EMERGENCY REGULATIONS
Governor's Office of Emergency Services
Text of Regulations

CALIFORNIA CODE OF REGULATIONS
Title 19. Public Safety
Division 2. Office of Emergency Services
Chapter 2. Emergencies and Major Disaster
Subchapter 4. Dam Inundation Mapping Procedures

§2575 Short Title

This Subchapter shall be known and may be cited as the Dam Inundation Mapping Procedures Regulations.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5,Government Code.

§2575.1 Purpose and Scope of Regulations

These regulations are adopted to implement the provisions of Government Code Section 8589.5. These regulations provide the standards for producing and submitting an inundation map, acquiring a waiver from the inundation mapping requirement, and administering the program.

These regulations are not applicable to those structures identified as Debris Basins in Department of Water Resources Division of Safety of Dams Bulletin 17-00 dated July 2000 and incorporated by reference herein.

These regulations are not intended to limit the authority of the Governor's Office of Emergency Services or any appropriate public agency to act under the police power of the state, when necessary to protect life and property from a threatened or actual dam failure.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.

§2575.2 Definitions

For purposes of this Subchapter only, the terms listed below shall have the meanings noted:

(a) "Alteration": Has the same meaning as specified in Section 6006 of the Water Code.

(b) "Appropriate Public Safety Agency": Any city, city and county, county, state, or other public agency organized, existing, and acting pursuant to the law, which is authorized under the law to exercise police power to establish emergency procedures and effect emergency actions within its jurisdiction.

(c) "Breach": A sudden opening through a dam that drains the reservoir. An uncontrolled breach is one that results in an unintentional discharge from the reservoir.

(d) "Breach elevation": The elevation of the water in a reservoir above sea level at the time of the dam failure using the National Geodetic Vertical Datum of 1929 (NGVD) standard (National Oceanic and Atmospheric Administration, National Geodetic Survey).

(e) "Breach time": The modeled time elapsed from initial dam failure to total dam failure.

(f) "Cross-section": A lower elevation point or linear representation on an inundation map where flood measurements are calculated.

(g) "Dam": Has the same meaning as specified in Sections 6002, 6003, and 6004 of the Water Code.

(h) "Dam Owner": The person, agency, jurisdiction or other legal entity responsible for a dam.

(i) "Debris": Soil, rock, and organic matter carried by the floodwaters that emanate from a watershed.

(j) "Debris Basin": A permanent flood control facility that has the primary purpose of separating debris from the floodwaters and storing the debris for future removal.

(k) "Debris Dam": A dam that has the primary purpose of holding back debris captured in, and stored by the debris basin.

(l) "Deflood time": The time elapsed from the initial failure of the dam until the measured location returns to its preflood water elevation prior to the failure.

(m) "Design Flood": The flood magnitude that a dam will be subject to for analysis in a dam failure study. When a federal survey has been authorized, the design probable maximum flood will be determined by the appropriate federal agency.

(n) "Dynamic Routing": Hydraulic flow routing based on the solution of the St.-Venant equation(s) to compute the changes of discharge and stage with respect to time at various locations along a stream. St.-Venant equations are nonlinear hyperbolic partial differential equations. The equations are derived from mass and momentum balances and are given by

$$\frac{\partial A}{\partial t} + \frac{\partial Q}{\partial x} = 0$$

$$\frac{\partial Q}{\partial t} + \left(\frac{gA}{B} - \frac{Q^2}{A^2}\right)\frac{\partial A}{\partial x} + \frac{2Q}{A}\frac{\partial Q}{\partial x} + gA(S_f - \bar{S}) = 0$$

where A is the cross sectional area of the channel, B is the width of the water surface, Q is the flow (discharge), g is the gravity, S_f is the friction slope, and $\bar{S}$ is the mean bed slope. The friction slope is a nonlinear function of the channel geometry. In the above equation it is assumed that the lateral inflow is zero.

(o) "Enlargement": Has the same meaning as specified in Section 6007 of the Water Code.

(p) "Flood": A temporary rise in water surface elevation of one foot or more greater than that existing under pre-dam failure conditions resulting in inundation of areas not normally covered by water as a result of a dam failure.

(q) "Flood Routing": A process of determining progressively the amplitude of a flood wave as it moves past a dam and continues downstream.

(r) "Flood Stage": A flood height at which a watercourse overtops its banks and begins to cause damage to any portion of the defined reach.

(s) "Flood Storage": The retention of water or delay of runoff either by planned operation, as in a reservoir, or by temporary filling of overflow areas, as in the progression of a flood wave through a natural stream channel.

(t) "Floodwave arrival time": The time counted from the failure of the dam until the arrival of the wave front (or leading edge of the flood wave). A flood wave is a minimum of one (1) foot increase in the level of water above the stream flow or natural surface elevation before the dam failure.

(u) "Floodwave maximum elevation": This is the highest flood stage elevation of the floodwaters as it passes a specific location. Floodwave maximum elevation cannot be less than the normal water elevation prior to the dam failure event because a "no flooding" condition exists.

(v) "Freeboard": Vertical distance between a specified stillwater reservoir surface elevation and the top of the dam, without camber.

(w) "Full": For an on stream dam, the maximum elevation of the water in the reservoir during the Inflow Design Flood (IDF); for an off stream dam, the maximum elevation of the water in the reservoir at the dam crest.

(x) "Hydrograph": A graphical representation of the water discharge with respect to time for a particular point on a stream, river or at the point of breach.

(y) "Inflow Design Flood (IDF)": The flood flow above which the incremental increase in downstream water surface elevation due to failure of a dam or other water impounding structure is no longer considered to present an unacceptable additional downstream threat. The upper limit of the IDF is the probable maximum flood.

(z) "Inundation Area": The area downstream of a dam that would be inundated or otherwise affected by the failure of the dam and accompanying large flood flows.

(aa) "Inundation Map": A map, as specified in Government Code 8589.5, showing the area that would be inundated by flooding from an uncontrolled release of a dam's reservoir.

(bb) "Inundation Pathway": The boundary of the floodwaters released by a dam failure.

(cc) "Office": The Governor's Office of Emergency Services.

(dd) “Overtopping”: The mode of dam failure wherein reservoir waters exceed crest elevation and the resultant flow causes failure by dam crest erosion.

(ee) “Peak flow”: The water flow expressed in cubic feet per second (cfs) at the floodwave maximum elevation.

(ff) “Probable Maximum Flood (PMF)”: The flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that is reasonably possible in the drainage basin under study.

(gg) “Probable Maximum Precipitation (PMP)”: Theoretically, the greatest depth of precipitation for a given duration that is physically possible over a given size storm area at a particular geographical location during a certain time of the year.

(hh) “Qmax”: Maximum breach discharge as measured in cubic feet per second (cfs).

(ii) "Reservoir": Has the same meaning as specified in Section 6004.5 of the Water Code.

(jj) “Reservoir Rim”: The boundary of the reservoir including all areas along the valley sides above and below the water surface elevation associated with the routing of the IDF.

(kk) “Reservoir storage elevation curve”: A reservoir capacity graph representing the elevation above mean sea level and acre feet of water.

(ll) “Retention Basin”: A reservoir of variable water storage capacity created by a dam designed to continuously pass flood waters in a controlled manner.

(mm) “Sensitivity Analysis”: An analysis in which the relative importance of one or more of the variables thought to have an influence on the phenomenon under consideration is determined.

(nn) “Stillwater Elevation”: The maximum elevation that a water surface would assume if all wave actions were absent and there were no outflows from nor inflows into the reservoir.

(oo) “Surcharge”: The volume or space in a reservoir between the controlled water retention level and the maximum water level. Flood surcharge cannot be retained in the reservoir but will flow out of the reservoir until the controlled retention water level is reached.

(pp) “Toe of the Dam”: The junction of the downstream slope or face of a dam with the ground surface; also referred to as the downstream toe. The junction of the upstream slope with the ground surface is called the heel or the upstream toe.

(qq) “U.S.G.S. Quad”: A topographical map produced by the United States Geological Survey with a minimum scale of 1:24,000 feet for a specific geographical area.

(rr) "Water storage elevation": Has the same meaning as specified in Sections 6008 of the Water Code.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code; Sections 6002, 6003, 6004 and 6025, Water Code.

§2576 Notification

A dam owner shall be notified by the Governor's Office of Emergency Services (hereinafter "Office") of the requirement for an inundation map as soon as the Office is informed of one of the following:

(a) a "Notice of Application" is filed with The Department of Water Resources, Division of Safety of Dams; or,
(b) a dam is under construction; or,
(c) a dam has been completed; or,
(d) a waiver previously granted by the Office is no longer applicable.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.

§2576.1 Method of Notification

(a) Notices under this subchapter shall be in writing and addressed to the dam owner of record as listed with the Department of Water Resources Division of Safety of Dams.

(b) In the event a dam owner fails to maintain a current address with the Division of Safety of Dams or cannot otherwise be contacted for any purpose of this Subchapter, the Office may make notice in any manner legally reasonable to give notice to the dam owner and such notice shall constitute written notice.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.

§2577 Requirement for Map

(a) Upon notification by the Office, the dam owner shall prepare a map showing the areas of potential flooding in the event of sudden and total failure of any dam.

(b) A technical study shall be prepared to support each dam failure inundation map submitted for approval under these regulations and conform to the requirements of Section 2577.4.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.

§2577.1 Responsibility

Dam owners shall be responsible for:

(a) The acquisition of all hydrologic, orographic, meteorological and topographical data, including development of flood routing information;

(b) The conduct of land surveys or studies to properly delineate the flood plain;

(c) The acquisition or development of any other materials or studies necessary to produce and support a dam failure inundation map;

(d) The preparation and submittal of an inundation map; and,

(e) Correcting and resubmitting an inundation map.

Authority cited: Sections 8567 and 8586 , Government Code.
Reference: Section 8589.5 , Government Code.

§2577.2 Civil Engineering

Except as otherwise provided for in Section 2577.5(e)(3), inundation maps and technical studies which are submitted to the Office shall be prepared by, or under the direction of, a civil engineer who is registered pursuant to California law and authenticated as provided in the Business and Professions Code, Division 3, Chapter 7 commencing with Section 6700.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.

§2577.3 Standard Requirements.

The following are standard requirements for an inundation map:

(a) A map and technical study shall be submitted to the Office 60 days prior to the filling of any dam under construction or enlargement.

(b) An inundation map and technical study shall be submitted to the Office within 180 days of the final approval of these regulations for any existing dam not having an approved inundation map, or for which the dam owner has not applied for a waiver.

(c) A dam owner shall respond to recommendations made by the Office to conform inundation maps to sections 2577.4-2577.5. The response shall be submitted to the Office within 60 days of mailing of such recommendations.

(d) Failure by the dam owner to comply with a request for information from the Office within 60 days and in a reasonably responsive manner shall be cause for the Office to disapprove an inundation map.

(e) An inundation map submittal will be considered complete when the Office has received two (2) copies of the completed technical study and map incorporating the recommendations by the Office.

(f) The Office, for good cause, may extend any time requirement. The Office may additionally forgo any information required for a complete inundation map submittal, including but not limited to the requirements of sections 2577.4 –2577.5 where the Office determines that it has sufficient information to commence and complete a review, and that all requirements for issuance of an approval will be met and substantial accuracy will not be compromised by such action.

(g) Each dam must have its own individual technical study. A technical study may only address multiple dams if it is a situation where it is probable that the failure of one dam will cause the failure of one or more dams downstream.

(h) The owner of a dam shall submit final copies of inundation maps to the Office within 60 days of notification by the Office that the technical study and map are approved.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.

§2577.4 Content of Technical Study

Each technical study submitted in support of an inundation map shall:

(a) Identify the hydrologic, orographic, meteorological and topographical data affecting the dam site, downstream areas and floodwater routing. The technical study shall present a narrative synopsis of this information.

(b) Describe the identifying and engineering character of the dam, including but not limited to:

(1) Type of construction (e.g., earth fill, rock fill, concrete arch, concrete gravity, hydraulic fill)

(2) Statistical information:
- (A) Name of dam / DWR Number
- (B) Location of Dam (including County)
- (C) Elevations using National Geodetic Vertical Datum (NGVD) of:
  1. Downstream toe of dam
  2. Design water storage pool elevation

3. Maximum flood surcharge elevation
4. Spillway crest elevation
5. Crest of dam elevation

(3) Capacity in acre-feet at normal water storage pool elevation
(4) Surface area in acres at normal water storage pool elevation
(5) Capacity in acre-feet at maximum flood surcharge
(6) Surface area in acres at maximum flood surcharge
(7) Capacity in acre-feet at emergency or open spillway crest
(8) Surface area in acres at emergency or open spillway crest
(9) Capacity in acre-feet at maximum impound or diverting elevation (crest of dam)
(10) Surface area in acres at maximum impound or diverting elevation (crest of dam)
(11) Height of dam measured from downstream toe to the crest
(12) Jurisdictions (cities, towns, county area) which could be affected by a dam failure

(c) Include the following graphical representations:

(1) The flood hydrograph at the dam site and, where feasible, at each downstream cross section location
(2) A reservoir storage elevation curve
(3) Cross section plots of all the cross sections including bank locations
(4) The dam break hydrographs routed to each cross section should specify the flood arrival time, flooding time, flood-wave maximum elevation, peak time and deflood time

(d) Use worst case breaching parameters based on National Weather Service breaching guidance, (Fread, D.L. (1988). The NWS DAMBRK model: Theoretical background and user documentation, HRL-258, Hydrological Research Laboratory, National Weather Service, Silver Spring, Maryland 20910), and incorporated by reference herein.

(e) Employ dynamic flood models where routing is a factor or may use hydrological models where routing is not a factor.

(f) Identify the modeling methodology and the reasons for its use, and the name and author of the modeling software. The technical study shall also include the input and output data files.

(g) Identify the downstream hazard potential. The hazard potential is the adverse impacts in the area downstream of a dam by the effect of floodwaters released by partial or complete failure of the dam.

NOTE: Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.

§2577.5 Content of Map

Each map prepared shall be based on the results of the technical study conducted pursuant to Section 2577.4. Each map or map set submitted shall:

(a) (1) Be a black line reproduction measuring 24 inches by 30 inches for the review copies and two reproducible copies measuring 24 inches by 30 inches for the final approved copy.

(2) Alternatively, a map may be submitted in an electronic or machine-readable format which, after consultation with and approval by the Office, is consistent with the intent of this section and meets the specifications thereof.

(b) (1) Be based on a U.S.G.S. quadrangle topographical map with a minimum scale of 1:24,000 (1 inch equals 2,000 feet).

(2) A larger scale may be used if the inundation area can be reasonably presented on a 24 inch by 30 inch map sheet and sufficient identifiable geographic identification points exist to reference the area in scale to other geographical points.

(c) Delineate the lateral boundary and termination of the inundation area. The boundary is terminated where floodwaters become less than one (1) foot above the elevation existing before the dam failure and the water velocity is less than 8.8 feet per second. Alternatively, the boundary at which the inundation area may be terminated may be into an existing body of water or channel, provided the dam breach flood discharge does not increase the water elevation by greater than one (1) foot above the flood stage that would have occurred under non-breach conditions or cause additional downstream cumulative impacts.

(d) Contain cross-sections located along the floodway at appropriate intervals indicating the following information:

(1) Sequential cross section number,
(2) Distance from dam,
(3) Flood-wave arrival time,
(4) Flood-wave maximum elevation,
(5) Deflood time and,
(6) Peak flow.

(e) Have an information block at the bottom of each map page and segmented to contain the following information:

(1) A block allowing the notation of revisions, the person and date the revision was performed and the person and date of acceptance of the revision of the map,
(2) A block containing the owner's name, address, telephone number and the date of preparation of the map,
(3) A block containing the name of the civil engineer, the engineering firm, address and telephone number. A portion of this block will be reserved for the signature, seal and Registered Civil Engineer number of the approving individual upon final approval of the map. Alternately, an authorized governmental agency pursuant to section 2577.2 may state the agency name, address and telephone number in lieu of engineer information and seal and,

(4) A block containing the name of the dam, the Department of Water Resources jurisdictional dam number and sheet number in the set stated as "Sheet __ of ___." The lower portion of this block will indicate the name of the county in which the dam is located.

(f) Contain an inset block on the face of the map depicting therein:

(1) An arrow indicating north,
(2) A scale segmented to show the 6,000 foot distance, the 4,000 foot distance, the 1,000 foot distance and the 500 foot distance, as applicable,
(3) A vicinity map of jurisdiction affected by the inundation area,
(4) The name of the U.S.G.S. quadrangle(s),
(5) The identity of any jurisdictions affected by the inundation area,
(6) An index showing the relationship of the map sheet to the other map sheets if the map is greater than one sheet and,
(7) Other explanatory information as may be warranted.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.

§2577.6 Enlargement of Dams

(a) When the Division of Safety of Dams provides notice to the Office of the enlargement of a dam or reservoir, the Office shall provide written notice to the dam owner of the requirements of this section.

(b) The dam owner shall provide an analysis to the Office within 90 days after receipt of notice from the Office. The analysis will address changes to the inundation area caused by the enlargement of the dam or reservoir and evaluate the applicability of the existing inundation map.

(c) Information required of the dam owner pursuant to this section shall be provided in sufficient clarity and detail to be readily interpreted and studied, and to permit an evaluation of the effect(s) of the proposed changes.

(d) The Office may require the submittal of any information, in addition to that specified in this section, that the Office considers necessary to determine the effects of the enlarged dam or reservoir on the existing inundation boundary.

(e) The need for a new inundation map shall be evaluated by the Office using the criteria identified in sections §2577.4 and §2577.5 (c) and the analysis submitted in (b) above.

(f) If the Office determines that a new inundation map is required, this Subchapter shall apply.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.

§2577.7 Notice of Noncompliance

(a) When the dam owner fails to provide the inundation map as requested by the Office or fails to secure a waiver from the inundation mapping requirement within the times prescribed in this Subchapter, the Office shall notify the dam owner in writing that the dam owner is in noncompliance with the provisions of this Subchapter.

(b) Approval of an inundation map may be revoked when the inundation map no longer meets the requirements of section 2577.4-2577.5 and is no longer an accurate emergency planning document. Upon notification of noncompliance by the Office, the dam owner shall be required to submit a new inundation map and technical study in compliance with section 2577.4-2577.5 within 180 days.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.

§2577.8 Notice of Approval

The Office shall notify the dam owner in writing that an inundation map is approved or not approved and the reason(s) therefor.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.

§2578. Waiver from Inundation Map Requirement

Up to 90 days after notice pursuant to section 2576, a dam owner may apply for a waiver from producing an inundation map where:
(a) The effects of potential inundation in terms of death or personal injury can be ascertained without an inundation map; and,
(b) Adequate evacuation procedures can be developed without benefit of an inundation map.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.

§2578.1 Application for Waiver

When requesting a waiver, the dam owner shall make application in writing to the Office. The letter of request shall include at a minimum:

(a) The name, address and telephone number of the dam owner; and,
(b) The location of the dam upon a U.S.G.S. Quadrangle map; and,
(c) Information in owner's possession as specified in section 2577.4(b).

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.

§2578.2 Local Consultation

The Office will notify the appropriate public safety agencies of the affected local jurisdictions and consult to determine if local emergency evacuation procedures can be developed without an inundation map.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.

§2578.3 Notice of Determination

The Office shall notify the dam owner in writing that the request for a waiver from the inundation mapping requirement was either approved, continued or withdrawn.

Authority cited: Sections 8567 and 8586, Government Code.
Reference: Section 8589.5, Government Code.