

**CONSTRUCTION AND OPERATION OF DAMS
IN COLORADO**

BY

**Michael D. Cola, P.E.
Water Resource Engineer
Office of the State Engineer
Dam Safety Branch
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This brochure is to provide general information regarding requirements for the construction and operation of a dam. Dams are categorized into five groups based on their construction and operation requirements. Each category has particular construction and operational requirements which must be met. Typical requirements include submitting an application for construction, obtaining approval by the State Engineer's Office, and cooperating with the safety inspection program. Additional requirements are notification of intent to construct a small dam, obtaining and complying with water rights, financing the project, properly accepting responsibility for damages caused by the dam, and developing an emergency preparedness plan. This brochure outlines these requirements and serves as a guide for locating the appropriate offices that review these requirements.

The Five Categories of Dams

1. **Jurisdictional Dam.** A jurisdictional dam is a dam that is greater than 10 feet in height to the spillway (See Figure 1); or impounds more than 100 acre-feet (AF) of water at the high water line; or impounds a reservoir with a surface area of more than 20 acres at the high water line. In order to construct, repair, alter, or modify such a structure, it is required to have formal plans and specifications approved by the State Engineer prior to construction for dams that have the potential for causing loss of life or property damage to others. The plans and specifications must be prepared by a professional engineer registered in Colorado, who is experienced in dam design.

Plans are engineering drawings showing the layout and details of the dam. The specifications contain criteria for construction materials and the procedures used to build the dam.

2. **Nonjurisdictional Dam.** A nonjurisdictional dam is a dam that is smaller in size than a jurisdictional dam and is not required to have plans approved by the State Engineer. The owner of a nonjurisdictional dam is required to submit a Notice of Intent to Construct an Impoundment Structure (see Applications and Fees). It is recommended that the owner employ persons experienced in dam design or construction to advise them on proper construction techniques.

3. **Livestock Water Tank.** A Livestock Water Tank (LSWT) is a dam intended to hold water for livestock. A LSWT can only be permitted on a normally dry stream, which is a stream that is considered dry 80% of the time. The stored water may not be used for irrigation. The dam cannot be greater than 15 feet from the bottom of the stream channel to the bottom of the spillway measured at the upstream toe, and the dam must also have a minimum of four feet of freeboard. The total maximum height of embankment cannot exceed 19 feet, and the capacity of the reservoir cannot exceed 10 AF. There are standard specifications for construction that are provided with the application form which is available from the State Engineer's Office.

4. **Erosion Control Dam.** An Erosion Control Dam (ECD) is a dam which may be constructed on normally dry water courses for the purpose of erosion control. The dam cannot have a vertical height exceeding 15 feet measured from the upstream toe to the bottom of the spillway channel, nor have a capacity exceeding ten acre-feet at the spillway level. An ECD must have an ungated outlet conduit with a 12-inch minimum diameter, or large enough to pass any storage in excess of two acre-feet in 36 hours. The dam may be constructed to impound two acre-feet of water below the outlet intake. There are standard specifications for construction that are provided with the application form which is available from the State Engineer's Office.

5. **Exempt Structures.** Exempt structures or dams are listed in Table 1. The word "exempt" is used in the statutes to exclude structures from the control of the State Engineer's Office. Exempt dams are monitored by agencies other than the State Engineer's Office. Telephone numbers of agency contacts for various exempt structures are listed in Table 1. The State Engineer's Office may be involved in evaluating an exempt structure, if requested by the responsible agency, or to confirm exempt status.

Applications and Fees

There is an application or notification procedure for each of the four categories of dams that are regulated by the State Engineer's office.

Jurisdictional Dam. Currently, an application to construct, repair, or modify a jurisdictional dam consists of submitting: 1) an application form, 2) formal plans and specifications, 3) supporting documentation, and 4) an application fee based on the rate of \$2 fee/\$1,000 estimated construction cost, with a maximum fee of \$200. The application for constructing, repairing or modifying a jurisdictional dam is made directly to the State Engineer's Office. Application forms are available from the State Engineer's or Division Engineer's office.

Nonjurisdictional Dam. Anyone planning to construct a nonjurisdictional dam must submit a completed "Notice of Intent to Construct a Nonjurisdictional Water Impoundment Structure" form to the appropriate Water Commissioner or Division Office. The forms are available from the State Engineer's or Division Engineer's office. There is no fee.

Livestock Water Tank and Erosion Control Dam. Livestock Water Tanks and Erosion Control Dams each have their own application forms and require a \$1 filing fee per structure. The forms are submitted to the Water Commissioner or Division Engineer and are forwarded to the State Engineer's Office for approval. The forms are available from the State Engineer's Office, and Division Engineer's office, and at most Soil Conservation Service offices.

DAM SAFETY PROGRAM

The State Engineer's Office has a Dam Safety Branch, which administers the State Dam Safety Program. The branch consists of a Design Review Unit and two Field Engineering Units. The Design Review Unit is primarily concerned with reviewing engineering designs, and performing construction inspections. The Field Engineering Units are responsible for safety inspections of about 2,000 jurisdictional dams.

The Design Review Unit reviews formal plans and specifications for jurisdictional dams. The proposed construction or repair of a dam is reviewed to determine compliance with the Design Review Manual, the Rules and Regulations (See Table 2), the Colorado Revised Statutes (See Table 3), and accepted engineering references and practice. Statutes require that plans and specifications be reviewed within six months. The Design Review Unit also reviews engineering studies, such as hydrology and geotechnical reports. These studies are reviewed when time permits and completion of a review can be delayed by other priorities. Plans are usually scheduled for review in the order in which they are received. Review comments and necessary revisions are provided to the owner's engineer. When plans and specifications, construction applications, and studies are approved, the owner and his engineer are notified in writing. Once plans and specifications are approved, the owner must initiate construction within five years, or the design must be resubmitted for approval to insure the design is current with the state of the art. Once the plans are approved, the owner is required to keep the state informed about initiation of construction, progress, and completion of the dam. The state conducts periodic inspections of the construction.

The Design Review Unit also reviews applications for LSWT's and ECD's forwarded from Division Offices. The Unit makes final checks for compliance with the statutes, and for completeness of the application. Applications are generally reviewed within two weeks.

All jurisdictional dams which pose a potential threat to life and property (Class I and Class II Dams) are inspected annually or more often if it is determined to be necessary by the State Engineer. Jurisdictional dams with the potential for

causing minor damage (Class III) are inspected at least once every five years.

Jurisdictional dams, which the State Engineer determines not to be a hazard, except perhaps to the respective dam owner, are not inspected routinely (Class IV). Further discussion of the four hazard classifications for jurisdictional dams is found in the Rules and Regulations, listed as a reference in Table 2 and available for purchase from the State Engineer's office.

Other dams may be inspected for compliance with size criteria or in response to a complaint or request for inspection. The cost of all dam inspections are usually invoiced to the owner as required by statute. The charges are based on the amount of time and expenses incurred but cannot exceed \$125 per day. When a complaint is received it is evaluated for urgency and handled based on a reasonable priority. The complainant is advised that if a dam is inspected and found safe, that they may be charged for the inspection. If the dam is unsafe, the owner will be advised and invoiced for the inspection. Further information on the Safety Inspection Program may be found in the State Engineer's Dam Safety Manual (see Table 2). Copies of the Dam Safety Manual are available from the State Engineer's Office.

WATER RIGHTS

Building a water storage dam does not insure that an owner will have the right to store water. The owner obtains a water right through the Water Court system. On the other hand, having a water right does not allow the owner to construct a dam. Construction of a dam must be approved separately.

There are seven Water (Irrigation) Divisions within the state based upon the seven major drainage systems or watersheds. They are: 1) the South Platte River, 2) the Arkansas River, 3) the Rio Grande, 4) the Gunnison River and Lower Dolores River, 5) the Colorado River, 6) the Yampa and White Rivers, and 7) the San Juan, Animas, La Plata, and Upper Dolores River (see Figure 2 and Table 4). Each of the divisions has a Water Court (see Table 4) which grants water rights and makes judgments on water cases. Separate from the Water Court is a Division office which administers water rights. The Divisions are further divided into former water districts. Maps showing the boundaries of the divisions and districts are available from the State Engineer's Office. Water Commissioners administer water rights within their districts and report to the Division Engineer. A reservoir will be permitted to store water if the State Engineer has determined that it is safe to do so and that water is legally available.

FINANCING

There are several agencies which have programs that can help finance the construction of dams. The money available from these programs varies with the agencies budget limitations from year to year. Money is generally available as low interest loans or grants depending on the purpose of the dam. Several of the agencies and their programs are outlined in Table 5.

LIABILITY AND INSURANCE

Colorado law provides that any owner, controller or operator who is found to be negligent is liable for certain damages resulting from the failure of the dam. However, no individual stockholder, officer, or member of the board of a company that owns a dam will be personally liable if the company has a valid liability insurance policy, or adequate substitute.

EMERGENCY PREPAREDNESS PLANS (EPP's)

An Emergency Preparedness Plan is required for dams where a failure would be likely to cause loss of life to downstream residents (Class I) or significant property damage (Class II). An Emergency Preparedness Plan (EPP) is a written procedure for reacting to emergency situations caused by the threat of a dam failure. The plan addresses emergency repairs to save a dam from failing, and for warning and evacuation of downstream residents. Key people who will implement the plan must be identified and involved in the plan. The plan must be updated on a timely basis to help insure its effectiveness. Guidelines for the contents of an EPP are provided in the Dam Safety Manual.

TABLE 1. EXEMPT STRUCTURES

<u>Structure</u>	<u>Regulating Agency</u>
1. Mill Tailing Impoundments	Colorado Division of Mined Land Reclamation 1313 Sherman Street Denver, CO 80203 Phone: 866-3567
2. Siltation Structures (Coal Mining)	Colorado Division of Mined Land Reclamation 1313 Sherman Street Denver, CO 80203 Phone: 866-3567
3. Liquid Impoundment Structures (Uranium Mill Tailings)	Colorado Department of Health 4210 E. 11th Ave. Denver, CO 80220 Phone: 331-4830

OTHER EXEMPT STRUCTURES

Structures not designed or operated for the purposes of storing water, such as:

- a. Highways
- b. Roadfills
- c. Railroad embankments
- d. Refuse embankments.
- e. Reservoirs which store water below the natural ground.

TABLE 2

OFFICE OF THE STATE ENGINEER DAM SAFETY BRANCH REFERENCE PUBLICATIONS

1. **Design Review Manual**
This manual provides a ready guide for the engineering community involved in the design of dams under Colorado Statutes. This includes specific directives for submitting plans and specifications.

2. **Rules and Regulations for Dam Safety and Dam Construction**
These rules are promulgated pursuant to the authority given the State Engineer in Sections 37-87-102 and 37-87-105, C.R.S. (1973 & 1988 Supp.) and Section 37-80-102 (11K), C.R.S. (1973), pursuant to Section 24-4-103, C.R.S.(1973).

3. **State of Colorado Dam Safety Manual**
Published June 1983 (Revised January, 1988)
This manual provides specific guidance to dam owners to enable them to carry out their responsibility to maintain a safe dam.

4. **Water Division and District Boundaries Map**
Published 1979 This is a map showing the seven divisions and their districts and their rivers and drainages.

Copies of these publications may be obtained from the Office of the State Engineer for fees established by regulation or statute.

TABLE 3. COLORADO REVISED STATUTES
RELATED TO DAM SAFETY

Statute	<u>Description</u>
Section 37-87-101 through 125 (1973 & 1988 Supp.)	Statutes addressing reservoirs.
Section 37-87-101, C.R.S. (1988 Supp.)	Storage of water.
Section 37-87-102, C.R.S. (1988 Supp.)	Definition of natural stream.
Section 37-87-103, C.R.S. (1973)	Notice of release of stored waters.
Section 37-87-104, C.R.S. (1988 Supp.)	Liability of owners for damage.
Section 37-87-104.5, C.R.S. (1988 Supp.)	Notification of ownership of dam.
Section 37-87-105, C.R.S. (1973 & 1988 Supp.)	Approval of plans for statutory reservoir dams.
Section 37-87-106, C.R.S. (1988 Supp.)	Cost of inspections and observations.
Section 37-87-107, C.R.S. (1973 & 1988 Supp.)	Safety inspections - amount of water to be stored.
Section 37-87-108, C.R.S. (1973 & 1988 Supp.)	Withdrawal of excess water.
Section 37-87-109, C.R.S. (1973)	Complaint that reservoir is unsafe.
Section 37-87-110, C.R.S. (1973 & 1988 Supp.)	Engineer may use force.
Section 37-87-111, C.R.S. (1973 & 1988 Supp.)	Expense of examination.
Section 37-87-112, C.R.S. (1973 & 1988 Supp.)	Review of action of State Engineer.
Section 37-87-114, C.R.S. (1973 & 1988 Supp.)	Penalty - disposition of fines.

TABLE 3 continued

Statute	Description
Section 37-87-114.4, C.R.S. (1988 Supp.)	Annual report.
Section 37-87-114.5, C.R.S. (1988 Supp.)	Applicability of provisions - exemptions.
Section 37-87-115, C.R.S. (1973 & 1988 Supp.)	Damages - State Engineer not liable.
Section 37-87-122, C.R.S. (1973 & 1988 Supp.)	Erosion Control Dams.
Section 37-87-124, C.R.S. (1988 Supp.)	Restriction of facilities within reservoirs.
Section 37-87-125, C.R.S. (1988 Supp.)	Notice of intent to construct impoundment structure.
Section 35-49-101 through 116, C.R.S. (1973 & 1988 Supp.)	Livestock Water Tanks.
Section 37-80-110(e) or (f) or (g) or (h), C.R.S. (1973)	Fees.
Section 37-87-115, C.R.S. (1973)	Gauge Rods.
Section 37-84-117, C.R.S. (1973)	Reservoir in streams.
Section 37-92-502(6), C.R.S. (1973)	Entering private land.
Section 37-92-502(7), C.R.S. (1973)	Obstructions in streams.

For additional information after 1988, the user is advised to reference the subsequent C.R.S. suppliments.

TABLE 4. STATE ENGINEER'S OFFICE, WATER DIVISION OFFICES, AND WATER COURTS

State Engineer's Office
 Dam Safety Branch
 1313 Sherman Street, Room 818
 Denver, CO 80203
 (303) 866-3581

<u>Division</u>	<u>Water Division Offices</u>	<u>Water Courts</u>
1	209 ARIX Building 800 8th Ave. Greeley, Co 80631 (303) 352-8712	P.O. Box C Greeley, CO 80632 (303) 356-4000
2	Colo Nat. Bank Bldg. 219 W. 5th St., Rm. 223 Pueblo, CO 81002 (719) 542-3368	305 Judicial Building 320 W. 10th Street Pueblo, CO 81003 (719) 546-5048
3	422 4th St. Alamosa, CO 81101 (719) 589-6683	Alamosa County Courthouse Alamosa, CO 81101 (719) 589-9107
4	Montrose County Courthouse 308 S. First St. Montrose, CO 81402 (303) 249-6622	P.O. Box 368 Montrose, CO 81402 (303) 249-5859
5	1429 Grand Ave. Glenwood Spgs., CO 81601 (303) 945-5665	Garfield County Courthouse 109 8th St., Suite 104 Glenwood Springs, CO 81601 (303) 945-8109
6	320 Lincoln Ave. Suite E Steamboat Spgs., CO 80477 (303) 879-0272	P.O. Box 773450 Steamboat Spgs., CO 80477 (303) 879-5020
7	1474 Main St. Durango, CO 81302-1880 (303) 247-1845	P.O. Box 3340 Durango, CO 81302-3340 (303) 247-2304

TABLE 5 - AGENCY FINANCE PROGRAMS

<u>Agency</u>	<u>Loan/Grant</u>	<u>Terms</u>	<u>Clients</u>	<u>Comments</u>	<u>Phone and Agency Address</u>
Agricultural Stabilization and Conservation Service (ASCS)	Cost sharing assistance for a maximum of \$3,500 per year per person, or \$10,000 per entity.	Generally one year cost sharing per project, except for qualifying long-term agreements (LTA's).	Agricultural producers	Cost sharing through the Agricultural Conservation Program (ACP). For priority conservation projects as determined by local county ASCS offices. Structures must be maintained by recipients for 10 years or ACP money must be refunded. Technical assistance must be done through SCS. No application fee.	2490 W. 26th Ave. Denver, CO 80211 (303) 964-0200 or see the phone book listings for local ASCS offices.
Bureau of Reclamation	Loans up to 2/3 of maximum allowable total project costs. Grants are available for multi-purpose with flood control recreation or fish and wildlife	Interest bearing loans for municipal or industrial supply and power generation. Interest rate is determined at time of loan. Loans up to a maximum of 40 years.	Government agencies, political subdivisions, conservancy districts, irrigation districts, water-user organizations and interstate compact agencies.	Water use must include irrigation. Loan/grants under the Small Reclamations Project Act of 1956 (Public Law 84-984). Cost \$5000 to process application plus the cost of any special studies.	Loan Program Office Denver Federal Ctr. Denver, CO 80225 (303) 236-8410

TABLE 5 - continued

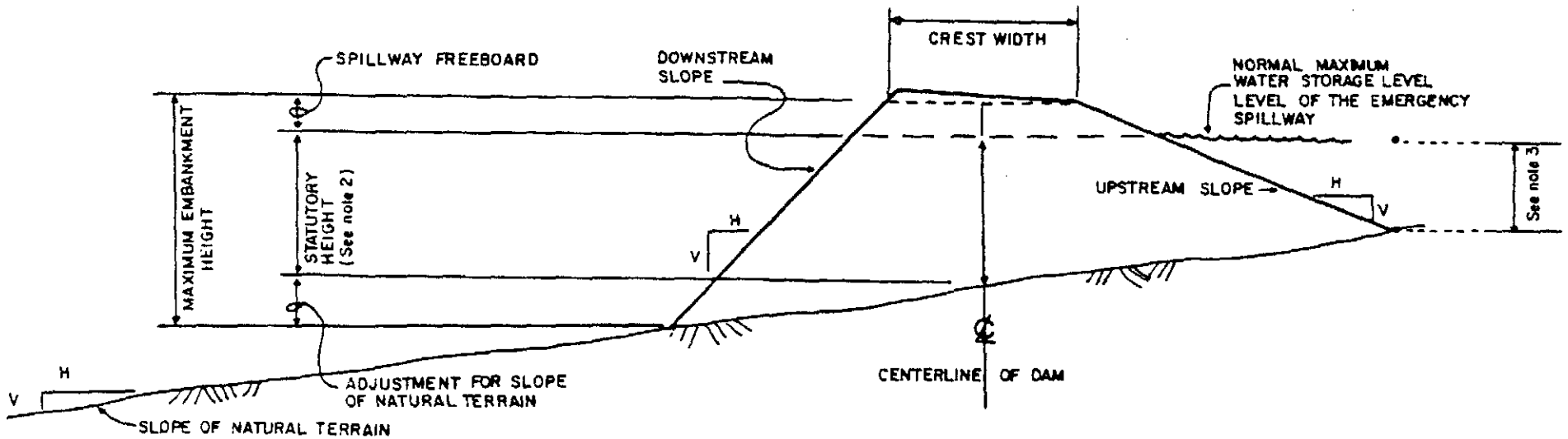
Colorado Water Conservation Board (CWCB)	Loans generally up to 50% of project cost. No grants.	Currently, interest rate is about 5%. Loans up to a maximum of 40 years.	All water users.	For creation and rehabilitation of raw water storage & transmission. Application is processed at no cost, but a feasibility study is required.	1313 Sherman St. Denver, CO 80203 (303) 866-3441
Colorado Water Resources and Power Development Authority	Loans funded through revenue bonds. No grants.	Applicant must show ability to repay loan. Loans up to 30 years.	Public entities such as municipalities and conservancy districts.	For all types of water use. No application fee.	Logan Tower Bldg. 1580 Logan Street Denver, CO 80203 (303) 832-1550
Farmer's Home Administration (FMHA) Community & Business Programs	Loans up to 100% of the project cost. Grants up to 75% of eligible project cost.	Interest rate depends on median income of community. Loans up to a maximum of 40 years.	Rural municipalities with populations under 10,000, water districts, non-profit water associations, and indian tribes.	For domestic water. Applicants must be unable to obtain credit elsewhere. No application fee.	2490 W. 26th Ave. Denver, CO 80211 (303) 964-0150

TABLE 5 - continued

<p>Farmer's Home Administration (FMHA) Farm Programs Division</p>	<p>Amount of loan depends on needs. If FMHA makes the loan directly, the maximum is \$200,000. If a private lender makes the loan, FMHA guarantees 90% repayment up to \$300,000.</p>	<p>Call for approximate interest rates. Loans up to a maximum of 40 years.</p>	<p>Individual farmers, ranchers, qualifying corporations, partnerships, and co-ops.</p>	<p>For irrigation, drainage improvement, soil and water conservation. Applicants must be unable to obtain credit elsewhere. For Erosion control projects, FMHA recommends costs sharing through ASCS and use of SCS to help design the structure. No application fee.</p>	<p>2490 W. 26th Ave. Denver, CO 80211 (303) 964-0150</p>
<p>Soil Conservation Service (SCS)</p>	<p>Cost sharing up to 70% of project costs for Livestock Water Tanks or Erosion Control Dams. Cost sharing up to 50% of project costs for irrigation structures.</p>	<p>Determined by local county offices. Contract for a lump sum of up to \$35,000. Structures must be built within 3 to 10 years.</p>	<p>Non-urban individuals or entities in the plains counties or the San Luis Valley.</p>	<p>Cost sharing available through the Great Plains Conservation Program (GPCP). The program also has a maintenance agreement which is related to the contract term. If the maintenance agreement is not kept, the client must return GPCP money. No application fee.</p>	<p>2490 W. 26th Ave. Denver, CO 80211 (303) 964-0291 or see the phone book listing for local SCS offices.</p>

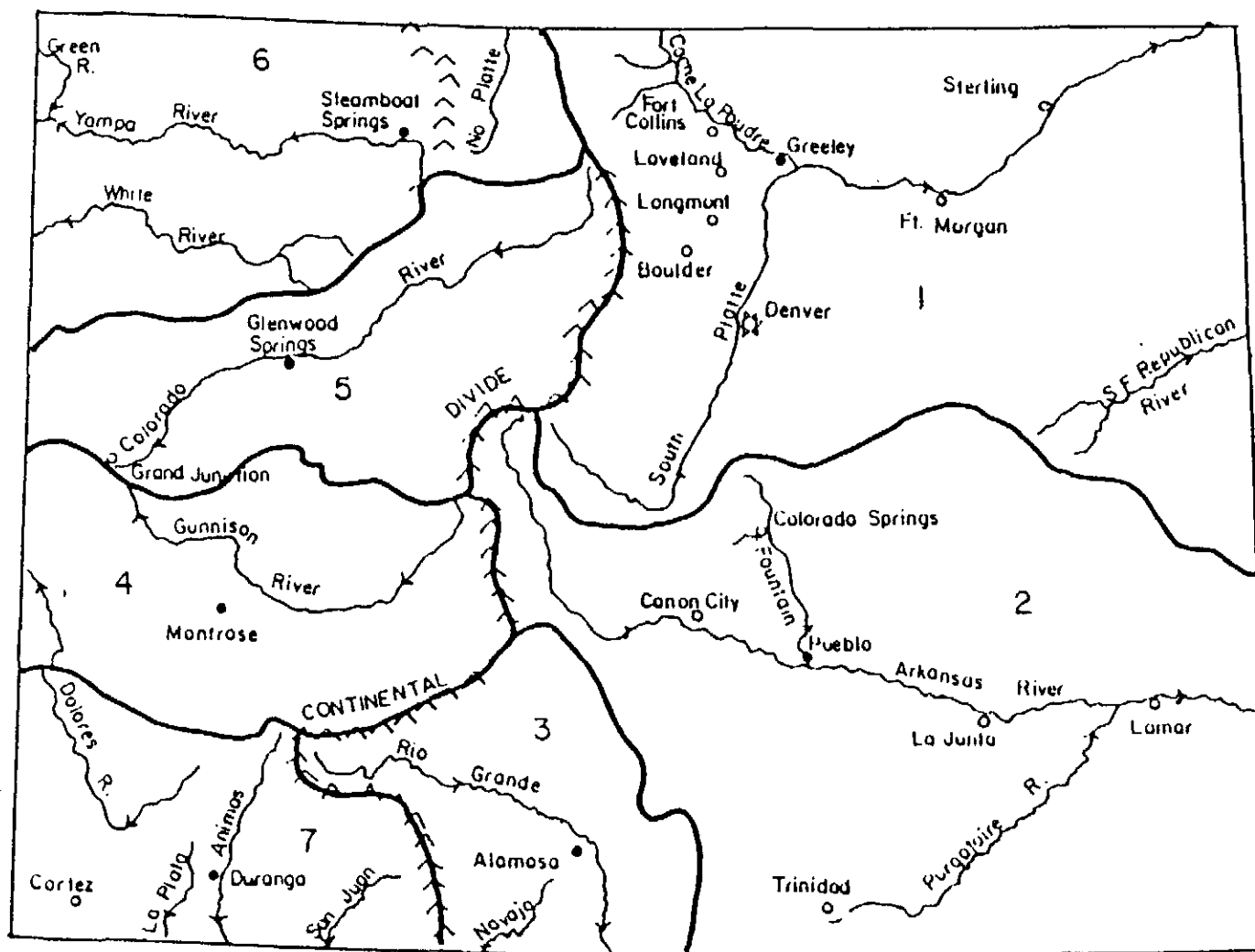
NOTE: A client may be able to combine funding from several of the above sources to raise the necessary capital to build a dam.

FIGURE 1. DAM CROSS SECTION AT THE MAXIMUM HEIGHT






- NOTE: 1. SLOPES ARE EXPRESSED AS A RATIO OF HORIZONTAL DISTANCE (H) TO VERTICAL DISTANCE (V). TYPICAL SLOPES ARE 3:1 ON THE UPSTREAM FACE AND 2:1 ON THE DOWNSTREAM FACE.
2. THIS IS THE HEIGHT OF THE DAM TO THE SPILLWAY AS DESIGNATED IN SECTION 37-87-105, C.R.S. (1973)(1988 Supp.)
3. FOR LIVESTOCK WATER TANKS AND EROSION CONTROL DAMS THE HEIGHT TO THE SPILLWAY MEASUREMENT IS MADE FROM THE UPSTREAM TOE BASED ON ESTABLISHED POLICY.

FIGURE 2 MAP OF COLORADO WATER DIVISION BOUNDARIES AND MAJOR DRAINAGE SYSTEMS



EXPLANATION

-  Direction of Flow
-  Division Boundary
- 5** Division Number
-  Location of Division Offices and Water Courts