Chapter 5

Drainage Map and Bridge Hydraulic Recommendation Sheet

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5.1 Drainage Map

Drainage maps are required for all projects that add mainline capacity or changes to the drainage hydraulics. Maps may be developed using a photographic (aerial or other) base map and included in the construction plans.

Preformatted drainage map sheet cells are located in the FDOT CADD Software. The upper (grid) portion of each sheet is used for plotting the project profile. The standard grid pattern for the profile portion of the sheet is five lines per inch, both in the horizontal and vertical. This will accommodate most scales. An optional grid with four lines per inch is available. This optional grid may be used if appropriate for scale.

Locate the topography of the project area in the remaining portion of the sheet. Utilize a horizontal and vertical scale of the profile so that the stations and elevations can be read directly from the grid without the use of a scale. Use the same horizontal scale for both the plan and profile views. Recommended scales for facility types are as follows:

Type of Facility	Horizontal Scale	Vertical Scale
Interstate Urban	1" = 500'	1" = 5'/1"=10'
Interstate & Other Rural	1"=1000'/2000'	1" = 10'/1"=20'
Municipal & Other	1"=200'/500'	1"= 5'/1" =10'

5.1.1 Plan View

The plan view must comply with the following requirements:

1. Show stationing every 500 feet for scales of 1" = 100'/200', every 1000 feet for a scale of 1" = 500' and every 5000 feet for scales of 1" = 1000'/2000'. For additional information see ***Figure 10.1*** in ***Chapter 10*** of this volume.

   Show horizontal alignment station equations and exceptions. Also show begin and end stations of project, construction, bridge, and bridge culverts.

2. Clearly label existing physical land features affecting drainage, such as lakes, streams, and swamps, by name and direction of flow. Show past high water elevations with date of occurrence, if available, and present water elevations with date of reading.

   Where applicable, show drainage divides and other information (such as pop-off elevations and spot elevations) to indicate the overland flow of water. Show drainage areas on maps in acres.

   Use inserts to show areas that are of such magnitude that the boundaries cannot be plotted at the selected scale.

3. Label existing road numbers and street names, drainage structures with type, size, flow line elevations, flow arrows and any other pertinent data. Refer to the FDOT CADD Software and the ***Design Standards***, ***Index No. 002*** for correct symbols for existing drainage facilities. In a situation of limited space, all data relating to existing drainage structures and pipes may be compiled in a table format and shown in either the plan or profile portion of the sheet. Should the space limitations be such that a table will not fit within the plan or profile view, a supplemental drainage data sheet is acceptable.

4. Show proposed drainage structures, cross drains, storm drain pipes, outfall structures and retention/detention pond locations. Label cross drains by pipe size and structure number. Label structures by structure number, storm drain pipes by pipe size, and ponds by pond number and area size. Show arrows to indicate direction of flow along proposed ditches.

5. Label Section, Township, Range, and county lines for rural and urban projects when occurring within the project limits.

6. Include a north arrow and scale, preferably in the upper right corner of the plan view.

7. If the drainage map is to be included in the contract plans set, include the following note:

   DO NOT USE THE INFORMATION ON THIS SHEET FOR CONSTRUCTION PURPOSES. This sheet is in the plans for documentation and to assist construction personnel with drainage concerns.

5.1.2 Profile View

The profile view, if shown, must comply with the following requirements:

1. The recommended vertical scale for rural and urban projects is 1" = 5' in level terrain and 1" = 10' in rolling terrain. A scale of 1" = 20' may sometimes be used for rural projects through rough terrain to avoid numerous profile breaks. The profile can be broken for rolling terrain in urban areas. However, a scale of 1" = 20' should never be used at locations of proposed storm drain systems.
2. Station numbers are to be shown along the bottom edge of the profile view.
3. Show elevation datum at each side of the sheet. In cases where the profile block is insufficient and excess space is available on the plan portion of the sheet, the profile block may be expanded.
4. Plot and label the profile of the existing natural ground, and note the existing elevation at each end, just above the station numbers.
5. Plot the proposed profile grade line. Percent of grade need not be shown. Plot the PC, PI, and PT of vertical curves using their respective standard symbols; however, no data (station, elevation, length of curve) needs be noted. Label begin and end project, construction, bridge and bridge culvert stations, station equations, and exceptions. Show profile grade line elevations at begin and end project stations and at the beginning and end of each additional drainage sheet.
6. Plot proposed cross drains and identify by structure number. Do not show skew or pipe slope in plotting, but plot to elevation and location at point of crossing the construction centerline.
7. For projects with storm drain systems, show only the mainline structure and pipes. Laterals need not be shown. Label each structure with its appropriate structure number, and flow line elevations noted for the incoming and outgoing pipes.
8. Show all high water elevations affecting base clearance or roadway grades.

5.1.3 Flood Data Summary Box

Show flood data on the drainage map, either in the plan or in the profile portion. If the drainage map is not included in the plans, show the flood data on the summary of quantities sheet or on the first plan-profile sheet.

Design, base and overtopping or greatest flood discharge and stage values are required for all cross structures (culverts and bridges), regardless of size, under the following conditions:

1. All new cross structures
2. All cross structures that are being modified, where modifications affect the existing hydraulic calculations.
3. All cross structures that have a history of flooding or other hydraulic problems, even if the structure is not to be modified; or
4. Cross structures that are not being modified but are being impacted by the modification of another cross structure within the same drainage basin.

Place the following note under the Summary of Flood Data table to avoid misuse and possible responsibility for changes in the flood information values over which the FDOT has no control:

> Note: The hydraulic data is shown for informational purposes only, to indicate the flood discharges and water surface elevations which may be anticipated in any given year. This data was generated using highly variable factors determined by a study of the watershed. Many judgments and assumptions are required to establish these factors. The resultant hydraulic data is sensitive to changes, particularly of antecedent conditions, urbanization, channelization and land use. Users of this data are cautioned against the assumption of precision which cannot be attained. Discharges are in cubic feet per second (cfs) and stages are in feet, NAVD 88.
>
> Definitions:
>
> Design Flood: Utilized to assure a standard level of hydraulic performance.
>
> Base Flood: Has a 1% chance of being exceeded in any year (100 yr. frequency).
>
> Overtopping Flood: Causes flow over the highway, over a watershed divide or thru emergency relief structures.
>
> Greatest Flood: The most severe that can be predicted where overtopping is not practicable.

A preformatted summary box with the note and definitions is located in the FDOT CADD Software.

The project drainage engineer must provide the information required to complete the box.

5.1.4 Interchange Drainage Map

If projects include interchanges or rest areas, include a drainage map on a 1" = 200' or 1" = 500' scale. The purpose of this detail is to show the small areas needed to calculate pipe sizes for the tabulation of drainage structures within these special areas. Should major drains pass through one of these areas, include a cross reference note indicating the proper sheet which reflects the drainage area for that through-structure.

5.2 Bridge Hydraulic Recommendation Sheet

When a Bridge Hydraulic Recommendation Sheet (BHRS) is required (see FDOT ***Drainage Manual, Topic No. 625-040-002***), it must be prepared on a preformatted sheet. The cell for this sheet is located in the FDOT CADD Software. The inclusion of this sheet in the contract plans set is required. Place the BHRS in the structures plans for bridges and in the roadway plans for bridge culverts.

Parallel (dual) bridges may be shown on one sheet, although a second sheet should be used, if necessary, to clearly convey the fit of the bridge to the stream bank. When two sheets are used, only the plan and profile information needs to be furnished on the second sheet.

A completed Bridge Hydraulic Recommendation Sheet is shown as ***Exhibit BHD-1***.

5.2.1 Required Information on BHRS

The preformatted BHRS is divided into the four regions listed below. The required information for each region is described in the following sections.

1. Plan View
2. Profile View
3. Location Map and Drainage Area
4. Existing Structures, Hydraulic Design Data and Hydraulic Recommendations

5.2.1.1 Plan View

1. Stationing, scale, and north arrow.
2. Existing topography (i.e., Including existing bridge) and contours (i.e., show elevations). Show sufficient detail in the vicinity of the proposed bridge to depict how the structure will tie to natural ground.
3. Label the name of the water body (i.e., St. Johns River).
4. Arrows showing the direction of the flow.
5. Proposed bridge begin and end station.
6. Limits of riprap.

5.2.1.2 Profile View

1. Stationing and scale.
2. One cross section which most represents the section at the proposed crossing.
3. Road profile for the proposed structure (i.e., stationing and elevation).
4. Proposed bridge with low member, and pier locations.
5. Abutment locations (e.g., toe of slope).
6. Flood elevations. For non-tidal crossings, show the Normal High Water (NHW) and Design Flood elevations. For tidal crossings, show the Mean High Water (MHW) and Design Flood Stage elevations.
7. Present water elevation with month, day and year of survey.
8. Bridge Number. The bridge number should be for the new (proposed) structure.

5.2.1.3 Location Map and Drainage Area

1. A north arrow.
2. The range and township.
3. An arrow showing the project location.
4. A location map similar to that used on the key sheet for most projects. Use an appropriate scale for the map so that the entire drainage area for the proposed structure is shown. (For projects with very large drainage areas, use a scale for the map that clearly shows the project location rather than a scale that shows the entire drainage area).

   Show the drainage area boundaries using a very heavy, broken line, with the area (in acres or square miles) shown within the boundary. The proposed structure location should be shown. Existing structures over the same water body and those structures that affect the hydraulics of the proposed structure should be located and numbered and corresponding existing structure information listed in the appropriate columns.

5.2.1.4 Existing Structures Data, Hydraulic Design Data, and Hydraulic Recommendations

The ***Bridge Hydraulics Handbook*** provides guidance for filling out this section.