The Flash Flood Guidance (FFG) system accesses parametric information from NWSRFS OFS during routine execution. In the menu for the FFGUID program the Setup selection is used to define parametric information needed by FFGUID to compute (Computation selection) and store flash flood guidance values in the database (Figure 1). In the menu for the PRODGEN program the Setup selection is used to define parametric information needed by PRODGEN to assemble FFG messages from FFG values stored in the database.

Internal Storage Requirements

The flash flood initialization program FFINIT requires significant internal storage for the three (optional five) threshold runoff grid arrays. Each array will hold gridded threshold runoff values for a specified duration of rainfall. The grid is the RFC subset of the national HRAP grid. (Reference Design Specs for the NEXRAD Gridded Precipitation Preprocessor Function - 02/12/90.)

The flash flood execution program FFEXEC uses the three (optional five) threshold runoff grid arrays described above plus three (optional five) output arrays. Each output array holds gridded flash flood guidance for a specified duration of rainfall. The grid is the RFC subset of the national HRAP grid.

Parametric Data Requirements

The associated data bases for the workstation are described in this section.

1. Each combination of location identifer and data type code forms a unique filename.

2. If not found, a new filename is created when defining parameters. An existing file is updated if the filename is found.

3. Capability to define data type GRID for gridded threshold runoff values. The input for gridded threshold runoff definition is specified in Section VI.3.6A-SETUP-GRID. The contents of the parametric data base data type GRRO is specified in Section VI.3.6C-INFILE-GRID.

4. Capability to define data type INOB for intensity and for adjusting threshold runoff values for slightly over bankfull. The input for the intensity and overbank factor is specified in Section VI.3.6A-SETUP-INTEN. The contents of the parametric data base data type INOB is specified in Section VI.3.6C-INFILE-INTEN.

5. Capability to define data type HFFG for headwaters. The input for headwater definition is specified in Section VI.3.6A-SETUP-HEAD. The contents of the parametric data base data type HFFG is specified in Section VI.3.6C-INFILE-HEAD.

6. Capability to define data type AFFG for areal locations used to compute county and urban FFG. The input for areal FFG definition is specified in Section VI.3.6A-SETUP-AREA. The contents of the parametric data base data type AFFG is specified in Section VI.3.6C-INFILE-AREA.

Time Series Requirements

Forecast flow time series may be used to adjust FFG for current flow. No

changes are necessary to use the time series. The forecast flow time series must be defined in OFS if FFG is to be adjusted.

Coding Specifications

Program required: (1) Setup function in program FFGUID to define and redefine parametric information used in computing FFG values and (2) Compute function in program FFGUID to compute FFG values.

Compute Function

The computational sequence for the FFGUID program will be as follows:

1. Select 'Grid' to compute gridded FFG (Figure 2).

   a. Fill the three (optional five) threshold runoff grid arrays from the three (five) files. An array for each duration.

   b. Get FFG record which includes the BASN identifier and rainfall-runoff curve from the PPPDB using subroutine RPPREC.

   c. Cycle through each grid point in BASN:

      - Get threshold runoff from appropriate array
      - (Option) adjust threshold runoff for high base flow as percent of bankfull flow (SHEF message from WFOs)
      - (Option) adjust threshold runoff for intensity, as needed
      - Compute FFG using the threshold runoff and linear interpolation in the rainfall-runoff curve. (The algorithm is shown in item 5 of Section 9.3-EX32.)
      - Store FFG in output grid array

   d. Repeat steps b and c for each duration.

   e. Write the three (optional five) output grid FFG arrays to the AWIPS DBMS.

2. Select 'Area' using data type code AFFG to compute areal guidance (Figure 3).

   a. Go through each grid point in area referenced by AFFG and compute sum of FFG and number of points with non-missing values from the gridded FFG array.

   b. Compute areal FFG = sum FFG / number of points.

   c. Repeat steps a to b for each duration.

   d. Store areal FFG for each duration in AFFG record.

   e. Repeat steps a to d for each AFFG record.

   f. Write the area name and FFG for each duration to the AWIPS DBMS.

3. Select 'Headwater' using data type code HFFG to compute headwater guidance (Figure 4).

   a. If option selected, get specified forecast flow time series based on

time series ID, data type code and time interval. Use subroutine RPRD to read time series from the Processed Data Base. Subroutine RPRDH is needed for the time series header to determine time of the contents. If the forecast flow option is not selected, go to step c.

b. For each duration determine the forecast flow at the time equal to time to peak after LSTCMPDY. If the time to peak is not a multiple of the time series interval, interpolate between the closest time series values.

c. Compute the threshold runoff for each duration using the forecast flows from step b (if option selected).

$$\text{threshold runoff} = \frac{\text{(flood flow - forecast flow)}}{\text{unitgraph peak}}$$

If the flood flow (flow at flood stage) is zero, then the values in the unitgraph peak fields are the threshold runoffs. This step is skipped.

d. (Option) adjust threshold runoff for intensity, as needed.

e. Read FFG record from PPPDB using subroutine RPPREC for the rainfall-runoff curve.

f. Using linear interpolation and the threshold runoffs, compute FFG from the appropriate rainfall-runoff relation for each desired duration. (The algorithm is shown in item 5 of Section IX.3-EX32.)

g. Apply the weight to the FFG values calculated in step e.

h. Apply weight to accounting model and snow model (if used) state variables.

i. Repeat steps e, f and g for each basin listed.

j. Store FFG for each duration, accounting model operation type, snow model operation type and their state variables in the HFFG record.

k. Write the headwater identifier, name, stream name, FFG for each duration, accounting model operation type, snow model operation type and the weighted state variables to the AWIPS DBMS.

Setup Function

The Setup sequence for the FFGUID program will be as follows:

Select 'Grid' to define and redefine the gridded threshold runoff values (data type GRID). The sequence for 'GRID' is show in Figure 5 and is described as follows:

1. Define the southwest corner of the RFC subset of the national HRAP grid by providing (1) the western most column, (2) number of columns, (3) the southern most row and (4) the number of rows.

2. The threshold runoff software will provide lat, lon (or perhaps row, column), time of duration and threshold runoff for each HRAP grid. These parameters may be in more than one ASCII file and input at different times.

3. Convert lat and lon at threshold runoff grid locations to RFC subset of national HRAP grid.

4. Store gridded threshold runoff in appropriate array depending on time of duration.

5. Repeat steps 2 to 4 for all ASCII files from the threshold runoff software. Only those grid points containing threshold runoff values in the ASCII file would be changed.

6. Write the three threshold runoff grid arrays to three files. Optional fourth and fifth file.

Select 'Intensity & overbank' to define and redefine intensity and overbank factors by basin boundaries (data type INOB). The sequence for 'INOB' is shown in Figure 6 and is described as follows:

1. Define intensity, overbank factor and basin boundary identifier for each basin boundary.

2. Store basin boundary identifier, intensity and overbank factors in a single array.

3. Write the array to a file.

Select 'Headwater' to define and redefine parameters for headwaters (data type HFFG). The sequence for 'HFFG' is shown in Figure 7 and is described as follows:

1. Define HFFG parametric data base record that covers the basin and the weight(s) to be applied to each.

2. Unitgraph peak for each duration.

3. Unitgraph peak times for each duration.

4. Flood flow (or get at execution time from rating curve file by specifying rating curve identifier).

5. Time series ID and type from PDB.

Select 'Area' to define and redefine parameters for counties and urban area (data type AFFG). The sequence for 'AFFG' is shown in Figure 8 and is described as follows:

1. Start with an area boundary for a zone, county, or urban area defined in the basin boundary file; or

1a. Start with a box defined by the lat and lon of the centroid of the area of interest along with 1/2 the width of the box in both lat and lon directions.

2. Write area identifier, boundary identifier (default same as area identifier), lat and lon of centroid, 1/2 width lat, 1/2 width lon and impervious area to a type AFFG record. Additional space is required in the type AFFG record to store the the three FFG values for the three durations.

3. Repeat steps 1 and 2 for other zones, counties and urban areas.

Figure 1. Relationship Between NWSRFS OFS and NWSFFGS

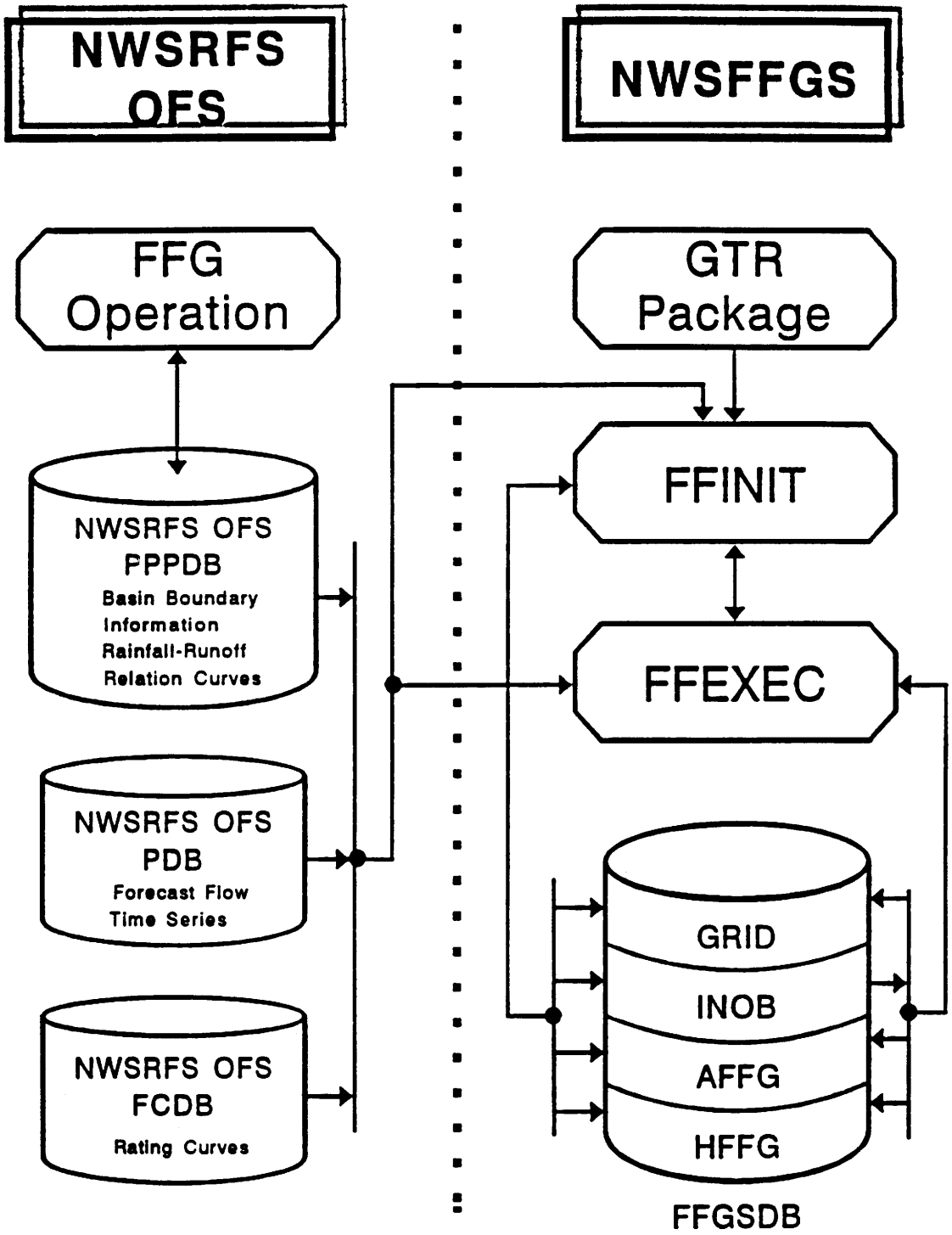

Figure 2. Computing Gridded Flash Flood Guidance in FFGUID

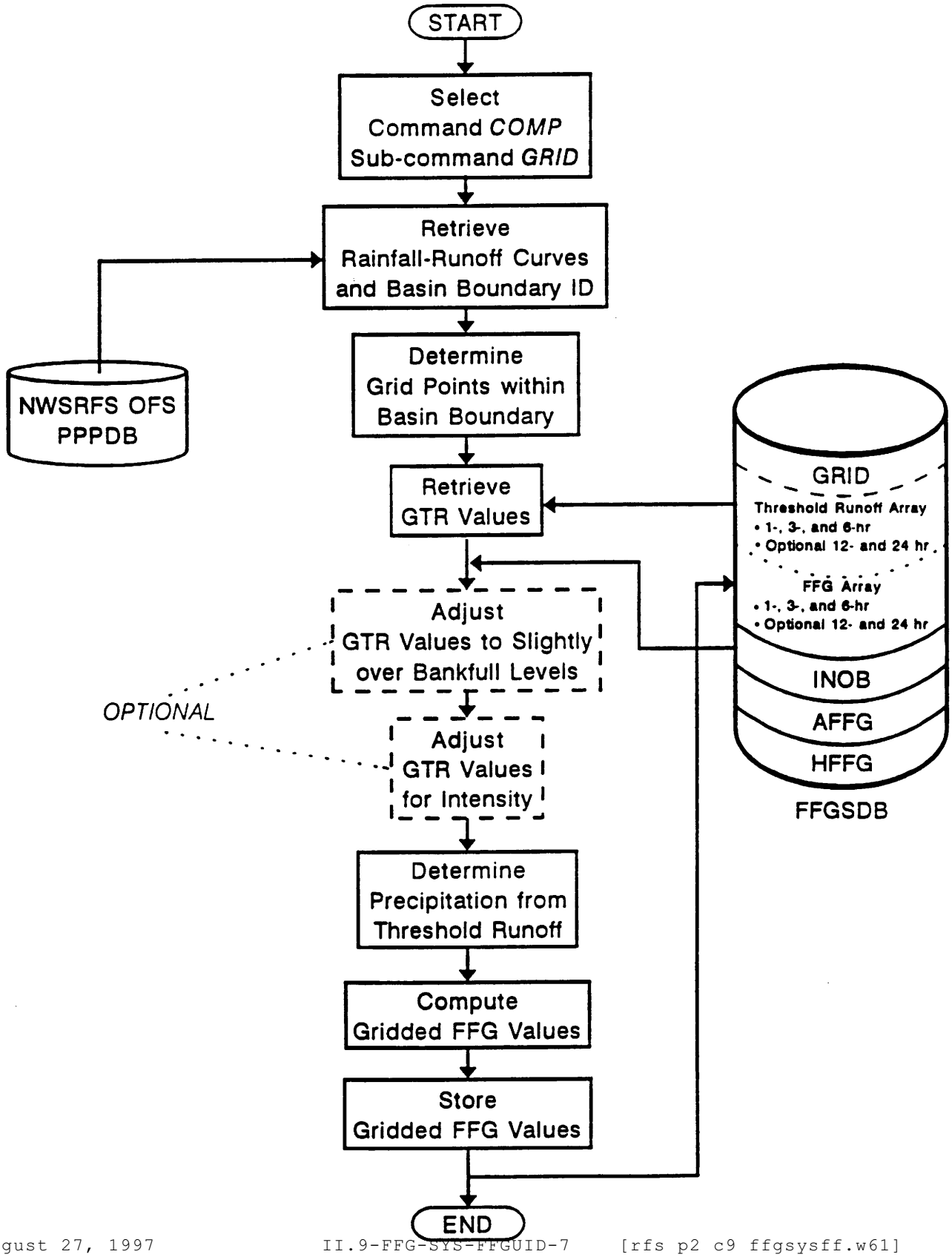

Figure 3. Computing Areal (Zone, County, Urban) Flash Flood Guidance Based on Precomputed Gridded Guidance in FFGUID

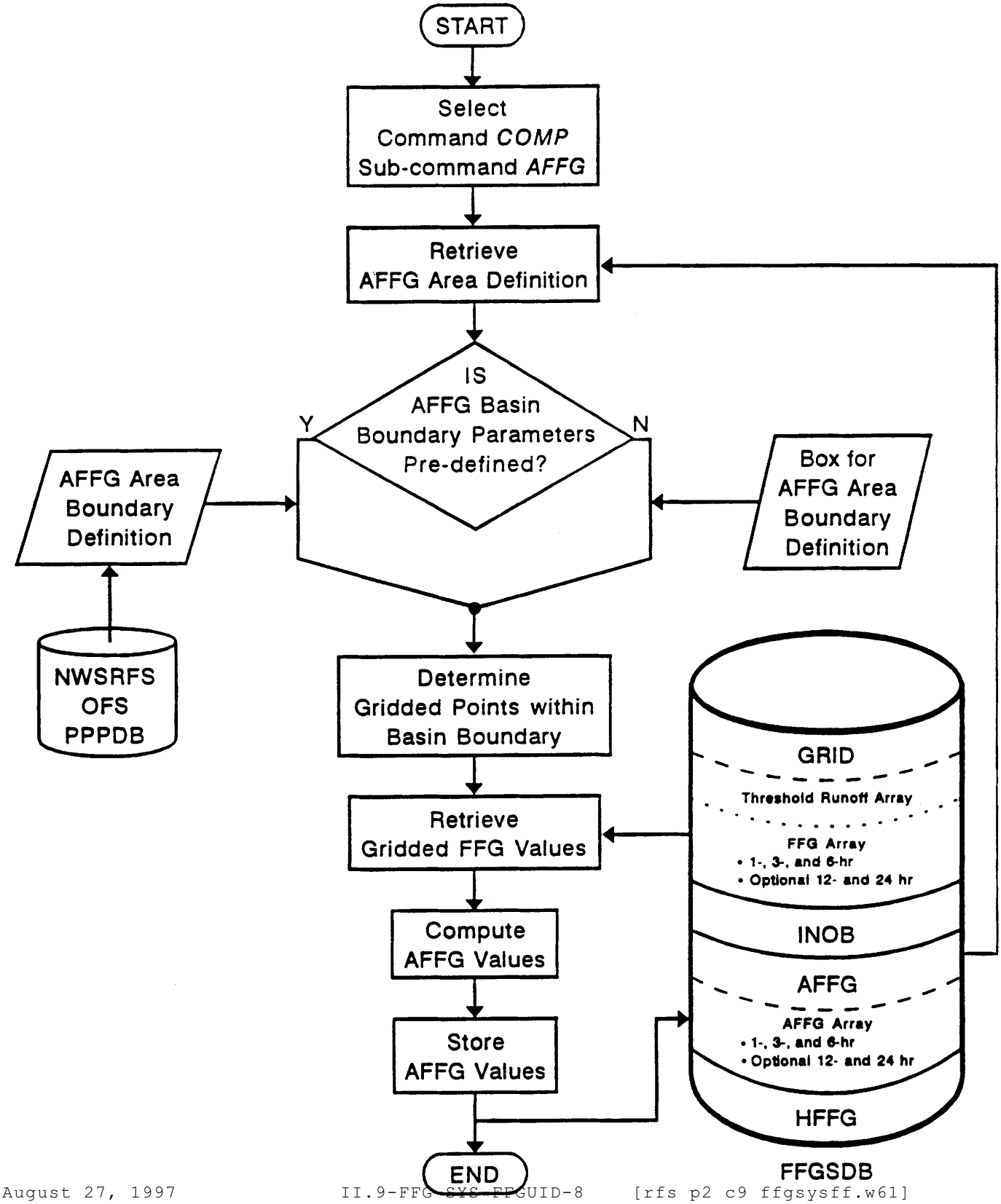

Figure 4. Computing Headwater Guidance in FFGUID

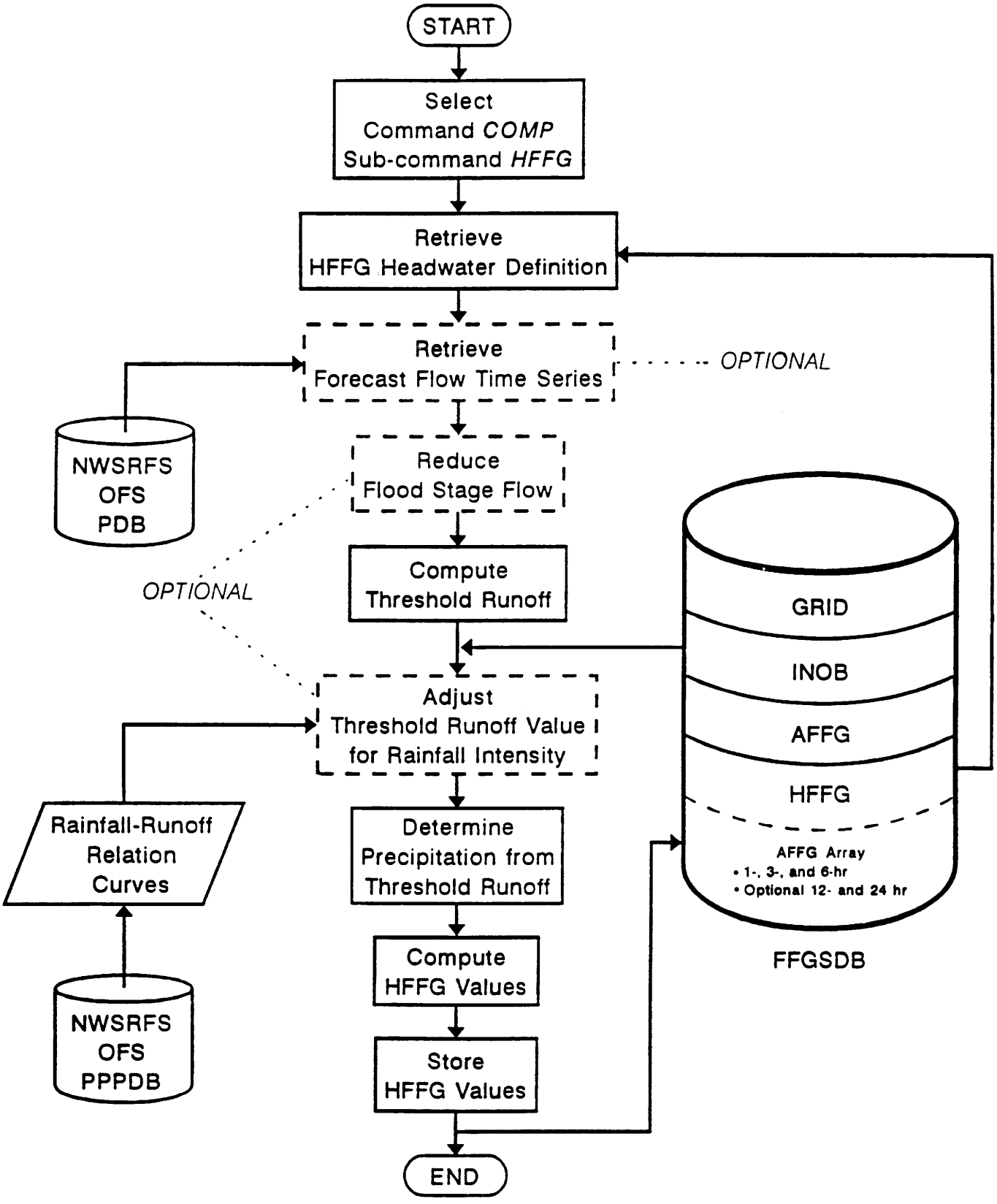

Figure 5. Defining Gridded Threshold Runoff in FFGUID

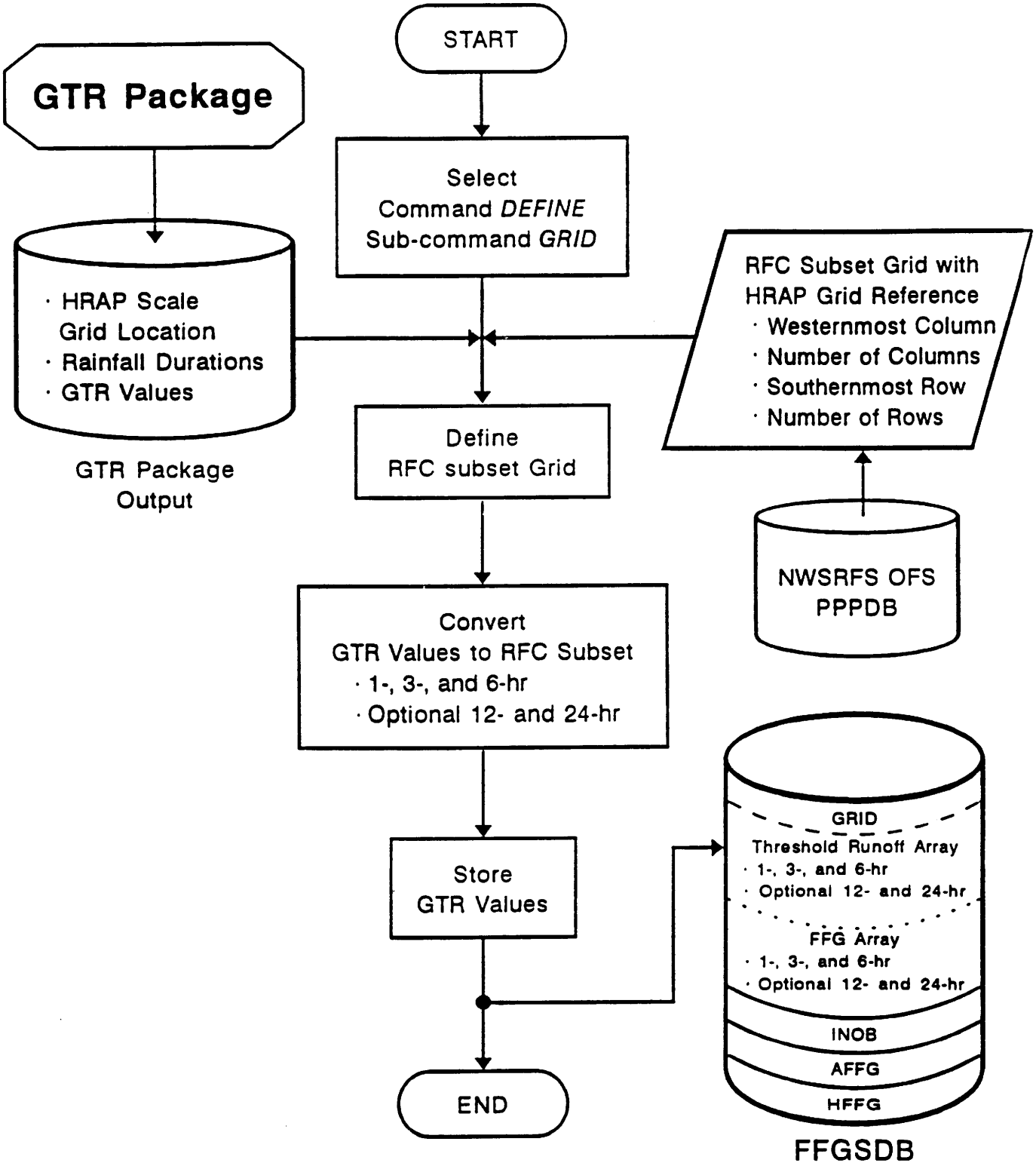

Figure 6. Defining Intensity and Overbank Factors in FFGUID

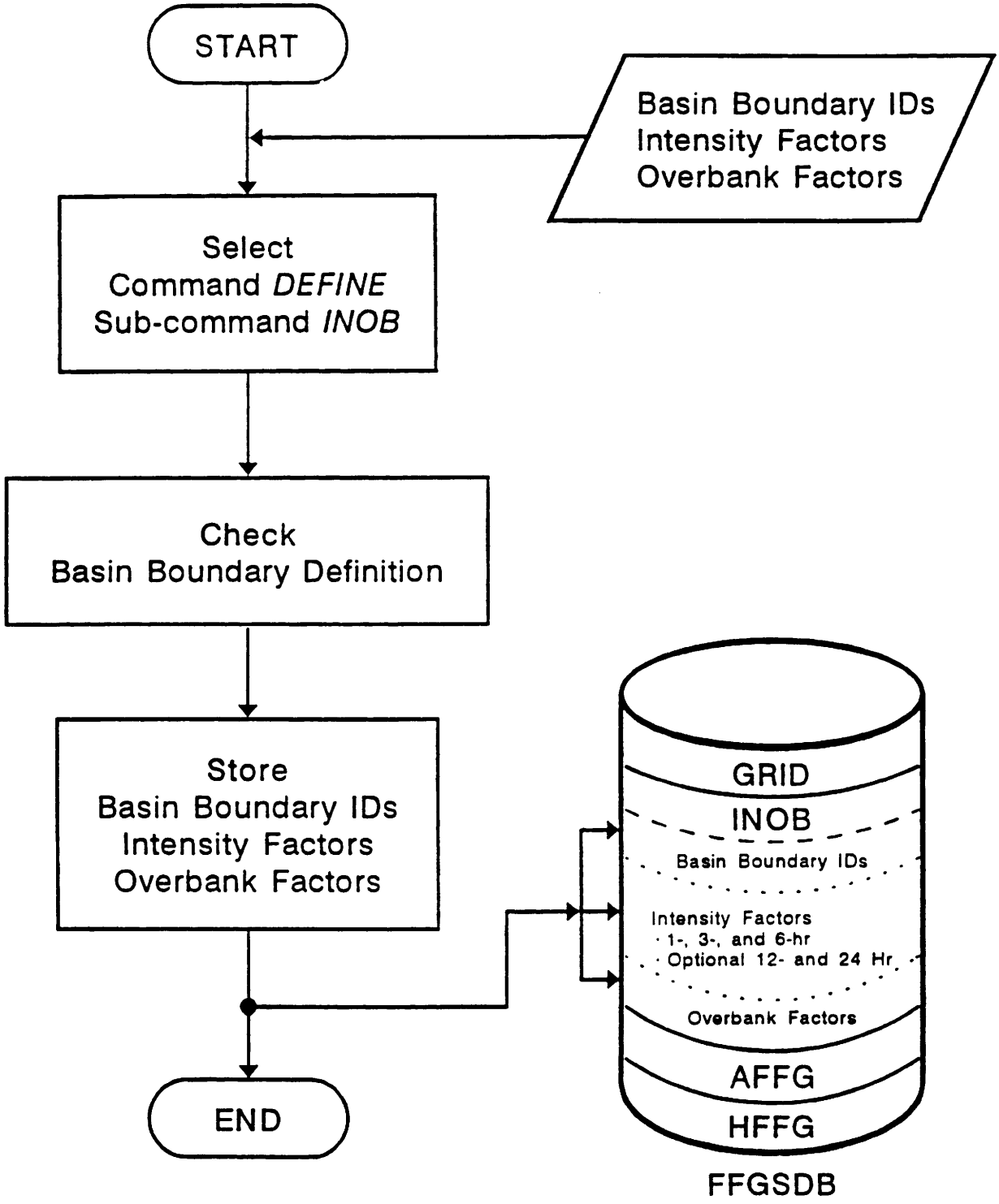

Figure 7. Defining Headwater Guidance Parameters in FFGUID

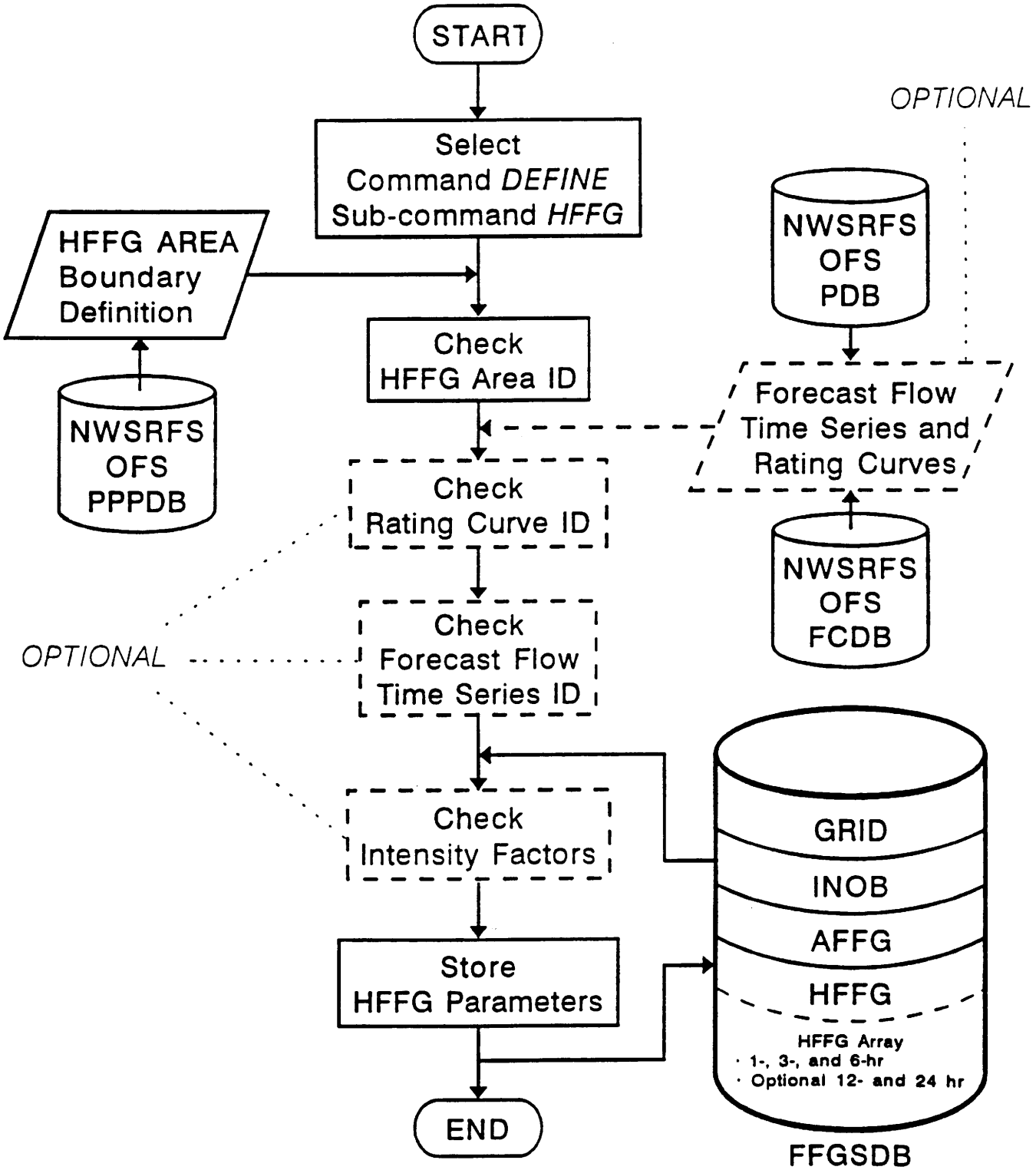

Figure 8. Defining Area Guidance Parameters in FFGUID