

2-4 Hydraulics Report

Thorough hydrologic investigations and hydraulics reports are required for structures in, over, or adjacent to streams and waterways which may affect the design or construction of structures.

The investigations and preparation of reports shall be performed by a Registered Civil Engineer who is competent in hydrologic investigations and studies, and shall conform to the *Bridge Design Specifications*, *Bridge Memo to Designers*, and other applicable Caltrans policies and procedures.

A separate Hydraulic Report shall be prepared for each structure and shall bear the State of California registration seal, license number, expiration date and signature of the Engineer responsible for its preparation. In addition, the report shall include the following basic information:

- District, County, Route, Post-Mile (PM) and Kilometer-Post (KP), and Expenditure Authorization (EA)
- State assigned Bridge Name, Bridge Number, and other pertinent information for the applicable structure
- A brief description of the hydrology
- Constraints or requirements which influence the selection of available alternatives, e.g. roadway geometric needs or driftway requirements
- Location of property at risk and a description of the potential damage
- Calculations to determine velocities, water surface elevations, backwater, and scour depth. A diskette with the data used to run the computer model shall be provided as well as contour mapping depicting cross section locations utilized for the computer model. An executable copy of the software used (with documentation) must be submitted if requested by the OSFP Liaison Engineer.

Generally, two types of hydraulics reports are required during the development of a structure project--a Preliminary Hydraulics Report (PHR) and a Final Hydraulics Report (FHR).

A PHR is required for the development of Advance Planning Studies (APS) at the Project Study Report (PSR) stage or at the Project Report (PR) stage. The PHR shall identify hydrologic factors and parameters that will affect the selection of the structure. The PHR does not necessarily have to be based on a thorough hydrologic study, but the study must be detailed enough so the proper structure layout and type can be identified. The PHR must be submitted for review as part of the APS submittal.



A FHR is required for the initiation of the Structure Type Selection process and the development of the structure General Plan. A draft FHR must be submitted for review four weeks in advance of the Type Selection Meeting date so that major issues affecting the basic layout of the structure are resolved prior to the meeting.

As structure project documents are developed (Contract Plans, Special Provisions, Foundation Report, and Hydraulics Report), it is imperative that the structure Project Engineer, specification engineer, geotechnical professional, hydrology engineer, and hydraulics engineer maintain close communication so these documents address all pertinent factors completely, consistently, and with the Project Engineer's concurrence.

The following parameters shall be used in the design of structures in waterways:

- Design for the flood having a two percent (2%) chance of being exceeded in any given year (designation Q50) or the flood-of-record, the greater of which shall be designated as the design flood.
- Sufficient freeboard shall be provided above the design flood, to pass anticipated drift. Drift evaluation must be performed to determine the horizontal and vertical driftway requirements. However, for PSR or PR planning studies a 0.6-meter minimum freeboard may be assumed.
- Convey the base flood (designation Q100). No freeboard is added to the base flood.
- Bridge foundations shall not fail due to scour from a flood having a one percent (1%) chance of being exceeded in any given year (base flood designation Q100).
- Place the top of pier footings at or below the potential total scour or provide sufficient pile extension or pile shaft embedment depth for the scour conditions, including lateral channel migration. Calculations similar to HEC-18, "Evaluating Scour at Bridge," FHWA may be used. The scour evaluation is an interdisciplinary evaluation consisting of hydraulic, geotechnical, and structural considerations.
- Structures shall convey flows without failure, independent of the use of slope protection, debris racks, energy dissipaters, or other measures to protect the structures.
- Culverts designed as part of the highway design shall conform to highway design requirements. Culverts defined as bridges by National Bridge Inspection Standards (NBIS) are to convey flows as a bridge and will meet the above requirements.

The Project Engineer shall have the responsibility for obtaining relevant hydrologic information required for the Hydrologic Summary Table to be placed on the Foundation Plan sheet of the contract plans. The summary table must include the following parameters:



- Dasin area
- Flood frequency
- Discharge
- Water surface elevations for the design flood, base flood, overtopping flood and flood of record

The following example Hydrologic Summary Table shows the required format:

Hydrologic Summary

Drainage Area: _____ Square Kilometers				
	Design Flood	Base Flood	Overtopping Flood	Flood of Record
Frequency (Years)				
Discharge (Cubic meters per second)				
Water Surface (Elevation at Bridge)				
<i>Flood plain data are based upon information available when the plans were prepared and are shown to meet Federal requirements. The accuracy of said information is not warranted by the State and interested or affected parties should make their own investigation</i>				