	07/17/2001	01/08/2005
G-402C	LX266	07/17/2001	01/08/2005
G-402D	LX267	07/17/2001	03/30/2004
G-404	LX269	05/06/2000	01/08/2005
EBPS	LX274	07/01/2001	04/30/2018
ESPS	LX273	12/20/2001	04/30/2018
G-357	LX263	03/01/2001	01/08/2005
G-204	SG578	05/01/2003	01/08/2005
G-205	SG579	05/01/2003	01/08/2005
G-206	SG580	05/01/2003	01/08/2005
G-507	SJ382	12/01/2003	07/22/2005
G-370	TA438	10/01/2003	
G-372	TA437	10/01/2003	
G-376A	TA445	02/27/2004	01/08/2005
G-376D	TA446	02/27/2004	01/08/2005
G-379A	TA449	09/17/2004	01/08/2005
G-379D	TA450	09/17/2004	01/08/2005
G-381A	TA447	06/09/2004	01/08/2005
G-381C	TA448	06/09/2004	01/08/2005
SSDD	TA459	06/01/2004	04/30/2018
SFCD	TR998	08/01/2005	04/30/2018
G-371	TS261	02/01/2006	

Structure	Preferred[1]	Effective Date[2]	Inactive Date[3] (if applicable)
G-373	TS260	02/15/2006	_
G-373BC	TS262	06/01/2005	07/21/2005
G-434	90327	11/01/2012	_
G-435	90328	05/17/2013	_
G-722	AM015	08/28/2015	
C-10	15645	05/01/2018	_
C-12A	15647	05/01/2018	_
C-12	15646	05/01/2018	_
C-4A	15648	05/01/2018	_
S236	15644	05/01/2018	_
EPD07	AM706	05/01/2018	_

~~n New, flow data time series for the Holey Land pump station begins on November 25, 1991~~

[1]The reference numbers in the table are keys to the data sets, known as "dbkeys".
[2] The term “Base period” indicates that the structure was part of the EAA model boundary from October 1, 1978, through September 30, 1988. The format is Month – Day – Year.
[3]A date is indicated for those structures that are inactive as of the date of this amendment. The format is Month – Day – Year.

TABLE A2
EAA BASIN
~~CURRENT~~ WATER QUALITY SAMPLING METHODS

Structure	Collection Site	Instrument[1]	Effective Date[2]	Inactive Date (if applicable)[3]
S-352	GRAVITY	G	Base Period	
S-2	PUMP	A	Base Period	
	GRAVITY	G	Base Period	
S-3	PUMP	A	Base Period	
	GRAVITY	G	Base Period	
S-5A Complex	PUMP	A	Base Period	
	GRAVITY	G		
S-6	PUMP	A	Base Period	01/08/2005
	GRAVITY	G		
S-7	PUMP	A	Base Period	01/08/2005
	GRAVITY	G		
S-150	GRAVITY	G	Base Period	01/08/2005
S-8	PUMP	A	Base Period	06/30/2000
	GRAVITY	G		
G-88	GRAVITY	G	Base Period	
G-136	GRAVITY	A	10/28/1991	01/08/2005
G-200A	GRAVITY	G	01/25/1994	07/10/1999
G-250	PUMP	A	03/06/1997	04/30/2005

Structure	Collection Site	Instrument[1]	Effective Date[2]	Inactive Date (if applicable)[3]
G-600	PUMP	A	11/24/1997	06/30/2000
G-606	GRAVITY	A	11/24/1997	06/30/2000
G-328	PUMP	A	04/01/2000	
G-344A	GRAVITY	A	10/01/1999	07/22/2005
G-344B	GRAVITY	A	10/01/1999	07/22/2005
G-344C	GRAVITY	A	10/01/1999	07/22/2005
G-344D	GRAVITY	A	10/01/1999	07/22/2005
G-349B	PUMP	A	10/01/1999	07/22/2005
G-350B	PUMP	A	10/01/1999	07/22/2005
G-410	PUMP	A	07/17/2001	07/22/2005
G-402A	GRAVITY	G~~A~~	07/17/2001	01/08/2005
G-402B	GRAVITY	G~~A~~	07/17/2001	01/08/2005
G-402C	GRAVITY	G~~A~~	07/17/2001	01/08/2005
G-402D	GRAVITY	G~~A~~	07/17/2001	03/30/2004
G-404	PUMP	A	05/06/2000	01/08/2005
EBPS	PUMP	A	07/01/2001	04/30/2018
ESPS	PUMP	A	12/20/2001	04/30/2018
G-357	GRAVITY	A	03/01/2001	01/08/2005
G-204	GRAVITY	G	05/01/2003	01/08/2005
G-205	GRAVITY	G	05/01/2003	01/08/2005
G-206	GRAVITY	G	05/01/2003	01/08/2005
G-507	PUMP	A	12/01/2003	07/22/2005
G-370	PUMP	A	10/01/2003	
G-372	PUMP	A	10/01/2003	
G-376A	GRAVITY	A	02/27/2004	01/08/2005
G-376D	GRAVITY	A	02/27/2004	01/08/2005
G-379A	GRAVITY	A	09/17/2004	01/08/2005
G-379D	GRAVITY	A	09/17/2004	01/08/2005
G-381A	GRAVITY	G	06/09/2004	01/08/2005
G-381C	GRAVITY	G	06/09/2004	01/08/2005
SSDD	PUMP	A	06/01/2004	04/30/2018
SFCD	PUMP	A	08/01/2005	04/30/2018
G-371	GRAVITY	G	02/01/2006	
G-373	GRAVITY	G	02/15/2006	
G-373_BC	GRAVITY	G	06/01/2005	07/21/2005
G-434	PUMP	A	11/01/2012	

Structure	Collection Site	Instrument[1]	Effective Date[2]	Inactive Date (if applicable)[3]
G-435	PUMP	A	05/17/2013	_
G-722	GRAVITY	A	08/28/2015	
CULV10	PUMP	G	05/01/2018	_
CULV12A	PUMP	G	05/01/2018	_
CULV12	PUMP	G	05/01/2018	_
CULV4A	PUMP	G	05/01/2018	_
S236	PUMP	G	05/01/2018	_
EPD07	PUMP	G	05/01/2018	_

[1]G = grab sample primary method
A = automatic sampler primary method, grab sample back-up
[2] The term "Base period" indicates that the structure was part of the EAA model boundary from October 1, 1978, through September 30, 1988. The format is Month – Day – Year.
[3]A date is indicated for those structures that are inactive as of the date of this amendment. The format is Month – Day – Year.

TABLE A3
EAA BASIN
RAINFALL STATIONS

Identifier[1]	Station	Theissen Weight
15197	ALICO_R	0.0974
15198	MIAMI LO_R	0.1076
15199	SOUTH BA_R	0.0844
15200	BELLE GL_R	0.1617
15201	PAHOKEE1_R	0.1438
15202	S5A_R	0.0989
15203	S6_R	0.0763
15204	S7_R	0.0592
15205	S8_R	0.1743

[1]The identifiers are also referred to as "dbkeys".

APPENDIX A3.1
FORTRAN PROGRAM FOR CALCULATING EAA BASIN FLOWS AND PHOSPHORUS LOADS

```
program eaatpld
c modified August, 2000 for various ECP elements
c modified may 1999 for STA-5 inflows from Miami Canal (G350B, G349B)
c modified october 1998 for STA-5 & STA-2
c modified march 1998 for STA-6
c utilizes all composite samples
c compute eaa tp load  10-96 - additional comments added  10-3-96
c useage:g
c        >eaatpld eaa.job
c eaa.job = input ascii file specifying case conditions
c subroutines in subr.for
c maximum dimensions
c number of days = 20000 12000 = 52 32 + years  ~(1978-203010)
c number of grab samples = 4000 2000 per station
c number of composite samples = 4000 2000 per station

c array dimensions increased to handle maximum of 7040 terms
      integer*4 dgrab,dcomp,dlast,dbase,dbase0,d0
      character*64 title
      character*32 ofile1,ofile2,ofile3,ofile4,cfile,qfile,ofile0
      character*32 ofile5
      character*32 blank /' '/
      character*8 slab,dum8,qlab,ulab,usave(70 40),mname(4)
      common /a/ flowu(20000 12000),wcomp(20000 12000),wuse(20000 12000),wusec(20000
12000)
      common /b/ wgrab(20000 12000)
      common /d/ dgrab(4000 2000),dcomp(4000 2000),cgrab(4000 2000),ccomp(4000 2000),
     & x(4000 2000),iym(700 400),qsave(700,70 400,40),wsave(700,70 400,40),isgn(70 40),
     & wcsave(700,70 400,40),sumd(6),sumw(6),y(4000 2000),prb(4000 2000),ratio(2),
     & wc(2),wg(2),ncg(2)
character*32 confile

c array definitions
c    flowu()  = daily flow
c    wgrab()  = daily load computed from grab samples
c    wcomp()  = daily load computed from composite samples
c    wuse()   = daily load used in final result
c    wusec()  = daily load computed from composite samples
c    cgrab()  = grab-sample concentration
c    dgrab()  = grab-sample date
c    ccomp()  = composite sample concentration
c    dcomp()  = composite sample date
c    qsave,wsave,wcsave(month,station)
c             = storage of monthly flow, load, & composite load

c number of load calc methods
      data nmeth/3/
```

```
      data mname/'noflow','compos','  grab','  miss' /

c qfac: convert cfs*days to output units = cfs-days
      data qfac/1./

c scale factor to convert input sample concs (ppm) to (ppb)
      data sf/1000./

c factor: convert cfs*ppb to kg/day; sig: level of outliers
c     factor=24.*3600.*(0.3048**3)/1.e6
      factor=24.*3600/3.28**3/1.e6

c grab/composite ratio
c iratio = 0 compute r1 & r2 separately (original algorithm)
c iratio = 1 set r2 = r1
      data iratio/0/

c read input file [eaa.job] to get station labels and input parameters
      open(7,file=' ',status="old")

c read control parameters
      read(7,*) title,qfile,dum8,cfile,dum8,
     &nmaxc,dum8,dbase0,dum8,dbase,dum8,sig,dum8

c title = problem title
c qfile = input daily flow file
c cfile = input sample concentration file
c nmaxc = maximum duration of composite samples
c dbase0 = first day of base period yyyymmdd = 19781001
c dbase  = last day of base period yyyymmdd = 19910930
c sig = significance level for outlier screening in base period

cc
cc March 98 Modification - Look for Composite Samples NAFTER days beyond last flow date
cc
      nafter = nmaxc
cc
cc end of modification
cc

c read date range
      read(7,*) iymd1,dum8,iymd2,dum8,idchk,dum8
      write(*,*) 'sample date range =',iymd1,iymd2
      read(7,*) ofile0,dum8,ofile5,dum8,ofile1,dum8,ofile2,dum8,
     &    ofile3,dum8,ofile4,dum8
c output files (* = optional)
c ofile0 - sample inventory
c ofile5 - totals by term & time period (base pd & after)
c *ofile1 - daily results
c *ofile2 - monthly results for each term
c *ofile3 - monthly crosstab   (term x month)
c ofile4 - monthly totals (sum of all terms)
```

```
c
      read(7,*)

c jdatei()  converts yyyymmdd to julian dates (days from Jan 1, 1900)
      jdbase=jdatei(dbase)
      jymd1=jdatei(iymd1)
      jymd2=jdatei(iymd2)
      jdchk=jdatei(idchk)
      d0=jymd1-1

c open output file for sample statistics
      open(17,file=ofile0)
      write(17,171) idchk
 171      format( 'QLEFT = FLOW (CFSD) BETWEEN LAST GRAB',
     &    ' SAMPLE DATE WITH POSITIVE FLOW &'
     &    i9,' NOT COVERED BY COMPOSITE SAMPLE'/
     &    '              COMPOSITE SAMPLES        GRAB SAMPLES'/
     &    'STATION       N   DFIRST    DLAST',
     &    ' NTOT NOUT NUSE   DFIRST    DLAST',
     &    '  RATIO1  RATIO2    QLEFT')

c open input flow file
      open (8, file=qfile,status='old')

c open daily output file
      if(ofile1.ne.blank) then
          open(10,file=ofile1,status="unknown")
          write(10,"(a64)") title
          write(10,  2)
      endif
   2          format('station   date   ip mth     flow',
     &        '     load   cgrab   ccomp   cused c/g ratio')

c open monthly output file
      if(ofile2.ne.blank) then
          open(11,file=ofile2,status="unknown")
          write(11,*) title
          write(11,*)
     &         'station  mnth  days flow(csd)  load(kg) conc(ppb)
     &         compos(kg)'
      endif

c nsta = number of stations (terms)
      nsta=0

c *********** for each station (term) in job file *************
   10 nsta=nsta+1

      read(7,*,end=500) ulab,slab,qlab,ipos,icomp,isgn(nsta)
c ulab = output label for mass-balance term
c slab = sample station code
c qlab = flow station code
```

```
c ipos = flow sign indicator (1 = use positive flows, -1 = use negative flows)
c icomp = composite sample indicator
c     0 = ignore composite samples
c     1 = use composite samples
c     2 = use comp. samples, force comp./grab ratio = 1.0 (option not used)
c isgn = sign of term in computing total outflow volume and load
c        1 = outflow term from EAA
c        0 = ignore term
c       -1 = inflow or thruflow term

c capitalize labels
      CALL CONCAP(SLAB,8)
      CALL CONCAP(QLAB,8)
      CALL CONCAP(ULAB,8)
      write(*,*)
      write(*,*) 'term = ',ulab
      write(*,*) 'sample station = ',slab
      write(*,*) 'flow label = ',qlab
      usave(nsta)=ulab

c *********** read daily flows for current station ***********

      call flowread(8,jymd1, jymd2,qlab,nq,flowu)
c file start date must be <= jymd1
c jymd2 is adjusted to reflect end of file
c flow data set should contain no missing values

      if(nq.le.0) go to 999
      write(*,*) 'flow dates =',kdate(jymd1),kdate(jymd2)

c ********** load sample data ***********

      ngrab=0
      ncomp=0

c fixed format input
      open(16,file=cfile,status="old")
      do i=1,4
          read(16,*)
      enddo

c read next sample
 40   read(16,41,end=60) dum8,dd,tt,conc
 41       format(a8,2x,10f10.0)
      itype=jfix(tt)

c convert yymmdd to days from Jan 1, 1900
      idd=dd
      jdd=jdate(dd)

c check stations
      CALL CONCAP(DUM8,8)
```

```
      if(dum8 .ne. slab) go to 40

c check date

cc modified march 1998
cc
cc    if(jdd.lt.jymd1.or.jdd.gt.jymd2) go to 40
cc
      if(jdd.lt.jymd1.or.jdd.gt.jymd2+nafter) go to 40
cc
cc end of modification
cc
c check for valid sample value
      if(conc.eq.0.) go to 40

c rescale concentration and set to absolute value (negative values < detection limit)
      conc=sf*abs(conc)

c check for composite vs. grab sample
c sample dates must be in increasing order
      if(itype.eq.7.or.itype.eq.24) then
c process composite sample
          ncomp=ncomp+1
          ccomp(ncomp)=conc
          dcomp(ncomp)=jdd
          if(ncomp.gt.1.and.dcomp(ncomp).lt.dcomp(ncomp-1)) then
              write(*,*) 'compos sample out of sequence: ',idd
              stop
          endif
      else
c process grab sample
          ngrab=ngrab+1
          cgrab(ngrab)=conc
          dgrab(ngrab)=jdd
          if(ngrab.gt.1.and.dgrab(ngrab).lt.dgrab(ngrab-1)) then
              write(*,*) 'sample date out of sequence: ',idd
              stop
          endif
      endif

      go to 40

c end of sample file
   60 continue
      if(ngrab.gt.0) write(*,*) 'grab samples =     ',ngrab,
     &               kdate(dgrab(1)),kdate(dgrab(ngrab))
      if(ncomp.gt.0) write(*,*) 'composite samples =',ncomp,
     &               kdate(dcomp(1)),kdate(dcomp(ncomp))
      close(16)

c calculate average concentrations by date
      call xred(dgrab,cgrab,ngrab)
```

```
      call xred(dcomp,ccomp,ncomp)
      write(*,*) 'daily-avg grab samples =     ',ngrab
      write(*,*) 'daily-avg composite samples =',ncomp

c scratch composite samples if switch indicates so
      if(icomp.le.0) ncomp=0

c assign daily flows in cfs
      do 70 j=1,nq
          if(ipos.eq.1) then
              flowu(j)=amax1(flowu(j),0.)
          else
              flowu(j)=abs(amin1(flowu(j),0.))
          endif
          wgrab(j)=0.
          wcomp(j)=0.
   70     wuse(j)=0.

c calculate loads from composite samples
      dlast=0.
      do i=1,ncomp

c date range to apply composite-sample concentration
          j2=dcomp(i)-d0
          j1=max0(1,j2-nmaxc)
          if(j1.le.dlast) j1=dlast+1
          if(j1.gt.j2) j1=j2
          do j=j1,j2
              wcomp(j)=flowu(j)*ccomp(i)*factor
          enddo
          dlast=j2
      enddo

c eliminate grab-samples collected on days with no flow
      mgrab=0
      do i=1,ngrab
          if(flowu(dgrab(i)-d0).gt.0.) then
              mgrab=mgrab+1
              dgrab(mgrab)=dgrab(i)
              cgrab(mgrab)=cgrab(i)
          endif
      enddo
      ngrabt=ngrab
      ngrab=mgrab
      write(*,*) 'grab samples on days with positive flow =',ngrab
      if(ngrab.gt.0) write(*,*) 'date range =',kdate(dgrab(1)),
     &              kdate(dgrab(ngrab))

c screen base-period  grab samples for outliers
c based upon log(c) vs. log(q) regression
c (Snedecor & Cochran, Statistical Methods, 1980, pp. 167-168)
      if(sig.gt.0.) then
```

```
          ngt=ngrab
  110     j=0
          do i=1,ngrab
              prb(i)=1.
              if(dgrab(i).le.jdbase) then
                  j=j+1
                  x(j)=alog(flowu(dgrab(i)-d0))
                  y(j)=alog(cgrab(i))
              endif
          end do
          call outlyr(x,y,j,sig,prb,nrej)
          if(nrej.gt.0) then
              m=0
              do 150 i=1,ngrab
              if(prb(i).gt.sig) then
                  m=m+1
                  dgrab(m)=dgrab(i)
                  cgrab(m)=cgrab(i)
              else
                  write(*,140) kdate(dgrab(i)),cgrab(i),prb(i)
  140                 format(' ***outlier: date =',i9,
     &                      ',  conc = ', f10.1, ',  prob =',f8.3)
              endif
  150         continue
              ngrab=m
c repeat screen until no outliers are found
              go to 110
          endif
              ngout=ngt-ngrab
      endif

c calculate daily loads from grab samples by interpolation
      do  i=1,ngrab
          x(i)=dgrab(i)-d0
      enddo
      call eint3(ngrab,x,cgrab,nq,wgrab)

cc end of mod
      do i=1,nq
          wgrab(i)=wgrab(i)*flowu(i)*factor
      enddo

c ratio = load computed from composite samples / load computed from grab samples
c calculate load ratio for days with both composite and grab samples
c calc separate ratios for base period (ratio(1)) and after (ratio(2))
      do i=1,2
          wg(i)=0.
          wc(i)=0.
          ncg(i)=0
      end do
      do 220 i=1,nq
          if(wgrab(i).gt.0.and.wcomp(i).gt.0.) then
```

```
              if(i+d0.gt.jdbase) then
                  j=2
              else
                  j=1
              endif
              wg(j)=wg(j)+wgrab(i)
              wc(j)=wc(j)+wcomp(i)
              ncg(j)=ncg(j)+1
          endif
  220     continue
      do j=1,2
          ratio(j)=ratv(wc(j),wg(j))
c set to 1 if composite samples are ignored
c or if icomp=2
          if(icomp.le.0.or.icomp.eq.2) ratio(j)=1.
      end do
c if missing, set ratio(2)=ratio(1)
      if(ratio(2).le.0.) ratio(2)=ratio(1)

c sample inventory
      if(ncomp.le.0) then
          jc1=0
          jc2=0
      else
          jc1=dcomp(1)
          jc2=dcomp(ncomp)
      endif
      if(ngrab.le.0) then
          jg1=0
          jg2=0
      else
          jg1=dgrab(1)
          jg2=dgrab(ngrab)
      endif
c qdang = total flow between last grab sample date used and last flow date
      qdang=0.

c final load
c sumd = total days
c sumw = total load
c lq = 1 no flow, 2=composite, 3=grab
      do lq=1,5
          sumd(lq)=0.
          sumw(lq)=0.
      end do

c loop around days
      do i=1,nq
          jdd=i+d0

c wusec tracks loads computed from composite samples
          wusec(i)=0.
```

```
          if(i+d0.gt.jdbase) then
              ipd=2
          else
              ipd=1
          endif

c meth=1 no flow
          if(flowu(i).le.0.) then
              wuse(i)=0.
              meth=1

c meth=2 use composite load
          else if(wcomp(i).gt.0.) then
              wuse(i)=wcomp(i)
              wusec(i)=wcomp(i)
              meth=2

c meth=3 use grab load
          else if(wgrab(i).gt.0.) then

c iratio = 0 use separate values
c iratio = 1 use base period values only
              if(iratio.eq.0) then
                  rr=ratio(ipd)
              elseif(iratio.eq.1) then
                  rr=ratio(1)
              endif
              if(rr.eq.0.) rr=1.
              meth=3
              wuse(i)=wgrab(i)*rr

c  diagnostic - flow after last grab sample used in calc loads
              if(jdd.gt.jg2.and.jdd.le.jdchk)
     &        qdang=qdang+flowu(i)
          endif

          sumw(meth)=sumw(meth)+wuse(i)
          sumd(meth)=sumd(meth)+1.

c output daily results on days with positive flow
          if(ofile1.ne.blank.and.meth.gt.1.and
     &    .flowu(i).gt.0.) then
              write(10,280) ulab,kdate(jdd),ipos,
     &        meth,flowu(i),wuse(i),
     &        ratv(wgrab(i),flowu(i))/factor,
     &        ratv(wcomp(i),flowu(i))/factor,
     &        ratv(wuse(i),flowu(i))/factor,ratio(ipd)
  280             format(a8,1x,i8,i3,i3,f9.1,f9.2,3f8.1,f10.3)
          endif
      end do
c end of date loop
```

```
c log file
      write(17,172) ulab,ncomp,kdate(jc1),kdate(jc2),ngrabt,
     &ngout,ngrab,kdate(jg1),kdate(jg2),
     &ratio(1),ratio(2),qdang
 172      format(1h",a8,1h",i5,2i9,3i5,2i9,2f8.4,f9.1)

      write(*,235)
  235     format(' station    ncomp   ngrab',
     &    '   days1  ratio1   days2  ratio2')
cc   &    '   days1  ratio1   days2  ratio2 usedratio') changed 2/27/98
      write(*,245) ulab,ncomp,ngrab,ncg(1),ratio(1),
     &ncg(2),ratio(2)
cc   &ncg(2),ratio(2),rr   changed 2/27/98
  245     format(1x,a8,3i8,f8.5,i8,2f8.5)

c  method summary
      write(*,305) (mname(i),i=1,nmeth)
  305     format(' breakdown of load estimation methods:'/
     &              ' method:  ',6a10)
      do i=1,nmeth
          sumd(nmeth+1)=sumd(nmeth+1)+sumd(i)
          sumw(nmeth+1)=sumw(nmeth+1)+sumw(i)
      enddo
      write(*,"(' days% :',6f10.1)")
     &(100.*ratv(sumd(i),sumd(nmeth+1)),i=1,nmeth)
      write(*,"(' load% :',6f10.1)")
     &(100.*ratv(sumw(i),sumw(nmeth+1)),i=1,nmeth)

      m=0
      nk=3

      kd= kdate(jymd1)/100

      do k=1,nk
          x(k)=0.
      enddo
      mm=0
      do i=1,nq
          jd=kdate(i+jymd1-1)/100
          if(jd.ne.kd) then
c output monthly totals for current station
              m=m+1
              cc=ratv(x(2),x(1))*qfac/factor
              if(ofile2.ne.blank)
     &        write(11,350) ulab,kd,mm,(x(k),k=1,2),cc,x(3)
  350             format(a8,i8,i4,2f10.1,f10.1,f10.1)
              qsave(m,nsta)=x(1)
              wsave(m,nsta)=x(2)
              wcsave(m,nsta)=x(3)
              iym(m)=kd
              do k=1,nk
                  x(k)=0.
```

```
              enddo
              mm=0
              kd=jd
          endif
          mm=mm+1
          x(1)=x(1)+flowu(i)*qfac
          x(2)=x(2)+wuse(i)
          x(3)=x(3)+wusec(i)
      end do

      m=m+1
      if(ofile2.ne.blank) then
          cc=ratv(x(2),x(1))*qfac/factor
          write(11,350) ulab,kd,mm,(x(k),k=1,2),cc,x(3)
      endif
      iym(m)=kd
      qsave(m,nsta)=x(1)
      wsave(m,nsta)=x(2)
      wcsave(m,nsta)=x(3)

c end loop around stations
      go to 10

c end of station list
  500 continue

c weighted sum over all stations
      usave(nsta)='Total'
      do i=1,m
          qsave(i,nsta)=0.
          wsave(i,nsta)=0.
          wcsave(i,nsta)=0.
          do j=1,nsta-1
              qsave(i,nsta)=qsave(i,nsta)+qsave(i,j)*isgn(j)
              wsave(i,nsta)=wsave(i,nsta)+wsave(i,j)*isgn(j)
              wcsave(i,nsta)=wcsave(i,nsta)+wcsave(i,j)*isgn(j)
          end do
      end do

c output monthly cross-tab
      if(ofile3.ne.blank) then
          open(12,file=ofile3,status="unknown")
          write(12,"(a64)") title
          write(12,*) 'flows in cfs-days'
          write(12,"(a6,2x,50a10)") 'month',(usave(i),i=1,nsta)
          do 530 i=1,m
  530         write(12,"(i6,50f10.1)") iym(i),(qsave(i,k),k=1,nsta)
          write(12,*)
          write(12,*) 'loads in kg'
          write(12,"(a6,2x,50a10)") 'month',(usave(i),i=1,nsta)
          do 540 i=1,m
  540         write(12,"(i6,50f10.1)") iym(i),(wsave(i,k),k=1,nsta)
```

```
          close(12)
      endif

c output totals before & after base period
      if(len_trim(ofile5).gt.0) then
c convert cfsd to kac-ft
          qqfac=24.*3600./43560./1000.
          open(12,file=ofile5)
          write(12,39) title,dbase
          do i=1,nsta
              x(1)=0.
              x(2)=0.
              y(1)=0.
              y(2)=0.
              tb=0
              ta=0
              do j=1,m
                  if(iym(j).gt.dbase/100) then
                      k=2
                      ta=ta+1
                  else
                      k=1
                      tb=tb+1
                  endif
                  x(k)=x(k)+qsave(j,i)
                  y(k)=y(k)+wsave(j,i)
              enddo
              ta=ta/12
              tb=tb/12
              write(12,38) usave(i),isgn(i),
     &        qqfac*x(1)/tb,y(1)/tb,ratv(y(1),x(1))*qfac/factor,
     &        qqfac*x(2)/ta,y(2)/ta,ratv(y(2),x(2))*qfac/factor
          enddo

 38       format(1h",a8,1h",i4,2(2f12.3,f10.1))
 39       format(a64/'Yearly Averages for Each Term & Time Period'/
     &    '            In Base Period <=',i8,8x,
     &    '       After Base Period'/
     &    'Term      Sign Flow(kaf/y)  Load(kg/y) Conc(ppb) '
     &    ' Flow(kaf/y) Load(kg/y)  Conc(ppb)')
      endif

c output monthly totals across all stations
      if(ofile4.ne.blank) then
          open(13,file=ofile4)
          write(13,"(a64)") title
          write(13,*) 'totals'
          write(13,567)
 567          format('month  flow(cfsd)    load(kg) conc(ppb)',
     &        ' grab(out) comp(out)  grab(in)  comp(in) comp(%)')

c loop around months
```

```
          do k=1,4
              y(k)=0.
          end do
          do i=1,m
              do k=1,4
                  x(k)=0.
              enddo
              do j=1,nsta-1
                  if(isgn(j).lt.0) then
c grab & composite inflows
                      x(3)=x(3)+wsave(i,j)-wcsave(i,j)
                      x(4)=x(4)+wcsave(i,j)
                  elseif(isgn(j).gt.0) then
c grab & composite outflows
                      x(1)=x(1)+wsave(i,j)-wcsave(i,j)
                      x(2)=x(2)+wcsave(i,j)
                  endif
              enddo
c composite as % of total absolute value
              x(5)=ratv(x(2)+x(4),x(3)+x(4)+x(1)+x(2))*100.
              write(13,560) iym(i),qsave(i,nsta),wsave(i,nsta),
     &        ratv(wsave(i,nsta),qsave(i,nsta))*qfac/factor,
     &        (x(k),k=1,5)
  560             format(i6,2f12.1,5f10.1,f8.1)
c sum over all months
              do k=1,4
                  y(k)=y(k)+x(k)
              enddo
              qsave(m+1,nsta)=qsave(m+1,nsta)+qsave(i,nsta)
              wsave(m+1,nsta)=wsave(m+1,nsta)+wsave(i,nsta)
              wcsave(m+1,nsta)=wcsave(m+1,nsta)+wcsave(i,nsta)
          enddo
          y(5)=ratv(y(2)+y(4),y(3)+y(4)+y(1)+y(2))*100.
          write(13,570) qsave(m+1,nsta),wsave(m+1,nsta),
     &    ratv(wsave(m+1,nsta),qsave(m+1,nsta))*qfac/factor,
     &    (y(k),k=1,5)
  570         format(/'total ',2f12.1,5f10.1,f8.1)
          close(13)
      endif
  999 close(10)
      end

      subroutine flowread(ifile,ibdate,iedate,clab,nq,values)

c modified March 2017 to include C10, C12, C12A, C4A, S236 and epd07
c modified Feb 2016 for A-1 FEB outflow structure g722
c modified Sept 2004 for STA3/4 inflows and outflows
c modified June 2004 for addition of g507, g204-g206
c modified August 2000 for various ECP elements
c reads daily flows - modified for STA-6 march 1998
c modified for STA-2 & STA-5 may 1999
c missing values not allowed in flow file
```

```
      character*8 clab
      character*8 labs(70 37)
      real values(1)

c these labels correspond to flow station labels in control file
      data labs /"s5a+s5aw",  "hgs5",     "wpbthru",  "s6",
     &           "s2/s6",     "hilthru",  "s7",       "s150",
     &           "s2/s7",     "thrulake", "thrus7",   "thrus150",
     &           "s8",        "s3",       "g88",      "g136",
     &           "holey",     "miathru",  "g250",     "g600",
     &           "g605",      "g606",     "g344a",    "g344b",
     &           "g344c",     "g344d",    "g328",     "g349b",
     &           "g350b",     "ebps",     "esps",     "g410",
     &           "g402a",     "g402b",    "g402c",    "g402d",
     &           "g404"       "g357",     "g204",     "g205",
     &           "g206",      "g507",     "g370",     "g372",
     &           "g376abc",   "g376def",  "g379abc",  "g379de",
     &           "g381ab",    "g381cdef", "ssdd",     "sfcd",
     &           "g371",      "g373" ,    "g373bc",   "g434",
     &           "g435",     "g722thru"/,   "c10",      "c12a",
     &           "c12",      "c4a",         "s236",     "epd07"/

c number of daily flows in input file
      data nqin /70 37/
      rewind ifile
      do i=1,4
          read(ifile,*)
      enddo
      nq = 0
      do I=1,nqin
          call CONCAP(LABS(I),8)
      enddo
  90  read(ifile,222,end=100) dd,qhgs5,qs5as5aw,qs2,
     &qs6, qs7, qs150, qs3, qs8, qg88, qg136, qholey,
     &qg250,qg600,qg605,qg606,qg344a,qg344b,
     &qg344c,qg344d,qg328,qg349b,qg350b,
     &qebps,qesps, qg410,qg402a,
     &qg402b, qg402c, qg402d,qg404, qg357,qg204,qg205,
     &qg206, qg507, qg370, qg372, qg376a, qg376d, qg379a,
     &qg379d, qg381a, qg381c, qssdd, qsfcd, qg371,
     &qg373, qg373bc, qg434, qg435, qg722,
     &qc10, qc12a,qc12,qc4a,qs236,qepd07


c Modify East Beach, South Florida and South Shore flows to account for the portion of
c these basins that was previously in the EAA.

      qebps = 0.813 * qebps
      qssdd = 0.966 * qssdd
      qsfcd = 0.799 * qsfcd
```

```
 222      format(100f10.0)

c convert yymmdd to julian
      jfdate=jdate(dd)
      if(jfdate.lt.ibdate) then
          goto 90
      elseif(jfdate.gt.iedate) then
          return
      elseif(nq.eq.0.and.jfdate.ne.ibdate) then
          write(*,*) 'flow file starting date too late: ',jfix(dd)
          stop
      elseif(nq.gt.0.and.jfdate-jflast.ne.1) then
          write(*,*) 'flow file dates out of sequence: ',jfix(dd)
          stop
      endif
      nq=nq+1
      jflast=jfdate

c split s2 outflow between s6 (hillsboro qs2h) and S7 (nnriver qs2n) basins
      qs2n =(qs2 / (1.534769))
      qs2h = qs2 - qs2n

c Adds STA3/4 outflows to total North New River inflows
c by adding g722 as an inflow to EAA

      qin = amax1(0., qs2n) - amin1(0.,qs7) - amin1(0., qs150)
     & + amax1(0.,qg376a) + amax1(0.,qg376d) + amax1(0.,qg379a)
     & + amax1(0.,qg379d) + amax1(0.,qg722)

c total flow thru in north new river canal
c Combines G370 flow through to S7 (9/28/04)
c Add G371 to flow through term for WY06

      ft = amin1(qin, amax1(0., qs7)+amax1(0., qs150))+ amax1(0., qg370)-
     & amax1(0.,qg376a) - amax1(0.,qg376d)-amax1(0.,qg379a)-
     & amax1(0.,qg379d)+ amax1(0., qg371) + amax1(0.,qg434)
     & + amax1(0.,qg435))

      do i = 1, nqin
          if(clab .eq. labs(i)) then
              ind = i
              go to 200
          endif
      end do
      write(*,*) 'flow station label not found:', clab
      stop
      go to 29
 200  goto (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,
     &20,21,22,23,24,25,26,27,28,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,
     &45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65), ind

c s5a+s5aw    outflow
```

```
 1    x = qs5as5aw
      go to 29

c hgs5 outflow
 2    x = qhgs5
      go to 29

c s5athru west palm beach canal flowthru
 3    if(qhgs5 .le. 0 ) then
          x = 0.
      else
          x = amin1(qhgs5, amax1(qs5as5aw+qg250-qebps, 0.))
      end if
      go to 29

c s6 outflow
 4    x = qs6
      go to 29

c s2/s6 s2 outflow to lake from hillsboro basin
 5    x = qs2h
      go to 29

c s6thru hillsboro canal flowthru
 6    if(qs2h .le. 0) then
          x = 0.
      else
          x = amin1(qs2h, amax1(qs6-qesps, 0.))
      end if
      go to 29

c s7 outflow
 7    x = qs7
      go to 29

c s150 outflow
 8    x = qs150
      go to 29

c s2/s7 outflow to lake from s7 basin
 9    x = qs2n
      go to 29

c thrulake - nnriver flowthru from lake
 10   if(qin .eq. 0) then
          x = 0.
      else
          x = amax1(0., qs2n) * ft / qin
      end if
      go to 29

c thrus7 - nnriver flowthru from s7
```

```
 11   if(qin .eq. 0) then
          x = 0.
      else
          x = -amin1(0., qs7) * ft / qin
      end if
      go to 29

c thrus150 - nnriver flowthru from s150
 12   if(qin .eq. 0) then
          x = 0.
      else
          x = -amin1(0., qs150) * ft / qin
      end if
      go to 29

c s8 outflow
 13   x = qs8
      go to 29

c s3 outflow
 14   x = qs3
      go to 29

c g88 inflow
 15   x = qg88
      go to 29

c g136 inflow
 16   x = qg136
      go to 29

c holeyland
 17   x = qholey
      go to 29

c s8 miami canal flowthru
 18   if(qs3 .le. 0) then
          x = 0.
      else
          x = amin1(qs3, amax1(0.,
     &    qs8-qg88-qg136+qholey-qg606-qg605+qg349b+qg350b-qg344a-
     &    qg344b-qqg344c-g344d-qg402a-qg402b-qg402c-qg402d+qg410+
     &    qg404 + qg357-qg204-qg205-qg206+qg507+qg372- qg381a - qg381c-
     &    qssdd - qsfcd + qg373 + qg373bc)
      endif
      goto 29

c enr inflow  - eaa outflow
 19   x=qg250
      goto 29

c sta6 inflow
```

```
 20   x=qg600
      goto 29

c sta6 bypass
 21   x=qg605
      goto 29

c sta6 outflow
 22   x=qg606
      goto 29

c sta5 outflows
 23   x=qg344a
      goto 29
 24   x=qg344b
      goto 29
 25   x=qg344c
      goto 29
 26   x=qg344d
      goto 29

c sta2 supplementary inflow

 27   x=qg328
      goto 29

c sta5 inflows from miami canal
 28   x=qg349b
      goto 29
 30   x=qg350b
      goto 29

c East Beach outflow - EAA inflow
 31   x=qebps
      goto 29

c East Shore outflow - EAA inflow
 32   x=qesps
      goto 29

c Rotenberger inflow  - EAA outflow
 33   x=qg410
      goto 29

c Rotenberger outflows - EAA inflow
 34   x=qg402a
      goto 29
 35   x=qg402b
      goto 29
 36   x=qg402c
      goto 29
 37   x=qg402d
```

```
      goto 29

c G404 outflow
 38   x=qg404
      goto 29

c G357 outflow
 39   x=qg357
      goto 29
c G204 inflow
 40   x=qg204
       goto 29
c G205 inflow
 41   x=qg205
       goto 29
c G206 inflow
 42   x=qg206
       goto 29
c G507 outflow
 43   x=qg507
       goto 29
c G370 outflow
 44   x=qg370
       goto 29
c G372 outflow
 45   x=qg372
       goto 29
c G376abc inflow
 46   x=qg376a
       goto 29
c G376def inflow
 47   x=qg376d
       goto 29
c G379abc inflow
 48   x=qg379a
       goto 29
c G379de inflow
 49   x=qg379d
       goto 29
c G381ab inflow
 50   x=qg381a
       goto 29
c G381cdef inflow
 51   x=qg381c
       goto 29
c SSDD inflow
 52   x=qssdd
       goto 29
c SFCD inflow
 53   x=qsfcd
       goto 29
c G371 outflow
```

```
 54    x=qg371
        goto 29
c G373 outflow
 55    x=qg373
        goto 29
c G373BC outflow
 56    x=qg373bc
        goto 29
c G434 outflow
 57    x=qg434
       goto 29
c G435 outflow
 58    x=qg435
       goto 29
c G722 A-1 FEB flow through
 59    if(qin .eq. 0) then
           x = 0.
       else
           x = amax1(0., qg722) * ft / qin
       end if
       go to 29
c East Beach outflow to Lake Okeechobee – New EAA outflow
 60    x=qc10
       goto 29
c Closter outflow to Lake Okeechobee – New EAA outflow
 61    x=qc12a
       goto 29
c East Shore outflow to Lake Okeechobee – New EAA outflow
 62    x=qc12
       goto 29
c South Shore outflow to Lake Okeechobee – New EAA outflow
 63    x=qc4a
       goto 29
c South Florida Conservancy outflow to Lake Okeechobee – New EAA outflow
 64    x=qs236
       goto 29
c South Florida Conservancy outflow to Industrial Canal – New EAA outflow
 65    x=qepd07
       goto 29


 29    values(nq) = x

       go to 90

 100   iedate=jfdate
       return
       end
c subroutines in subr.for


c subroutines for eaa software
```

```
c
c date functions
c
c date sequence number = number of days from Jan 1, 1900 (= Lotus 123 date)
c All reals=real*4, All integers = Integer*4
c function               inputs          returns
c idate(iy,im,id)        iy,im,id        date sequence number
c jdate(d)               yymmdd          date sequence number
c kkdate(d)              yymmdd          yyyymmdd
c jdatei(k)              yyyymmdd        date sequence number
c kdate(j)               date sequence   yyyymmdd
c ddate(j)               date sequence   yymmdd
c sub yymmdd(d,iy,im,id) yymmdd          iy,im,id
c sub iymmdd(k,iy,im,id) yyyymmdd        iy,im,id
c idbt(k1,k2)            2 x yyyymmdd    days between 2 dates, inclusive
c imonth(char3)          character month month number
c mday(iy,im)            iy,im           number of days in month

        function idate(iy,im,id)

       integer mdy(12)
        DATA MDY/0,31,59,90,120,151,181,212,243,273,304,334/

c returns days from Jan 1, 1900 for input iy,im,id
c year in yy format

c years
       jy=iy+1900

c if iy<50 assume turn of century
       if(iy.lt.50) jy=jy+100

        idate=0
c check for valid date
        if(im.le.0.or.im.gt.12) return
       if(id.lt.1.or.id.gt.mday(iy,im)) return

        idate=mdy(im)+(jy-1900)*365.+id+(jy-1897)/4

c add 1 day if leap year and after february
        if(mod(jy,4).eq.0.and.im.gt.2) idate=idate+1
        return
        end

            function jdate(d)
c returns date sequence number for input d in yymmdd format
            call yymmdd(d,iy,im,id)
            jdate=idate(iy,im,id)
            return
            end

       function jdatei(id)
```

```
c returns date sequence number for input id in yyyymmdd format
       j=id-19000000
       jdatei=jdate(float(j))
       return
       end



       function kkdate(d)
c returns yyyymmdd for input in yymmdd
       kkdate=d+19000000
       if(d.le.500000.) kkdate=kkdate+1000000
       return
       end



       function kdate(id)
c returns integer date yyyymmdd for julian date id
       kdate=ddate(id)
       if(kdate.eq.0) then
              return
              elseif(kdate.lt.500101) then
              kdate=kdate+20000000
              else
              kdate=kdate+19000000
              endif
       return
       end

        function ddate(id)

c returns date in yymmdd format for input id =
c      number of days from Jan 1, 1900

             ddate=0.
             if(id.le.0) return

c first find year, roughly
             jy=id/367
 13          if(idate(jy+1,1,1).le.id) then
                    jy=jy+1
                    goto 13
                    endif

c find month
             do 10 jm=2,12
               if(idate(jy,jm,1).gt.id) goto 12
 10          continue
 12          jm=jm-1

c find day
```

```
             jd=id-idate(jy,jm,1)+1

ccc adjust year
            if(jy.gt.99) jy=jy-100

c compute ddate
             ddate=10000.*jy+jm*100.+jd
             return
             end


       subroutine yymmdd(date,iy,im,id)

c convert real date yymmdd to integer year yy, month, day

       iy=0
       im=0
       id=0
       iy=jfix(date/10000.)
       im=jfix((date-iy*10000.)/100.)
       id=jfix(date-iy*10000.-im*100.)
       return
       end

       subroutine iymmdd(idate,iy,im,id)

c convert integer date to integer year, month, day

       iy=0
       im=0
       id=0
       iy=jfix(idate/10000)
       im=jfix((idate-iy*10000)/100)
       id=jfix(idate-iy*10000-im*100)
       return
       end

       function mday(iy,im)

c number of days in current month

       dimension mdy(12)
       data mdy/31,28,31,30,31,30,31,31,30,31,30,31/
       mday=0
       if(im.gt.12.or.im.lt.1) return
       mday=mdy(im)
       if(im.eq.2.and.mod(iy,4).eq.0.) mday=mday+1
       return
       end

          subroutine outlyr(x,y,n,sig,prb,nrej)
c screen for outliers - linear regression y(n) vs. x(n)
```

```
c sig = rejection significance level
c returns prb(n) = significance level for rejection
c nrej = number of screened data points
c snedecor and cochran, p. 157-158
         dimension x(1),y(1),prb(1)
         if(n.le.3) return
         sy=0.
         sy2=0.
         sx=0.
         sx2=0.
         sxy=0.
         nrej=0
         nn=n
c first compute regression
         do 100 i=1,n
             prb(i)=1.
             sy=sy+y(i)
             sx=sx+x(i)
             sy2=sy2+y(i)*y(i)
             sx2=sx2+x(i)*x(i)
             sxy=sxy+x(i)*y(i)
 100         continue
         txy=sxy-sx*sy/n
         tx2=sx2-sx*sx/n
         ty2=sy2-sy*sy/n
         tx=sx/n
         ty=sy/n
         b=txy/tx2
         a=ty-b*tx
c find maximum residual
 10      rmax=0.
         j=0
         do 200 i=1,n
         if(prb(i).eq.1.) then
            resid=abs(y(i)-b*x(i)-a)
             if(resid.gt.rmax) then
               j=i
               rmax=resid
               endif
            endif
 200     continue
         if(j.le.0) return
c compute regression with point j excluded
         nn=nn-1
         if(nn.le.3) return
         sxy=sxy-x(j)*y(j)
         sx2=sx2-x(j)*x(j)
         sy2=sy2-y(j)*y(j)
         sy=sy-y(j)
         sx=sx-x(j)
         txy=sxy-sx*sy/nn
         tx2=sx2-sx*sx/nn
```

```
         ty2=sy2-sy*sy/nn
         tx=sx/nn
         ty=sy/nn
         b=txy/tx2
         a=ty-b*tx
         se2=(ty2-b*b*tx2)/(nn-2)
         if(se2.le.0.) return
         se=sqrt(se2)
c test residual
         resid=y(j)-b*x(j)-a
         sr=se*sqrt( 1.+1./nn + (x(j)-tx)**2/tx2 )
         t=resid/sr
         prb(j)=probt(t,nn-2)*(nn+1)
         if(prb(j).gt.sig) return
         nrej=nrej+1
         go to 10
         end

        subroutine eint3(n,e,x,ni,xi)
c interpolation
c inputs e(i),x(i),i=1,n
c output ei(i),xi(j),j=1,ni
c      ei(j)==j

        dimension x(1),e(1),xi(1)
c
         i=1
         do 100 j=1,ni
            if(j.gt.e(i)) go to 110
              xi(j)=x(i)
              go to 100
 110        if(j.lt.e(n)) go to 120
              xi(j)=x(n)
              go to 100
 120        if(j.le.e(i+1)) go to 125
              i=i+1
              go to 120
 125        f=(j-e(i))/(e(i+1)-e(i))
            xi(j)=(1.-f)*x(i)+f*x(i+1)
 100    continue
        return
        end

          subroutine xred(ix,y,n)
c replaces x() and y() with running means
c for common values of ix()
c length n
c destroys input vectors
          dimension y(1)
          integer ix(1),ixlast
          if(n.le.1) return
          ixlast=ix(1)
```

```
          m=1
          k=0
          sum=y(1)
          do 10 j=2,n
          if(ix(j).ne.ixlast) then
             k=k+1
             ix(k)=ixlast
             y(k)=sum/m
             ixlast=ix(j)
             m=0
             sum=0.
             endif
          m=m+1
          sum=sum+y(j)
 10       continue
          k=k+1
          ix(k)=ixlast
          y(k)=sum/m
          n=k
          return
          end


       function ratv(x1,x2)
c divide x1 by x2 or set to 0.
       if(x2.ne.0.) then
           ratv=x1/x2
           else
           ratv=0.
           endif
       return
       end

       function ic8(c1,c2)
c compares strings c1 and c2
c returns 1 if they are identical
c case not significant
       character*8 c1,c2,c3,c4
c
       c3=c1
       call concap(c3,8)
       c4=c2
       call concap(c4,8)

       if(c3.eq.c4) then
            ic8=1
           else
            ic8=0
           endif
        return
        end
```

```
      function match(n,label,char)
c lookup char in label()
      character*8 label(1),char
      match=0
      do 10 i=1,n
      if(ic8(char,label(i)).gt.0) then
        match=i
        return
        endif
 10   continue
      return
      end

       function probg(s,r,z)
c  f statistic
c used with probf and probt
       u=2./9./s
       v=2./9./r
       q=abs((1.-v)*(z**.333333)-1.+ u)/sqrt(v*z**.6666667+u)
       if (r.lt.4) q=q*(1.+.08*(q**4)/(r**3))
       probg=.5/(1.+q*(.196854+q*(.115194+q*(3.44e-04+q*.019527))))**4
       return
       end

       function probt(t,n)
c  two-tailed - modified from "some common basic programs"
       probt=1.0
       if(t.eq.0..or.n.le.0) return
       w=t*t
       if (w.lt..5) then
          s=n
          r=1.
          z=1./w
          else
          s=1.
          r=n
          z=w
          endif
 20    probt=probg(s,r,z)
       if(w.lt..5) probt=1.-probt
       return
       end

      subroutine concap(string,n)
c convert string to caps
      character*1 string(1)
      do i=1,n
      j=ichar(string(i))
      if(j.gt.96.and.j.lt.123) string(i)=char(j-32)
      enddo
      return
      end
```

```
      subroutine pquote(cin,cout)
c returns string cin enclosed in quotes
c     xxxxx ---> "xxxxx"
      character*16 cin,cout,ctemp
      character*1 cc(16)
      equivalence (ctemp,cc(1))
      cout=' '
      ctemp=cin
      n=len_trim(cin)
      cc(n+1)='"'
      write(cout,1) (cc(i),i=1,n+1)
 1     format('"',20a1)
      return
      end


      function idbt(id1,id2)
c days between id1 & id2, inclusive
      idbt=jdatei(id2)-jdatei(id1)+1
      return
      end

      function imonth(c)
c convert character month to integer month
      character*3 c
      character*3 mlab(12) /'JAN','FEB','MAR','APR','MAY','JUN',
     &             'JUL','AUG','SEP','OCT','NOV','DEC'/

      imonth=0
      if(len_trim(c).le.0) return

      call concap(c,3)
      do i=1,12
              if(c.eq.mlab(i)) goto 5
             enddo
      write(*,*) 'Invalid Month =', c
      stop
 5    imonth=i
      return
      end
```

APPENDIX A3.2
FLOW COMPUTATION METHODS USED TO CALCULATE EAA BASIN FLOWS

Table of Contents

GATED SPILLWAYS

Parameters

C_{cf}	=	discharge coefficient for controlled free flow
C_{cs}	=	discharge coefficient for controlled submerged flow
C_{ot}	=	discharge coefficient for over-the-top flow
C_{uf}	=	discharge coefficient for uncontrolled free flow
C_{us}	=	discharge coefficient for uncontrolled submerged flow
G_o	=	gate opening, in feet
g	=	acceleration due to gravity, 32.2ft/sec^2
H	=	approach head over the spillway sill, which is the difference between the upstream stage and the sill elevation, in feet
H_g	=	approach head over the gate, in feet
h	=	submergence head over the spillway sill, which is the difference between the downstream stage and the sill elevation, in feet
L	=	length of spillway sill perpendicular to flow, in feet
n_1	=	exponent of approach head
n_2	=	exponent of submergence head
n_3	=	exponent of total head
n_4	=	exponent of gate opening
W	=	width of gate, in feet

Uncontrolled Free Flow

$$Q = C_{uf} L H^{n_1}$$

Spillway
S-5AS
S-7
S-8
S-351
S-352
S-354
G-371
G-373

Uncontrolled Submerged Flow

$$Q = C_{us} L h^{n_2} (H - h)^{n_3} \sqrt{2g}$$

Spillway
S-5AS
S-7
S-8
S-351
S-352
S-354
G-371
G-373

Controlled Free Flow

$$Q = C_{cf} L G_o \sqrt{2g(H - 0.5G_o)}$$

Spillway
S-5AS
S-7
S-8
S-351
S-352
S-354
G-371
G-373

Controlled Submerged Flow

$$Q = C_{cs} L G_o^{n_4} h^{n_2} \sqrt{2g(H-h)}$$

Spillway
S-5AS
S-7
S-8
S-351
S-352
S-354
G-371
G-373

Over-the-top Flow

$$Q = C_{ot} W H_g^{1.5} \sqrt{2g}$$

Spillway
S-5AS
S-7
S-8
S-351
S-352
S-354

PUMPS

Parameters

C	=	coefficient of discharge for siphon
C_0-C_9	=	coefficients of pump rating equation
H	=	head, downstream stage minus upstream stage, in feet
H_{fact}	=	normalizing head factor, in feet
H_{hi}	=	head from affinity laws corresponding to the high rpm rating equation, in feet
H_{lo}	=	head from affinity laws corresponding to the low rpm rating equation, in feet
N	=	engine speed, in rpm
N_{fact}	=	normalizing engine speed factor, in rpm
N_{hi}	=	engine speed of high rating equation, in rpm
N_{lo}	=	engine speed of low rating equation, in rpm
N_{min}	=	minimum engine speed below which no discharge is possible, in rpm
n	=	exponent of head for siphon
X	=	normalized head parameter
Y	=	normalized engine speed parameter

Pump Flow

Constant-speed Pump
A single-variable polynomial is used.

$$Q = C_0 + C_1 H + C_2 H^2 + C_3 H^3$$

Pump
G-200A
G-200B
G-349B
G-350B

Variable-speed Pump
Interpolation of single-variable polynomials is performed. The pump affinity laws are used to obtain the adjusted head, H_{lo}:

$$H_{lo} = H(\frac{N_{lo}}{N})^2$$

The adjusted head H_{lo} is used to compute Q_{lo}.

$$Q_{lo} = C_0 + C_1 H_{lo} + C_2 H_{lo}^2 + C_3 H_{lo}^3$$

Pump
S-5A
S-6
S-7
S-8
G-404
G-410
EBPS
ESPS
G-507
G-370
G-372
SSDD
SFCD
G-434
G-435
C-10
C-12A
C-12
C-4A
S236
EPD07

The adjusted head, H_{hi} is:

$$H_{hi} = H(\frac{N_{hi}}{N})^2$$

The adjusted head H_{hi} is used to compute Q_{hi}.

$$Q_{hi} = C_0 + C_1 H_{hi} + C_2 H_{hi}^2 + C_3 H_{hi}^3$$

The affinity laws are used to obtain the discharge Q at engine speed N:

$$Q = Q_{lo} + (Q_{hi} - Q_{lo})(\frac{N - N_{lo}}{N_{hi} - N_{lo}})$$

Variable-speed Pump with Very Variable Head
A two-variable polynomial used. The normalized head and engine speed are:

$$X = \frac{H}{H_{fact}}$$

$$Y = \frac{N - N_{\min}}{N_{fact}}$$

Pump
S-2
S-3

The pump discharge is:

$$Q = C_0 + C_1 X + C_2 Y + C_3 X^2 + C_4 XY + C_5 Y^2 + C_6 X^3 + C_7 YX^2 + C_8 XY^2 + C_9 Y^3$$

Siphon Flow
The siphon discharge is:

$$Q = CH^n$$

Siphon
S-6

CULVERTS
Refer to:

Fan, A. (October 1985). *A General Program to Compute Flow through Gated Culverts* (Technical Memorandum). West Palm Beach: South Florida Water Management District, West Palm Beach.

Parameters

The parameter defined here correspond to the variables defined by A. Fan.

Barrel	=	barrel shaped coding, “0” = circular, “1” = box
C	=	orifice flow coefficient due to inlet shape
C_w	=	weir flow coefficient (flashboard)
D	=	diameter of pipe culvert or height of box culvert, in feet
G_h	=	height of gate, in feet
G_{type}	=	gate type coding, “0” = circular, “1” = rectangular, “2” = weir
G_w	=	width of gate, in feet
IN_{el}	=	inlet invert elevation, in feet m.s.l. or NGVD
K	=	entrance loss coefficient due to shape of gate edge
L	=	length of culvert, in feet
N	=	number of barrels
n	=	Manning’s roughness coefficient
OUT_{el}	=	outlet invert elevation, in feet m.s.l or NGVD
r	=	refernece elevation for flashboard elevation, in feet m.s.l. or NGVD
S_{wb}	=	total side weir length (riser or wing wall), in feet
S_{we}	=	side weir crest elevation (riser or wing wall), in feet
W	=	width of box culvert
W_b	=	weir length (flashboad)

Culverts	Culverts
G-136	G-402A
G-88	G-402B
S-150	G-402C
S-5AE	G-402D
G-357	G-204
G-205	G-206
G-376A	G-376D
G-379A	G-379D
G-381A	G-381C
G-722	

APPENDIX A4
EAA FARM SCALE ALLOCATION

This Appendix sets forth the procedure the District will follow in the future to regulate total phosphorus (TP) loads from individual farms when the EAA Basin has been determined to be "Not In Compliance" with the Target or Limit according to the procedures set forth in Appendix A3. Within the context of the methodology described, "farm" refers to a hydrologic drainage area described by the District in the permits as a basin ID.

1. Individual permittees may participate in an Early Baseline Option to establish a base-year data set by monitoring the farm-level water quality and quantity discharge for a period of one year beginning January 1, 1993. The permittee who elects this option will be required to have approved BMPs in place by January 1, 1994. These permittees will be required to reduce their rainfall-adjusted phosphorus loading by at least 25 percent as compared to the rainfall-adjusted base-year loading. The procedure outlined in Appendix A3 will be used for rainfall adjustment.

2. The base year data will be verified for reasonableness. The determination will be based on an analysis of outliers, an analysis of consistency with existing total phosphorus data, rainfall data, and other relevant information. Permitted structures for which monitoring data are determined to be unreasonable shall be excluded from further participation in the Early Baseline Option.

3. In determining compliance in any future year, the measured EAA total basin load for the specified May 1 - April 30 period will be compared to the Target for the EAA Basin for the specified May 1 - April 30 period, calculated according to Appendix A3. The comparison is represented by the following ratio:

$$Y = \text{Target} / \text{Measured}$$

4. The Unit Area Loading (UAL) for each permitted structure and acreage tributary to it will be calculated. The calculation will be based on concentration and flow data reported by the permittee pursuant to the approved monitoring plan for the specified May 1 - April 30 period. The UAL will be calculated according to the following equation:

$$UAL_i = L_i \ / \ A_i$$

where,

UAL_i = Unit Area Load for $Farm_i$ (lbs/acre-year)

L_i = Load calculated by SFWMD from flow and concentration data supplied by Farm i, plus other data obtained by SFWMD, as necessary (lbs/year)

A_i = Area of Farm i (acres)

5. The UAL will be adjusted to reflect average rainfall conditions observed in the 1979 - 1988 base period and to reflect spatial variations in rainfall among EAA subbasins in the current year. The Adjusted Unit Area Load ($AUAL_i$) will be based on observed rainfall in the corresponding EAA subbasin (S5A, S6, S7, or S8) in the specified May 1 - April 30 period. It will be calculated according to the following:

$$AUAL_i = UAL_i \ (R_{am} / R_a)^{2.868}$$

$$R_a = \exp [X + 1.053 (C-C_m) - 0.1170 (S-S_m)]$$

where,

m = subscript denoting average value of rainfall statistic in base period for EAA Subbasin containing Farm i (see attached Table)

R_{am} = base period log-mean adjusted rainfall for EAA Subbasin containing Farm i (inches, see attached Table)

R_a = Adjusted subbasin rainfall in current year (inches)

X, C, S = Values as defined in Appendix A3 and computed for each subbasin

Basin	X_m	C_m	S_m	R_{am}
EAA Total	3.866	0.7205	0.7339	47.73
S5A[1]	3.918	0.7636	0.9999	50.31
S6[2]	3.907	0.7302	0.7476	49.77
S7	3.835	0.7198	0.6112	46.27
S8[3]	3.822	0.8409	0.8409	45.68

[1]Also to be used for East Beach Water Control District basin ID 50-033-02.
[2]Also to be used for Agricultural Lease 3420 basin ID 50-077-01, and East Shore Water Control District basin ID 50-080-01.
[3]Also to be used for South Shore Drainage District basin ID 50-081-02, and South Florida Conservancy District basin ID 50-010-06.

6. The AUAL for the entire EAA Basin (ALOAD, lbs/yr), including basin IDs 50-033-02, 50-077-01, 50-081-02, and 50-010-06, will be calculated according to the following:

$$ALOAD = SUM \ [AUAL_i * A_i]$$

7. The Farm -Level Target Load (FTLOAD, lbs/yr) will be calculated based on the assumption that the percentage reduction in total load required at the Farm scale equals the percentage reduction required at the Basin scale. The calculation will be based on the following:

$$FTLOAD = ALOAD * Y$$

8. For those permittees who elected to participate in the Early Baseline Option, compliance will be determined by adjusting both current and base year measured loads to average rainfall conditions using the procedure given in paragraph 5 above. Permittees who have achieved the 25% load reduction will be identified by comparing the adjusted load for the base year with the adjusted load for the current year.

9. Permittees who did not elect to participate in the Early Baseline Option are subject to a Maximum Unit Area Loading (MUAL, lbs/acre-yr) discharge limit, which is computed by solving the following equation:

$$FTLOAD = SUM [MUAL * A_j] + SUM [AUAL_i * A_i]$$

The first summation (j) is over all Farm s with $AUAL_j$ greater than MUAL, excluding those who have taken the Early Baseline Option and achieved a minimum 25% load reduction. The second summation is over all remaining Farms, which include (a) Farms with $AUAL_i$ below MUAL; and (b) Farms which elected the Early Baseline Option and met the minimum 25 percent load reduction requirement.

10. Revised BMP plans will be required for all permitted structures and tributary acreages whose $AUAL_j$ exceed MUAL. Revised BMP plans will also be required from all permittees who elected the Early Baseline Option, but did not achieve at least a 25 percent load reduction. Compliance and enforcement procedures are set forth in Rule 40E-63.145(3), (4), and (5), F.A.C.