Introduction

In February 2002, a number of changes were made to the computational scheme. The documentation was updated to describe these changes. The text describing the old computational scheme is colored red below.

Dayflow is a computer program developed in 1978 as an accounting tool for determining historical Delta boundary hydrology. Dayflow output is used extensively in studies initiated by the Department of Water Resources (DWR), the Department of Fish and Game (DFG), and less frequently by other State and Federal agencies [e.g., U. S. Bureau of Reclamation (USBR)] and private consultants.

In 2000, the software used to perform Dayflow calculations was rewritten in Java. Input data was stored in a HEC-DSS file, and output was written to an ASCII file.

The Dayflow program presently provides the best estimate of historical mean daily flows: (1) through the Delta Cross Channel and Georgiana Slough; (2) past Jersey Point; and (3) past Chipps Island to San Francisco Bay (net Delta outflow). The degree of accuracy of Dayflow output is affected by the Dayflow computational scheme and the accuracy and limitations of the input data. The input data include the principal Delta stream inflows, Delta precipitation, Delta exports, and Delta gross channel depletions. Both monitored and estimated values are included as described in this Dayflow program documentation. Currently, flows are not routed to account for travel time through the Delta. All calculations involving inflows, depletions, transfers, exports, and outflow are performed using data for the same day. All Dayflow summary reports distributed through January 1985, providing flow data through August 1984, and data for September 1984 reported herein were generated according to the algorithm described in the Computational Scheme section.

Dayflow program documentation is presented as follows:

1. Computational Scheme
2. Summary Tables of Monthly Data
3. Input Data Documentation
4. Methodology for Dayflow Output Generation
5. Summary of Equations

*This program has also been referred to as the DAYFLO and DAY FLOW model.

The Dayflow computational scheme was developed to derive three types of quantities:

- Net Delta Outflow estimates at Chipps Island
- Interior Delta flow estimates at significant locations
- Summary and fish-related parameters and indices

Computational Scheme part 1: Net Delta Outflow Estimates at Chipps Island (QOUT)

An estimate of net Delta outflow at Chipps Island is derived by performing a water balance about the boundary of the Sacramento-San Joaquin Delta, taking Chipps Island as the western limit (this quantity should not be confused with the total tidal flow, which is much larger). Figure 1 is a map of the area of interest. A flow schematic is shown in Figure 2.

\[ QOUT = QTOT + QPREC - QGCD - QEXPORTS - QMISDV \] (1)

This equation was modified from the original equation

\[ QOUT = QTOT + QPREC - QGCD - QEXPORTS \] (1)

to include QMISDV, which was previously included in QEXPORTS.

Where:

- \( QOUT \) Net Delta outflow at Chipps Island
- \( QTOT \) Total Delta inflow
- \( QPREC \) Delta precipitation runoff estimate
The parameters on the right side of the equation are input data used to calculate net Delta outflow. These input parameters are further defined in the Input Data Documentation Section, including exceptions and changes made to the parameters appearing in the equations presented.

**Total Delta Inflow (QTOT).**

The principal surface water inflows, miscellaneous stream flows, and the Yolo Bypass flow addition near Rio Vista are included in determination of total Delta inflow according to the following equation:

\[ QTOT = QSAC + QEAST + QYOLO \]  

**Eastern Delta inflow (QEAST)**

QEAST includes inflow to the Delta from the northeast, east, and southeast (Marsh Creek is the exception, flowing to the Delta from the southwest). QEAST is defined as:

\[ QEAST = QSJR + QCSMR + QMOKE + QMISC \]  

**Miscellaneous stream flow (QMISC)**

\[ QMISC = \text{Calaveras River flow} + \text{Bear Creek flow*} + \text{Dry Creek flow*} + \text{Stockton Diverting Canal flow*} + \text{French Camp Slough flow**} + \text{Marshall Creek flow*} + \text{Morrison Creek flow*} \]  

* monitoring discontinued; not used after WY 1997  
** monitoring discontinued; not used after WY 2005  

Previous releases of Dayflow calculations have included QCSMR and QMOKE in QMISC.

**Yolo Bypass flow addition to the Delta water balance (QYOLO)**

\[ QYOLO = \text{Yolo Bypass flow at Woodland} + \text{Sacramento Weir Spill} + \text{South Fork Putah Creek flow} \]  

Some of the calculations associated with the determination of total surface water inflow to the Delta are performed prior to the execution of the Dayflow program, while others are performed during program execution, as described in the Methodology for Dayflow Output Generation section.

**Delta Precipitation Runoff Estimate (QPREC).** In Dayflow, daily Delta precipitation is approximated using precipitation measured at Stockton Fire Station No. 4 in units of inches. It is assumed that the entire Delta receives the same depth when calculating the volume of water precipitated (depth multiplied by the area of the Delta (see pertinent notes in the Input Data Section). It is further assumed that the storm drainage is distributed evenly over five days, the day the precipitation was measured and the following four days. Precipitation is converted to a volumetric flow rate by dividing the volume of water (in cubic feet) by five days (in seconds) making its units consistent with other input data (e.g. streamflow).

**Deltawide Gross Channel Depletion Estimate (QGCD).** Gross channel depletion (consumptive use) in the Delta is a difficult quantity to estimate because of the many variables involved. Direct monitoring is impractical at present; therefore, various approximation techniques are used. Gross channel depletion is a significant parameter in the Dayflow program. Each month of the year has been assigned an average value, but the same annual pattern is used regardless of meteorological and hydrological conditions. Daily mean estimates were determined graphically by fitting the monthly averages with a continuous curve (see Input Data Documentation section).

In Fall 2010, DWR staff identified a problem with double counting Byron Bethany Irrigation District (BBID) in the Dayflow computational scheme of Gross Channel Depletion (GCD). This was corrected by subtracting historical BBID data from GCD in the 2010 data set, and will be subtracted in future data sets thereafter. DWR staff is in the process of collecting the rest of the historical data for BBID diversions.

**Net Channel Depletion (QCD)**

The Dayflow parameter net channel depletion (QCD) is an estimate of the quantity of water removed from Delta channels to meet consumptive use (QGCD).
QCD is defined as:

\[ QCD = QGCD + QMISDV - QPREC \]  (6)

The assumption is made that all of the precipitation runoff is available to meet consumptive use.

This equation was modified from the original equation

\[ QCD = QGCD - QPREC \]  (6)

to include QMISDV.

Total Delta Exports and Diversions/Transfers (QEXPORTS).

The primary purpose of including the total exports parameter is to account for all water diverted from the Delta by the Federal and State governments to meet water agreements and contracts. These include Central Valley Project pumping at Tracy (QCVP), the Contra Costa Water District Diversions at Middle River (new for WY 2010; data begin on 01AUG2010), Rock Slough, and Old River (QCCC), the North Bay Aqueduct export (QNBAQ), and State Water Project exports (Banks Pumping Plant or Clifton Court Intake, QSWP). The equation for total exports is:

\[ QEXPORTS = QCVP + QCCC + QSWP + QNBAQ \]  (7)

This equation was modified from the original equation

\[ QEXPORTS = QCVP + QCCC + QSWP + QMISDV \]

to replace QMISDV with QNBAQ.

Export/Inflow Ratio (EXPIN)

The Export/Inflow Ratio is the combined State and Federal Exports divided by the total Delta inflow (QTOT).

\[ EXPIN = \frac{(QCVP+QSWP-BBID)}{QTOT} \]  (8)

Previous releases of Dayflow calculations have used the following equation:

\[ EXPIN = QEXPORTS/QOUT \]

It should be noted that since Clifton Court Forebay came on line, the SWP export (QSWP) has been taken as Clifton Court Forebay intake minus the Byron-Bethany Irrigation District diversion (explained in the Input Data Documentation section).

Computational Scheme part 2: Interior Delta Flow Estimates

The Dayflow program has been used to evaluate flow at three interior Delta locations:

1. flow through the Delta Cross Channel and Georgiana Slough (QXGEO),
2. San Joaquin River flow past Jersey Point (QWEST), and
3. Sacramento River flow past Rio Vista (QRIO, used exclusively by the Department of Fish and Game). The derivations of these flow estimates are described below.

1. Delta Cross Channel and Georgiana Slough Flow Estimate (QXGEO). To obtain an approximation for cross-Delta flow (north Delta water reaching the central and southern Delta channels), the amount of water reaching the Mokelumne River system from the Sacramento River via the Delta Cross Channel and Georgiana Slough must be known. Because there are no streamflow gaging stations on either channel, empirical relationships have been developed to estimate Delta Cross Channel and Georgiana Slough flow given the Sacramento River flow at I Street Bridge in Sacramento. Since the Delta Cross Channel has two separately operated gates, three relationships are needed, for conditions when (1) both gates are closed (i.e., only Georgiana Slough flow), (2) one gate is open, and (3) both gates are open. The amount of time that each condition exists during a day is used to estimate the mean daily flow. It should be noted that even though the Sacramento River flow gaging station was moved to Freeport in October 1979, the relationships have not been reverified. Details of the empirical relationships now used, which were revised in 1978, are presented in the Input Parameter Documentation section.

In 2002, streamflow gages were installed in the Delta Cross Channel and Georgiana Slough. Starting with the water year 2003 calculations, the definition of QXGEO was changed to be the sum of these two flows. The empirical equations are used when there are missing data.

2. San Joaquin River Flow Estimate Past Jersey Point (QWEST). The amount and direction of San Joaquin River flow past Jersey Point is indicative of the water balance about the central and southern Delta. In particular, net reverse flow past Jersey Point indicates that higher salinity water (ocean) is being drawn into the interior Delta as a result of high depletions and exports with respect to stream inflows, precipitation, and cross-Delta flows. The following is used to determine this flow (using Dayflow parameters):

\[ QWEST = QSJR + CSMR + QMOKE + QMISC + QXGEO - QEXPORTS - QMISDV - 0.65(QGCD - QPREC) \]  (9)

An error was made in previous QWEST calculations, which used the following equation:

\[ QWEST = QSJR + CSMR + QMOKE + QMISC + QXGEO - QEXPORTS - 0.65(QGCD + QMISDV - QPREC) \]

It is assumed that 65 percent of the net Delta channel depletions occur in the central and southern Delta (i.e., San Joaquin River system).
3. Sacramento River Flow Estimate Past Rio Vista (QRIO). Assuming that 28 percent of the net Delta channel depletions (QGCD - QPREC) occur along the Sacramento River between Freeport and Rio Vista, the following equation has been used to provide DFG with estimated flows past Rio Vista (using Dayflow Parameters):

\[ QRIO = QSAC + QYOLO - QXGEO - 0.28 \times (QGCD - QPREC) \] (10)

An error was made in previous QWEST calculations, which used the following equation:

\[ QRIO = QSAC + QYOLO - QXGEO - 0.28 \times (QGCD + QMISDV - QPREC) \]

In other DWR studies, the depletions allocated to this area have been as high as 35 percent of the Delta-wide net channel depletion.

Summary and Fish-Related Parameters and Indices

The Dayflow data base was developed by DWR in 1964 at the request of DFG. The data base was originally intended for fish and fisheries studies and, for many years, was used solely by DFG and DWR (primarily in biological work). The computational scheme used to generate the data base was partially automated (computerized) in 1978. The following are parameters or indices used by DFG:

- Percent water diverted from the Delta (QDIVER)
- Effective inflow to the western/central Delta (QEFFECT)
- Effective percent diverted from the western/central Delta (QEFDIV)

A brief description of each parameter follows.

**Percent Water Diverted (QDIVER).** This index is calculated to quantify the portion of Delta water diverted for internal use and exports. In the most general form, it can be defined as:

\[ QDIVER = \frac{QTOT - QOUT}{QTOT} \times 100 \] (11)

Expressing net Delta outflow (QOUT) by its components (see equations 1 and 6), the percent water diverted can be expressed as:

\[ QDIVER = \frac{QCD + QEXPORTS}{QTOT} \times 100 \] (12)

**Effective Western/Central Delta Inflow (QEFFECT).** This parameter was developed for the purpose of striped bass studies. Since striped bass are primarily in the western/central Delta, a water balance for this region would be more informative than a similar balance for the entire Delta. The parameter QEFFECT was defined to factor out from total Delta inflow (QTOT) the portion of San Joaquin River water not reaching the western/central Delta. This portion is the water diverted either by southern Delta water users or for exports. Therefore, QEFFECT is defined as:

\[ QEFFECT = QTOT - QSJ4SD \] (13)

Where:

- QSJ4SD = amount of San Joaquin River water used in, or diverted from, the southern Delta (i.e., not reaching the western/central Delta; this is not a parameter in Dayflow).
- QTOT = as defined in equation 2.

To determine the amount of San Joaquin River water not reaching the western/central Delta (QSJ4SD), three general southern Delta flow patterns or cases are considered. Several flow quantities used to describe these cases are defined in Table 1. Previous QSJ4SD calculations have used the following equation, which appears in the original documentation:

\[ \text{If } QSJR \leq \left[ QEXPORTS + 0.42 \times (QCD) \right], \text{ then } QSJ4SD = QSJR \]

\[ \text{If } QSJR > \left[ QEXPORTS + 0.42 \times (QCD) \right] \text{ and } [QEXPORTS + 0.42 \times (QCD)] < [0.65 \times (QSJR) + 0.15 \times (QCD)], \text{ then } QSJ4SD = [0.65 \times (QSJR) + 0.15 \times (QCD)] \]

\[ \text{If } QSJR > \left[ QEXPORTS + 0.42 \times (QCD) \right] \text{ and } [QEXPORTS + 0.42 \times (QCD)] \leq [0.65 \times (QSJR) + 0.15 \times (QCD)], \text{ then } QSJ4SD = [QEXPORTS + 0.42 \times (QCD)] \] (14)
Effective Percent Western/Central Delta Water Diverted (QEFDIV). This index used for striped bass studies is defined as:

\[ \text{QEFDIV} = \left( \frac{\text{QEEFECT} - \text{QOUT}}{\text{QEEFECT}} \right) \times 100 \] (15)

The following observations are made regarding net diversions from the western/central Delta:

Case 1. Water is needed from the western/central Delta to meet the difference between Delta net channel depletions plus exports and San Joaquin River flow.

Case 2. Water is needed from the western/central Delta to meet the difference between 85 percent of Delta net channel depletions plus exports and 65 percent of San Joaquin River flow.

Case 3. Water is needed from the western/central Delta to meet 58 percent of Delta net channel depletions.

Summary Tables of Monthly Data

Summary tables were generated for Dayflow include mean monthly Delta inflow and net Delta outflow (in cubic feet per second) and total monthly Delta inflow and net Delta outflow (in thousands of acre-feet). These tables are presented in Attachment F.

Refer to Attachment B for a discussion on other data bases of historical Delta hydrology.

* See Figure III-6 of the Draft EIR PC Project, Department of Water Resources, August 1974.

** See the Salinity Incursion and Water Resources Appendix to DWR Bulletin 76, April 1962.

Input Data Documentation

The calculations described in the Computational Scheme Section can be performed once the necessary input data have been acquired and assembled in a data base. The methodology for constructing the input data base and generating the output is outlined in the next section. The input data parameters used to run the Dayflow program are briefly described herein. References for more detailed documentation are also provided.

The input data parameters are the principal streamflows to the Delta, Delta precipitation, exports and diversions from the Delta, and Delta consumptive use (gross channel depletions). The input data include both monitored and estimated values. These parameters are listed in Table 2, along with the Dayflow parameter(s) affected, data type (monitored, estimated, etc.), the source agency and reference, the station or parameter code used by the source agency, and comments.

The streamflow and precipitation stations are designated on the map in Figure 3. The labels (numbers) used on the map appear in Table 2 under the DWR Station Number column to allow cross referencing. The source agency references reported in Table 2 can be used to obtain additional information about data monitoring history and methodology and techniques used to collect the streamflow and precipitation data.

Estimated input parameters requiring further explanation are discussed below.

Delta Gross Channel Depletion Estimates (QGCD)

Estimates for monthly gross channel depletion currently used to run the Dayflow program were derived at the Central District office. The Byron-Bethany ID diversion that is included in the mean monthly gross channel depletion is monthly total cubic feet per second divided by the number of days in the month.

<table>
<thead>
<tr>
<th>Month</th>
<th>Gross Channel Depletion (cfs/month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>October</td>
<td>1,865</td>
</tr>
<tr>
<td>November</td>
<td>1,730</td>
</tr>
<tr>
<td>December</td>
<td>2,081</td>
</tr>
<tr>
<td>January</td>
<td>1,210</td>
</tr>
<tr>
<td>February</td>
<td>883</td>
</tr>
<tr>
<td>March</td>
<td>1,310</td>
</tr>
<tr>
<td>April</td>
<td>1,880</td>
</tr>
<tr>
<td>May</td>
<td>2,434</td>
</tr>
<tr>
<td>June</td>
<td>3,747</td>
</tr>
<tr>
<td>July</td>
<td>4,352</td>
</tr>
<tr>
<td>August</td>
<td>3,785</td>
</tr>
<tr>
<td>September</td>
<td>2,632</td>
</tr>
</tbody>
</table>

Estimates for daily mean gross channel depletions were determined graphically using the above monthly mean estimates. These values are reported in Table 3. The values in Table 3 are used for all water years regardless of meteorological and hydrological conditions.

Preliminary evaluations indicate that refinement of the input data for gross channel depletions to reflect annual as well as seasonal variations would result in significant changes in estimates of net Delta outflow. This refinement is in progress. By using existing land-use survey and pan evaporation data from 1955 as input to the DWR Division of Planning consumptive use model, a data base of historical
monthly total gross channel depletion estimates for the Delta has been developed. Work is underway to document this data base and to quantitatively evaluate how its use as input to the Dayflow program would affect estimates of net Delta outflow. This data base will also be made available for other studies requiring better estimates of historical Delta gross channel depletions.

**Delta Precipitation Runoff Estimates (QPREC)**

Only the precipitation station at Stockton Fire Station No. 4 has been used to represent Deltawide precipitation. The assumption is made that runoff from precipitation during a particular day takes place uniformly over that day and the following four days. Also, the precipitation occurring naturally on water surfaces in the Delta (7 to 8 percent of the total Delta area) is not routed explicitly. Finally, it is assumed that all of the precipitation runoff occurring daily is available for consumptive use for the same day (i.e., gross channel depletions; net channel depletion = gross channel depletion - precipitation runoff).

The volume of water precipitated is calculated by multiplying the depth of precipitation measured at Stockton Fire Station 4 during a day by the area of the watersheds making up the Delta. For October 1, 1955, through September 30, 1980, this area was taken to be 738,000 acres. For October 1, 1980 through September 30, 1984, this area was changed to 682,230 acres, an area about 7.6 percent smaller than the former. Documentation for this change is not available, and Delta precipitation runoff (QPREC) has not been revised using a single value for the area of the Delta. Therefore, the values for QPREC reported in the Dayflow Output reflect this discrepancy in Delta watershed area.

Work has been initiated to develop a data base of total daily precipitation for seven stations in the Delta to provide a better estimate of available precipitation. These stations are used in the DWR Division of Planning consumptive use model discussed in the previous section. They are: Brentwood (Contra Costa County), Davis 2 WSW Experimental Farm, Galt Fire Station, Lodi, Rio Vista, Stockton Fire Station 4, and Tracy-Carbona. When data from these stations are used, the Delta watershed area will be the total area of the Theissen polygons applied to these stations (678,200 acres).

The following evaluations need to be made.

- Whether the runoff distribution pattern now used is valid.
- How the explicit routing of precipitation on water surfaces would affect the runoff distribution pattern.
- Whether all runoff is available for meeting consumptive use.

**Delta Cross Channel and Georgiana Slough Flow Estimate (QXGEO)**

Flows through the Delta Cross Channel and Georgiana Slough are not gaged. Therefore, empirical equations were developed in 1978 using historical data to relate these flows to Sacramento River flow (QSAC) at I Street Bridge in Sacramento. In 2002, streamflow gages were installed in the Delta Cross Channel and Georgiana Slough. Starting with the water year 2003 calculations, the definition of QXGEO was changed to be the sum of these two flows:

\[
Q_{XGEO} = \text{Delta Cross Channel Flow} + \text{Georgiana Slough Flow}
\]

The empirical equations are used when there are missing data. Two independently operated gates control flow through the Delta Cross Channel. Consequently, three equations are needed, one for each of the following conditions.

- Both gates closed; flow only through Georgiana Slough
  \[
  Q_{XGEO} = 0.133 \times QSAC + 829
  \]

- One gate open plus flow through Georgiana Slough
  \[
  Q_{XGEO} = 0.216 \times QSAC + 2660
  \]

- Both gates open plus flow through Georgian Slough
  \[
  Q_{XGEO} = 0.293 \times QSAC + 2090 (16)
  \]

Available definition plots are presented in Figure 4.

These equations have not been checked for accuracy after Sacramento River flow measurements were taken at Freeport in October 1979. The magnitude of the error introduced into flow estimates for the Delta Cross Channel and Georgiana Slough since October 1979 should be evaluated.

**State Water Project Exports (QSWP)**

In 2003, the definition of QSWP was changed to include only Clifton Court Inflow. The change was made to improve the representation of the State Water Project's direct influence on Delta currents, water levels, and transport of biota.

In 2002, the definition of QSWP was changed to include only Banks Pumping Plant flow.

Previous QSWP values used the following equation:

\[
Q_{SWP} = \text{Clifton Court Forebay Inflow} - \text{BBID}
\]

The following is the reason for using this equation:
The parameter QSWP (representing Banks Pumping Plant flow) has been used in the Dayflow program to account for daily exports from the Delta by the State Water Project. In the Dayflow database, QSWP represents daily mean pumping rates at the Harvey O. Banks Delta Pumping Plant (formerly Delta Pumping Plant) from October 1, 1967, through April 30, 1971. During this period, SWP export pumping was direct from Delta channels.

Since Clifton Court Forebay came on line, SWP exports have been taken from the forebay and not directly from Delta channels. Consequently, estimates of net Delta outflow are affected by the amount of water diverted into Clifton Court Forebay (intake) from Old River at West Canal. Therefore, values for QSWP used in the Dayflow data base since May 1, 1971 represent daily mean Clifton Court Forebay intake flows after a necessary correction.

Before Clifton Court Forebay came on line, Byron-Bethany Irrigation District (BBID) withdrawals were channel depletions. As noted in the documentation for gross channel depletions (see QGCD above), an average value for the BBID withdrawal was included in QGCD estimates as a portion of gross channel depletions (i.e., the BBID withdrawal was not explicitly accounted for). Since Clifton Court Forebay has been on line, BBID diversions have been taken out of the forebay and are no longer a direct channel depletion. To correct for the current inclusion of BBID withdrawals in QGCD values, actual BBID withdrawals from CliftonCourt Forebay (as reported by DWR operations) are subtracted from the Clifton Court Forebay intake (QSWP) to prevent double-counting. As a result, the values reported for QSWP since May 1, 1971 are actually Clifton Court Forebay intake minus the BBID withdrawal.

Once the estimates for historical gross channel depletion (see QGCD above) are used in running the Dayflow program, this correction will not be needed.

**Miscellaneous Water Diversions/Transfers (QMISDV)**

The parameter QMISDV was added to the Dayflow program when it was partially automated in 1978. It was included to account for water diversions and transfers other than consumptive use (gross channel depletions, QGCD) and exports (QCCC, QCVP, and QSWP) that would affect daily estimates of historical net Delta outflow. Mean monthly values for QMISDV are reported in Table 5 are other water diversions and transfers occurring in the Delta from October 1955 through September 1984 (Dayflow data base period of record) that have not been accounted for. These events need to be evaluated with respect to their effect on estimates of net Delta outflow for possible inclusion in the Dayflow data base as QMISDV.

**Estimated distance from Golden Gate to 2 ppt Sallinity (X2), km**

The 1994 Bay-Delta agreement established standards for salinity in the estuary. Specifically, the standards determine the degree to which salinity is allowed to penetrate up-estuary, with salinity to be controlled through delta outflow. The basis for the standards is a series of relationships between the salinity pattern and the abundance or survival of various species of fish and invertebrates. These relationships have been expressed in terms of X2, the distance from the Golden Gate to the point where daily average salinity is 2 parts per thousand at 1 meter off the bottom (Jassby et al. 1995).

In Dayflow, X2 is estimated using the Autoregressive Lag Model:

\[ X2(t) = 10.16 + 0.945 \times X2(t-1) - 1.487 \log(QOUT(t)) \]  

(17)

where

- \( t \) = current day
- \( t-1 \) = previous day

The X2 calculation to be used in DAYFLOW should not be confused with the position of X2 needed to insure compliance with the Habitat Protection Outflow standard of D-1641, which is determined based on salinity measurements or Net Delta Outflow Index calculations.

**Notes from the 1986 Dayflow Documentation**

In using the Dayflow data reported for water year 1983-84, certain information is essential for proper interpretation.

1. All input data acquired for water year 1983-84 is preliminary and subject to revision following final screening by the respective sources (see Table 2).
2. The Dayflow program was run for water year 1983-84 only through August, because data for Mokelumne River were not available at time of execution. Also, the program was run without data for Marsh Creek (not monitored) and Dry Creek (not available).
3. Certain input parameter records were missing data for various days. The specific parameters, the dates for which data are missing, and the estimated or assumed values substituted are presented in Table 4 of the Dayflow Output Addendum (January 1985). The Dayflow program was executed for water year 1983-84 with these substituted values.
4. The read statement format error (mentioned in the previous section) was corrected, and the Dayflow program was run using the input data deck for water year 1982-83. For water years prior to 1982-83, revisions were made in February 1985. The changes for water years prior to 1983-84 are documented in Attachment C and reported in Attachment G.
5. Outdated headings used in prior Dayflow output listings were revised, as shown in Figure 5.

**Summary of Equations**

1. \( QOUT = QTOT + QPREC - QGCD - QEXPORTS - QMISDV \)
2. \( QTOT = QSAC + QEAST + QYOLO \)
3. \( Q_{EAST} = Q_{SJR} + Q_{CSMR} + Q_{MOKE} + Q_{MISC} \)

4. \( Q_{MISC} = \) Calaveras River flow
   + Bear Creek flow*
   + Dry Creek flow*
   + Stockton Diverting Canal flow*
   + French Camp Slough flow**
   + Marsh Creek flow*
   + Morrison Creek flow*

* monitoring discontinued; not used after 1997
** monitoring discontinued; not used after WY 2005

5. \( Q_{YOLO} = \) Yolo Bypass flow at Woodland
   + Sacramento Weir Spill
   + South Fork Putah Creek flow

6. \( Q_{CD} = Q_{GCD} + Q_{MISDV} - Q_{PREC} \)

7. \( Q_{EXPORTS} = Q_{CVP} + Q_{CCC} + Q_{SWP} + Q_{NBAQ} \)

8. \( \text{EXPIN} = (Q_{CVP}+Q_{SWP}-Q_{BID})/Q_{TOT} \)

9. \( Q_{WEST} = Q_{SJR} + Q_{CSMR} + Q_{MOKE} + Q_{MISC} + Q_{XGEO} - Q_{EXPORTS} - 0.65 (Q_{GCD} - Q_{PREC}) \)

10. \( Q_{RI} = Q_{SAC} + Q_{YOLO} - Q_{XGEO} - 0.28 (Q_{GCD} - Q_{PREC}) \)

11. \( Q_{DIVER} = ((Q_{TOT} - Q_{OUT}) / Q_{TOT}) \times 100 \)

12. \( Q_{DIVER} = ((Q_{CD} + Q_{EXPORTS}) / Q_{TOT}) \times 100 \)

13. \( Q_{EFFECT} = Q_{TOT} - Q_{SJ4SD} \)

14. If \( Q_{SJR} \leq [Q_{EXPORTS} + 0.42 (Q_{CD})] \), then \( Q_{SJ4SD} = Q_{SJR} \)
    If \( Q_{SJR} > [Q_{EXPORTS} + 0.42 (Q_{CD})] \) and \( Q_{SJR} > [0.65 (Q_{SJR}) + 0.15 (Q_{CD})] \), then \( Q_{SJ4SD} = [0.65 (Q_{SJR}) + 0.15 (Q_{CD})] \)
    If \( Q_{SJR} > [Q_{EXPORTS} + 0.42 (Q_{CD})] \) and \( Q_{SJR} < [0.65 (Q_{SJR}) + 0.15 (Q_{CD})] \), then \( Q_{SJ4SD} = [Q_{EXPORTS} + 0.42 (Q_{CD})] \)

15. \( Q_{EFFECT} = Q_{TOT} - Q_{SJ4SD} \)

16. \( Q_{XGEO} = \) Delta Cross Channel Flow + Georgiana Slough Flow OR if missing data:

    Both gates closed; flow only through Georgiana Slough
    \( Q_{XGEO} = 0.133 (Q_{SAC}) + 829 \)

    One gate open plus flow through Georgiana Slough
    \( Q_{XGEO} = 0.216 (Q_{SAC}) + 2660 \)

    Both gates open plus flow through Georgiana Slough
    \( Q_{XGEO} = 0.293 (Q_{SAC}) + 2090 \)

17. \( X_2(t) = 10.16 + 0.945X_2(t-1) - 1.487\log(Q_{OUT}(t)) \)
**Table 1**
Definition of Quantities Used to Determine Parameter QEFFECT

<table>
<thead>
<tr>
<th>Quantity</th>
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<td>0.42 (QCD)</td>
<td>It is assumed that about 42 percent of Deltawide net channel depletions occur in the southern Delta.*</td>
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<tr>
<td>0.65 (QSJR)</td>
<td>It is assumed that 65 percent of the San Joaquin River flow splits into Old River (just upstream of Mossdale) and toward CVP and SWP export sites during certain hydrologic conditions.**</td>
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<tr>
<td>0.15 (QCD)</td>
<td>It is assumed that 15 percent of Deltawide net channel depletions occur along the San Joaquin River from the Old River split to the central Delta.*</td>
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<tr>
<td>QEXPORTS + 0.42 (QCD)</td>
<td>Total amount of water either exported from or used in the southern Delta.</td>
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<tr>
<td>0.65 (QSJR) + 0.15 (QCD)</td>
<td>The amount of San Joaquin River water (1) flowing into Old River, and (2) diverted for use along the San Joaquin River from the Old River split to the central Delta.</td>
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### Table 2
**INPUT DATA DOCUMENTATION**

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See Table 1 for DAYFLOW parameter definitions

1/- See Table 1 for DAYFLOW parameter definitions

2/-
CD - Central District, DWR; computer printout or data forms.
O&M - Operations and Maintenance, DWR, Dispatcher's Daily Report; computer printout.
USBR - U. S. Bureau of Reclamation, Sacramento, CA; data acquired from O&M.
NWS - U. S. National Weather Service; data acquired from CD.

3/- See DWR Bulletin 230-81 (December 1981) for details; refer to Figure 3 for locations.

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Representative station:
Delta = 738,000 acres (10/55-9/80)
Delta = 682,230 acres (10/80-9/84)
Table 3
DELTA – WIDE GROSS CHANNEL DEPLETION ESTIMATES
MEAN DAILY VALUES IN CFS
FROM DAYFLOR DATA SUMMARY
DEVELOPED IN 1965 – USED FOR ALL YEARS
CALIFORNIA DEPARTMENT OF WATER RESOURCES
CENTRAL DISTRICT

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Table 4
MISCELLANEOUS DIVERSIONS
MEAN DAILY VALUES IN CFS
FROM DAYFLOR DATA SUMMARY
PROGRAM VERSION: JAN. 1985 RUN DATE: FEB. 1985
CALIFORNIA DEPARTMENT OF WATER RESOURCES
CENTRAL DISTRICT

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Source:
Table 6: Dayflow Input DSS Pathnames

The following is a table of DSS pathname parts used as input to the Dayflow program. It is not necessary for the pathname parts to be spelled exactly as they appear in this table, however, it helps to be consistent. The Dayflow Input Abbreviations, must be spelled exactly as they appear in the table because they are hard coded into the Dayflow program. The preferred source of data is the IEP database. The A part for all data taken from the IEP database should include the word “HIST”. If the A part begins with “RLTM”, the data should not be used for Dayflow. If the B part listed in the table below is an RKI value, the data should be available in the IEP database. If the B part is another format, such as “YOLOWOOD”, the data are not available in the IEP database and will have to be processed separately and added to your DSS input file. F parts may vary; you do not necessarily have to use the F part listed in the table.

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Data Provider Information

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Dayflow input station maps
**Dayflow Input Stations***

(1997 – present)

*river flows, exports, and precipitation

- ▲ exports/diversions
- ◆ inflows

**PRIOR DAYFLOW INPUT STATIONS 1985-1996**
Figure 2: Delta Hydraulic Scheme used in Dayflow
Figure 3: Streamflow and Precipitation Stations used for Dayflow Input Data
Streamflow and Precipitation Stations used for DAYFLOW Input Data
1985-1996
Figure 4: Relationship between flows in Georgiana Slough, Delta Cross Channel and Sacramento River April 1978
Figure 5: Hydrologic Data For The Sacramento – San Joaquin Estuary Dayflow Program Summary

### Table: Hydrologic Data for the Sacramento-San Joaquin Estuary (CFS)

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