



CHAPTER 2
CWCB PRINCIPLES

SECTION 1
CWCB RULES AND REGULATIONS

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CHAPTER 2 CWCB PRINCIPLES

SECTION 1 CWCB RULES AND REGULATIONS

1.0 INTRODUCTION

On September 12, 2005, the CWCB adopted “Rules and Regulations for Regulatory Floodplains in Colorado” (Rules). The purpose of these Rules is to provide uniform standards for regulatory floodplains (or floodplains) in Colorado, to provide standards for activities that may impact regulatory floodplains in Colorado, and to stipulate the process by which floodplains will be designated and approved by the Colorado Water Conservation Board. Rules for 100-year floodplains are of statewide concern to the State of Colorado and the Colorado Water Conservation Board. These Rules will also assist the CWCB and communities in Colorado to develop sound floodplain management practices and to assist with the implementation of the National Flood Insurance Program (NFIP).

These Rules are reprinted in this Section 1.1 of Chapter 2 for ease of reference by the Manual’s users. The CWCB’s goal is to maintain this Manual with current Rules. However, the Manual users should check the CWCB’s website for the most current rules, which will take precedence over these printed in this Manual.

As part of the Rules, CWCB adopted three Appendices to the Rules. “Appendix A – Base Mapping” is reprinted in its entirety in Chapter 8. “Appendix B – Hydrology” is reprinted in Chapter 9 with additional explanatory notes and references. “Appendix C – Hydraulics” is reprinted in Chapter 10 with additional explanatory notes and references.

1.1 RULES AND REGULATIONS FOR REGULATORY FLOODPLAINS IN COLORADO

The following Rules and Regulations are reprinted from the electronic file located on the CWCB website.

DEPARTMENT OF NATURAL RESOURCES
COLORADO WATER CONSERVATION BOARD

**RULES AND REGULATIONS FOR REGULATORY
FLOODPLAINS IN COLORADO**

JULY 2005
Effective December 2005



RULES AND REGULATIONS FOR REGULATORY FLOODPLAINS IN COLORADO

COLORADO WATER CONSERVATION BOARD DEPARTMENT OF NATURAL RESOURCES

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RULES AND REGULATIONS FOR REGULATORY FLOODPLAINS IN COLORADO

- Rule 1.** **Title:** The formal title of the previous rules and regulations was "Rules and Regulations for the Designation and Approval of Floodplains and of Storm or Floodwater Runoff Channels in Colorado" as approved in 1988. The new title for these 2005 rules and regulations is "Rules and Regulations for Regulatory Floodplains in Colorado". They may be referred to herein collectively as the "Rules" or individually as "Rule". These 2005 rules supersede the 1988 rules.
- Rule 2.** **Authority:** These rules are promulgated pursuant to the authority granted the Colorado Water Conservation Board (Board or CWCB), in sections 37-60-106(1)(c), 37-60-106(1)(k), 37-60-108, 30-28-111(1) and (2), 31-23-301(1) and (3), and 24-65.1-403 (3) and 24-4-103, C.R.S. (2004).
- Rule 3.** **Purpose and Scope:**
- A. Purpose.** The purpose of these rules is to provide uniform standards for regulatory floodplains (or floodplains) in Colorado, to provide standards for activities that may impact regulatory floodplains in Colorado, and to stipulate the process by which floodplains will be designated and approved by the Colorado Water Conservation Board. Rules for 100-year floodplains are of statewide concern to the State of Colorado and the Colorado Water Conservation Board. These rules will also assist the CWCB and communities in Colorado to develop sound floodplain management practices and to assist with the implementation of the National Flood Insurance Program (NFIP).
- B. Scope**
- a. **Zoning.** These rules apply to all floodplain information developed for zoning and for floodplain permitting purposes for streams in the State of Colorado by, but not limited to, individuals, corporations, local government agencies, regional government agencies, state government agencies, Indian tribes, and federal government agencies.
 - b. **Subdivisions.** These rules generally apply to the approval of subdivision drainage reports that provide 100-year floodplain information, which is a responsibility of local government and is covered in Rule 6. However, local governments are encouraged to ensure that site-specific floodplain delineations prepared during development activities are consistent with floodplain information designated and approved by the Board.
 - c. **Design Criteria.** These rules do not apply to the selection of optimal economic criteria for the construction of roads, bridges, irrigation structures, or any other facility in the floodplain.
 - d. **Dam Failure floodplain.** These rules do not apply to the identification of the area potentially inundated by the catastrophic or sudden failure of any man-made structure such as a dam, canal, irrigation ditch, pipeline, or other artificial channel.

Rule 4. Definitions: Floodplain Rule Terms Defined. The following definitions are applicable to these Rules and Regulations for Regulatory Floodplain in Colorado.

<u>Term</u>	<u>Definition</u>
Alluvial Fans	A fan-shaped sediment deposit formed by a stream that flows from a steep mountain valley or gorge onto a plain or the junction of a tributary stream with the main stream. Alluvial fans contain active stream channels and boulder bars, and recently abandoned channels. Alluvial fans are predominantly formed by alluvial deposits and are modified by infrequent sheet flood, channel avulsions and other stream processes.
Approximate floodplain information	Floodplain information that significantly reduces the level of detail for topographic mapping or hydraulic calculations to arrive at floodplain delineations without a comparison of water surface profiles with a topographic map of compatible accuracy. The level of detail for hydrology is consistent with that of detailed floodplain information.
Base Flood	Synonymous with 100-year flood and it means a flood having a one percent chance of being equaled or exceeded in any given year.
Base Flood Elevation (BFE)	The elevation shown on a FEMA Flood Insurance Rate Map for Zones AE, AH, A1-A30, AR, AR/A, AR/AE, AR/A1-A30, AR/AH, AR/AO, V1-V30, and VE that indicates the water surface elevation resulting from a flood that has a one percent chance of equaling or exceeding that level in any given year.
Basin	The total land surface area from which precipitation is conveyed or carried by a stream or system of streams under the force of gravity and discharged through one or more outlets.
Channel	Low lying area where water flows regularly or intermittently with a perceptible current between observable banks, although the location of banks may vary under different conditions.
Channelization	The artificial creation, enlargement or realignment of a stream channel.
Code of Federal Regulations	(CFR) is the codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the Federal Government. It is divided into 50 titles that represent broad areas subject to Federal regulation. FEMA regulations fall under 44 CFR.
Community	Any political subdivision in the state of Colorado that has authority to adopt and enforce floodplain management regulations through zoning, including, but not limited to, cities, towns, unincorporated areas in the counties, Indian tribes and Drainage and Flood Control Districts.

<u>Term</u>	<u>Definition</u>
Debris Flows	Movement of mud and water downward over sloping terrain. The flow typically consists of a mixture of soil, rock, woody debris and water that flows down steep terrain.
Designation and Approval	Certification by formal action of the Board that technical information developed through scientific study using accepted engineering methods suitable for making land use decisions under statutorily authorized zoning powers.
Detailed Floodplain Information	Floodplain information prepared utilizing topographic base mapping, hydrologic analysis, and hydraulic calculations to arrive at precise water surface profiles and floodplain delineations suitable for making land use decisions under statutorily authorized zoning powers.
Development	Any man-made changes to improved or unimproved real estate, including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations.
DFIRM Database	Database (usually spreadsheets of data and analyses that accompany DFIRMs). The FEMA Mapping Specifications and Guidelines outline requirements for the development and maintenance of DFIRM databases.
Digital Flood Insurance Rate Map (DFIRM)	FEMA digital floodplain map. These digital maps serve as “regulatory floodplain maps” for insurance and floodplain management purposes.
Digital Terrain Model (DTM)	Digitally encoded information about the elevation (or variation of relief) of a given area. Often the terms DTM (Digital Terrain Model) and DEM (Digital Elevation Model) are used interchangeably.
Federal Register	The official daily publication for rules, proposed rules, and notices of Federal agencies and organizations, as well as executive orders and other presidential documents
FEMA	Federal Emergency Management Agency
FEMA - Guidelines & Specifications for Flood Hazard Mapping Partners	Floodplain mapping specifications published by FEMA. The current guiding documents are posted on FEMA’s website and provide the minimum national standards for base map data and floodplain information.
500-year floodplain	An area that has a 0.2 percent chance of flooding in any given year.

<u>Term</u>	<u>Definition</u>
"Flood" or "Flooding"	<p>A general and temporary condition of partial or complete inundation of normally dry land areas from:</p> <ol style="list-style-type: none"> 1. The overflow of water from channels and reservoir spillways; 2. The unusual and rapid accumulation or runoff of surface waters from any source; or 3. Mudslides (e.g., mudflows) excess surface water that is combined with mud and other debris that are sufficiently fluid so as to flow on and over the surface of normally dry land areas, as when earth is carried by a current of water and deposited along the path of the current.
Flood Contour	A line shown on a map joining points of equal elevation on the surface of floodwater that is perpendicular to the direction of flow.
Flood Insurance Rate Map (FIRM)	A FIRM is the official map of a community on which FEMA has delineated both the special hazard areas and the risk premium zones applicable to the community.
Flood Mitigation Project	A project within or adjacent to a flooding source that is specifically intended to reduce or eliminate the negative impacts caused by excessive floodwaters through improvement of drainage, flood control, flood conveyance or flood protection.
Floodplain	The area of land that could be inundated as a result of a flood including the area of land over which floodwater would flow from the spillway of a reservoir.
Floodplain Management	The operation of an overall program of corrective and preventive measures for reducing flood damage, including, but not limited to, zoning or land-use regulations, flood control works, and emergency preparedness plans.
Floodplain Management Regulations	Zoning ordinances, subdivision regulations, building codes, health regulations, land-use permits, special purpose ordinances (floodplain ordinance, grading ordinance, or erosion control ordinance) and other applications of police powers. The term describes state/local regulations that provide standards for flood damage preservation and reduction.
Floodplain Maps	Maps that show in a plan view the horizontal boundary of floods of various magnitudes or frequencies. Such maps include, but are not limited to, Flood Hazard Boundary Maps (FHBM), Flood Insurance Rate Maps (FIRM), and Digital Flood Insurance Rate Maps (DFIRM) published by FEMA, Flood Prone Area Maps published by the U.S. Geological Survey (USGS), Flooded Area Maps published by the U. S. Army Corps of Engineers (COE), Flood Hazard Area Delineations (FHAD) published by the Urban Drainage and Flood Control District (UD&FCD).
Floodplain Studies	A formal presentation of the study process, results, and technical support information developed for floodplain maps.

<u>Term</u>	<u>Definition</u>
Floodway	Highest hazard portion of the floodplain where floodwater is likely to be deepest and fastest. It is the area of the floodplain that must be kept free of obstructions to allow floodwaters to move downstream.
Foreseeable Development	The potential future development of, or changes in, the land uses that are likely to take place during the period of time covered by a community's adopted master land use plan, or comprehensive community plan, over a 20-year period. If there is no adopted community plan, then potential development patterns based on zoning, annexations, and other relevant factors should be evaluated.
Freeboard	The vertical distance in feet above a predicted water surface elevation intended to provide a margin of safety to compensate for unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood such as bridge openings and the hydrological effect of urbanization of the watershed.
Geographic Information Systems (G.I.S.)	Computer software that utilizes databases and terrain mapping to store and display special and tabular data, such as floodplains, as layers (e.g. political boundaries, roadways, structures, topographic information, etc.) for natural resource management and other uses.
Hydraulic analysis	The determination of flood elevations and velocities for various probabilities based on a scientific analysis of the movement and behavior of floodwaters in channels or basins.
Hydrogeomorphology	Study of the physical appearance and operational character of the river as it adjusts its boundaries to the magnitude of stream flow and erosional debris produced within the attendant watershed.
Hydrologic Analysis	The determination of the peak rate of flow, or discharge in cubic feet per second, for various selected probabilities for streams, channels, or basins based on a scientific analysis of the physical process.
Letter of Map Amendment (LOMA)	An amendment to the currently effective FEMA map that establishes that a property is not located in a Special Flood Hazard Area. LOMAs are issued by FEMA.
Letter of Map Revision (LOMR)	An official amendment to the currently effective FEMA map. It is issued by FEMA and changes flood zones, delineations, and elevation.

<u>Term</u>	<u>Definition</u>
LIDAR (Light Detection and Ranging)	LIDAR uses the same principle as RADAR. The LIDAR instrument transmits light out to a target. The transmitted light interacts with and is changed by the target. Some of this light is reflected and scattered back to the instrument where it is analyzed. LIDAR is widely used for collection of ground topography data used in floodplain studies.
Metadata	Data about the data used in a floodplain study. Metadata is commonly used in GIS and usually includes information about the intellectual content of the image, digital representation data, and security or rights management information.
Mitigation	The process of preventing disasters or reducing related hazards. Mitigation can be structural, such as flood proofing structures, diverting floodwaters, purchasing property for open space, detention ponds, floodwalls and levees, etc. It can also be nonstructural in nature, such as education, planning, and design of flood prevention measures, emergency preparedness plans, and early flood warning detection systems.
Mudflow	A river of liquid and flowing mud on the surfaces of normally dry land areas, as when earth is carried by a current of water. Other earth movements, such as landslide, slope failure, or a saturated soil mass moving by liquidity down a slope, are not mudflows.
National Flood Insurance Program (NFIP)	FEMA's program of flood insurance coverage and floodplain management administered in conjunction with the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The NFIP has applicable Federal regulations promulgated in Title 44 of the Code of Federal Regulations. The U.S. Congress established the NFIP in 1968 with the passage of the National Flood Insurance Act of 1968.
North American Datum 1927 (NAD 1927)	Refers to the North American Datum of 1927.
North American Datum 1983 (NAD 1983)	Refers to North American Datum of 1983.
National Geodetic Vertical Datum 1929 (NGVD 1929)	Based on the sea level vertical datum of 1929.
North American Vertical Datum 1988 (NAVD 1988)	The vertical adjustment system using the new sea level datum from the 1980's. It redefines the heights of several hundred thousand benchmarks across North America.
Notification	Written notice to FEMA, CWCB, and all local governments affected by a proposed stream alteration activity.

<u>Term</u>	<u>Definition</u>
100-year Flood	A flood having a recurrence interval that has a one-percent chance of being equaled or exceeded during any year (1% chance exceedance probability). The terms "one-hundred-year flood" and "one percent chance flood" are synonymous with the term "100-year flood". The term does not imply that the flood will necessarily happen once every one hundred years, however a flood of this magnitude is expected to be equaled or exceeded, based on long-term averages, once during any given one hundred year period.
100-year Floodplain	The area of land susceptible to being inundated as a result of the occurrence of a one-hundred-year flood. This term is synonymous with the term "state regulatory floodplain".
Post Wildfire Hydrology	Methodologies and calculations developed to account for the increased stormwater runoff following forest fires. Post-wildfire hydrology is typically evaluated every 3 to 5 years to assess the need for further revision based on watershed recovery, forest regrowth, and other factors.
Raster Images	A collection of electronic dots called pixels. Each pixel is a tiny colored square. When an image is scanned, the image is converted to a collection of pixels called a raster image. Scanned graphics and web graphics (JPEG and GIF files) are the most common forms of raster images.
Regulatory Floodplain	Synonymous with the 100-year, or 1% chance, floodplain.
Stream Alteration Activity	Any manmade activity within a stream or floodplain that alters the natural channel, geometry, or flow characteristics of the stream for purposes other than Flood Mitigation Projects that are intended for the improvement of drainage, flood control, flood conveyance or flood protection.
Topography	Configuration (relief) of the land surface; the graphic delineation or portrayal of that configuration in map form, as by contour lines.
Triangulated Irregular Network Model (TIN)	A significant alternative to the regular raster of a DEM that has been adopted in numerous GIS programs and automated mapping and contouring packages. The TIN model was developed in the early 1970's as a simple way to create a surface from a set of irregularly spaced points.
Universal Transverse Mercator (UTM)	The Universal Transverse Mercator (UTM) projection and grid system was adopted by the U.S. Army in 1947 for designating rectangular coordinates on large-scale military maps. UTM is currently used by the United States and NATO armed forces. The UTM system divides the earth into 60 zones each 6 degrees of longitude wide.

Term
Vector Images

Definition

A collection of connected lines and curves that produce objects. When creating a vector image in a vector illustration program, node or drawing points are inserted and lines and curves connect notes together. This is the same principle as "connect the dots". Each node, line and curve is defined in the drawing by the graphics software by a mathematical description. Every aspect of a vector object is defined by math included node position, node location, line length and on down the line. Text objects are created by connecting nodes, lines and curves. Every letter in a font starts out as a vector object. Vector images are object-oriented while raster images are pixel oriented.

Water Surface Profile A graph that shows the relationship between the vertical elevation of the top of flowing water and of the streambed with the horizontal distance along the stream channel.

Rule 5. State Regulatory Floodplain: The regulatory floodplain is the 100-year floodplain. "Storm or Floodwater Runoff Channels" are within the 100-year floodplain. Sections 24-65.1-101 & 24-65.1-202(2)(a)(I) and 24-65.1-302(1)(b)&(2)(a) and 24-65.1-403(3) and 24-65.1-404(3), C.R.S. (2004) deems the designation of floodplains a matter of statewide importance and interest and gives the CWCB the responsibility for the designation of the 100-year floodplain.

Rule 6. Standards for Delineation of Regulatory Floodplain Information:

A. Intent of this Rule. This rule contains standards for approximate and detailed floodplains.

B. Level of Detail.

- a. Approximate floodplain information will be based on detailed hydrology computed for the 100-year flood. Hydraulic information shall be produced using approximate, field, or limited techniques and best available topographic/survey data.
- b. Detailed floodplain information will be based on detailed hydrologic and hydraulic determinations for the 100-year flood. Flood profiles and floodplain delineations for the 100-year flood and other frequencies, if any, shall be plotted, preferably using a digital technique. Floodplain delineations for the 500-year flood are encouraged, but not required, by the CWCB. The CWCB shall only designate and approve 100-year floodplain information.

C. Base Mapping. Base mapping for floodplain studies shall meet the minimum standards as set forth in Appendix A and any other method approved by the Board.

D. Topography and Surveys. Topographic and field survey information for floodplain studies shall meet the minimum standards as set forth in Appendix A.

E. Vertical Datum and Horizontal Control.

- a. New topographic information obtained for floodplain studies in Colorado shall be produced using a vertical datum standard based on NAVD 1988. Existing flood profiles and Base Flood Elevations based on NGVD 1929 Datum shall be converted to NAVD 1988 for the purposes of new and revised floodplain mapping studies. New studies, utilizing previous topographic information that was originally developed using NGVD 1929 vertical datum, shall be produced on NAVD 1988 datum by appropriately converting the vertical information to the new datum for modeling and mapping purposes.
- b. The accepted Horizontal Projection standards are UTM (Zone 12 or 13 depending on Geographic location within the state) and State Plane coordinates.
- c. Additional requirements are set forth in Appendix A.

F. Geographic Information Systems (GIS). GIS information for floodplain studies in Colorado shall meet the minimum standards as set forth in Appendix A. New floodplain studies submitted for CWCB designation and approval shall be in conformance with CWCB approved GIS standards for digital floodplain information.

G. Hydrology. Hydrologic analyses for floodplain studies in Colorado shall be completed using the information contained in Appendix B and other methods approved by the CWCB. In addition, the following rules apply to hydrology studies:

- a. All floodplain studies, regardless of the level of detail (e.g. approximate or detailed) shall utilize detailed hydrologic information. The CWCB recognizes existing and future watershed conditions for the purposes of computing flood hydrology. Future watershed conditions, in addition to existing conditions, shall be evaluated when Foreseeable Development is expected.
- b. Any new study performed by a sponsor to evaluate precipitation information and/or design storm criteria shall be completed in such a way that it is scientifically defensible and technically reproducible.
- c. All jurisdictions and communities affected by revised precipitation data, due to their geographic proximity and/or their location within a particular watershed, are encouraged to participate in the update process, and shall be given the opportunity by the study sponsor to review and comment on the revised information. Opponents to the revised information shall present technically accurate and sound scientific data at a CWCB hearing that clearly demonstrates that the information in question is inaccurate. The CWCB shall make the final determination regarding disputes.
- d. Within any given watershed, or hydrologic subregion, consistency in precipitation data and runoff methodology shall be pursued to the extent possible through cooperation of all affected jurisdictions and entities.

H. Detailed Hydraulic Method. Hydraulic analyses for floodplain studies in Colorado shall be completed using protocols as set forth in Appendix C.

I. Floodplain Delineations. Floodplain delineations shall be completed using protocols that are approved by the CWCB and shall comply with the technical quality assurance standards as follows:

- a. The flood elevations and the floodplain delineations on the maps must correlate reasonably to the best available topographic information for the stream and adjacent corridor and must meet an acceptable level of technical accuracy.
- b. The planimetric features on the floodplain maps (including but not limited to streets and highways, stream centerlines, bridges and other critical hydraulic features, corporate limits, section lines and corners, survey benchmarks) must be consistent with the best available aerial photographs or other suitable information for the stream and the adjacent corridor as determined through prevailing industry practices and must meet an acceptable level of technical accuracy.

J. Special Floodplain Conditions. There are a number of special floodplain conditions, or natural flood hazards, in Colorado that fall outside of the standard riverine environment. Studies for the 100-year flood involving special conditions shall be completed using protocols that are approved by the CWCB. The special conditions are:

- a. Alluvial fan and debris flow floodplains located within foothill and mountainous regions of Colorado shall be considered on a case-by-case basis.
- b. Post-wildfire hydrology shall be considered in forested areas immediately following moderate to intense wildfires resulting in approximately 15% or greater burn area of the affected watershed (actual wildfire impacts shall be evaluated on a case-by-case basis). Interim flood advisory maps, based on burned watershed conditions, shall be produced at the request of the local governing authority or by Board initiative. The interim floodplain maps shall be produced using CWCB Flood Response Program funding using post-wildfire hydrology that shows increased runoff from hydrophobic soils and lack of vegetation. The post-wildfire maps shall be evaluated every 3 to 5 years to assess the need for further revision based on watershed recovery, forest regrowth, and other factors.
- c. Ice jam flooding shall be considered within stream reaches where this phenomenon is known to occur. Ice jam flooding can be analyzed utilizing methodologies available through the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL), located in Hanover, New Hampshire.
- d. Erosion zones and stream migration problems shall be considered on a case-by-case basis, either at the request of the sponsoring local government or by Board initiative, within stream reaches where these problems are anticipated or known to occur.

K. Written reports and maps. The results of the hydrologic analyses, hydraulic analyses, and floodplain delineations shall be summarized in a written report and submitted to the CWCB. All approximate and detailed floodplain information that is presented to the CWCB for designation and approval shall be properly titled, dated, organized, and bound as a stand-alone document. In addition to the hard copy final report, the CWCB requires that a digital copy of the final report be submitted in MS Word and PDF formats. All pertinent technical backup data such as GIS files, hydrologic and hydraulic models, and all pertinent technical backup data shall also be provided to the CWCB in acceptable digital formats. The CWCB shall electronically distribute to interested parties, to the extent possible, pertinent study information. Access to original GIS information will be provided to local governments and other authorized users through a secure and protected website or other secure means.

- a. The flooded area maps shall show, at a minimum, the flood boundaries, the location of all cross sections used in the hydraulic analysis, the reference line drawn down the center of the floodplain or low flow channel, and a sufficient number of flood contours in order to reconstruct the flood water surface profiles.
- b. Flood contours, such as Base Flood Elevations, shall be drawn as wavy lines drawn normal to the direction of flow of floodwater and shall extend completely across the area of the 100-year floodplain. Each flood contour shall indicate its elevation to the nearest whole foot.
- c. The flooded area map scale shall be 1-inch equals 500 feet or such map scale showing greater detail. FEMA map panels may also be published at 1 inch equals 1,000 feet or 1 inch equals 2000 feet.
- d. Where discrepancies appear between flooded area maps and water surface profiles, any 100-year water surface profile designated and approved by the Board shall take precedence over any corresponding flooded area map for the same stream reach or site location.

L. Contractor Qualifications

- a. Qualified engineers licensed in Colorado shall direct or supervise the floodplain mapping studies and projects within the regulatory floodplain. All floodplain maps, reports and project designs within the regulatory floodplain shall be certified and sealed by the Colorado registered professional engineer of record.
- b. Federal agencies or other recognized and qualified government authorities may produce floodplain mapping work as a study proponent or on behalf of a study proponent.

Rule 7. Standards for Regulatory Floodways:

A. Designation of floodways. Designation and approval of floodway information shall be considered by reference as being within the designation and approval of corresponding 100-year regulatory information. For waterways with base flood elevations for which floodways are not computed, the community shall have the discretion to apply floodway regulations according to its own determination, as outlined in FEMA Regulation 44 CFR 60.3(c)(10) (2004) and incorporated by reference into this rule.

B. Establishment of Floodway Criteria. The CWCB recognizes that designated floodways are administrative limits and tools used by communities to regulate existing and future floodplain developments within their jurisdictions. Communities may choose to delineate floodways based on FEMA's 1-foot rise criteria or based on more strict criteria (e.g. depth and velocity criteria, 0.5-foot rise, etc.). The CWCB floodway rule is synonymous with communities' adopted floodway criteria. Where no local floodway criteria exist, the CWCB recommends the use of the minimum FEMA standard.

C. Incorporation of FEMA's Floodway Regulations. All regulations defined in FEMA Regulation 44 CFR 60.3(c)(10) and 44 CFR 60.3(d) (2004) are hereby incorporated by reference into this rule. All communities participating in the National Flood Insurance Program that have Base Flood Elevations defined for one or more of the waterways within their jurisdictions can adopt and enforce these floodway regulations. Failure to enforce

floodway regulations may impact the community's standing in the National Flood Insurance Program and may eliminate or reduce eligibility for federal or state financial assistance for flood mitigation and disaster purposes.

D. Communities in Which This Rule Applies. Communities with designated Regulatory Floodplains that have Base Flood Elevations defined for one or more of the waterways within their jurisdictions shall be required to establish a technical (quantified) criteria for floodway determination and regulation.

Rule 8. Criteria for Determining the Effects of Dams on Regulatory Floodplains:

A. Flood Control Dams. If a publicly owned, operated and maintained dam is specifically designed and operated either in whole or in part for flood control purposes then its effects shall be taken into consideration when delineating the floodplain below such a dam. The effects of the dam shall be based upon the 100-year flood under Foreseeable Development, with full credit to be given to the diminution of peak flood discharges, which would result from normal dam operating procedures.

B. Non-Flood Control Dams. If a dam is not specifically designed and operated, either in whole or in part, for flood control purposes, then its effects, even if it provides inadvertent flood routing capabilities which reduce the 100-year flood downstream, shall not be taken into account and the delineation of the floodplain below such a dam shall be based upon the 100-year flood that could occur absent the dam's influence. However, if adequate assurances have been obtained to preserve the flood routing capabilities of such a dam, then the delineation of the floodplain below the dam may, but need not, be based on the assumption that the reservoir formed by the dam will be filled to the elevation of the dam's emergency spillway and the 100-year hydrology can be routed through the reservoir to account for any flood attenuation effects.

C. Adequate Assurances. For the purposes of Rule 8.B. "adequate assurances" shall, at a minimum, include appropriate recognition in the community's adopted master plan of: (1) the flood routing capability of the reservoir, as shown by comparison of the 100-year floodplain in plan and profile with and without the dam in place in order that the public may be made aware of the potential change in level of flood protection in the event that the reservoir flood routing capability is lost, (2) the need to preserve that flood routing capability by whatever means available in the event that the reservoir owners attempt to make changes that would decrease the flood routing capability, and (3) a complete Operations and Maintenance Plan.

In addition, an agreement shall be executed between the Board and the affected local governments (or between the Urban Drainage and Flood Control District (District) and the affected local governments if the subject floodplain is within the District) that expresses the intent of the parties to assure that the flood routing capabilities of the reservoir will be maintained by whatever means necessary if the reservoir owners attempt to make changes to the reservoir.

Rule 9. Criteria for Determining Effects of Levees on Regulatory Floodplains:

A. Ownership. Privately owned, operated, or maintained levee systems will not be considered in the hydraulic analysis to be performed pursuant to rule 5 or rule 6 unless a local ordinance mandates operation and maintenance of the levee system and the criteria set forth below are met. Levees for which the community, State, or Federal government has responsibility for operations and maintenance will be considered provided that the criteria set forth below are met.

B. Freeboard. A minimum levee freeboard of 3 feet shall be necessary, with an additional 1-foot of freeboard within 100 feet of either side of structures within the levee or wherever the flow is constricted such as at bridges. An additional 0.5-foot above this minimum is also required at the upstream end, tapering to the minimum and the downstream end of the levee.

C. Field Inspection and Maintenance. The levee shall be structurally sound and adequately maintained. Sedimentation effects shall be considered for all levee projects. Certification from a federal agency, state agency, or a Colorado registered professional engineer that the levee meets the minimum freeboard criteria as stated above and that it appears, on visual inspection, to be structurally sound and adequately maintained shall be required on an annual basis. Levees that have obvious structural defects, or that are obviously lacking in proper maintenance, shall not be considered in the hydraulic analysis.

D. Internal Drainage. Where credit will be given to levees providing 100-year protection, the adequacy of interior drainage systems shall be evaluated. Areas subject to flooding from inadequate interior drainage behind levees will be mapped using standard procedures.

E. Human Intervention and Operation. In general, evaluation of levees shall not consider human intervention (e.g. capping of levees by sandbagging, earth fill, or flashboards) for the purpose of increasing a levee's design level of protection during an imminent flood. Human intervention shall only be considered for the operation of closure structures (e.g. gates or stop logs) in a levee system designed to provide at least 100-year flood protection, including adequate freeboard as described above, provided that such human operation is specifically included in an emergency response plan adopted by the community.

F. Analysis. For areas protected by a levee providing less than 100-year protection, flood elevations shall be computed as if the levee did not exist. For the unprotected area between the levee and the source of flooding, the elevations to be shown shall be obtained from either the flood profile that would exist at the time levee overtopping begins or the profile computed as if the levee did not exist, whichever is higher. This procedure recognizes the increase in flood elevation in the unprotected area that is caused by the levee itself. This procedure may result in flood elevations being shown as several feet higher on one side of the levee than on the other. Both profiles shall be shown in the final report and labeled as "before levee overtopping" and "after levee overtopping" respectively.

Rule 10. Stormwater Detention.

Hydrologic determinations and increased runoff from development and urbanization shall be considered through detention measures to mitigate the higher runoff characteristics.

A. Stormwater/Floodwater Runoff Detention. The hydrologic analysis shall consider the effects of on-site detention for rooftops, parking lots, highways, road fills, railroad embankments, diversion dams, refuse embankments (including but not limited to solid waster disposal facilities), mill tailings, impoundments, siltation ponds, livestock water tanks, erosion control dams, or other structures only if they have been designed and constructed with the purpose of impounding water for flood detention and are owned, operated and maintained by a government body. Detention structures that are randomly located, privately owned, or privately maintained shall not be included in the hydrologic analysis unless it can be shown that they exacerbated downstream peak discharges.

B. Irrigation Facilities. The CWCB recommends that irrigation facilities (including but not limited to ditches and canals) not be used as stormwater or flood conveyance facilities, unless specifically approved and designated by local governing jurisdictions and approved by the irrigation facility owners. The flood conveyance capacity of irrigation facilities shall be acknowledged only by agreement between the facility owners and local governing jurisdictions. The CWCB will designate and approve 100-year floodplain information for irrigation facilities if the above recommendations are met.

Rule 11. Effects of Flood Mitigation Measures and Stream Alteration Activities on Regulatory Floodplains

In order to assist the CWCB in carrying out its mission to protect the health, safety, and welfare of the public, through the prevention of floods in Colorado, the CWCB requires the following:

A. Detention/flood control storage shall be designed and constructed as part of a basinwide program for the watershed.

B. Detention facilities shall adequately consider flow rates and flow volumes.

C. Flood control channels shall include a low-flow channel with a capacity to convey the average annual flow rate, or other appropriate flow rate as determined through a hydrogeomorphological analysis, without excessive erosion or channel migration, with an adjacent overbank floodplain to convey the remainder of the 100-year flow. The channel improvement shall not cause increased velocities or erosive forces upstream or downstream of the improvement.

D. Channelization and flow diversion projects shall appropriately consider issues of sediment transport, erosion, deposition, and channel migration and properly mitigate potential problems through the project as well as upstream and downstream of any improvement activity. A detailed geomorphological analysis shall be performed to assist in determining the most appropriate design.

E. Low-lying areas (below BFE) “protected” by levees, flood fringe areas raised by fill, or perched flow diversion or channelization projects shall not be considered to be removed from the 100-year floodplain for the purpose of building basements.

F. Project proponents for a mitigation activity must evaluate the residual 100-year floodplain. Proponents are also encouraged to map the 500-year residual floodplain for the evaluation of critical facilities.

G. All flood protection and mitigation projects shall be maintained to ensure that they retain their structural and hydraulic integrity. Annual inspections including, as appropriate, field surveys of stream cross-sections, shall demonstrate to the appropriate regulatory jurisdictions that the project features are in satisfactory structural condition, that adequate flow capacity remains available for conveying flood flows, and that no encroachment by vegetation, animals, geological processes such as erosion, deposition, or migration, or by human activity, endanger the proper function of the project. If any significant problems are noted in such annual inspections, the local regulatory jurisdiction shall notify the CWCB within 30 days of the inspection.

H. Any stream alteration activity proposed by a project proponent must be evaluated for its impact on the regulatory floodplain and be in compliance with federal, state and local floodplain rules, regulations and ordinances.

I. Any stream alteration activity shall be designed and sealed by a Colorado registered professional engineer.

J. Stream alteration activities shall be properly permitted by local, state and federal agencies and shall be in conformance with FEMA Regulations 44 C.F.R. parts 59, 60, 65, and 70 (2004).

K. Stream alteration activities shall not be constructed unless the project proponent demonstrates through a floodway analysis and report, sealed by a Colorado registered professional engineer, that there are no adverse floodway and floodplain impacts resulting from the project.

L. No adverse floodway impact means that there is a 0.0-foot rise in the proposed conditions compared to existing conditions floodway.

M. The Stream Alteration proponent shall provide Notification to the CWCB whenever the proposed Stream Alteration activity would result in proposed water surface profile increases to the regulatory 100-year flood profile in excess of 0.3 vertical feet (unless the local governing authority has adopted more stringent standards). Such Notification by the proponent shall be in writing, and meet the intent of notice procedures as described in 44 CFR parts 59, 60, 65, and 70. In addition, whenever a proposed Stream Alteration activity in combination with all other previous floodplain alteration activities results in a cumulative increase of 1.0 vertical feet or greater, Notification shall also be provided by the Stream Alteration proponent.

Rule 12. Process for Designation and Approval of Regulatory Floodplains:

A. Designation and Approval Requirements. The Board will designate and approve regulatory floodplains and storm or floodwater runoff channels by the adoption of written resolutions based only upon such floodplain information as the Board determines meets the standards set forth in Rule 6, as applicable, with consideration of the effects of dams and levees being subject to the criteria or Rules 8 and 9, respectively and any mitigation activity in Rule 11.

B. Base Flood. The 100-year flood shall be the basis for all designation and approvals by the Board, for zoning purposes, of regulatory floodplains in Colorado.

C. Conditions. All designations and approvals of approximate floodplain information by the Board shall be based on the Board's designation action. The community shall be notified by a CWCB resolution that a case-by-case review of the approximate floodplain information will be required, and that a detailed hydrologic and hydraulic analysis will be necessary prior to development activities taking place in the identified approximate 100-year floodplain.

D. Provisional Designation. The CWCB may designate and approve, on a provisional basis and for a maximum period of time not to exceed three years, floodplain information that does not meet the minimum requirements as set forth in Rule 6.

E. Process for Taking Designation and Approval Actions. The Board shall consider the designation and approval of floodplain information either by request of a community or by acting on its own initiative.

- a. **Consideration at a Community's Request.** The Board shall consider designation and approval of floodplain information upon written request from the governing body of any community having jurisdiction in the area where the floodplain information is applicable. The letter of request shall identify the report title, date, author or agency which prepared the report, stream name (s), upstream and downstream limits of the stream reach (es) to be designated, stream length (s) in miles, type of designation requested (detailed or approximate), and any other relevant information. The Board shall receive such a request at least 30 days prior to the Board meeting at which consideration of designation and approval is requested.
- b. **Consideration at the Board's initiative.** If designation and approval of a floodplain would be in the best interest of the health, safety, and welfare of the citizens of the State of Colorado, then the Board may take action at its own initiative to consider the designation and approval of floodplain information. In such cases, the Board shall notify the affected communities in writing at least 45 days prior to the Board meeting at which it will consider the designation and approval of floodplain information within their jurisdiction.
- c. **Notification of Adopted Resolutions.** The CWCB shall send signed copies of each adopted resolution of designation and approval to the legislative bodies of each community having jurisdiction in the study area and to FEMA.

Rule 13. Designation and Approval of Changes to Regulatory Floodplains:

When changes are made to the characteristics of a floodplain that do not result in a revision of a community's Flood Insurance Rate Maps or Flood Hazard Boundary Maps (and a subsequent designation of the new map), the Board will designate and approve changes to the regulatory floodplain caused by development, new or better technical information, or other sources. This designation of changed floodplains will be by the adoption of written resolutions based upon such floodplain information as the Board determines meets the standards set forth in Rules 6-12.

A. Conditions. All changes to designated floodplains shall meet the same conditions as those required for original approval and designation.

B. Process for Designation and Approval of Changes to a Regulatory Floodplain. The Board may consider the designation and approval of floodplain information either by request of a community or by acting on its own initiative.

- a. Consideration at a Community's Request.** The Board shall consider designation and approval of changes to a regulatory floodplain upon written request from the governing body of any community having jurisdiction in the area where the floodplain information is applicable. The Board shall receive such requests at least 30 calendar days prior to the Board meeting at which consideration of designation and approval is requested.
- b. Consideration at the Board's Initiative.** If designation and approval of a floodplain would be in the best interest of the health, safety, and welfare of the citizens of the State of Colorado, then the Board may take action at its own initiative to consider the designation and approval of floodplain information. In such cases, the Board shall notify the affected communities in writing at least 45 days prior to the Board meeting at which it will consider the designation and approval of floodplain information within their jurisdiction.
- c. Notification of Adopted Resolution.** The CWCB shall send signed copies of each adopted resolution of designation and approval of changes to a regulatory floodplain to the legislative bodies of each community having jurisdiction within the limits of the changed floodplain within 30 calendar days of designation and approval.

C. Identification of Designations of Changes to a Regulatory Floodplain. The designation of the changes to the regulatory floodplain will be given a reference identification number that will differentiate the changed designation from the original. It is implied that designations to changes to a regulatory floodplain will only rescind the affected portions of the previously designated floodplain information. All other unaffected reaches will remain as originally designated.

D. Map Revisions to Flood Insurance Rate Maps or Flood Hazard Boundary Maps. Floodplain map revisions (e.g. FEMA Letters of Map Revision) will be designated twice annually by the CWCB during a regularly scheduled Board meeting and will not be subject to a full technical review by the CWCB staff.

Rule 14. Variances

A. Consideration by the Board. Request for a variance to any of these rules may be considered by the Board provided the entity requesting the variance has submitted a written request to the CWCB Director and notice of the request is given to the community, if different from the entity requesting the variance, that would be affected by the variance, if granted.

B. Contents of a Request for Variance. The request for a variance shall identify:

- a. The rule from which the variance is requested,
- b. The communities that would be affected by the variance,
- c. The reasons why the rule cannot be complied with,
- d. The estimated difference in water surface elevations, flood velocities and flood boundaries that will result if the requested variance is granted than if the calculations are made through strict compliance with the rule,
- e. The estimated number of people and structures that will be impacted by granting of the variance, and
- f. Any other evidence submitted by the community, the Colorado Water Conservation Board staff, or other party of interest.

C. Factors to be considered. Variances may be issued by the Board if it can be determined that:

- a. There is a good and sufficient cause, and
- b. The variance is the minimum necessary, considering the flood hazard, to afford relief, and
- c. Failure to grant the variance would result in exceptional hardship to the community and that the hardship is not the community's own making, and
- d. The granting of a variance will not result in increased vulnerability to flood losses, additional threats to public safety, extraordinary public expense, create nuisances, cause fraud or victimization of the public, hide information of significant interest to the public or conflict with existing local laws or regulations.

Rule 15. Incorporation by Reference: FEMA Regulations 44 CFR Parts 59, 60, 65, and 70 (2004) are incorporated herein by reference. Materials incorporated by reference are those in existence as of the effective date of this regulation and do not include later amendments. These Rules may be updated to reflect changes to the FEMA regulations that are incorporated by reference. The material incorporated by reference is available for public inspection during regular business hours at the Colorado Water Conservation Board, 1313 Sherman Street, Room 721, Denver, CO 80203 or may be examined at any state or federal publications depository library, or on the FEMA or CWCB website. These regulations are hereby incorporated by reference by the Colorado Water Conservation Board and made a part of these Rules and Regulations for Regulatory Floodplains in Colorado. Parties wishing to inspect these materials should contact the State of Colorado NFIP Coordinator, located at the Colorado Water Conservation Board.

Rule 16. Severability: If any portion of these Rules is found to be invalid, the remaining portion of the Rules shall remain in force and in effect.

Rule 17. Recommended Activities for Regulatory Floodplains:

The following list contains floodplain management activities and actions suggested by the CWCB to increase a community's overall level of flood protection. Communities and other authorized government entities may:

- A. Adopt local standards above and beyond the FEMA and CWCB minimum requirements.
- B. Develop a Flood Response Plan that identifies responsibilities/actions before, during and after a flood event.
- C. Enroll in FEMA's National Flood Insurance Program (NFIP) and possibly FEMA's Community Rating System (CRS) Program.
- D. Develop an early warning flood detection system (flood warning system) using available technologies such as automated precipitation and stream flow gages linked to an appropriate notification system.
- E. Coordinate with lenders, insurance agents, real estate agents, and developers to prepare and discuss educational tools based on state and federal requirements.
- F. Promote wise floodplain development and support effective structural and non-structural flood mitigation projects.
- G. Conduct floodplain studies in areas of Foreseeable Development that do not currently have detailed floodplain studies.
- H. Maintain an electronic or paper library of local flood related data.
- I. Develop a flood risk outreach program and notify flood prone residents annually of flood hazards and the need for flood insurance.
- J. Encourage elevation of floodprone structures and floodproofing of structures in the floodplains. Utilize available state/federal mitigation and preparedness funds.
- L. Require certified floodplain managers to review proposed land developments.
- M. Advise the public at large that flooding does occur above and beyond the 100-year flood. Communities would be wise to consider using the 500-year floodplain for regulating critical facilities such as fire stations, hospitals, police stations, nursing homes, electrical power stations, water supply treatment plants, and other important facilities. Floods greater than 500-year floods do occur, and loss of life and property is possible in areas mapped outside of both the 100-year and 500-year floodplains. Communities are encouraged to identify areas prone to flooding outside of the 500-year floodplain where loss of life or substantial property damage may occur.

N. Utilize the concept of “No Adverse Impact” floodplain management where the action of one property owner does not adversely impact the rights of other property owners, as measured by increased flood peaks, flood stage, flood velocity, and erosion and sedimentation. No Adverse Impact could be extended to entire watersheds as a means to promote the use of retention/detention or other techniques to mitigate increased runoff from urban areas.

O. Prohibit the construction of new levees that are intended to remove land from a regulatory floodplain for the purpose of allowing new development activity to take place in areas that are otherwise flood prone.

P. Require an appropriate level of freeboard at bridges between the 100-year water surface elevation and the lowest elevation of the lowest structural member to allow for passage of waterborne debris.

Q. Maintain a flood hazard page on the community website with links to the CWCB, FEMA Flood Map Store, National Flood Insurance Program, National Weather Service, local building codes, and local permitting information.

Rule 18. **Effective Date:** These Rules shall apply to the designation and approval of all floodplain information made by the Board on or after _____, 2005 and are, therefore, not retroactive to any floodplain information designated and approved by the Board prior to the effective date.

Floodplain Rules and Regulations

Statement of Basis and Purpose

July 13, 2005

Proposed Basis and Purpose for CWCB floodplain Rules and Regulations:

1. These Rules are promulgated to carry out the authority and responsibilities of the Colorado Water Conservation Board (“the Board” or “CWCB”) pursuant to sections 37-60-106(1)(c), 37-60-106(1)(k), 37-60-108, 30-28-111(1) and (2), 21-23-301(1) and (3), and 24-65.1-403 (3) and 24-4-103, C.R.S. (2004). Under sections 24-65.1-101 & 24-65.1-202(2)(a)(I) and 24-65.1-302(1)(b)&(2)(a) and 24-65.1-403(3) and 24-65.1-404(3), C.R.S. (2004), the designation of floodplains is a matter of statewide importance and interest and the CWCB has the responsibility for the designation and approval of 100-year floodplains. The Rules will help to carry out the CWCB’s statutory mission to devise and formulate methods, means, and plans for the prevention of flood damages. § 37-60-106(1)(c).
2. The purpose of the Rules is to provide uniform standards for regulatory floodplains in Colorado, to provide standards for activities that may impact regulatory floodplains in Colorado and to stipulate the process by which floodplains will be designated and approved by the CWCB. These Rules will also assist the CWCB and Colorado communities in developing sound floodplain management practices and in assisting with the implementation of the National Flood Insurance Program. Flood loss reduction is the primary purpose for implementing a sound flood protection program since flooding is the number one natural disaster responsible for both property damage and human fatalities in Colorado.
3. The Rules contain standards and specifications for approximate and detailed regulatory floodplain determinations in Colorado. The Rules also contain detailed standards within Appendix A (concerning base mapping requirements), Appendix B (concerning hydrology), and Appendix C (concerning hydraulics). The Rules will identify and contain the flood-related information within the Appendices that are also specifically adopted as part of this rulemaking. The Appendices are generally modeled after the federal floodplain guidelines that are widely accepted but quickly changing. Specific information pertinent to Colorado is also contained within the Appendices to supplement the federal requirements.
4. The Rules will provide the necessary steps for floodplain mapping partners to follow in order to have county and community flood hazard information designated and approved by the CWCB so that statutory requirements can be met.
5. The Rules will assist communities and other floodplain mapping partners with developing and providing accurate 100-year floodplain information for use in wise floodplain management activities. The Rules provide for a process whereby all affected communities have the opportunity to review, analyze, and object to the floodplain studies if not based on technically accurate and sound scientific data.
6. The Rules provide for the CWCB’s review of the results of the hydrologic analyses, hydraulic analyses, and floodplain delineations in a published floodplain study report. The Rules provide

that a qualified Colorado registered professional engineer in good standing shall direct or supervise the floodplain mapping studies and projects within the regulatory floodplain and that such floodplain maps, reports and project designs within the regulatory floodplain shall be certified and sealed by the Colorado registered professional engineer of record.

7. The Rules provide that designation and approval of floodways shall be considered, as requested by the local governing entity, as part of the designation and approval of corresponding 100-year regulatory floodplains. The Rules provide criteria for determining the effects of dams, levees, stormwater detention, irrigation facilities, flood mitigation measures and stream alteration activities on or in regulatory floodplains in order to quantify peak flood discharges and to assess the effects of flooding conditions that would result therefrom.
8. The Rules set forth the process and procedures for the CWCB to designate and approve regulatory floodplains. The 100-year flood shall be the basis for all designation and approvals by the Board, for zoning and land use purposes, of regulatory floodplains in Colorado.
9. The Rules provide the process and procedures for the CWCB to designate and approve changes to regulatory floodplains resulting from development, watershed changes, new or better technical information, or other factors, subject to the same criteria as required for an original approval and designation.
10. The Rules provide for procedures and conditions of proposed variances from the Rules if such variance is for good and sufficient cause and will not increase flooding or threaten public safety.
11. The Rules will provide additional information and recommendations, above and beyond the 100-year floodplain requirements, that can serve communities in need of technical, regulatory, and administrative information in order to allow for safe and reasonable floodplain development that will lead to better protection of Colorado citizens and their property.



CHAPTER 2
CWCB PRINCIPLES

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**CHAPTER 2
CWCB PRINCIPLES**

**SECTION 2
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PRINCIPLES**



CHAPTER 2 CWCB PRINCIPLES

SECTION 2 CWCB OPERATING PRINCIPLES

2.0 INTRODUCTION

The criteria and design standards presented in the COLORADO FLOODPLAIN AND STORMWATER CRITERIA MANUAL (hereinafter referred to as Statewide Manual) are provided to help guide the state and local agencies and the practicing engineers in dealing with the stormwater and floodplain analysis, design, and management issues. The intent of the Statewide Manual is not to supersede the existing related storm drainage manuals that have been adopted by various agencies but rather to supplement the existing manuals. Also, it is not the intention of CWCB to mandate the use of the recommended engineering and management criteria outlined in the Statewide Manual.

This section provides CWCB Operating Principles in dealing with the following topics:

- Criteria manual discrepancy resolution
- New and revised floodplain delineations
- Regulatory 100-year floodplains
- Designated floodways
- Hydraulic structures
- Hydrology
- Floodplain development practices
- Critical facilities
- Flood conveyance in irrigation ditches and canals
- Stormwater runoff detention
- Water rights
- Water quality

2.1 CRITERIA MANUAL DISCREPANCY RESOLUTION

Currently, many communities within the State of Colorado do not have adequate drainage manuals that address the floodplain and stormwater management and engineering issues. Establishment and enforcement of minimum drainage standards are vital for these communities to reduce future flood damages to public and private properties and promote public safety and general welfare of their communities.



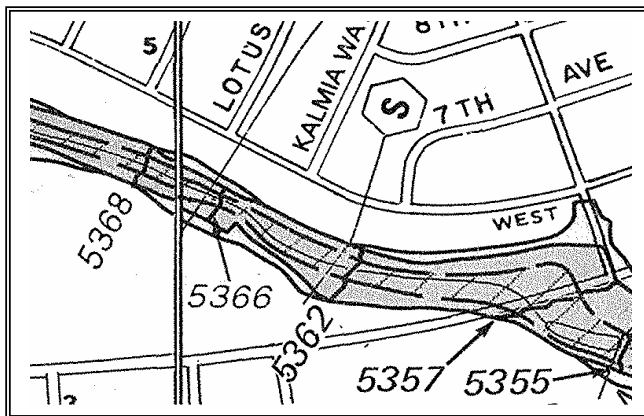


OPERATING PRINCIPLE

THE CWCB RECOMMENDS THAT GOVERNMENT ENTITIES IN COLORADO ADOPT THE STATEWIDE MANUAL AT THEIR OWN DISCRETION, WHOLLY OR IN PART, DEPENDING ON THE NEEDS OF THE ADOPTING AGENCY. EACH ENTITY ADOPTING THE CONTENTS OF THE STATEWIDE MANUAL IS RESPONSIBLE FOR ENFORCEMENT OF THE MANUAL WITHIN ITS JURISDICTIONAL BOUNDARIES.

IN THE EVENT THAT CONFLICTS ARISE BETWEEN THE STATEWIDE MANUAL AND OTHER DRAINAGE MANUALS, THE MANUAL ADOPTED BY THE ENTITY THAT HAS JURISDICTION OVER THE SUBJECT AREA WILL GOVERN.

2.2 NEW AND REVISED FLOODPLAIN DELINEATIONS



In order to effectively regulate existing and new floodplain improvements and to reduce the amount of future losses due to flooding, flood hazard areas should be clearly identified, studied, and delineated. Many drainageways have been analyzed by various local, state, and federal agencies, and their floodplain delineations can be found on either the Flood Insurance

Rate Maps (FIRMs) published by the Federal Emergency Management Agency (FEMA) or the community's floodplain maps. However, throughout the State, numerous floodplain areas that are subject to severe flooding have not yet been studied, and as new developments occur in these flood hazard areas, local agencies face the challenge of developing the flood hazard area information.

OPERATING PRINCIPLE

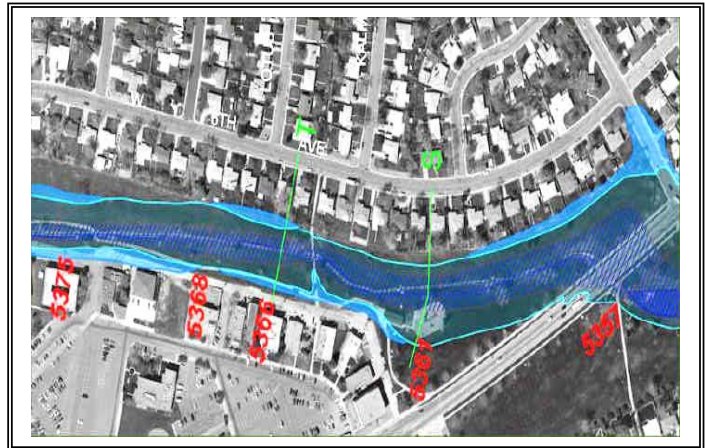
ALL NEW AND REVISED FLOODPLAIN DELINEATION STUDIES WITHIN THE STATE OF COLORADO SHOULD BE PREPARED IN ACCORDANCE WITH THE COLORADO WATER CONSERVATION BOARD (CWCB) "RULES AND REGULATIONS FOR THE DESIGNATION AND APPROVAL OF FLOODPLAINS AND OF STORM OR FLOODWATER RUNOFF CHANNELS IN COLORADO". THE FLOODPLAIN DELINEATION CRITERIA PRESENTED IN THE STATEWIDE MANUAL ARE THE TECHNICAL GUIDELINES OF THE CWCB RULES AND REGULATIONS.

2.3 REGULATORY 100-YEAR FLOODPLAINS

Floodplain is the area of land susceptible to being inundated as a result of the occurrence of a flood event. Floodplain boundaries can be delineated based on two different analysis approaches: detailed and limited methods. The detailed study approach should be used when accurate floodplain information including floodplain limits, water surface elevations and profiles, flood depths and velocities, and



floodway limits are needed for the drainageway being studied. The limited study method may be used when detailed floodplain information is not necessary. The limited study usually results in the delineation of approximate flood hazard areas without base flood elevations.



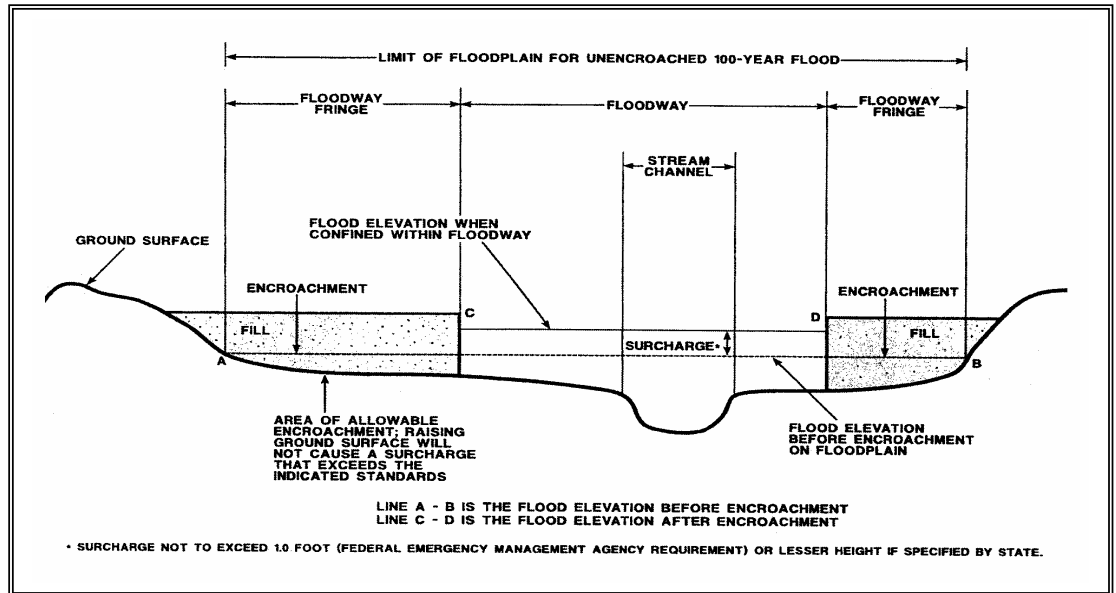
The floodplain limits resulting from a 100-year flood event should be delineated, as a minimum, for all floodplain studies. The 100-year peak discharge at a given point is the estimated peak discharge that has a 1% probability of occurrence in any given year.

OPERATING PRINCIPLE

THE 100-YEAR FLOODPLAINS DELINEATED BY DETAILED OR LIMITED METHODS ARE CONSIDERED TO BE THE REGULATORY FLOODPLAINS OF THE STORM OR FLOODWATER RUNOFF CHANNELS IN COLORADO AS DEFINED IN 37-60-106, COLORADO REVISED STATUTES (CRS).

2.4 DESIGNATED FLOODWAYS

The floodway represents the community's regulatory limit of encroachment into the 100-year floodplain for those watercourses with the established floodway boundaries.



The floodway is defined by Federal Emergency Management Agency (FEMA) as the channel plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year discharge can be conveyed with no more than one foot rise in the water surface above the base flood elevations (BFE). Encroachment into the



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designated floodway is prohibited unless it can be demonstrated using appropriate detailed engineering analyses that the proposed encroachment will not cause any rise in the 100-year water surface elevation.

However, some local jurisdictions in Colorado have determined that the FEMA's 1-foot rise floodway criteria is inadequate to protect the existing and future developments within their communities, and have adopted a stricter floodway delineation criteria (i.e. UDFCD's 0.5-foot rise criteria) in addition to the FEMA criteria.

OPERATING PRINCIPLE

THE CWCB RECOGNIZES THAT DESIGNATED FLOODWAYS ARE ADMINISTRATIVE LIMITS AND TOOLS USED BY COMMUNITIES TO REGULATE EXISTING AND FUTURE FLOODPLAIN DEVELOPMENTS WITHIN THEIR JURISDICTIONS. THEREFORE, COMMUNITIES MAY CHOOSE TO DELINEATE FLOODWAYS BASED ON FEMA'S 1-FOOT RISE CRITERIA OR BASED ON MORE STRICT CRITERIA BY ALLOWING A LESSER AMOUNT OF RISE ABOVE THE BASE FLOOD ELEVATIONS. THE CWCB FLOODWAY OPERATING PRINCIPLE IS SYNONYMOUS WITH COMMUNITIES' ADOPTED FLOODWAY CRITERIA. WHERE NO LOCAL FLOODWAY CRITERIA EXIST, THE CWCB RECOMMENDS THE USE OF THE MINIMUM FEMA STANDARD.

2.5 HYDRAULIC STRUCTURES

A drainage system may be comprised of natural open channel sections, manmade channels, culverts and bridges, levees, dams and reservoirs, detention basins, drop structures, and other related facilities. Hydraulic structures are defined as the drainage facilities that are designed to convey storm or floodwater to a downstream receiving water body.



The recommended design and technical standards for some of the most commonly encountered hydraulic structures are provided in the Statewide Manual. The information presented in the Statewide Manual should be considered to be the minimum hydraulic design standards. Additional analyses may be necessary for unique or unusual site conditions.

Establishment of the minimum engineering standards will help to produce consistency in the design of the hydraulic structures and provide integrated drainage systems that act together to protect the public health, safety, comfort, convenience, welfare, property and commerce. The minimum design standards for the following hydraulic structures are presented in the Statewide Manual:



- Open Channels
- Bridges and Culverts
- Dams and Reservoirs
- Levees
- Detention Basins
- Drop Structures

OPERATING PRINCIPLE

THE CWCB RECOMMENDS THAT GOVERNMENT ENTITIES IN COLORADO ADOPT THE DESIGN STANDARDS PRESENTED IN THE STATEWIDE MANUAL FOR HYDRAULIC STRUCTURES. THE CRITERIA PRESENTED IN THE STATEWIDE MANUAL ARE CONSIDERED TO BE MINIMUM STANDARDS. HOWEVER, GOVERNMENT ENTITIES MAY ADOPT HIGHER DESIGN STANDARDS IF THEY SO DESIRE.

IT IS RECOMMENDED THAT DESIGN AND CONSTRUCTION OF HYDRAULIC STRUCTURES THAT ARE CONSIDERED FOR FULL OR PARTIAL FUNDING BY THE CWCB BE PREPARED IN ACCORDANCE WITH THE GUIDELINES PRESENTED IN THE STATEWIDE MANUAL. THE CONSTRUCTION OF NEW OR MODIFIED HYDRAULIC STRUCTURES SHOULD NOT ADVERSELY IMPACT ADJACENT PROPERTIES WITHOUT DUE PROCESS AS REQUIRED BY FEMA REGULATIONS AND CWCB RULES AND REGULATIONS.

2.6 HYDROLOGY

Hydrologic analysis is performed to determine peak flow rates and/or hydrographs for various selected storm frequencies based on a scientific analysis of the physical hydrologic process of streams, channels, or basins. The estimated flow rates are used to perform hydraulic analysis of existing or proposed drainageways, delineate flood hazard areas, and design drainage structures.

There are many different flow estimation analysis methods and techniques available. However, not all of the methods can be effectively utilized in Colorado. Some methods are not applicable for the hydrologic conditions that exist in Colorado, and other methods cannot be utilized easily or accurately due to the lack of measured data. Also, the computed flow estimates may vary considerably depending on the analysis methods utilized for a given watershed. Therefore, it is necessary to define minimum standards for hydrologic analysis in order to promote accuracy and consistency in the computed flow rates.

OPERATING PRINCIPLE

THE CWCB OPERATING PRINCIPLE IS TO PRESENT HYDROLOGIC METHODS AND MODELS THAT CAN BE USED TO PRODUCE REASONABLE PEAK FLOW RATES AND HYDROGRAPHS FOR USE IN FLOOD-RELATED STUDIES AND PROJECTS ALONG DRAINAGEWAYS WITHIN THE STATE.

IT IS RECOMMENDED THAT THE FLOW RATES, FOR THE PURPOSE OF FLOODPLAIN DELINEATIONS, BE CALCULATED IN ACCORDANCE WITH THE HYDROLOGY CRITERIA PRESENTED IN THE STATEWIDE MANUAL OR BY



USING OTHER TECHNICALLY ACCEPTABLE METHODS AS APPROVED BY THE CWCB AND/OR FEMA.

2.7 FLOODPLAIN DEVELOPMENT PRACTICES

The purposes of floodplain development management practices are to provide



guidelines, conditions, and restrictions for developments in the floodplain areas while protecting the public health, safety, welfare, and property from flood danger and damage.

Floodplain management program elements may include, but are not limited to, floodplain management regulations, structural and non-structural flood mitigation measures, flood warning systems,

emergency response procedures, operations and maintenance, flood insurance, and public education.

To provide impetus for proper floodplain management, the United States government, acting through the FEMA National Flood Insurance Program (NFIP), has established regulations for development in floodplain areas. Working closely together with the participating local communities and the CWCB, the NFIP program helps reduce future flood losses by regulating developments in the 100-year floodplains and by providing flood insurance coverage. National flood insurance coverage is available to property owners and occupants of insurable properties in the communities participating in the NFIP. Flood insurance is required for federal or federally insured loans for building structures located within the FEMA Special Flood Hazard Areas (SFHA). Compliance with the NFIP regulations allows property owners to obtain lower cost flood insurance premiums. Therefore, there are substantial amount of benefits to local communities for remaining in compliance with the NFIP's regulations.

OPERATING PRINCIPLE

COMMUNITIES THROUGH APPROPRIATE FLOODPLAIN MANAGEMENT PRACTICES SHOULD REGULATE AREAS THAT ARE SUBJECT TO FLOODING FROM A 100-YEAR STORM EVENT. THE CWCB RECOMMENDS THAT COMMUNITIES ADOPT AND ENFORCE THE FLOODPLAIN MANAGEMENT CRITERIA PRESENTED IN THE STATEWIDE MANUAL. COMMUNITIES ARE ENCOURAGED TO ADOPT AND ENFORCE FLOODPLAIN MANAGEMENT REGULATIONS, AT THEIR OWN DISCRETION, THAT ARE MORE RESTRICTIVE THAN THOSE PRESENTED IN THE STATEWIDE MANUAL AND THOSE REQUIRED BY FEMA.

2.8 CRITICAL FACILITIES

New and substantially improved critical facilities should be constructed outside of the 100-year flood hazard areas and the lowest floor should be elevated above the 500-



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year flood elevation. If the 500-year flood elevation is not available, the lowest floor should be elevated at least 3 feet above the 100-year flood elevation.

Critical facilities include, but are not limited to:

- Structures or facilities that use or store highly volatile, flammable, explosive, toxic and/or water reactive materials.
- Hospitals, nursing homes and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a flood.
- Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for flood response activities before, during and after a flood event.
- Public and private utility facilities that are vital to maintaining or restoring normal services to flooded areas before, during and after a flood event.



OPERATING PRINCIPLE

THE CWCB RECOMMENDS THAT COMMUNITIES CONSIDER THE 500-YEAR FLOODPLAIN AS CRITERIA FOR DEVELOPMENT OF CRITICAL FACILITIES.

2.9 FLOOD CONVEYANCE IN IRRIGATION DITCHES AND CANALS

There are a number of active, semi-active, or abandoned irrigation ditches and canals within the State of Colorado. These irrigation facilities were originally designed with flat slopes and limited flow conveyance capacities to mainly convey irrigation water to farmers, settlers, and other users. Because the canals and ditches



were usually designed to traverse watersheds, many of these facilities have historically intercepted storm runoffs from the upstream rural and agricultural type basins.

However, with urbanization of the upstream basins, the storm runoffs entering the irrigation facilities have increased in rate, quantity, and frequency. Since the



irrigation facilities are not designed and constructed to safely convey storm runoff flows, they should not be used as outfall points for urbanized area storm drainage systems, unless it can be proven safe through appropriate detailed engineering analysis and the facility owner's consent can be secured. Since the owner's liability from ditch failure increases with the acceptance of storm runoff, the responsibility should be clearly defined before a combined system is approved.

OPERATING PRINCIPLE

THE CWCB RECOMMENDS THAT IRRIGATION FACILITIES (I.E DITCHES AND CANALS) NOT BE USED AS STORMWATER OR FLOOD CONVEYANCE FACILITIES, UNLESS SPECIFICALLY APPROVED AND DESIGNATED BY LOCAL GOVERNING JURISDICTIONS AND ACKNOWLEDGED BY THE IRRIGATION FACILITY OWNERS. THE FLOOD CONVEYANCE CAPACITY OF IRRIGATION FACILITIES SHOULD BE ACKNOWLEDGED ONLY BY AGREEMENT BETWEEN THE FACILITY OWNERS AND LOCAL GOVERNING JURISDICTIONS. THE CWCB MAY DESIGNATE AND APPROVE 100-YEAR FLOODPLAIN INFORMATION FOR IRRIGATION FACILITIES IF THE ABOVE RECOMMENDATIONS ARE MET.

2.10 STORMWATER RUNOFF DETENTION

Detention basins have been commonly used to mitigate increase in peak flows due to new developments. Detention is also considered a viable method to reduce urban drainage costs. Temporarily detaining storm runoff can reduce downstream flood hazards as well as reduce pipe and channel sizes in urban areas. Storage also provides for sediment and debris collection, which helps to maintain water quality in downstream channels and streams. However, detention may not be necessary where downstream drainage facilities in their original or previously improved condition are adequate in capacity to carry flows from fully developed upstream areas without negatively impacting downstream properties.



OPERATING PRINCIPLE

THE CWCB RECOMMENDS THAT LOCAL GOVERNMENT ENTITIES REQUIRE ADEQUATE DETENTION FACILITIES BE APPROPRIATELY DESIGNED AND CONSTRUCTED BY DEVELOPMENT PROPONENTS TO MITIGATE THE INCREASE IN FLOWS CAUSED BY URBANIZATION AND INCREASED IMPERVIOUS SURFACES. THE FLOOD ATTENUATION BENEFITS OF PUBLICALLY OWNED, OPERATED, AND MAINTAINED DETENTION FACILITIES OR PUBLICALLY CONTROLLED PRIVATELY OWNED DETENTION FACILITIES SHOULD BE FULLY RECOGNIZED FOR THE PURPOSE OF DETERMINING FLOOD HAZARD AREAS DOWNSTREAM OF THE DETENTION FACILITIES. THE ATTENUATION BENEFITS OF PRIVATELY OWNED DETENTION FACILITIES THAT ARE NOT CONTROLLED BY PUBLIC AGENCIES SHOULD NOT BE CONSIDERED IN FLOODPLAIN ANALYSES.



2.11 WATER RIGHTS

When drainage systems interfere with existing water rights, the value and use of the water are affected. The existing drainageways and storage locations frequently interrelate with the water rights, which should be addressed when planning the facility to preserve their integrity.

Ditches that have direct flow rights from a stream are controlled by headgates. Drainage improvements, which alter the quantity (or quality) of the water available to the headgate, affect the ability to divert water. Other ditches obtain all or portions of the rights by intercepting the shallow groundwater (seepage right). If the water right has not been abandoned or transferred to another location, the drainage design (including the sub-surface system) should be planned and constructed to preserve the water right. Similar situations can also occur when planning drainage facilities near reservoirs.

OPERATING PRINCIPLE

THE CWCB RECOGNIZES THE IMPORTANCE AND EXISTENCE OF CONDITIONAL AND ADJUDICATED WATER RIGHTS IN COLORADO. ALL NEW DRAINAGE FACILITIES SHOULD BE PLANNED AND CONSTRUCTED WITH PROPER RECOGNITION GIVEN TO THE EXISTING WATER RIGHTS AND APPLICABLE WATER LAWS. DRAINAGE SYSTEMS HAVE THE POTENTIAL TO INTERFERE WITH EXISTING WATER RIGHTS, THEREFORE, THE VALUE AND USE OF WATER RIGHTS SHOULD BE ADDRESSED DURING PLANNING AND IMPLEMENTATION OF DRAINAGE FACILITIES WHERE APPLICABLE.

2.12 WATER QUALITY

A number of studies by the Environmental Protection Agency (EPA) and others have shown that site disturbances due to construction and resulting urbanization decreases the quality of stormwater runoff from the natural conditions. Degraded stormwater runoff quality can have significant adverse impacts on the aquatic ecosystem of the receiving water body, thereby ultimately impacting the quality of life in adjacent communities



In 1972, Congress passed what is currently referred to as the Clean Water Act (CWA). The Act established the National Pollutant Discharge Elimination System (NPDES) program. On December 8, 1999, EPA published final rules for the Phase II stormwater program. Until recently, efforts under the NPDES program have focused on non-stormwater



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discharges from industries and municipal wastewater treatment plants. However, in the last several years, the EPA has expanded the NPDES program to cover stormwater discharges.

OPERATING PRINCIPLE

THE CWCB ENCOURAGES DESIGN OF DRAINAGE FACILITIES AND OTHER MEASURES THAT ENHANCE THE QUALITY OF STORM RUNOFF. PLANNING AND DESIGN OF DRAINAGE FACILITIES SHOULD BE PREPARED TO MINIMIZE ADVERSE IMPACTS AND/OR IMPROVE WATER QUALITY OF THE RESULTING STORM RUNOFF DISCHARGES. DRAINAGE FACILITIES MAY BE DESIGNED TO FUNCTION AS BOTH STORM RUNOFF CONVEYANCE AND WATER QUALITY ENHANCEMENT FACILITIES. THIS RECOMMENDATION IN NO WAY SUPERSEDES REQUIREMENTS RELATED TO THE EPA'S NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) OR OTHER WATER QUALITY STANDARDS.

CHAPTER 2
CWCB PRINCIPLES

SECTION 2
CWCB OPERATING
PRINCIPLES