



Dam Safety in Oregon

A General Guide





State of Oregon
Water Resources Department
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Oregon Water Resources Department

www.wrd.state.or.us - Dam Safety website, forms, and administrative information. The website is updated regularly with news and events.

Federal Emergency Management Agency

www.fema.gov - US government agency dedicated to disaster mitigation, preparedness, and response and recovery planning. Links can be found on their website to Dam Safety and the FEMA Emergency Action Plan. This website is regularly updated with current emergency related news.

Association of State Dam Safety Officials

www.damsafety.org - ASDSO is a non-profit organization of state and federal dam safety regulators, dam owners and operators, engineering consultants, manufacturers and suppliers, and others interested in dam safety. ASDSO's vision is to lead the US dam safety community with a strong, unified voice and effective programs and policies towards furtherance of dam safety.

Bureau of Reclamation

www.usbr.gov - The Bureau of Reclamation is the second largest supplier of wholesale water and hydroelectric power in the American West. They promote water conservation, recycling, and reuse. The Bureau of Reclamation is a contemporary water management agency with a strategic plan outlining numerous programs, initiatives, and activities that will help meet new water needs and balance the multitude of competing uses of water in the west.

US Army Corps of Engineers

www.usace.army.mil - Their mission is to provide quality, responsive engineering services to the nation including planning, designing, building, and operating water resources and other civil works projects. Navigation, flood control, environmental protection, and disaster response links are updated regularly.



Purpose

Dam safety is an important issue of which the public needs to be familiar. This booklet has been designed to cover topics that will benefit the public, engineers, dam owners, and watermasters. This booklet also covers Oregon's laws pertaining to dams and a glossary of commonly used terms.



History

of the Dam Safety Program

Dam safety laws in Oregon were first adopted in 1909, and then modified in 1927, and again in 1929 following the catastrophic failure of California's St. Francis Dam, when the statutes were amended to their present form, more or less. Initially, the review of design plans and specifications was conducted by the State Engineer, and then by a staff engineer in the State Engineer's Office. This one person operation continued until 1956 when the staff was increased to two-full time engineers.

In 1975, further amendments to Oregon water laws merged the State Engineer's Office and the Water Resources Board, forming the Water Resources Department and changing the title of the department head from "State Engineer" to "Water Resources Director". The State Water Policy Review Board and oversight committee was also created,

consisting of 7 members from the public appointed by the Governor. As a consequence, the authority to take enforcement actions for protection of human life and property related to Dam Safety was transferred from the State Engineer to the Water Resources Director.

An inspection technician was added to the Dam Safety Program in 1978. Also, Dam Safety added five engineers with funding provided by Congress. A direct result of the increased funding allowed completion of 50 Phase I Inspections Reports for existing high hazard, non-federal dams within the state. In 1982, the program ended as federal funding was eliminated. All but two of the engineering positions and the inspection technician position were also eliminated.

The name of the State Water Policy Review Board was changed to the Water

Resources Commission in 1983, and to it was given new responsibilities for policy decisions, rule making, and management of the agency. Shortly thereafter, the Commission delegated much of its new found authority back to the Director's Office. Until this time, Dam Safety had existed as a separate, stand alone unit.

Later, Dam Safety was combined with the Enforcement Division within the agency. The program was reduced to a single Dam Safety Engineer and one technician. Watermasters were assigned routine inspection duties for existing dams in addition to their other water distribution and regulation assignments. Additionally, other program areas were assigned to the remaining Dam Safety Engineer, including Hydroelectric Facility licensing and Hydrographics.

In 1990, the agency was reorganized so that Dam

Safety was combined with Computer Services, GIS, Hydrographics, Hydrology, and Groundwater to form the Technical Services Division. The Hydroelectric Licensing section was moved into the Water Rights Division, however the Dam Safety Engineer was still required to manage a division with about 35 employees.

In 1993, an engineer was hired as Dam Safety Coordinator to upgrade and replace the technician position that was eliminated due to retirement. For a short while, the Technical Services Division was combined with the Field Services Division, but then reverted to the previous arrangement that placed Dam Safety in the Technical Services Division. At present, the Dam Safety Engineer also serves as Division Administrator. The Dam Safety Coordinator is responsible for the management of the Dam Safety Program.

Responsibility

Duties of the Dam Safety Program

The Dam Safety Program is responsible statewide for the review and approval of dam designs, scheduling inspections of existing dams and reservoirs, conducting site inspections of new dam construction, and maintaining both the National Dam Inventory (NID) and the state database.

It is important to realize that the ultimate responsibility for the continued safe operation of any dam or reservoir rests entirely with the dam owner(s). Oregon does not require proof of insurance before a reservoir is filled with water. Typically, water right holders own the land upon which most dams and reservoirs are built. In cases where there are no associated water rights or where the water right holder does not own the real property where the structure is situated, the State presumes the land owner also to be the owner of the dam.

The Dam Safety Coordinator provides assistance to watermasters and to owners and operators of dams when questions or situations arise that require engineering advice or training. Other duties include hazard assessment of existing structures, review of emergency management plans, and review of water right transactions (applications, permits, certificates) to assure that appropriate conditions are met that will help to provide safety for downstream life and property.

“To serve the public by practicing and promoting responsible water management.”

*Water Resources
Department Mission
Statement*

The Dam Safety Coordinator also performs all regular clerical and office support duties. The state is divided into four regions and twenty watermaster districts. In addition to their duties relating to regulation of water use and distribution, the watermasters assist with performing routine and regularly scheduled inspections of low hazard dams and reservoirs within their respective districts according to a schedule prepared and updated by the Dam Safety Coordinator.



Approximately 8 to 10 percent of each watermaster's time is allocated toward dam and reservoir inspections. At present, nearly 1300 dams and reservoirs are inspected at an interval of 1 to 5 years. Of those, more than 100 structures are owned, operated, or supervised by federal organizations who also maintain active dam safety programs. Some examples of these federal organizations are the Corps of Engineers, Bureau of Reclamation, and certain hydroelectric power generating facilities licensed by the Federal Energy Regulatory Commission (FERC). The Oregon Water Resources Department participates with the respective federal agencies in the inspection of those structures.

Responsibility

For more information about the National Flood Insurance Program (NFIP), visit the website:
www.floodsmart.gov

The National Flood Insurance Program (NFIP) provides federally backed flood insurance in communities that comply with minimum standards for floodplain management. As an incentive, standard homeowners and commercial property located within a designated “flood zone” can receive an insurance premium rate reduction based on various activities that communities voluntarily undertake to reduce flood losses. Once enrolled in the NFIP, each participating community is evaluated based upon the number of credit points earned according to prerequisite activities listed under the NFIP’s Community Rating System (CRS). Depending on the total number of credit points, the CRS assigns a community to one of 10 classes. A maximum 45% insurance premium discount is possible if all CRS criteria are satisfied.

For more information about the Association of State Dam Safety Officials (ASDSO), visit the website:
www.damsafety.org

Under CRS Activity 630, a participating community will automatically receive up to 75 credit points if their respective state has a dam safety program that meets certain criteria based on the Model Dam Safety Program recommended by the Association of State Dam Safety Officials (ASDSO). Information and guidelines contained as key components of the

Model State Dam Safety Program are broken into the following chapters:

- I. Legislation and Regulations
- II. Permitting, Design Approval and Authorization to Impound
- III. Inspection
- IV. Enforcement
- V. Emergency Response
- VI. Program Staff and Funding
- VII. Program Staff and Dam Owner Education and Training
- VIII. Dam Safety Program Public Relations Plan

Presently, the Oregon dam safety program does not have authority to take corrective or emergency action if a dam owner fails to comply with an Order. Therefore, Oregon communities participating in the NFIP do not receive any credit points for the state dam safety program. In order for communities to receive this additional credit, all of the elements listed in the Model Dam Safety Program must also be included in the state's program.



What Constitutes a Dam?

“Dam” is not specifically defined in any of Oregon’s statutes or rules. Regardless of a legal definition per Oregon law, a dam is taken here to mean: “any artificial barrier, including appurtenant works, that impounds or diverts the flow of water.”

(See Glossary)

Hazard vs. Risk

When considering hazard in terms of dam classification, it is important to realize that the term “Hazard” is not the same as “Risk”. For example, a large dam may be rated a high hazard structure because its location is such that a catastrophic failure and sudden release of water could adversely threaten downstream life and property. However, the same dam also could be at low risk for failure because it is conservatively engineered, receives regular inspections, and is exceptionally well maintained. Thus, its probability for failure is very low. In other words, risk is the product of hazard multiplied by the probability that a failure will occur.



Another example to illustrate this concept would be a smaller sized irrigation reservoir located miles from human habitation. In this situation, the dam is rated a low hazard structure because of its location, but it could be at high risk for failure because it was not properly designed by an engineer, it has never been inspected, and it is poorly maintained.

It is important to realize that a dam's hazard rating does not define the physical condition of the structure. Instead, "Hazard" is the definition that is used to estimate the amount of damage that could occur in the event the dam were to suddenly fail and release the contents of its reservoir. For that reason, any dam that is rated a high hazard structure must be properly designed, regularly inspected, and maintained in the best condition at all times because the consequences of a failure are just too great to ignore. All reasonable methods must be implemented to reduce the *risk of failure* for high hazard dams.



Hazard



Probability
of Failure
Occurring

Oregon Dam Safety has divided existing dams into three hazard classifications. Each rating is an estimate of the potential consequences to downstream life and property that would result from a catastrophic dam failure.

Low

Low hazard dams are scheduled to be inspected every 4 to 5 years depending on the owner's ability to maintain the dam. A sudden or rapidly developing failure of the dam or a sudden uncontrolled release of stored water from the reservoir would not appear to threaten human life. Downstream property damage would be limited primarily to the stream channel.

Significant

Significant hazard dams are scheduled to be inspected every 2 to 3 years depending on the condition of the dam, and the owner's ability to provide upkeep, the maintenance record, or the outward appearance of the dam. A sudden or rapidly developing failure of the dam or a sudden uncontrolled release of stored water would most likely result in significant property damage, and/or the potential for causing the indirect loss of human life.

High

High hazard dams are scheduled to be inspected on an annual basis, alternating between seasons. A sudden or rapidly developing failure of the dam or a sudden uncontrolled release of stored water would likely result in direct loss of human life. Severe and/or widespread property damage would also be expected to occur.

Permits

Reservoir Permits and the Permitting Process

Under Oregon law, all water belongs to the public. With few exceptions, any person wishing to appropriate and store surface water or ground water must first obtain a permit from the Water Resources Department. The water right, once developed, is considered to be a type of property right and is attached to the land where it was established. Consequently, real property with an attached water right may be several miles from the actual source of water. In Oregon, landowners with water flowing past, through, or below their property do not automatically have a right to use that water.

Oregon's water laws are based on the Principal of *Prior Appropriation*. This means the first person to obtain a water right on a stream is the last to be shut off in times of low streamflows. In water-short times, the water right holder with the oldest date of priority can demand the water specified in their water right regardless of the needs of junior users. If there is a surplus beyond the needs of the senior right holder, the water right holder with the next oldest priority date can take as much as necessary to satisfy needs under their right and so on down the line until there is no surplus or until all rights are satisfied. The date of application for a permit to use water usually becomes the priority date of the right. Generally, storage water rights have a junior priority date. For that reason, reservoirs are typically filled during the non-irrigation season from excess winter stream flow.

Reservoir applications and other forms can be found on the web:
www.wrd.state.or.us

Permits

Reservoir Permits and the Permitting Process

Oregon's Water Code

four fundamental provisions

1. Beneficial purpose without waste

Surface or ground water may be legally diverted for use only if it is used for a beneficial purpose without waste.

2. Priority

The water right priority date determines who gets water in a time of shortage. The more senior the water right, the longer water is available in a time of shortage.

3. Appurtenancy

Generally, a water right is attached to the land described in the right, as long as the water is used. If the land is sold, the water right goes with the land to the new owner.

4. Must be used

Once established, a water right must be used as provided in the right at least once every five years. With some exceptions established in law, after five consecutive years of non-use, the right is considered forfeited and is subject to cancellation.

Applying for a Permit to Use Water

Oregon law requires a Reservoir Permit from the Water Resources Department to store water in an above-ground reservoir. Additionally, a separate permit is needed to apply the stored water to a beneficial use. In most instances, two applications for permits are usually required for above ground reservoirs, those being:

- A *primary* application for reservoir storage of a given volume of water, including both ground water and stream flow and pumped ground water sources.
- A *secondary* application to appropriate surface water or to use water from a reservoir in excess of the amount that was needed to initially fill the reservoir. A secondary application is required to maintain the level of water in the reservoir and to replenish the amount of stored water lost due to evaporation and/or seepage.

Obtaining a permit is a critical hurdle in obtaining a water right. A reservoir permit is the authorization necessary from the State of Oregon via the Water Resources Department to store water. With few exceptions, any existing or proposed hydraulic structure for storage of water requires a permit, regardless of its height or capacity.

- The Alternate Review Application Process for a Water Right Permit pertains to a pond or reservoir of any storage capacity with a dam height less than 10 feet. If the dam is 10 feet or greater, the maximum amount of water stored under the Alternate Review Process must be less than 9.2 acre feet.
- The Standard Review Application Process is for any reservoir that is both greater than or equal to 9.2 acre feet and with a dam height of 10 feet or greater. With few exceptions, engineered plans and technical specifications must be submitted for review and approval before a Reservoir Permit will be issued for these larger sized structures.

Permits

Reservoir Permits and the Permitting Process

Preparing the Reservoir Application

All entries should be typewritten or neatly printed with dark ink. The appropriate filing fee(s) shall accompany each application at the time of submittal. All items must be completed even though portions of the required information may appear on supplemental maps or drawings. Incomplete applications will be returned to the applicant, and will not be assigned a priority date until they are determined to be complete.

How an Application is Processed

Once a completed application has been received, the Department must provide public notice of the application within 60 days. The purpose of the public notice is to allow the public the opportunity to submit detailed, legally obtained information to the Department for consideration as to whether or not the application would be injurious to existing water rights. The Department also notifies other state agencies including the Oregon Department of Fish and Wildlife (ODFW). ODFW provides comments as appropriate regarding potential impact to existing fishery resources. All comments must be submitted within 60 days of the public notice.

Within the prescribed 60-day period, if the Department does not find injury to existing water rights or is notified about detrimental impacts to existing fishery resources, then the Department may issue a Final Order that will

Even if there are no fish living in the stream, the Department is required to notify ODFW of all applications.

allow issuance of a permit within 180 days of the priority date. Because of the processing timelines set forth in ORS 537.409, the Department suggests applicants make certain to file an application prior to scheduling excavation work or expending a large amount of money.

Nonstatutory (Small) Dams Not Subject to Design Review

Nonstatutory dams, those that are less than 10 feet in height or that impound less than 9.2 acre feet, do not require design approval and construction oversight by the Water Resources Department. Nonetheless, a permit to store water is likely required. The local watermaster can assist in filing an application for a permit to store water for these smaller structures.

It is recommended that earthen embankment dams less than 10 feet in height or less than 9.2 acre feet storage capacity have a crest width no less than 8 feet, an upstream slope no steeper than 3:1, and a downstream slope no steeper than 2:1. An emergency spillway channel should be constructed around the dam, not over the top of the fill, and lined to prevent erosion. The spillway should be able to withstand the 50-year flood flow without overtopping the dam. It should also direct the passing flow downstream to prevent erosion of the embankment.

For best results, all brush, stumps, roots, and organic matter should be cleared from the borrow area and beneath the dam. Only fill materials consisting of non-organic and cohesive soils adjusted in moisture to optimum water content should be used for construction of the dam. Individual layers should not exceed 8 inches in thickness and should be compacted with a sheepsfoot roller or similar equipment. Fill material should be placed in thin layers parallel with the long axis of the dam.

Statutory Sized (Large) Dams

The following list is a summary of the minimum requirements for examination and approval of design plans and technical specifications for construction of dams greater than or equal to 10 feet in height and that impound 9.2 acre feet or more of storage. **A licensed professional engineer must prepare these design documents and submit them for approval prior to construction.**

1. Vicinity Map

- ∴ Location of dam and reservoir in relation to township, range, and quarter-quarter section, together with a survey tie (bearing and distance) from a benchmark on the dam to an established government land corner.
- ∴ Watershed map that delineates the contributing drainage area into the reservoir.
- ∴ Access roads, significant land features, urban areas, or downstream development.
- ∴ Borrow areas, quarries, utilities, and property lines within project boundaries.

2. Plan View of Dam and Appurtenances

- ∴ Topographic contour map, maximum 2-foot interval.
- ∴ Locate by station the primary outlet and auxiliary or emergency spillway; if applicable, include toe drains, filters, log boom, or fish by-pass facilities.
- ∴ Area/Capacity Diagram or stage/storage data tabulating hydraulic depth versus corresponding surface area and reservoir storage capacity.
- ∴ Locations of field exploration or subsurface investigation including bore holes, test pits, excavations, trenches, monitoring wells, and other invasive methods.

3. Profile Parallel to Centerline Axis of Dam

- ∴ Existing ground surface and thickness of stripping or grubbing.
- ∴ Grade line for cutoff trench and/or excavation for foundation.
- ∴ Bedrock or foundation material contacts.
- ∴ Crest elevation of dam; include camber if applicable.
- ∴ Locate by station the primary outlet and auxiliary or emergency spillway; if applicable, include toe drains, filters, log boom, or fish by-pass facilities.

4. Sectional View of Dam at Maximum Section

- ∴ Upstream and downstream slopes, including erosion control or armoring.
- ∴ Dam dimensions and elevations; X (width) and Y (height) coordinates.
- ∴ Emergency spillway crest elevation and spillway channel grade line(s).
- ∴ Water surface elevations, including normal pool and flood maximum.
- ∴ Interior material zones and/or internal filters.
- ∴ Invert elevations of outlet conduit, toe drains, and other internal piping.
- ∴ Existing ground surface and thickness of stripping or grubbing.
- ∴ Cutoff trench and/or excavation for foundation, with dimensions.

5. Emergency Spillway Detail Drawing

- ∴ Both a sectional and profile view.
- ∴ Elevations and dimensions at all stations where channel configuration or grade lines transition or otherwise change.
- ∴ Dimensions and elevations for stilling basin or other flow and energy dissipaters, including both formed-in-place concrete or constructed channel armoring.
- ∴ Elevations and dimensions of flow control mechanisms such as flash boards, stop logs, lift or tainter gates, or channel splitters.

6. Outlet Conduit and/or Primary Spillway Detail Drawing

- ∴ Cross section showing sizes, dimensions, and type(s) of material, including concrete encasement and/or pipe bedding.
- ∴ Draw down curve, flow rating information, or discharge capacity data.
- ∴ Longitudinal section (profile) illustrating configuration and position of conduit and all joints, flanges, or other connections.

7. Outlet Works Detail Drawing

- ∴ Operating gates or valves, and guard gates or valves; if manufactured, list the name, model number, supplier, etc.
- ∴ Base block or anchor, pedestals, operating stem and/or lift mechanism.
- ∴ Fish screen, trash rack, or other clog prevention device.

8. Technical Data

- ∴ All elevations referenced to established benchmark, such as MSL or NGVD.
- ∴ Hydrologic report or calculations verifying adequacy of emergency spillway at 100-year storm (1% flow) or PMF as appropriate.
- ∴ Summary report of foundation investigation which may include site geology, ground water hydrology, drill logs, test pits, laboratory test results and geotechnical stability analysis for rapid drawdown, flood loading and/or seismic analysis as appropriate.
- ∴ Bid package or a complete set of technical specifications for design, manufacture, placement, and testing of construction materials or material components as appropriate.

9. Operation and Maintenance Manual

(Significant and High Hazard Dams)

- ∴ Preventative maintenance schedule, contact information, storage/release schedule.

10. Emergency Action Plan

(High Hazard Dams)

- ∴ Dam failure/breach analysis for both sunny day and storm scenario.
- ∴ Downstream inundation maps for sunny day and storm failure scenarios.
- ∴ Monitoring and/or warning systems, notification charts, and evacuation procedure(s).

Inspection

Process of Inspecting Dams

No person shall construct any dam that is 10 feet or greater in height and stores 9.2 acre feet or more, unless the Department has made an examination of the site and of the plans and specifications and other features involved in the construction of such works, and has approved them in writing. (ORS 540.350; amended 1981)

Periodic inspection of existing hydraulic structures for protection of public safety is part of the Oregon Dam Safety Program. However, Oregon laws do not specify the frequency of inspections. The inspections are made under the supervision of the Dam Safety Coordinator.

Many dam owners do not realize their responsibility and liability toward the downstream public and environment.

If a person residing on or owning land in the neighborhood of any dam after completion, or in the course of construction, applies to the Director desiring inspection of the works, the Director may order an inspection, or he may make such order on his own motion. If the inspection is deemed justified by the Director, he may require that the owner pay all or part of the expenses for the inspection. (ORS 540.390)

If a potential risk is discovered during an inspection or the structure is determined to be unsafe, the owner of the dam is notified and requested to take necessary action to prevent failure of the dam. Owners are expected to maintain their hydraulic structure in a safe and responsible manner and make proper repairs to keep it operational.

Rating Criteria

Very Good Condition

- a. No apparent problems; new or newly replaced.
- b. Well maintained and supervised.
- c. No need for increased maintenance or monitoring activities.

Acceptable Condition

- a. Fully functional and trouble-free operation.
- b. Increased maintenance or monitoring may be necessary.
- c. Letter to owner may be appropriate to advise of maintenance/monitoring.

Unsatisfactory Condition

- a. Marginally functional under normal conditions, but could be a potential problem under extreme loading or operating conditions not routinely experienced.
- b. Intensive maintenance program necessary to prevent further deterioration.
- c. Minor repair, rehabilitation, or restoration may be necessary in addition to increased maintenance or monitoring activities.

Repair or Replace

- a. Non-functional, defective, or missing component.
- b. Deterioration has progressed beyond ability of maintenance program or owner's willingness to adequately restore to design conditions.
- c. Major repair or rehabilitation necessary to restore dam, spillway, or appurtenant works to original design or to standards acceptable to OWRD Dam Safety.

Inspection Form

Process of Inspecting Dams



State of Oregon
Water Resources Department
725 Summer Street NE, Suite A
Salem, Oregon 97301-1266
(503) 986-6900

Dam Safety Inspection Form

Name of Dam or Reservoir: _____ Date: _____
 Permit/Certificate: _____ District: _____ NID: _____ File: _____
 Height: _____ Storage: _____ Photo Attached: _____ Hazard: Low Medium High
 Inspector: _____ Weather: _____ Score: _____

Component	Next inspection:	Observation and Remarks	Rating
I. Primary Dam	<input type="checkbox"/> Earthen <input type="checkbox"/> Rock Zoned <input type="checkbox"/> Concrete <input type="checkbox"/> Other		
Upstream slope			
Crest			
Downstream slope			
Right abutment			
Left abutment			
Toe			
Auxiliary dam/dike???	Yes <input type="checkbox"/> No <input type="checkbox"/> If "Yes", include on separate inspection form.		

II. Reservoir	Pool level/elevation:	Point of reference:
Floating debris/trash		
Landslides/erosion		
Log boom		

III. Instrumentation	Flow Rate	Water Level	Description/Condition
Toe drains			
Weirs/flumes			
Monitoring wells			
Other			

Go to www.wrd.state.or.us to find WRD forms.

Name of Dam or Reservoir: _____ Date: _____

IV. Primary Outlet	<input type="checkbox"/> Manual	<input type="checkbox"/> Power Assist	<input type="checkbox"/> Other
Trickle tube			
Inlet structure			
Outlet structure			
Control works/stem			
Low level conduit			
Valve/sluice gate	Diameter: _____	Date last fully cycled. Month: _____	Year: _____
Trash rack			
Secondary outlet??	Yes <input type="checkbox"/> No <input type="checkbox"/>	If "Yes", include on separate inspection form.	

V. Emergency Spillway	<input type="checkbox"/> Earthen/Sod	<input type="checkbox"/> Rock	<input type="checkbox"/> Concrete	<input type="checkbox"/> Other
Flashboards				
Control gate				
Approach channel				
Discharge channel				
Stilling basin				
Auxiliary spillway??	Yes <input type="checkbox"/> No <input type="checkbox"/>	If "Yes", include on separate inspection form.		

VI. Security	
Fencing, signage	
Vehicle access road	
On Site Dam Tender	Yes <input type="checkbox"/> No <input type="checkbox"/> Name: _____
Emergency Plan	Yes <input type="checkbox"/> No <input type="checkbox"/> Not required <input type="checkbox"/>

Rating Criteria: Observed Structural or Mechanical Condition
 5 – Very Good
 4 – Acceptable
 3 – Unsatisfactory
 1 – Repair or Replace

10/2005 DMS


Enforcement

Enforcement Procedures

The Dam Safety Program maintains an inventory of existing hydraulic structures that exceed statutory height and storage criteria. When, during the course of inspection of any of the inventoried dams, a particular structure is discovered to be in violation of safety conditions that would adversely affect or threaten downstream life and property, the Director may act to cause the dam owner to remedy the situation.

Upon discovery of a safety hazard that poses a threat to life or property, the Department may notify the owner in writing of the hazard and action(s) necessary to return to the project and appurtenant works to safe design, mechanical operational, or maintenance standards. Failure by the owner to perform the required action may result in proceedings for one or more of the following scenarios:

1. Notice and opportunity for a contested case hearing. [As provided for in ORS 540.350(5).]
2. Cancellation of the permit for failure to make a satisfactory Claim of Beneficial Use.
3. Posting of the structure to prevent storage or to limit operation until the owner has complied with the requested action.
4. Instituting legal action by the District Attorney or Attorney General to have the facility declared a public nuisance.
5. Issuance of an order to prevent storage or to breach the dam. [As provided for in ORS 540.370.]
6. Any other enforcement action permitted by law.



Check out
ORS 183 and
ORS 540 for
more information
about dam safety
enforcement.



Appendices



Statutory Authority

Oregon Revised Statutes pertaining
to dams, reservoirs, and dam safety,
specifically and generally:

ORS 537.190

ORS 540.400

ORS 537.211

ORS 541.050

ORS 537.248

ORS 541.060

ORS 537.400

ORS 541.510

ORS 537.409

ORS 541.515

ORS 537.420

ORS 541.520

ORS 540.340

ORS 541.525

ORS 540.350

ORS 541.530

ORS 540.360

ORS 541.540

ORS 540.370

ORS 541.545

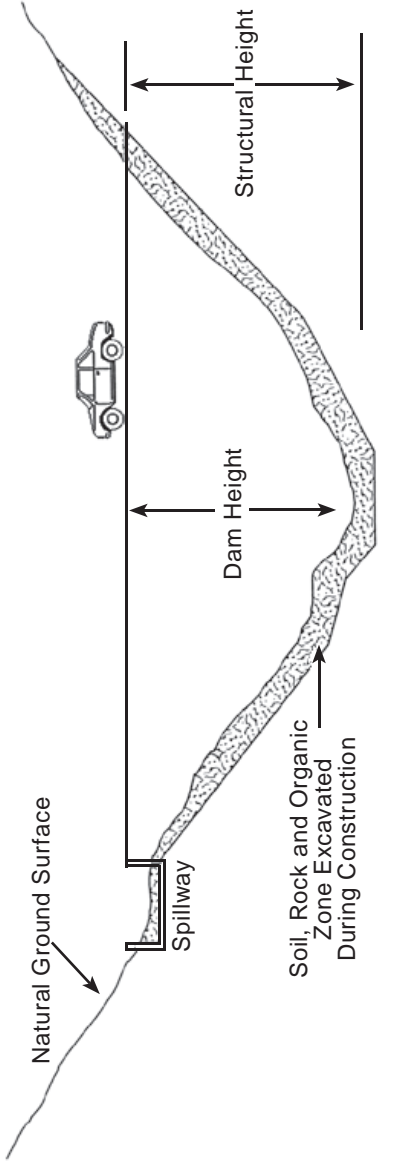
ORS 540.380

ORS 540.390

Go to
www.wrd.state.or.us
for more information
about Oregon
water laws.

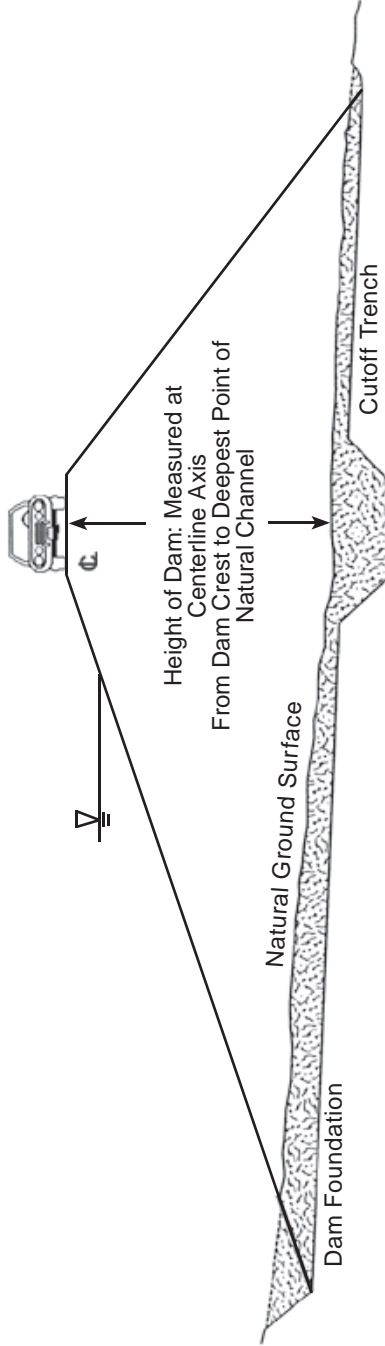
Dam Components

Longitudinal View Along Centerline Axis

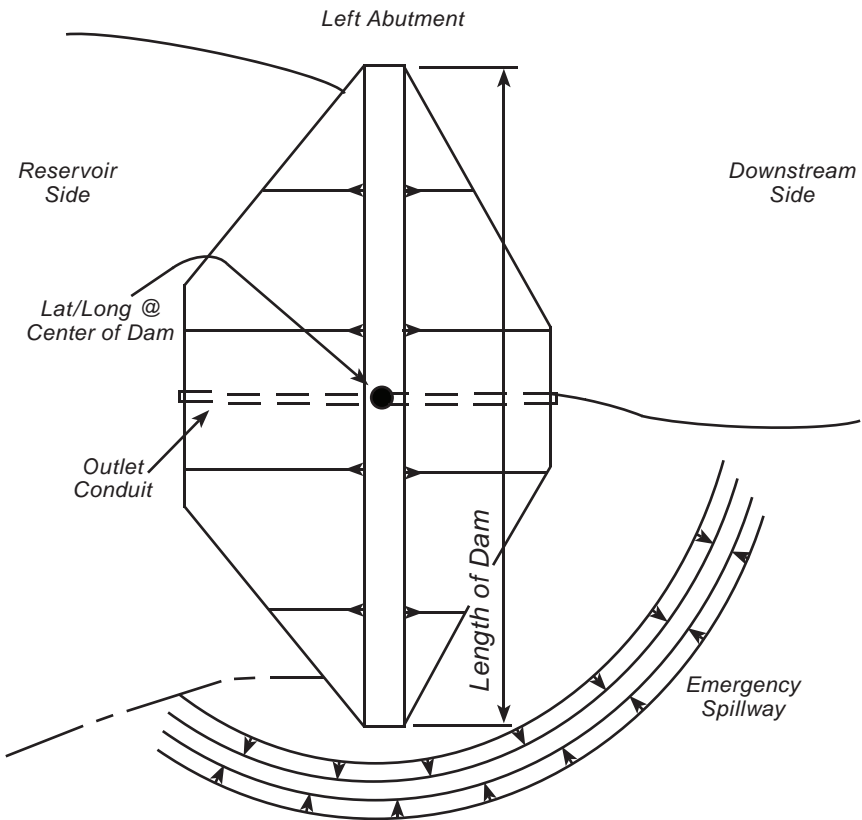


Dam Components

Cross Section (Typical)



Dam Plans



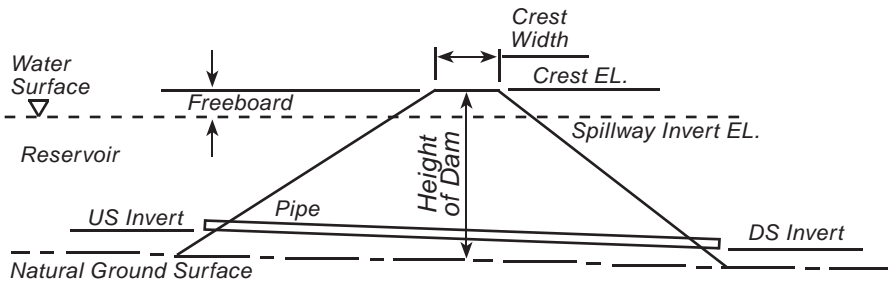
Right Abutment

**Plan
(Typical)**

Dam Plans

Measured Dimensions

- Length of Dam Between Abutments
- Dam Crest Elevation
- Dam Crest Width
- Emergency Spillway Crest Elevation
- Maximum Dam Height
- Principle Spillway Inlet Elevation
- Principle Spillway Outlet Elevation
- Freeboard



Section

Glossary

Abutment: That part of the valley wall against which a dam is constructed. The left and right abutments of dams are defined with the observer viewing the dam looking in the downstream direction, unless otherwise indicated.

Acre foot: The volume or amount of water needed to cover 1 acre (43,560 square feet) 1 foot deep (325,851 gallons).

Breach: An eroded opening through a dam or spillway that drains the reservoir. A controlled breach is a constructed opening. An uncontrolled breach is an unintentional opening which allows uncontrollable discharge from the reservoir.

Channel: A general term for any natural or artificial facility for conveying water.

Cohesionless Soil: A soil possessing little or no shear strength when unconfined (sand).

Cohesive Soil: A soil that exhibits considerable shear strength when unconfined (clay).

Collar: A thin collar placed at uniform intervals along an outlet conduit to retard water seepage.

Compaction: Mechanical action to increase the density of a soil by reducing the number or size of internal voids.

Conduit: A closed conveyance pipe used to release water through a dam.

Contested Case: A legal proceeding before an agency.

Core: A zone of low permeability material in an embankment dam. The core is sometimes referred to as central core, rolled clay core, or impervious zone.

Cutoff Trench: A trench excavated beneath the dam foundation and backfilled with impermeable material to retard water seepage under the dam.

Dam: An artificial barrier across a watercourse or valley for creating a reservoir, diverting water from a channel, or creating hydraulic head. "Any artificial barrier, including appurtenant works, that impounds or diverts the flow of water."

Dam Crest: The top surface of the dam.

Glossary

Dam Failure: Catastrophic type of failure characterized by the sudden, rapid, and uncontrolled release of impounded water.

Dike: An artificial protective barrier or obstacle designed to prevent flooding of adjacent land surrounded by water.

Drain: A pipe or similar feature that collects and directs water to a specified location.

Embankment: An engineered earth fill.

Emergency Action Plan: A formal plan of procedures to alleviate risk during construction of or after completion of a dam, or to reduce the consequences to life and property that would result from a dam failure. Also, a plan of action to be taken to reduce the potential for property damage and loss of life in an area affected by a dam failure or large flood.

Filter: A material or zone of materials designed to provide drainage without causing movement or erosion of the individual particles comprising the filter.

Final Order: Final agency action expressed in writing.

Flashboard (Stoplogs): Planed timber or steel beams that are physically placed on top of each other in a channel or an outlet so as to adjust the flow of water. Flashboards often are an alternative to gates or valves in low-head situations.

Flood: A temporary rise in water levels resulting in inundation of areas not normally covered by water. May be expressed in terms of probability of exceedance per year, such as 1 percent chance flood, or expressed as a fraction of the probable maximum flood or other referenced flood of record.

Flood Frequency: Refers to the probability (expressed in percentage) that a flood will occur in a given year, example 20%, 10% ,or 1%.

Flood, Probable Maximum (PMF): The largest flood that is estimated for a selected location on a stream resulting from the probable maximum precipitation storm (PMP) in combination with extreme runoff conditions.

Flood Surcharge: The storage volume between the top of the active reservoir storage and the design maximum water level.

Foundation: The ground surface upon which a dam is constructed.

Freeboard: The vertical distance between the design high-water level in the reservoir and the dam crest.

Gate: A movable, watertight barrier for the control of water flowing through a pipe or channel. (See Valves)

Groin: The area along the contact (or intersection) of the face of a dam with the abutments.

Hazard Classification: The rating for a dam based on the potential consequences of failure. The rating considers the aggregate damage to downstream life and property that failure of the dam could cause.

Height: The maximum vertical distance from natural ground surface to the top of a dam.

Hydrograph: A graph showing, for a given point on a stream or conduit, the discharge, stage, velocity, available power, or other properties of water with respect to time.

Hydrologic Connection: Condition where water can move between a surface water source and an adjacent sub-surface aquifer.

Impervious: Not allowing liquid to pass through; waterproof.

Instream Flow: Minimum quantity of water necessary to support the public use requested by an agency.

Inundation Map: A map delineating the area that would be flooded by a particular flood event. It includes the ground surfaces downstream of a dam showing the estimated encroachment by water released because of failure of a dam or from abnormal flows released through a dam's spillway.

Invert: Elevation at the bottom of a pipe, conduit, or culvert.

Levee: An artificial protective barrier built adjacent to a waterway to prevent flooding of bordering land.

Maximum Water Surface: The highest acceptable water surface elevation with all factors affecting the safety of the structure considered. It is the highest water surface elevation resulting from a computed routing of the inflow design flood through the reservoir under established operating criteria. This surface is also the top of a surcharge capacity.

Glossary

Minimum Streamflow: A rate of flow established by administrative rule necessary to support aquatic life or minimize pollution.

Normal Water Surface: The highest elevation at which water is normally stored, or the design surface elevation which the reservoir is expected to be operated.

Order: Agency action expressed orally or in writing directed to a named person or persons; includes any agency decision issued in connection with a contested case hearing.

Outlet Works: A device to provide controlled releases from a reservoir.

Piping: A characteristic type of erosion of embankment or foundation material (soil) due to leakage. The action of water passing through a soil mass resulting in removal of particles leading to the development of channels or “pipes”.

Precipitation, Probable Max (PMP): The greatest amount of precipitation possible resulting from a specified size storm occurring during a distinct period of time at a particular geographic location.

Reservoir: A body of water impounded by a dam or other artificial construction in which water can be stored.

Reservoir Surface Area: Ground surface area covered by water when a reservoir is filled to a specified level.

Risk: The relationship between the consequences resulting from an adverse event and its probability of occurrence.

Seepage: The slow movement or percolation of water through a permeable medium; specifically, flow through small cracks, voids, or interstices in a dam, abutment, or foundation.

Soil: Sediments or other unconsolidated and non-cemented aggregations of particles produced by the chemical/mechanical disintegration of rocks.

Spillway: A structure over or through which flow is discharged from a reservoir. If the rate of flow is controlled by mechanical means such as gates, it is considered a controlled spillway. If the geometry of the spillway is the only control, then it is defined as an uncontrolled spillway.

Spillway, Auxiliary: Any secondary spillway that is designed to be operated very infrequently or only in anticipation of extreme climactic events.

Spillway, Emergency: A spillway that is designed to provide additional protection against overtopping of dams and is intended for use under extreme conditions such as misoperation or malfunction of the service spillway or other emergency conditions.

Spillway, Primary: A spillway that is designed to provide continuous or frequent regulated or unregulated releases from a reservoir without significant damage to either the dam or its appurtenant structures.

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

Storage, Active (Normal): The volume of the reservoir that is readily available for beneficial use such as power generation, irrigation, flood control, water supply, fish culture, and others.

Storage, Dead: The volume of water that lies below the invert of the lowest outlet and that cannot readily be withdrawn from the reservoir.

Toe of Dam: Those portions of a dam slope that intersect natural ground surface, either upstream or downstream.

Top of Dam (Crest): The elevation of the uppermost surface of a dam, usually a road or walkway excluding any parapet wall, railing, etc.

Valves: Valves, as distinguished from gates, are constructed so that the closing member remains in the water passageway for all operating positions.

Void: Open spaces inside soil, rock or concrete that may be filled with air or water or some other gas or liquid.

Watermaster: Field representative (1 of 20 statewide) authorized by statute to regulate established water rights according to Oregon's water laws, based on the principle of prior appropriation.



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