



**REQUIRED CONTENT AND FORMAT
FOR
HYDRAULIC REPORTS UTILIZING HEC-RAS OR HEC-2**

The following are minimum requirements for hydraulic analyses utilizing HEC-RAS or HEC-2:

General

1. A narrative report stating the goals, assumptions, and design concepts underlying the drainage system and including, at minimum, the information listed below. Additional information may be required as appropriate depending upon the size and complexity of the project.
2. The report must be signed and stamped by the registered civil engineer who is in responsible charge of preparing the hydraulic study. The report should be labeled “draft” for initial submittals.
3. The report must be organized in a logical manner and a summary of the results and associated impacts resulting from the project must be given in the text portion of the report. Specifications for minimum content are provided below. Typical preferred report format is shown on [Figure 1](#).
4. A vicinity map showing the location of the project area in relationship to well-known features
5. A topographic map of the watershed containing the area being studied and upstream watershed areas. (Maps at a 1 inch to 800 feet scale map are available from the County Department of Public Works)
6. A table indexed to the watershed map which indicates drainage area, soil and cover types, land use, pervious infiltration rates, impervious areas and design flows for both pre-development and post-development conditions.
7. A description of the hydrologic methods used and identification of any extraordinary hydrologic conditions and how they were treated.
 - a) Design criteria tabulation for 10-year and 100-year storm runoff
 - b) Peak discharge computations for pipe sizing
 - c) Peak discharge computations for 100-year runoff
 - d) Assumptions as to upstream storage
8. The study limits must extend sufficiently far downstream to clearly establish the water surface elevation at the downstream end of the project.
9. The study limits must extend a sufficient distance upstream of the project to clearly demonstrate the impacts of the proposed project on the upstream properties. This generally means extending the run upstream to the point where the baseline (or pre-project) and postproject water surfaces are the same.
10. Should a floodway analysis be required, in addition to satisfying all FEMA floodway requirements, the floodway must be established by reducing equal conveyance in each overbank to a point where water surface elevations increase by no more than one foot. Deviations from this method must be discussed with and agreed upon by the District prior to submittal of the floodway analysis.

11. It should be noted that the District does not permit encroachments into the floodplain that adversely impact water surface elevations or velocities on adjacent properties without written permission from the affected property owners. This is in effect even if the encroachment takes place within a floodplain where a regulatory floodway is established, and the encroachment is outside of the regulatory floodway.

Content – Plan Sheets / Construction Drawings

Complete and separate existing and proposed condition plan sheets must be provided. The drawings must include the following:

12. HEC-RAS – Cross sections must be drawn at the proper length and include a layout line coinciding with the channel or floodplain centerline. The layout line shall be labeled with stationing on the plan sheets. The point where the layout line intersects each cross section is to be set to station zero. Cross section transverse stations will be positive to the right of the layout line and negative to the left, looking downstream. HEC-2 – Cross sections must be drawn to the proper length with tic marks placed at the beginning and ending stations. A common beginning station must be used. **REQUIRED CONTENT AND FORMAT FOR HYDRAULIC REPORTS UTILIZING HEC-RAS OR HEC-2**
13. Each cross section must be labeled with the cross section number. The label must be located at the left end of the cross section looking downstream. The right and left “overbank” locations on each cross-section shall be marked on the work map in some consistent fashion, i.e. a circle, square or triangle must be placed on the cross section at each overbank location.
14. The floodplain must be accurately plotted on each plan sheet
15. Areas of ineffective flow must be clearly shown.
16. The underlying topography and contour labels on the work map must be legible.
17. All proposed grading, culverts, bridges, drop structures, access ramps, etc... that impact the floodplain must be shown.
18. Proposed access roads and turnarounds must be shown.
19. Proposed finished grade elevations adjacent to the floodplain must be shown. When proposed conditions grading is shown on/over existing topography, sufficient labeling of grades at top and toe of slopes and flowlines shall be provided to allow the reviewer to reconcile the model cross-sections to the plan sheets

Content - Narrative and Supporting Information

A complete hydraulic study must be provided including:

20. A printout of HEC-RAS or HEC-2 input and output files must be provided. The output files should also include at least one summary table. The report must include a narrative and, if multiple scenarios are modeled, a table explaining the computer modeling runs. If HEC-RAS is used, there are often multiple “Projects” and “Plans” employed. The names and interrelationship of all component input files and output files shall be explained.
21. All proposed grading, culverts, bridges, drop structures, access ramps, etc... that impact the floodplain must be included in the modeling.
22. A CD-ROM with the input and output files shall be included in the report package.
23. A channel centerline profile plot showing thalweg elevation, water surface elevation and critical depth must be provided. The thalweg need not necessarily coincide with the layout line.
24. Cross section plots for all cross sections, plotted at no more than four per each 8½ x 11 sheet must be provided. Each cross section must be labeled with the cross section number and must

show the entire cross section, water surface elevation, and distribution of Manning's "n" values over the cross section. If feasible, it is greatly preferred that the scale of the cross section plots be consistent.

25. A description of the Manning's "n" values used and explanation for why they were chosen must be provided.
26. A description of and a rational explanation for how the upstream and downstream boundary conditions were established must be provided in the report narrative and should be annotated in the hydraulic input file comment fields.
27. Photographs of the existing study reach should be included if it is felt they will assist in conveying information to the reviewer.