



# Oregon

Kate Brown, Governor

## Water Resources Department

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## MEMORANDUM

TO: Water Resources Commission

FROM: Thomas M. Byler, Director

SUBJECT: Agenda Item L, March 13, 2015  
Water Resources Commission Meeting

### **Request for Adoption of Rules – OAR Chapter 690, Division 20, Dam Safety**

#### **I. Introduction**

Staff provided an overview of Oregon's Dam Safety Program to the Water Resources Commission (Commission) during its November 2014 meeting. During this agenda item, the Water Resources Department (Department) will ask the Commission to adopt changes to rules for the safety of dams (OAR 690-020-0000 through 690-020-0500). Dam Safety Program staff members have incorporated thoughtful and extensive input from a Rules Advisory Committee, the public, and legal counsel to prepare these proposed rule changes for the Commission's consideration and action.

#### **II. Background**

Oregon Revised Statutes (ORS) 540.350 to 540.400 authorize and direct the Department to take actions related to the design, construction, inspection, and safety of dams. Dams that are ten-feet high or more and that store 3 million gallons (9.2 acre feet) of water or more are subject to Oregon's dam safety statutes.

Oregon has a good dam safety record, with technical expertise, partnerships, and programs in place. However, in recent years, we have learned more about the vulnerabilities of Oregon's infrastructure to earthquakes and extreme floods. The proposed rules are intended to provide essential information so that engineers and dam owners can design, construct, and repair dams based on current knowledge of floods, earthquakes, and other conditions that can affect the safety of dams.

### **III. Discussion**

The dam safety rules regarding the review and approval of engineering plans and specifications for new dams need an update. Rule modifications for the dam safety fee were made in 2009; however, the last time the rules for engineering, construction and maintenance of dams were significantly updated was about 20 years ago. Accepted dam safety practices have changed significantly over this time period, and the proposed rules codify current practice. These rules also clarify the process for dam breach inundation analysis as adopted in 2010.

At the present time, the designs for between five and ten new dams are submitted each year. This number is likely to increase in the near future, with a need for water storage likely to increase.

**Rules Advisory Committee:** In developing the draft rules, the Department convened a Rules Advisory Committee, comprised of the following dam owners and engineers:

- ✓ Large dam owner - Robert Klein, McMinnville Water and Light
- ✓ Small dam owner and attorney - Genice Rabe, Croft Dam West Salem
- ✓ Engineer of small dams - Eric Urstadt, P.E., Stuntzner Engineering
- ✓ Geotechnical engineer large dams - Gerry Heslin, P.E., Cornforth Consultants
- ✓ Hydrology and hydraulic engineering - Chris Bahner, P.E., West Consultants
- ✓ Rules and statutes for engineering standards of practice - Jim Doane, P.E.

The Rules Advisory Committee met on June 19, 2014, to review and discuss proposed rule changes. This committee provided significant edits to the proposed rules, to better ensure they can be easily understood by dam owners and engineers, and to provide clear, objective-based rules to protect people and property. After the Rules Advisory Committee discussion, all of the rules were carefully reviewed by the Department of Justice, to ensure that there was clear statutory authority for these proposed rules.

### **IV. Proposed Rules**

Attachment 1 shows the rules as proposed for adoption. The proposed rule changes provide:

- Clear instructions so that owners and engineers know what is required to build and maintain a safe dam;
- Specific design objectives for engineers, including the design elements that will be required for dam safety;
- Standards for seismic stability and spillway capacity based on the dam's hazard rating; and
- Specific criteria for inundation analysis, so the Department can objectively and accurately classify the hazard rating of each dam.

**Public Hearing and Comments:** The Department held a public hearing on September 29, 2014, but no one attended. The Department also accepted public comment on the draft rules from September 1 to October 3, 2014.

Attachment 2 shows the rule changes as originally proposed during the public comment period (black text in bold and strikethrough), along with proposed revisions in blue text made in response to public comments. Attachment 3 includes a summary of public comments and the Department's responses.

A total of four written comments were received during the public review period (Attachment 4). Three of the comments were from professional engineers supporting the need for changes. Two of the engineers supported the changes as proposed (Jim Doane and Eric Ward), and one supplied additional comments (George Robison). These comments helped the Department add more detail to hazard classifications without changing the intent. The comments also suggested removing confusing language, and continuing to provide technical resources for dams that have an exemption under ORS 537.400.

The most extensive set of comments were from WaterWatch of Oregon. These comments focused on five major areas:

- Use of fees;
- Diminished hazard rating criteria;
- Use of the term "statutory dam";
- Conduit size and its relationship to policy decisions on releases; and
- Guidelines for small dams.

In addition, WaterWatch had concerns about the composition of the Rules Advisory Committee, and had a number of specific comments on individual rules. The Rule Advisory Committee was composed of engineers and dam owners, as the principal rule changes were related to engineering design, construction practices, and dam owner responsibilities for keeping dams safe.

As shown in Attachment 2, the Department made changes to the draft rules in response to the concerns expressed above, except where the comments conflicted with the statutory authority for these rules. These changes were reviewed by the Department of Justice and were confined to the Department's legal authorities.

## **V. Alternatives**

The Commission may consider the following alternatives:

1. Adopt the final proposed Chapter 690, Division 20, dam safety rules in Attachment 1.
2. Adopt final proposed dam safety rules as modified by the Commission.
3. Not adopt the final proposed dam safety rules and ask the Department to return with more information.

## **VI. Recommendation**

The Director recommends Alternative 1.

Attachment 1 – Final Proposed Chapter 690, Division 20, Dam Safety Rules - Clean  
Attachment 2 – Final Proposed Chapter 690, Division 20, Dam Safety Rules - Strikethrough  
Attachment 3 – Summary of Public Comments and the Department's responses  
Attachment 4 – Public Comments Received

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OREGON ADMINISTRATIVE RULES  
WATER RESOURCES DEPARTMENT  
CHAPTER 690  
DIVISION 20  
DAM SAFETY

**690-020-0000**

**Purpose and Applicability**

(1) The purpose of these rules is to implement ORS 537.400(4) and ORS 540.350 through ORS 540.390 with actions that are intended to ensure the safety of the dams insofar as dams may affect possible damage to life or property. The Department is authorized to review design and specifications for dam construction and modification, to conduct routine inspections, and to take enforcement actions on dams that do not ensure the safety of life and property.

(2) These rules apply to dams that are subject to ORS 540.350 through 540.390 and which exceed the height and storage limits described in ORS 540.400.

(3) These rules do not apply to:

(a) Dams that are less than ten feet high or that store less than 3 million gallons (9.2 acre feet), except for general guidance and permit requirements described in OAR 690-020-0029; or

(b) Water storage tanks or various types of tanks that are part of water treatment facilities.

(4) The dam safety fee authorized by ORS 536.050(2) shall be used to support the dam safety program as described in OAR 690-020-0200.

(5) The State Engineer may delegate dam safety duties to a dam safety engineer working for the Department for the purposes of ORS 540.350 through 540.390.

**690-020-0022**

**Definitions**

Unless the context requires otherwise, the following definitions apply in OAR 690, Division 20:

(1) "Abutment" means a natural valley or canyon side against which the dam is built;

(2) "Acre-foot" means the equivalent volume of one acre covered with one foot of water (325,900 gallons);

(3) "Annual Exceedance Probability Flood" means the likelihood of specific flood flow being equaled to or exceeded in any given year at that specific location, expressed as a percentage;

(4) "As-built drawing" means an engineering drawing of a dam as it was actually constructed, noting all differences between original design and actual constructed condition;

(5) "Conduit" means a closed conveyance used to release water through a dam;

(6) "Core" means a soil of low permeability within an embankment dam;

(7) "Cutoff Trench" means a trench excavated beneath the dam foundation and backfilled with low permeability material to retard water seepage;

(8) "Dam" means a hydraulic structure built above the natural ground grade line that is used to impound water. Dams include all appurtenant structures, and together are sometimes referred to as "the works." Dams include wastewater lagoons and other hydraulic structures that store water, attenuate floods, and divert water into canals;

(9) "Dam Crest" means the top of the dam;

(10) "Dam Height" means the maximum height of the dam as measured at the maximum section along the dam's longitudinal axis;

(11) "Department" means the Oregon Water Resources Department;

(12) "Director" means the Director of the Oregon Water Resources Department;

- (13) “Embankment” means an engineered earth fill;
- (14) “Emergency Action Plan” (EAP) means a plan that assists the dam owner or operator and local emergency manager perform actions that ensure the safety of people in the event of a potential or actual dam failure or in the event of a sudden release of water;
- (15) “Engineer of Record” means the professional engineer registered in Oregon working for the dam owner to design the dam to current safety standards and is responsible to oversee safe construction of the dam;
- (16) “Foundation” means the ground surface upon which a dam is constructed;
- (17) “Freeboard” means the vertical distance between the high-water level in the reservoir and the dam crest;
- (18) “Gate” or “Valve” means a permanent device for regulating water flow through the dam;
- (19) “Hazard Rating” means the rating established by the department of the potential damage to life and property downstream of a dam in the event of a dam failure;
- (20) “High Hazard Rating” means that if a dam were to fail, loss of human life would be expected;
- (21) “Inflow Design Flood” (IDF) means a volume and peak flood flow that the engineer of record will design to safely pass over or through the spillway;
- (22) “Low Hazard Rating” means that if a dam were to fail, loss of life would be unlikely and damage to property would not be extensive;
- (23) “Pressurized Conduit” means any pipe that penetrates into a dam that may have a gate, valve, or irrigation pipe placed in the dam or at the outlet so that all or a portion of the pipe within the dam is under hydrostatic pressure when the valve is closed;
- (24) “Probable Maximum Flood” (PMF) is the largest flood that could occur at a specific location, determined by the most severe set of atmospheric, soil moisture and snowpack conditions that are reasonably possible at that location;
- (25) “Significant Hazard Rating” means that if a dam were to fail, loss of life would be unlikely but damage to property would be extensive;
- (26) “Soil Filter” means soil with a gradation designed to inhibit movement of adjacent, finer grained soils;
- (27) “Spillway” means a structure constructed to bypass flood water and prevent water overtopping the dam crest. Dams may have two or more spillways.
- (28) “State Engineer” means a registered professional engineer working for the Department, and may be either the Director or a principal assistant working for the Director as described in ORS 536.032.
- (29) “Tank” means a fully-enclosed (bottom and sides) hydraulic structure made from metal, reinforced concrete, rigid fiberglass, or plastic that provides its own water-sealing and structural stability.
- (30) “Toe Drain” is a drainage structure designed to collect and remove seepage water from the toe of the dam and to discharge this water in a manner where it can be measured;
- (31) “Zoned Embankment” means an embankment dam with a core of low permeability materials, soil filter materials, drainage and other materials placed to improve performance and safety of the dam.

### **690-020-0023**

#### **Dam Safety Process Requirements for Construction of Dams**

- (1) Dam safety requirements shall be based on the hazard rating of the dam, in order to efficiently protect life and property.
- (2) Any person, corporation, association, firm, partnership, limited liability company, joint stock company, unit of local government as defined in ORS 190.003, or State agency must, before beginning any construction on a dam, secure the services of a qualified engineer to design the dam and also to provide information on the dam as it was actually constructed. This engineer shall be deemed the engineer of record for the purposes of these rules.

(3) The engineer of record shall design the dam and develop plans and specifications consistent with these rules.

(4) Prior to beginning construction on any dam subject to these rules, written approval of dam designs, drawings and specifications must be obtained from the State Engineer as described in OAR 690-020-0080.

(5) The engineer of record must oversee construction of the dam consistent with rules governing administration of dam construction in OAR 690-020-0065 to evaluate whether the dam is constructed consistently with approved plans and specifications.

- (a) Any essential design changes must be described and justified in a letter sent to the State Engineer with the "as-built" drawings.

### **690-020-0025**

#### **General Requirements**

(1) The Director may require additional information or data beyond that specified in these rules to determine the safety of a proposed dam.

(2) The Director may include, as part of any permit to construct a dam, limitations and conditions that pertain to construction, operation, maintenance, and the protection of lives and property. These limitations and conditions become, by reference, part of the water right certificate and remain in effect throughout the life of the water right.

(3) Approved plans and specifications for construction are, by reference, considered limitations and conditions placed on the water right permit and water right certificate. The Director retains the authority to place additional limitations and conditions on the water right relative to operation and maintenance.

(4) Dams constructed or operated in violation of limitations and conditions included in the water right permit or certificate are subject to restricted use. The certificate affirms the applicant's right to store water subject to the limitations and conditions therein.

(5) For new dams on stream channels, an outlet conduit must be installed to permit drainage of all or most of the reservoir and for passage of flow to downstream, instream and out of stream water right holders or instream minimum releases unless the engineer of record provides another alternative and demonstrates the safety and efficacy of this alternative to the State Engineer.

(6) The Department shall determine water impoundment volumes in acre-feet as follows:

- (a) For dams impounding water for an authorized beneficial use, the impoundment volume indicated in the area-capacity curve as measured from the bottom of the reservoir to the spillway crest. For dams with multiple spillways, 'spillway crest' is referring to the crest of the lower elevation spillway.
- (b) For wastewater treatment lagoons, the impoundment volume is that indicated in the wastewater lagoon plans and specifications.
- (c) For diversion or flood control dams, the impoundment volume is that calculated at full reservoir at the dam highest elevation spillway crest level.

(7) The State Engineer may approve final designs, drawings and specifications for water storage reservoirs after a water storage application and a draft final order for that application have been issued by the Department.

(8) Any person, firm or private or municipal corporation must provide to the State Engineer an evaluation of whether the dam includes measures that make it readily adaptable to power generation for any new dam over 25 feet high on a stream with average annual flow over 2 cubic feet per second, unless exempted from this requirement as provided in ORS 540.350(3).

(9) For any dam rated high hazard, the Department must review and approve an Emergency Action Plan prior to filling the reservoir.

(10) For any dam rated high or significant hazard, the Department must review and approve an operations and maintenance manual prior to construction on the dam.

#### **690-020-0029**

##### **Recommendations for Dams Under 10 Feet High or Storing less than 9.2 Acre-feet**

(1) Persons constructing or designing dams under ten feet high or storing less than 9.2 acre feet may be subject to requirements for use of registered engineers as specified in ORS 672.002 through 672.091.

(2) The Department is authorized to provide guidance for the construction of dams requiring a water right permit but not requiring State Engineer review and approval of designs, plans and specifications.

(3) Potential dam owners are advised that even small dams, should they fail, may cause injury to people and property. Dam owners should consider designs and inundation analysis methods described in OAR 690-020-0035 through 690-020-0065, OAR 690-020-0100, and OAR 690-020-0120.

(4) Persons proposing to build a dam under 10 feet high or storing less than 9.2 acre-feet must comply with all the requirements for a storage permit in ORS 537.409 and in OAR 690-020-0310.

#### **690-020-0035**

##### **Minimum Engineering Design Requirements**

(1) A design report or multiple design reports must be submitted with the drawings and specifications by the engineer of record for all new dam construction. Design reports may be completed by other engineers registered to practice in Oregon.

(2) The design report(s) for new dam construction must include the following elements:

(a) Site suitability evaluation as provided in OAR 690-020-0036;

(b) Hydrology and inflow design flood as provided in OAR 690-020-0037;

(c) Dam structure design (embankment, concrete or other) as applicable and as provided in OAR 690-020-0038 – 690-020-0041;

(d) Spillway design as provided in OAR 690-020-0042;

(e) Design for penetrating conduit(s) as provided in OAR 690-020-0043; and

(f) Methods for determining whether a dam is operating properly based on the hazard rating of the dam as provided in OAR 690-020-0044 (monitoring and instrumentation).

(3) If multiple reports are submitted, each must be stamped by the engineer who prepared the report and the engineer of record must compile and understand reports for preparation of drawings and specifications.

#### **690-020-0036**

##### **Site Suitability and/or Geotechnical Evaluation**

The design for new dam construction shall characterize the soil and rock at and around the dam site and shall include the following elements:

(1) A description of the general and local geology and geomorphology at and around the dam and reservoir. Field investigation by a geotechnical engineer and/or engineering geologist is required for all high hazard dams and also for significant hazard dams where landslides, faults, dispersive soils or liquefiable soils could reasonably be expected near the dam site. All such features shall be shown on a map of the dam site, and described as necessary for design of the dam. For dams on rock, mapping of discontinuities relevant to safety of the dam and evaluation of the need for grouting is required.

(2) Subsurface investigation to determine distribution of relevant earth materials. This investigation shall include borings or test pits; identification of springs, seeps and groundwater encountered at the dam site; and evaluation of the potential for landslides into the dam or reservoir.



- (a) All materials shall be logged by the Unified Soil Classification System; blow counts (for borings only); and description of samples taken for testing.
  - (b) Subsurface investigations for High Hazard dams shall include drilling to a minimum depth 1.5 times the height of the dam or at least 10 feet into bedrock, whichever is less.
- (3) Soil and or rock evaluation and testing of relevant materials. This evaluation may include: proctor compaction testing from all borrow areas; estimation or testing the permeability of soils to be used in dam construction; and an assessment for the presence of dispersive soils.
- (a) An analysis of materials in the foundation and proposed embankment shall be completed if materials are prone to liquefaction or significant settlement.
  - (b) Where suitable materials can be collected, strength tests shall be required for all high hazard dams, and may be required by the State Engineer for significant hazard dams.
  - (c) Testing of dynamic soil properties may be required for high hazard dams in areas with large ground acceleration potential from earthquake loading.
- (4) Borrow area locations. Areas proposed for borrow shall be identified and shown on the drawings.
- (5) Earthquake considerations. Seismic site characterization is required for high hazard dams, and may be required for significant hazard dams. A seismic site characterization shall include earthquake sources, ground motion hazard, peak ground acceleration, and recommended ground motions (time histories).
- (6) Site preparation criteria. The site evaluation shall recommend a depth of stripping unsuitable materials, and also a minimum, and where necessary, maximum depth for the cutoff trench.

#### **690-020-0037**

##### **Hydrology and Inflow Design Flood**

The design shall characterize flow into and through the reservoir and dam and shall include the following elements:

- (1) A topographic map delineating the drainage area contributing to the dam, with the drainage area size labeled in square miles and showing the specific location of the proposed dam.
- (2) For dams on stream channels, the name of the stream where the dam is located, the name of the principal watershed, and a determination of average annual inflow into reservoir and potential to fill the reservoir.
- (3) Dam failure inundation analysis is required for any dam that might be high or significant hazard. The inundation analysis shall comply with OAR 690-020-0120.
- (4) The inflow design flood that is the basis of hydraulic design for the dam shall be determined based on the hazard rating of the dam.
  - (a) The inflow design flood for a high hazard dam is the Probable Maximum Flood (PMF).
  - (b) The minimum inflow design flood for a significant hazard dam is the 0.2 percent annual exceedance probability flow.
  - (c) The minimum inflow design flood for a low hazard dam is a 1.0 percent annual exceedance probability flow.
  - (d) The inflow design flood for a lagoon or off channel reservoir is the maximum capacity of inflow pumps, ditches plus the maximum local storm precipitation over the lagoon.
  - (e) For watersheds under 30 square miles, the engineer may consider just the 24-hour storm to help determine the PMF, while for larger basins the engineer shall utilize at least a 72-hour storm for calculating the PMF for a general storm.
- (5) For a high hazard dam, the engineer of record may also propose to determine an inflow design flood based on a quantitative analysis of risk to people and property.
- (6) Designs shall include a description of all hydrologic parameters and the method used to determine the inflow design flood hydrograph and the volume of the inflow design flood, which is to be determined considering basin size and other factors as appropriate to the watershed above the dam.

(7) The design report must include the information used to develop the stage and storage capacity curve for the reservoir, including the capacity with and without excavation for construction.

**690-020-0038**

**Embankment Dam Structures**

Designs for Embankment (soil and or rock) dams shall include the following elements:

- (1) A determination of embankment stability and stable embankment slope angles.
  - (a) Embankment dams shall be designed to have stable slopes during construction, and under all conditions of reservoir operation.
  - (b) Standard slopes of 3:1 upstream and 2:1 downstream may be used at the discretion of the engineer of record for low and significant hazard dams as long as low strength materials are not used in the embankment and conditions leading to elevated pore water pressures are not present.
  - (c) Dams that are rated high hazard must be designed as zoned embankment dams and/or include a chimney drain designed also as a filter.
  - (d) High hazard dams shall be analyzed for static and seismic slope stability, and also for deformation analysis. The State Engineer may require static and or seismic slope stability analysis for significant hazard dams. At a minimum, seismic analysis shall be based on full reservoir under steady state seepage conditions. Factors of safety shall be evaluated by slope stability analyses using appropriate strength parameters based on laboratory or insitu testing. For materials that can be reasonably tested either on site or in a laboratory, soil strength values may not be based on assumptions and must be made on strength testing of the appropriate soil or rock units.
  - (e) High Hazard dams shall be designed for the maximum credible earthquake. If the State Engineer requires seismic analysis of a significant hazard dam, deformation analysis shall be designed for the 0.2 percent annual exceedance probability earthquake.
  - (f) Abrupt changes in depth of compressible foundation material shall be identified and where present, the design shall prevent significant differential settlement.
- (2) Analysis of seepage and leakage expected through the dam and design of measures to prevent internal erosion and excess leakage.
  - (a) Steady state seepage and internal drainage conditions beneath, around and through the dam shall be quantified for all high hazard dams, and may be required by the State Engineer for significant hazard dams.
  - (b) A core of low permeability material protected by a soil filter is required for all high hazard dams. A core and soil filter is required for any significant hazard dams where the engineer of record or State Engineer determines piping could potentially occur. All core and filter zones must be of a configuration with dimensions that can be readily constructed.
  - (c) Internal drains and/or soil filters shall be used as needed to drain water and prevent internal erosion of the dam. Toe drains shall be standard design practice for water storage facilities, but not for most wastewater lagoons.
  - (d) Internal drain pipes to collect and distribute seepage flows from internal filters and drains shall be comprised of material that is non-corrodible, designed to carry the overburden load, and be no smaller than 6 inches in diameter.
- (3) A safe and accessible dam crest.
  - (a) The dam crest shall be of sufficient width to be accessible by equipment and vehicles for emergency operations and maintenance, and shall have a road to allow crest access during periods when the spillway is flowing.

- (b) The crest shall have a camber sufficient to maintain the design freeboard, based on the anticipated crest settlement, and in no case shall the camber be less than 0.5 feet.
  - (c) Roads located on the dam crest shall have appropriate surfacing to provide a stable base that resists rutting and provides adequate traction for access and safety in wet conditions.
  - (d) The crest shall have adequate cross slopes to prevent ponding.
- (4) Measures to control wave and surface erosion as needed.
- (a) For reservoirs large enough to generate significant waves, the design shall include a determination of minimum freeboard based on expected waves. The design shall also include slope protection for wave action if significant waves are likely.
  - (b) The downstream slope shall be provided with a well maintained cover of non-woody vegetative cover, or a gravel or rock surface, to prevent surface erosion. No woody vegetation shall be planted on the dam during the life of the structure unless specifically designed by the engineer of record, by demonstrating that cover plants will not affect critical dam functions.

#### **690-020-0041**

##### **Concrete Dam Structures**

Designs for concrete mass dams must be prepared by a structural engineer and a geotechnical engineer and/or engineering geologist. This rule does not apply to concrete flashboard dams. Designs for all other concrete dams shall include the following elements:

- (1) Concrete dams shall be specified as gravity, arch, arch-gravity, or buttress. Gravity dams can be of conventional mass concrete or roller compacted concrete.
- (2) Dams shall be designed to be stable during construction and under all conditions of reservoir operation.
  - (a) Headwater and tailwater elevations pertinent to the design shall be described with respect to both static and dynamic loading.
  - (b) Uplift pressure distributions assumed for design shall be provided.
  - (c) When foundation drains are used to reduce uplift, the assumed drain efficiency shall be indicated and permanent access shall be provided at the project to inspect and maintain the drains.
- (3) Sliding stability shall be evaluated at lift joint surfaces, at the dam foundation interface, and at discontinuities in the foundation materials beneath the dam and abutments.
  - (a) Factors of safety shall be based on limit equilibrium methods.
  - (b) For earthquake loadings, the critical acceleration (acceleration required to initiate sliding) may be less than the peak ground acceleration of the design earthquake. In such cases a permanent sliding displacement shall be determined in lieu of a sliding factor of safety.
  - (c) Overturning of the dam on its foundation shall be evaluated for static and seismic loading.
- (4) Seismic stability analysis is required for certain concrete dams and shall demonstrate the dam can withstand the design earthquake without loss of life or damage to property.
  - (a) High hazard dams shall be designed for the maximum credible earthquake based on current information from the US Geological Survey or a site specific seismic evaluation. A dynamic stress analysis that considers the dynamic characteristics of the dam and the ground motions of the design earthquake shall be provided for high hazard dams.
  - (b) Where the State Engineer requires seismic analysis on significant hazard dams, they shall be designed for the 0.2 percent annual probability of exceedance earthquake. The Department may require a dynamic stress analysis for significant hazard dams.
- (5) When foundation grouting is needed, the design for the grout curtain and/or consolidation grouting of the foundation shall be required.

- (6) Specific properties of mass concrete that can be important to design and construction include the compressive strength (at 28 days and one-year), modulus of elasticity, Poisson's ratio, shear strength, tensile strength, volume change during drying, thermal coefficient of expansion, specific heat, thermal conductivity, permeability and durability.
- (a) As a minimum for static loadings, the assumed compressive and shear strengths for the parent concrete, lift joint surfaces, and the dam-foundation contact shall be provided.
  - (b) In addition, tensile strength assumptions for the aforementioned regions for dynamic loadings (seismic) shall also be provided.
  - (c) Air entraining agents shall be provided in the concrete mix to provide freeze-thaw protection and to improve the workability of lean mass concrete mixes. The quantity of air entrained in mass concrete shall be in the order of 5 percent.
- (7) Mix design and construction methods used to minimize cracking due to temperature gradients between interior regions subject to heat of hydration effects and surfaces exposed to ambient temperatures shall be specified. Treatment of lift joint surfaces to achieve desired shear and tensile strengths shall be indicated. Treatment of contraction joints to prevent leakage and/or to transfer load between adjacent monoliths shall be described.
- (8) When reinforcing steel is used, the strength properties of the reinforcement shall be provided and contract drawings shall clearly indicate the size, location, spacing, and cover requirements.
- (9) The minimum crest width must be 15 feet unless otherwise approved. The dam crest and appurtenant structures shall be accessible by equipment and vehicles for emergency operations and maintenance.

#### **690-020-0042**

##### **Spillways**

All dams must have a spillway. Spillway(s) design shall include the following minimum elements:

- (1) Utilization of inflow design flood. Determination of inflow design flood as described in OAR 690-020-0037 is required to determine the required spillway capacity.
- (2) Hydraulic evaluation of flow through control section. Flood flow through the control section must be calculated and the minimum freeboard at the inflow design flood must be 1 foot for high hazard dams and 2 feet for significant and low hazard dams.
- (3) Optional low elevation spillway. An interior spillway connected to the low level conduit may be used for low and significant hazard dams, and for high hazard dams only with specific approval by the State Engineer. The capacity of the low elevation spillway may be considered in design of the overflow spillway.
- (4) Stable spillway control section. The spillway control section must be hydraulically and structurally stable for the inflow design flood and have permanent features so that the control section is identifiable for re-measurement of cross section during routine inspections.
- (5) Spillway channel stability. Spillways shall be designed to be structurally adequate and stable under all conditions of reservoir operation. Spillway structures of high hazard dams shall be designed for earthquake ground motions per OAR 690-020-0036.
- (6) Reinforced concrete specifications. Structural elements of reinforced concrete shall be designed for both strength and serviceability. The 28 day strength of structural concrete shall be provided. The strength properties of the reinforcing materials shall also be provided and contract drawings shall clearly indicate the size, location, spacing, and cover requirements. Treatment of construction joints and contraction/expansion joints shall be described and special provisions for strength transfer and leakage prevention identified. Air entrainment shall be provided in cast-in-place concrete if needed for freeze-thaw protection, durability, and workability.

(7) Debris booms. For high and significant hazard dams, debris or log booms may be required. Where required, they shall be designed for the spillway approach where logs and other debris may block or damage the spillway structure. The design shall specify the necessary anchor capacity, and the design of the anchors.

(8) Gates and Flashboards. Detailed drawings and specifications are required for spillway gate structures or flashboards, if present on the proposed dam. Operations and maintenance manuals are required for any dam with a gated spillway, or where flashboards or stop-logs are used in the spillway.

(9) Energy dissipation. The design of stilling basins for high hazard dams, and where required by the State Engineer for significant hazard dams, shall be based on calculated hydraulic forces and designed to dissipate energy from the inflow design flood.

#### **690-020-0043**

##### **Penetrating Conduit (s) and Control of Flow Through Conduits**

All new dams on stream channels must have a low level conduit. All other dams must have a low level conduit or other means to safely drain the reservoir. The conduit and related control structures must be designed to meet the following criteria:

(1) Ability to lower the reservoir. The minimum diameter of the conduit should be determined through analysis of the time required to drain the dam at average inflow.

(a) The conduits for high hazard dams shall be capable of releasing the top five feet of the reservoir in five days.

(b) The conduits for significant and low hazard dams must be able to release the top five feet of the reservoir in ten days.

(c) All conduits must be of sufficient size to allow passage of inflows as needed.

(d) In no case shall conduits be smaller than 8 inches in diameter.

(2) Durable and water-tight conduits. Conduits must be made of medium to heavy gage durable materials. Pipe joints must be designed to seal and prevent leakage. Corrugated metal culverts are only acceptable for low hazard dams, and only when the conduits are encased in concrete. Encasement of conduits in concrete may be used to assist in the design of a durable conduit and to reduce the potential for seepage and erosion adjacent to the conduit.

(a) Diaphragms using materials designed as an effective soil filter are required for any conduits not designed as encased in concrete, and are required regardless of encasement for all high hazard dams.

(b) Seepage collars may not be used in any dam.

(3) Control Mechanisms. The design for the control mechanism must be sturdy, durable, allow for air venting when needed, and allow manual operation to drain the reservoir if hydraulic or other power controls are inoperable. Hydraulic controls must have redundancy if control relies on any submerged hydraulic hoses. Intake structures for outlet works must have trash racks unless the engineer of record shows trash racks are unnecessary, or unsafe to construct due to conditions at the dam site. For high and significant hazard dams, measures to prevent unauthorized use of the control mechanism must be included in this design.

(4) Outlet structure. The outlet structure must not be submerged when the inlet control gate or valve is fully closed. The outlet structure must be designed to protect the conduit from mechanical damage and convey water to the stream channel without channel erosion and cavitation near the gate structure.

(5) Pressurized operation. Conduits must be specified as suitable for pressurized operation if they are to be operated with controls other than at the inlet of the conduit. Conduits for dams with pressurized conduits shall have a guard gate installed at the upstream end of the conduit.

- (a) Operations and maintenance manuals are required for any dam designed for pressurized operation, and the plans must include procedures for periodic inspections of the interior of any pressurized pipes.

**690-020-0044**

**Monitoring and Instrumentation**

Designs must include methods for determining if the dam is operating properly based on the hazard rating of the dam, and include:

- (1) Staff gage near controls for the conduit. The staff gage shall be clearly marked in feet and tenths of feet, and extend to within one foot of the crest of the dam. Markings and numbers on the gage rod shall be of sufficient size to be easily readable from the crest of the dam.
- (2) Multiple and easily accessible outlets of all toe drains. Toe drains shall be designed to discharge into locations where flows can be evaluated and monitored. Multiple discharge points are required in order to isolate seepage to various sections of the dam and foundation. Discharge points must be located where routine dam maintenance is not likely to damage the drains.
  - (a) For high hazard dams, drains must have a measuring weir or other device, and a basin for settling drainage water so that internal erosion can be identified.
  - (b) Where drainage galleries are provided for concrete dams, seepage measuring devices should be provided and accessible for making the necessary readings.
- (3) Unique Identification. All instrumentation and exterior drains shall be labeled with a unique identifying marker designed for durability and to withstand maintenance activities.
- (4) All high hazard and where required by the engineer of record or State Engineer, significant hazard dams shall have the following instrumentation:
  - (a) Monuments that allow measurement of the horizontal and vertical movements of the dam. Control or benchmark monuments shall be placed in areas not subject to movement;
  - (b) Piezometers to allow monitoring of the phreatic surface within the dam or for concrete dams, to determine uplift pressures.
  - (c) Instrumentation to measure strong ground motions for dams in locations where the peak ground acceleration in the 0.2 percent annual probability of exceedance earthquake is greater than 0.4g.

**690-020-0047**

**Geosynthetics**

Geosynthetics shall not be used as the sole element employed to perform an essential dam safety function. Redundant design features are required whenever geosynthetics are used for essential dam safety functions.

**690-020-0048**

**Modification of Standard Design Requirements**

Exceptions to design standards may only be obtained with written approval from the State Engineer. Where the engineer of record requests design exceptions, the request must be in writing, be affixed with the engineer of record's professional stamp, and include a report describing why design standards are inapplicable to the safety of the dam.

**690-020-0055**

**Design Drawings**

The engineer of record shall submit applicable drawings when the engineer believes the design is ready for review and approval by the State Engineer.

- (1) Drawings must accurately portray the work to be accomplished and be of sufficient detail to clearly define all features of the project. After all changes required by the State Engineer are made, final design drawings must be neatly and accurately drawn to a scale sufficiently large for the drawings to be readily interpreted.
- (2) Drawings must be uncluttered and easy to understand for determination of design compliance by the contractor, the engineer of record, and the State Engineer.
- (3) Drawings must be no larger than 24" X 36". Other acceptable sizes for drawings are 17" X 22" and 22" X 34". All drawings must have a graphic scale bar so that scale can be determined after enlargement or reduction. Each sheet shall be numbered sequentially with the first sheet being sheet number one along with the total number of sheets; e.g., 1 of 6.
- (4) Drawings shall include the following information:
  - (a) An official dam name, which must not have already been used for a dam as indicated in the Oregon dam safety database. This unique name must be affixed on each drawing;
  - (b) The first drawing must include a location map with the drainage basin, the dam and reservoir, streams within the drainage area, and the location of the nearest access highway. This drawing must include legal location of the dam (Township and Range Section), and the location of the survey reference point with latitude, longitude, elevation, and datum elevation (NAVD1988);
  - (c) A contour map of the reservoir site showing the legal location of the dam with a contour interval no greater than 5 feet. A plan of the dam should be superimposed on this map. If scale permits, this drawing should show the location of the spillway(s), conduit inlet and outlet, and the location, distance and direction to a government land corner or other permanent survey marker;
  - (d) Area and storage capacity curves and information on the hydrology of the proposed reservoir drainage area in square miles;
  - (e) A profile of the dam site at the center of the dam;
  - (f) A cross section of the dam at maximum section;
  - (g) Plan view(s) of dam at maximum section, and other sections as needed;
  - (h) Cross section(s) of dam, including the maximum section with the official dam height;
  - (i) Spillway details, spillway approach control discharge, and energy dissipation;
  - (j) Low level conduit details, including diameter, material, encasement; and
  - (k) Slide gate or valve details including the trash rack, control stem, pedestal and wheel, or other control details, and air vent.
- (5) Elevations must be clearly labeled on applicable drawings and include the:
  - (a) Base of dam and official height of dam;
  - (b) Dam crest;
  - (c) Spillway control section;
  - (d) Base of spillway discharge; and
  - (e) Invert of the conduit at both the inlet and outlet.
- (6) All drawings must be dated and have sufficient space for State Engineer's approval stamp, at least 3" x 3" near the lower right hand corner of the drawing.
- (7) Drawings must be designated as final design drawing or as-built drawings.

#### **690-020-0060**

##### **Construction Specifications**

All drawings for dams must be accompanied by construction and material specifications that include the following:

- (1) Construction conditions. Specifications must include the construction period based on typical weather for that location and in-stream work periods if applicable, and may include a process for the engineer of record to modify the construction period.
- (2) Clearing of the dam site and reservoir. Specifications must include the area to be submerged by the new or enlarged reservoir and specify that the submerged area shall be cleared of logs and debris prior to filling the reservoir. The specifications must require that the footprint of the dam shall be cleared of all soils containing organic materials, and that this material may not be used for dam construction.
- (3) Cutoff trench requirements. Specifications must include the minimum trench depth, width at base of the trench, and maximum side slope steepness. These specifications shall be based on the subsurface investigations and direct that the cutoff trench may not be filled if it contains standing water. A requirement not to begin filling the cutoff trench until approved by engineer of record, and where specified, by State Engineer or Dam Safety Engineer, must also be included in the specifications.
- (4) Material specification standards. The specifications shall include material and testing specifications for dam materials, conduits, control structures, and other appurtenant structures, using an ASTM standard methodology if available.
- (5) Soil Compaction. The typical compaction specification is 95 percent of standard proctor density, though the engineer of record may use a different compaction standard. Specifications shall include the types of acceptable compaction equipment, by material source if necessary. Specifications shall also include maximum lift thickness. To reduce potential for leakage around the conduit, specifications shall prohibit soil compaction dry of optimum moisture content for materials placed immediately above or adjacent to the conduit. Specifications must also include verification testing of soils, with representative samples selected for testing by the engineer of record and not the contractor.
- (6) Concrete placement. Specifications shall include means to prevent separation of aggregate and cement, air entrainment requirements if needed, methods for placement and vibration of concrete, required minimum 28 day strength, slump, moisture and temperature requirements for curing. Alkali reactive aggregate shall not be used in the concrete.
- (7) Conduit specifications. Specifications must include the material, diameter, and thickness of the conduit, and the length of conduit required for the project. Methods for sealing joints must be specific. Specifications must require that all materials from a manufacture are certified to meet this test, or that the engineer of record has tested the materials directly.
- (8) Accepting and Rejecting Materials. Specifications must include tolerances for acceptable departure from material specifications and a process for rejection of defective materials or workmanship.
- (9) Notification by the engineer of record to the State Engineer of changed conditions critical to the safety or operations of the dam. Specifications shall include State Engineer notification if previously unidentified springs, slope movement or sand lenses are identified, or if storm or other damage occurs during construction.
- (10) The specifications must require supervision by the engineer of record during construction and for inspection by the Director or Director's authorized representative at any time during the construction period.
- (11) The specifications must also contain a provision to the effect that plans or specifications shall not be altered or changed without the written approval of the State Engineer.

#### **690-020-0065**

##### **Dam Construction**

The Engineer of record shall submit plans for administering the construction of the dam to the State Engineer for approval. Construction plans must include the following:

- (1) Construction of the dam shall be observed and documented by the engineer of record and employees working for the engineer of record as applicable.



- (2) The engineer of record or an inspector working for the engineer of record shall be on-site as needed for instructions to the contractor, approval of initial excavation, acceptance of materials, and general project administration.
- (3) The dam owner shall cease construction activity if the engineer of record is no longer employed or for any reason cannot complete necessary construction administration activities. Construction may resume when a new engineer of record is employed, the State Engineer has been notified of the new engineer of record, and both engineers have discussed the project.
- (4) The engineer of record shall observe the construction of the dam. It is the engineer of record's responsibility to make periodic inspections to evaluate whether the construction is proceeding in accordance with the approved plans and specifications. The engineer of record shall endeavor to prevent defects and deficiencies in the construction of the dam and appurtenant structures, and shall disapprove or reject work identified that fails to conform to the approved plans and specifications.
- (5) The engineer of record shall confirm foundation design assumptions once surface materials have been stripped and the cutoff trench excavated. Changes in actual foundation conditions from assumptions made in the initial site evaluation shall be communicated to the Department.
- (6) The engineer of record shall maintain a record of construction that shall include:
  - (a) logs of construction inspections whenever such inspections are made by the engineer or the engineer's employee;
  - (b) all test results pertaining to construction;
  - (c) photographs; and
  - (d) construction problems and remedies.
- (7) The engineer of record shall complete as-built drawings and a final construction report, including statements that the observations are either consistent or inconsistent with the design drawings and specifications. If key elements of construction were not observed, the construction report shall detail those specific elements that were not observed.

#### **690-020-0070**

##### **Submittals and Notifications by the Engineer of Record**

- (1) When necessary, the engineer of record must include an inundation analysis that complies with OAR 690-020-0120 prior to submitting the design report, plans and specifications, so that the Department can determine the hazard rating of the dam.
- (2) All final designs, drawings and specifications submitted to the State Engineer for approval must be prepared and stamped by a professional engineer licensed to practice in the State of Oregon. The first page of the drawings, the specifications, and the construction administration plan must be stamped by the engineer of record. All submitted materials must be addressed directly to the State Engineer and labeled as a dam safety submission.
- (3) Final drawings shall be submitted on full size paper. The design reports and specifications must be submitted as packaged 8.5 x 11 inch bound documents, with essential maps folded within.
- (4) A schedule of construction will be provided to the State Engineer prior to initiating construction of any significant or high hazard dam.
- (5) Prior to completion of the cutoff trench and all stripping of foundation and embankments the engineer of record shall notify the State Engineer to allow for State Engineer inspection of the excavation. The required notice to the State Engineer is as follows:
  - (a) 48-hours for a low hazard dam;
  - (b) 120-hours for a significant hazard dam; and
  - (c) for high hazard dams, 240-hours or the time specified in the approval, whichever is longer.
- (6) Any changes made to the designed location, height or width of the dam, or to materials used in dam construction shall be reported in writing immediately to the State Engineer.

- (7) If any slope instability is observed during construction in the embankment or adjacent to the dam or into reservoir, it shall immediately be reported to the State Engineer by phone.
- (8) If for any reason the engineer of record ceases construction administration work, the engineer of record must immediately notify the State Engineer of the situation, by phone and in writing.
- (9) For high hazard rated dams, the final emergency action plan and any additional inundation analysis required for the EAP as described in OAR 690-020-0400 must be submitted by the Engineer of Record prior to or concurrent with submission of the as-built drawings and the project completion report.
- (10) The engineer of record must submit as-built drawings and a project completion report. A project completion report must include the following:
- (a) As-built drawings, if possible on the same sheet as the initial design drawings. As-built drawings shall be submitted in the form of electronic copies of all applicable drawings;
  - (b) A completion report stating either that the dam has been built according to the drawings with changes to improve safety as documented in the as-built drawings, or that essential safety functions are unknown;
  - (c) A list of the days the engineer of record was on site, the number and location of material tests, and observations of all changed conditions;
  - (d) Test results (compaction, strength, permeability) must be summarized in the completion report;
  - (e) The completion report must document the observations and decisions made and communicated to the contractor or dam owner. Photographs of key stages of construction, including but not limited to photographs of the cutoff trench, borrow pit development, trenching and placement of the conduit, the spillway before and after placement of concrete; and
  - (f) The project completion report shall be stamped by the engineer of record.

#### **690-020-0080**

##### **Written Approval by State Engineer**

- (1) Prior to commencing construction activity, all design reports, drawings of the dam and critical appurtenant structures, specifications, and plans for construction administration must be approved by the State Engineer as indicated by the State Engineer's stamp and a written letter of approval from the State Engineer.
- (2) The State Engineer's approval of design plans and specifications shall be valid only for five years. Upon request, written requests for time extensions may be granted in writing by the State Engineer.
- (3) The following activities which involve the construction or operation of an existing permitted dam that may impair the safety of the dam require State Engineer approval of engineered designs:
- (a) any changes that affect storage capacity of the dam or increase dam height above that in the approved drawings for the dam, including all dam rises other than adding fill to restore crest height lost to settlement or erosion;
  - (b) any changes to or near the spillway that may affect spillway capacity or ability to pass flows safely;
  - (c) installation of any valve or gate on the downstream side of the dam;
  - (d) Removing and replacing or otherwise excavating into or near the dam to place or replace any conduit or utility in the dam;
  - (e) replacement of the conduit control structure;
  - (f) installation of any valve on the downstream side of the low level conduit, or directly connecting irrigation pipe to the low level conduit;
  - (g) repair of damage which has already significantly weakened the dam;
  - (h) Any activity where at least 30 percent of fill material in the dam is impacted by that activity; and
  - (i) Any other change to the dam that affects its safety as determined by the State Engineer.

(4) Prior written approval will not be required for replacement or lining of toe drains, relining of conduits of low hazard dams, and for specific actions required in a safety emergency. As-built drawings may be sent to the State Engineer after completion of such projects to show these projects have been completed in a safe manner.

(5) For pre-existing dams without a valid storage permit, the State Engineer may approve plans and specifications so that a permit may be issued only if the engineer of record provides the following:

- (a) Drawings of the dam as it exists during the engineer's evaluation and survey of the dam. These drawings should include all the critical features as described in OAR 690-020-0035, except for those elements that cannot be evaluated such as the cutoff trench;
- (b) Evaluation of any embankment distress, including erosion, seepage or leakage;
- (c) Condition and function of the conduit and its controls, capacity and stability of the spillway;
- (d) Any other safety information needed as determined by the State Engineer;
- (e) Designs as needed to bring the dam up to the current standards based on the hazard classification of that dam;
- (f) As improved drawings of the dam showing that all necessary modifications have been made with a report from the engineer describing the necessary work that was completed; and
- (g) The source of all information used to develop the as-improved drawings must be documented in a report submitted by the engineer. This includes but is not limited to the engineer's measurements, engineer's observations, a photographic record, and testimony of individuals.

(6) No newly constructed dam may store water until final written approval of necessary plans, specifications or other information is received from the Department.

- (a) Final approval may be obtained only after construction has been completed and as-built drawings and a satisfactory project completion report have been submitted to and approved by the State Engineer.
- (b) The State Engineer shall notify the Engineer of Record and dam owner in writing when final documents have been approved.

#### **690-020-0100**

##### **Hazard Rating of Dams**

(1) Dams shall be assigned a hazard rating of high, significant, or low.

(2) The department shall utilize dam breach inundation analysis as a primary factor to determine the hazard rating of dams as described in OAR 690-020-0120.

(3) Using the dam breach inundation analysis described in OAR 690-020-0120, the department shall make the final determination of any hazard rating using the following criteria:

- (a) An inundation depth of flowing water of at least two feet over the finished floors of dwellings, other frequently occupied buildings, or road surfaces where a vehicle is likely to be present establishes a "high hazard" rating.
- (b) Any inundation depth of water over the floorboards of structural buildings establishes a "significant hazard" rating.
- (c) For other roads and vulnerable utilities, an inundation depth of two feet or evidence of depth and velocity capable of creating damage establishes a "significant hazard" rating.
- (d) Wherever heavy recreational or other frequent use occurs downstream a "high hazard" rating shall be established to prevent probable loss of life. Such designation shall not depend on the presence of downstream infrastructure.

(e) For water depths close to those listed in the subsections (a) and (c), the Department may also consider water velocity in its determination of hazard rating.

(4) The hazard rating of a dam shall remain in effect until the rating is revised by the Department using the procedures described in OAR 690-020-0120. A dam owner may request that the Department revise a hazard rating. The owner must provide information in support of the request and prepared by an engineer licensed in Oregon and familiar with hydraulic and hydrologic calculations and using the procedures described in OAR 690-020-0120.

#### **690-020-0120**

##### **Dam Breach Inundation Analysis**

(1) A dam breach inundation analysis must be submitted with the design for any new dam, except only for dams in a remote location far enough from buildings, high use recreation sites or high use public roads so that damage or fatalities from a dam breach would be very unlikely as determined by the State Engineer.

(2) A dam breach inundation analysis is required to change the hazard rating of an existing dam.

(3) The dam breach inundation analysis must use a breach time based on dam materials and thickness and other factors that would influence the time it would take for the dam to breach from internal erosion, overtopping, or displacement.

(4) Any simplified and conservative hydraulic model may be used to show that a dam should be rated low hazard. The State Engineer may determine if the model was used appropriately and conservatively.

(5) Accepted and hydraulically consistent models must be used to conduct the inundation analysis for significant and high hazard dams, as these will be used in the event of an emergency at the dam. Models developed by the US Army Corps of Engineers including HEC-RAS are the preferred methods of analysis. Other models that use hydrodynamic equations checked for minimum tolerances such as FLO 2D are also acceptable for conducting dam breach inundation analysis.

(a) Information on the specific model used for analysis, dam breach parameters and justification, and all assumptions made for the analysis must be included in the documentation for the inundation analysis.

(6) Inundation analysis for hazard rating of high and significant hazard dams must be conducted with the reservoir at full pool and inflow equal to the 0.2 percent annual exceedance probability flood flow. The analysis must show on a map areas inundated, areas inundated by greater than 2 feet, and all frequently occupied structures.

(7) The following additional information shall also be required for newly constructed or modified high hazard rated dams.

(a) A sunny day and a PMF inflow analysis as part of the emergency action plan.

(b) The inundation mapping must include cross sections with depth and times to flood wave arrival, and must be extended downstream to a location where no significant property damage exists.

#### **690-020-0150**

##### **Routine Inspection of Dams**

(1) The Department shall maintain a program of inspecting dams and may conduct routine safety inspections of dams with an inspection frequency based on the hazard rating of the dam and may specify modifications necessary to insure the safety of the works to prevent possible damage to life or property.

(2) The frequency of inspections may be based on the hazard classification of the dam. Inspections may occur as follows:

(a) Inspections for high hazard dams may be scheduled on an annual basis;

(b) Inspections for significant hazard dams may be scheduled every three years; and

- (c) Inspections for low hazard dams may be scheduled every six years.
- (3) Expedited inspections may be conducted if an urgent dam safety issue is identified or if there is a potential change in hazard classification.
- (4) Following an inspection, the Department shall provide to dam owners a letter with the inspection observations and recommendations that assist the dam owner to ensure the safety of the dam.

#### **690-020-0200**

##### **Fees for Dams**

- (1) Dam owners subject to dam safety regulations shall submit to the Department an annual fee on the basis established under ORS 536.050(2).
- (2) Dam owners who fail to pay an annual fee on or before six months after the billing date may be required to pay a late fee of \$100.
- (3) If a dam owner fails to pay the annual fee or late fee charged by the Department, the Department may, after giving the dam owner notice by certified mail, place a lien on the real property where the dam is located for the fees owed by the dam owner.
- (4) Multiple large dams connected together and separated only by embankments or other manmade materials (common with sewage lagoons) will count as one dam for fee purposes.
- (5) The Department may use the dam safety fee to support dam safety inspections; conduct dam breach inundation analysis for existing dams; help dam owners complete emergency action plans for existing dams; conduct or support the technical analysis of the safety of specific dams; and other actions as needed to support the dam safety program.

#### **690-020-0250**

##### **Maintenance of Dams**

- (1) When inspecting dams to insure the safety of the dam, the Department may consider whether the dam owner has conducted routine maintenance on dams as follows:
- (a) Whether brush and trees have been removed and whether vegetation on the embankment or spillway has been mowed;
  - (b) Whether burrowing animals are controlled and animal burrows are filled;
  - (c) Whether surface erosion is effectively controlled;
  - (d) Whether freeboard and adequate crest width have been maintained;
  - (e) Whether the spillway is functioning correctly and that its capacity has not been reduced;
  - (f) Whether mechanical equipment has been properly cycled and lubricated;
  - (g) Whether cracked concrete structures have been properly patched, sealed, caulked or replaced to prevent deterioration;
  - (h) Whether debris, rock, or earth have been removed from outlet conduits, outlet channels or spillway channels;
  - (i) Whether worn or damaged parts of conduit outlet valves or controls are in need of repair or replacement;
  - (j) Any other condition or activity that might affect safety of the dam.
- (2) The Department may find that a dam is not safe if large trees or large woody vegetation exists on the dam.
- (3) Maintenance deficiencies observed during periodic dam safety inspections shall be described in an inspection letter provided to the dam owner.

#### **690-020-0300**

##### **Modification of Dams Requiring Notification and/or Approval**

(1) The activities described in OAR 690-020-0080(3) are considered such significant modification of the dam so as to constitute new construction requiring approval of engineered designs prior to initiating these activities.

(2) Any activity that will increase the volume or rate of water released during failure requires a new inundation analysis using methods described in OAR 690-020-0120 unless the dam is in a remote area with no downstream development or high recreational use areas that might be affected by a dam breach flood.

(3) Certain repairs that may affect the safety of the dam require on site analysis by an engineer during the actual repair process in order to determine the specific repairs needed. Prior approval of drawings for these repairs will not be required, as conditions encountered on site are likely to deviate from plans. Therefore, submission of an as-built drawing by the engineer of the following repairs indicating the repairs have been made correctly may be deemed as evidence of the safety of the dam:

- (a) Slip lining of existing conduits that does not involve excavation into the dam and does not result in a significant reduction in the time required for the conduit to empty the reservoir;
- (b) Replacement of toe drains; and
- (c) Any other such repairs as determined by the State Engineer.

#### **690-020-0350**

##### **Operations and Maintenance Plans**

(1) As part of the plans submitted with the design, the engineer shall provide to the Department operations and maintenance plans for new significant and high hazard dams, and for any new dam with a gate or flashboard as part of the spillway. The dam owner shall be responsible for implementation of operations and maintenance plans, and compliance with these may be reviewed during dam safety inspections.

(2) Operations and maintenance plans may include but are not limited to:

- (a) Procedures for operation of all gates and valves;
- (b) Specified frequency for cycling of the slide gate and/or valves;
- (c) The time of year flashboards are allowed in the spillway;
- (d) Removal of trees and shrubs, and mowing other vegetation as needed;
- (e) Routine inspections, including evaluation of seepage flow, and visual identification of any turbid seepage;
- (f) Water release plan in the event of a flood forecast when reservoir is above a certain level; and
- (g) Measurement frequency for all monitoring instrumentation installed at the dam.

#### **690-020-0400**

##### **Emergency Action Plans (EAP) and Emergencies**

(1) Draft Emergency Action Plans are required prior to completion of new dam construction or modification as described in OAR 690-020-0300(1), and final EAP's must be submitted prior to filling the reservoir. The final emergency action plan must be reviewed and approved by the State Engineer. EAPs for dams constructed after March 2015 must be updated at least once every two years, including but not limited to ensuring all notification contacts are current.

(2) Dam owners are encouraged to complete emergency action plans for their existing high hazard dams.

(3) An EAP shall contain, as a minimum, the following key elements:

- (a) Emergency condition detection;
- (b) Emergency level determination;
- (c) Notification and communication lists applicable to each of the emergency levels;

- (d) Expected actions to prevent a dam failure incident or to help reduce the effects of a dam failure and facilitate response to an emergency;
  - (e) Inundation mapping that normally includes both a sunny day and a probable maximum flood failure; and
  - (f) Procedures for termination of the emergency.
- (4) Dam owners of high or significant hazard dams shall immediately notify the State Engineer of potential or actual dam failure situations.
- (5) Dam owners shall notify the State Engineer of any breach of any dam subject to these regulations.
- (6) If the Department observes evidence of a dam at risk of imminent failure and a risk to life or property, local public safety officials shall be notified of the situation.

**690-020-0500**

**Enforcement**

- (1) When any dam is found to be in violation of the terms and conditions of the water right permit or certificate, or directly threatens life or property, or when any structure is found where lack of maintenance or unauthorized alterations could lead to a direct threat to life or property, the Department shall notify the owner in writing of the violation and the action necessary and specified time allowed to bring the structure up to design, operation, or maintenance standards.
- (2) Failure by the owner to perform the required action may result in proceedings for one or more of the following:
- (a) Notice and opportunity for a contested case hearing as provided for in ORS 540.350(5).
  - (b) Posting of the structure to prevent storage or to limit operation until the owner has complied with the requested action required to fulfill conditions of the permit or certificate.
  - (c) Instituting legal action by the District Attorney or Attorney General to have the facility declared a public nuisance.
  - (d) Issuance of an order to prevent storage or to breach the embankment as provided for in ORS 540.370.
  - (e) Any other enforcement action permitted by law.
- (3) Engineering work that is inconsistent with any rules in this Division may be referred to the Oregon State Board of Examiners for Engineering and Land Surveying, for appropriate actions.

**OREGON ADMINISTRATIVE RULES  
WATER RESOURCES DEPARTMENT  
CHAPTER 690  
DIVISION 20  
DAM SAFETY**

**690-020-0000****Purpose and Applicability**

(1) These rules describe the standards and requirements under which the department will administer and enforce the design, construction, maintenance, inspection, and fees regarding dams in Oregon. The purpose is to provide the guidance necessary for dams to be constructed and operated in a manner that will ensure the protection of life and property and to provide the department with the resources necessary to manage and support the construction and safe operation of dams in accordance with these rules.

**(1) The purpose of these rules is to implement ORS 537.400(4) and ORS 540.350 through ORS 540.390 with actions that are intended to ensure the safety of the dams insofar as dams may affect possible damage to life or property. The Department is authorized to review design and specifications for dam construction and modification, to conduct routine inspections, and to take enforcement actions on dams that do not ensure the safety of life and property.**

(2) These rules apply to:

(a) Dams that are not subject to ORS 540.350–540.390 as described in 540.400.

(b) Dams that are subject to ORS 540.350–540.390 and which exceed the statutory limits as described in ORS 540.400(1) & (2).

**(2) These rules apply to dams that are subject to ORS 540.350 through 540.390 and which exceed the ~~statutory~~ height and storage limits described in ORS 540.400.**

(3) These rules do not apply to:

**(a) Dams that are less than ten feet high or that store less than 3 million gallons (9.2 acre feet), ~~except for general guidance and permit requirements described in OAR 690-020-0029;~~ or**

**(b) ~~Metal or reinforced concrete~~ Water storage tanks or various types of tanks that are part of water treatment facilities.**

**(4) The dam safety fee authorized by ORS 536.050(2) shall be used to support the dam safety program as described in OAR 690-020-0200.**

**(5) The State Engineer may delegate dam safety duties to a dam safety engineer working for the Department for the purposes of ORS 540.350 through 540.390.**

**690-020-0022****Definitions**

Unless the context requires otherwise, the following definitions apply in OAR 690, Division 20:

(1) “Abutment” means a natural valley or canyon side against which the dam is built;

(2) “Acre-foot” means the equivalent volume of one acre covered with one foot of water (325,900 gallons);

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- (3) **“Annual Exceedance Probability Flood” means the likelihood of specific flood flow being equaled to or exceeded in any given year at that specific location, expressed as a percentage;**
- (4) **“As-built drawing” means an engineering drawing of a dam as it was actually constructed, noting all differences between original design and actual constructed condition;**
- ~~(35)~~ “Conduit” means a closed conveyance used to release water through a dam;
- (6) **“Core” means a soil of low permeability within an embankment dam;**
- (47) “Cutoff Trench” means a trench excavated beneath the dam foundation and backfilled with low permeability material to retard water seepage;
- ~~(58)~~ “Dam” means a hydraulic structure built above the natural ground grade line that is used to impound water. **Dams include all appurtenant structures, and together are sometimes referred to as “the works.”** Dams include wastewater lagoons and other hydraulic structures that store water, attenuate floods, and divert water into canals;
- (69) “Dam Crest” means the top of the dam;
- (10) **“Dam Height” means the maximum height of the dam as measured at the maximum section along the dam’s longitudinal axis;**
- ~~(711)~~ “Department” means the Oregon Water Resources Department;
- ~~(812)~~ “Director” means the Director of the Oregon Water Resources Department;
- ~~(913)~~ “Embankment” means an engineered earth fill;
- (14) **“Emergency Action Plan” (EAP) means a plan that assists the dam owner or operator and local emergency manager perform actions that ensure the safety of people in the event of a potential or actual dam failure or in the event of a sudden release of water;**
- (15) **“Engineer of Record” means the professional engineer registered in Oregon working for the dam owner to design the dam to current safety standards and is responsible charge to oversee safe construction of the dam;**
- ~~(1116)~~ “Foundation” means the ground surface upon which a dam is constructed;
- ~~(1217)~~ “Freeboard” means the vertical distance between the ~~designed~~ high-water level in the reservoir and the dam crest;
- ~~(1318)~~ “Gate” or “Valve” means a permanent device for regulating water flow through the dam;
- ~~(1419)~~ “Hazard Rating” means the rating established by the department ~~for a large dam that pertains to of the potential level and degree of damage to life and property downstream of a dam in the event of a dam failure results in a catastrophic release of water;~~
- (20) **“High Hazard Rating” means that if a dam were to fail, loss of human life would be expected;**
- ~~(15)~~ ~~“Large Dam” for dam safety purposes, means a dam with a height of 10 feet or more and impounding 3,000,000 gallons (9.2 acre-feet) or more of water;~~
- (21) **“Inflow Design Flood” (IDF) means a volume and peak flood flow that the engineer of record will design to safely pass over or through the spillway;**
- (22) **“Low Hazard Rating” means that if a dam were to fail, loss of life would be unlikely and damage to property ~~other than that owned by the dam owner~~ would not be extensive;**
- (23) **“Pressurized Conduit” means any pipe that penetrates into a dam that may have a gate, valve, or irrigation pipe placed in the dam or at the outlet so that all or a portion of the pipe within the dam is under hydrostatic pressure when the valve is closed;**

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**(24) “Probable Maximum Flood” (PMF) is the largest flood that could occur at a specific location, determined by the most severe set of atmospheric, soil moisture and snowpack conditions that are reasonably possible at that location;**

**(25) “Significant Hazard Rating” means that if a dam were to fail, loss of life would be unlikely but damage to property ~~other than that owned by the dam owner~~ would be extensive;**

~~(16) “Significant dam work” means an activity to repair, rehabilitate, enlarge or otherwise alter a dam in which: 1) at least 30% of the fill material is impacted by the activity, 2) a spillway is being enlarged or repaired that affects the height or hydraulics of the spillway, 3) dam height and/or reservoir size is being increased, 4) a low level outlet conduit or inlet gate is being reworked with excavation or 5) any other activity that could affect the integrity of the dam or its auxiliary works;~~

~~(17) “Small dam” for dam safety purposes, means a dam with a height of less than 10 feet or impounding less than 3,000,000 gallons (9.2 acre-feet) of water; and~~

**(26) “Soil Filter” means soil with a gradation designed to inhibit movement of adjacent, finer grained soils;**

~~(1027) “Emergency Spillway” means an overflow structure constructed to bypass flood water and prevent water overtopping the dam crest. Often, dams may have two or more spillways. The lower elevation spillway that spills first is referred to as the principle spillway. The higher elevation spillway is referred to as the emergency spillway;~~

**(28) “State Engineer” means a registered professional engineer working for the Department, and may be either the Director or a principal assistant working for the Director as described in ORS 536.032.**

~~(29) “Statutory Dam” means a dam that is ten feet in height or taller, and that stores at least 9.2 acre feet of water;~~

~~(1829) “Tank” means a fully-enclosed (bottom and sides) hydraulic structure made from metal, reinforced concrete, rigid fiberglass, or plastic that provides its own water-sealing and structural stability.~~

~~(3130) “Toe Drain” is a drainage structure designed to collect and remove seepage water from the toe of the dam and to discharge this water in a manner where it can be measured;~~

~~(3231) “Zoned Embankment” means an embankment dam with a core of low permeability materials, soil filter materials, drainage and other materials placed to improve performance and safety of the dam.~~

690-020-0023

**Dam Safety Process Requirements for Construction of Dams**

**(1) Dam safety requirements shall be based on the hazard rating of the dam, in order to efficiently protect life and property.**

**(2) Any person, corporation, association, firm, partnership, limited liability company, joint stock company, unit of local government as defined in ORS 190.003, or State agency must, before beginning any construction on a dam, secure the services of a qualified engineer to design the dam and also to provide information on the dam as it was actually constructed. This engineer shall be deemed the engineer of record for the purposes of these rules.**

**(3) The engineer of record shall design the dam and develop plans and specifications consistent with these rules.**

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(4) Prior to beginning construction on any dam subject to these rules, written approval of dam designs, drawings and specifications must be obtained from the State Engineer as described in OAR 690-020-0080.

(5) The engineer of record must oversee construction of the dam consistent with rules governing administration of dam construction in OAR 690-020-0065 to evaluate whether the dam is constructed consistently with approved plans and specifications.

(a) Any essential design changes must be described and justified in a letter sent to the State Engineer with the "as-built" drawings.

~~(6) Persons constructing or designing dams under ten feet high or storing less than 9.2 acre feet may be subject to requirements for use of registered engineers as specified in ORS 672.002 through .091.~~

## 690-020-0025

### General Requirements

(1) The ~~d~~**D**irector may require any **additional** information or data ~~beyond~~**to** that ~~outlined herein~~ **specified in these rules to determine which that the director finds necessary for determining** the safety of the a proposed structure **dam**.

~~(2) Whenever possible, precipitation and runoff records shall be submitted as part of the design for new or significant dam work on existing dams. If records are not available for the basin in which the dam is located, the hydrological/hydraulic criteria used in the design shall be submitted.~~

~~(23)~~ The ~~d~~**D**irector may include, as part of any permit to construct a dam, limitations and conditions that pertain to construction, operation, maintenance, and the protection of lives and property. These limitations and conditions become, by reference, part of the **water right** certificate and remain in effect throughout the life of the water right.

~~(34)~~ Approved plans and specifications for construction are, by reference, considered limitations and conditions placed on the water right permit and water right certificate. The ~~d~~**D**irector retains the authority to place additional limitations and conditions on the water right relative to operation and maintenance.

~~(45)~~ Dams constructed or operated in violation of limitations and conditions included in the **water right** permit or certificate are subject to restricted use ~~and permit cancellation procedures~~. The certificate affirms the applicant's right to store water subject to the limitations and conditions therein.

~~(56)~~ **For new dams on stream channels, an outlet conduit with a minimum diameter of 8" must be installed in any in-stream reservoir to permit drainage of all or most of the reservoir and for passage of flow to downstream prior** ~~to~~ **senior-instream and out of stream water rights holders or instream minimum releases unless the engineer of record provides another alternative and demonstrates the safety of this alternative to the State Engineer.** The director may waive this requirement if the director determines that the conduit is not needed for dam safety and will not be needed to pass flow for the benefit of other water rights, minimum perennial streamflows, or if the director determines an adequate alternative for passing flow is provided. Adequate alternatives must be capable of passing flow in sufficient quantity to satisfy downstream needs, and can include pumps, by-pass channels and siphons. Conduit material should be chosen based on design and site condition requirements. Acceptable conduit materials include reinforced concrete cylinder pipe; cast in-place, reinforced concrete; appropriate PVC; concrete encased corrugated metal pipe or plastic pipe; ductile iron; and cast iron. All joints should be water tight. The conduit valve should be installed at the upstream end and

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should be industry manufactured with specifications consistent to the applied usage. Special provisions should be made for pressure conduits gated on the downstream end.

(7) The department shall determine the height of a dam by calculating the vertical distance (measured in feet) between the center point of the dam crest relative to and above the stream channel and the lower of either the natural soil surface that was in place prior to the construction of the dam or where a channel incision exists, the bottom of the channel incision. This measurement is to be taken at the maximum section along the dam's longitudinal axis.

(68) The ~~d~~Department shall determine water impoundment volumes (in acre-feet or millions of gallons) as follows:

- (a) For dams impounding water for an authorized beneficial use, the impoundment volume indicated in the area-capacity curve **as measured** from the bottom of the reservoir to the spillway crest. For dams with multiple spillways, 'spillway crest' is referring to the crest of the ~~principle~~ or lower elevation spillway.
- (b) For wastewater treatment lagoons, the impoundment volume **is that** indicated in the wastewater lagoon plans and specifications, ~~and~~.
- (c) For diversion or flood control dams, the impoundment volume **is that** calculated at full reservoir at the dam ~~emergency~~ (highest elevation) spillway crest level.

(7) **The State Engineer may approve final designs, drawings and specifications for water storage reservoirs after a water storage application and a draft final order for that application have been issued by the Department.**

(8) **Any person, firm or private or municipal corporation must provide to the ~~s~~State ~~e~~Engineer an evaluation of whether the dam includes measures that make it readily adaptable to power generation for any new dam over 25 feet high on a stream with average annual flow over 2 cubic feet per second, unless exempted from this requirement as provided in ORS 540.350-(3).**

(9) **For any dam rated high hazard, the Department must review and approve an Emergency Action Plan prior to filling the reservoir.**

(10) **For any dam rated high or significant hazard, the Department must review and approve an operations and maintenance manual prior to construction on the dam.**

#### 690-020-0029

Small **Recommendations for Dams, Recommended Minimum Standards Under 10 Feet High or Storing less than 9.2 Acre-feet**

**(1) Person constructing or designing dams under ten feet high or storing less than 9.2 acre-feet may be subject to requirements for use of registered engineers as specified in ORS 672.002 through 672.091.**

**(2). The Department is authorized to provide guidance for the construction of dams requiring a water right permit but not requiring State Engineer review and approval of designs, plans and specifications.**

**(3). Potential dam owners are advised that even small dams, should they fail, may cause injury to people and property. Dam owners should consider designs and inundation analysis methods described in OAR 690-020-0035 through 690-020-0065, OAR 690-020-0100, and OAR 690-020-0120. the rules for jurisdictional dams.**

**(4). Persons proposing to build a non-jurisdictional dam under 10 feet high or storing less than 9.2 acre-feet must comply with all the requirements for a storage permit in ORS 537.409 and in OAR 690-020-0310.**

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The following information is presented for the applicant's assistance in constructing small earthfill dams:

- (1) It is recommended that the crest width of the dam be not less than 8 feet.
- (2) It is recommended that the upstream slope of the dam be no steeper than 3:1.
- (3) It is recommended that the downstream slope of the dam be no steeper than 2:1.
- (4) It is recommended that the spillway channel be constructed around the dam, not over the top of the fill. The spillway is commonly excavated in natural material and, if necessary, lined to prevent erosion. The spillway should be large enough to pass the 50-year flood flow without overtopping the dam. Assistance is available from the department in sizing the spillway. Flow passing through the spillway should be returned to the creek channel at a sufficient distance downstream to prevent erosion of the dam's embankment.
- (5) It is recommended that all brush, stumps, roots, and organic matter should be cleared from the area to be occupied by the dam. All such material should also be removed from the borrow area.
- (6) It is recommended that the outlet pipe be encased with concrete or other method to allow for proper compaction and the prevention of uncontrolled seepage.
- (7) Embankment material should be spread parallel with the dam axis in layers not exceeding eight inches in thickness and adequately compacted with sheepfoot roller or other similar equipment.
- (8) It is recommended that prior to construction the dam owner have the dam's potential hazard to downstream properties studied using methods listed in 690-020-0100. It is recommended that any dam with a potential significant or high hazard rating be designed by a registered engineer familiar with dam engineering. It is advisable for any dam nearing or surpassing the dam height or storage thresholds for a "large dam" to be designed by a registered engineer.

#### **690-020-0035**

##### **Large Dams; Minimum Engineering Design Requirements**

- (1) All maps, plans, and specifications for the construction of new large dams or significant dam work for existing large dams, must be prepared by a professional engineer licensed to practice in the State of Oregon.
- (2) Before initiating design, the engineer shall obtain design criteria from the department.
- (3) No newly constructed large dam shall be permitted to store water until written approval is received from the department. Approval will be given after construction has been completed and is certified by the supervising engineer to have been constructed in accordance with the approved plans and specifications.
- (4) Design documents shall include the following:
  - (a) Plans:
    - (A) Plans for dams submitted for approval must accurately portray the work to be accomplished and be of sufficient detail to adequately define all features of the project. Plans must be submitted on good-quality mylar or vellum and must be neatly and accurately drawn to a scale sufficiently large, with an adequate number of views, for the drawing to be readily interpreted. To meet the requirements of this subsection, the director may allow plans for dams to be submitted electronically. The format of the plans in terms of file type, projection and other details must be approved by the department.
    - (B) Several sheets may be used to eliminate the necessity of large bulky drawings. No map or plan should be larger than 24 x 36 inches. The following information will be required:

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- (i) A contour map of the reservoir site which will show the location of the dam by quarter-quarter section, township, range and tax lot; and the name and location of the stream flowing through the reservoir. Government survey lines must be indicated on this map, along with a survey tie to the dam axis from a government land corner. Area and capacity curves and/or tables of the proposed reservoir must be shown;
- (ii) A map of the drainage basin showing the location of the dam and reservoir and the streams within the drainage area. This map may be prepared from existing reliable topographical maps and it must include: the number of square miles of drainage area; a brief description of the area; the percentage of bare and timbered lands; and general characteristics of the watershed, whether precipitous, rolling, or comparatively flat. The estimated discharge as well as the spillway capacity at different reservoir water levels should also be provided in the plans or specifications. Extraneous information can also be included in specifications or a separate hydrology report as to not clutter up the map;
- (iii) A topographic map of the dam site with contour intervals not to exceed 5 feet. A plan of the dam should be superimposed on this map showing the location of spillways, outlet conduits, and other relevant auxiliary structures;
- (iv) A profile of the dam site taken on the axis of the dam and a profile of the spillway along its axis. The profile should also show the location of the outlet conduit and spillway. A log showing the classification of materials encountered below the surface as shown by test pits or borings;
- (v) A cross section of the dam at maximum section showing complete details and dimensions;
- (vi) Plans showing sections of the outlet conduit, control works, and spillways. These sections should be in sufficient number and detail to make definite all features of the structure.
- (b) Specifications. All plans for dams must be accompanied by construction and material specifications:
- (A) The specifications shall describe in detail the methods and/or performance criteria to be followed in performing each class of work and shall set forth the requirements for the various types of material to be used in permanent construction;
- (B) The specifications must contain a provision for supervision by the engineer during construction and for inspection by the director or director's authorized representative at any time during the construction period;
- (C) The specifications must also contain a provision to the effect that plans or specifications shall not be altered or changed without the written approval of the director or the director's authorized representative.
- (5) Construction: Construction should be supervised by an engineer licensed to practice in Oregon. As a minimum the following notices and construction reports shall be submitted to the Department:
- (a) Notice of beginning of construction;
- (b) Notice of intent to begin placement of fill materials;
- (c) Completion report including test results, "as built" drawings, and certificate of completion in accordance with approved plans and specifications.
- (6) During the design process for any newly constructed dams or for significant dam work to existing dams that involves potentially changing the volume or rate of water released during failure, the dam owner or owner's representative must submit to the department an inundation analysis using methods described in 690-020-100. The department shall use this analysis to determine the hazard rating of the dam in accordance with 690-020-100.

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~~(a) If a dam is rated as high hazard, an emergency action plan is required and the plan must be reviewed and approved by the department.~~

~~(b) The inundation/evacuation map for the dam must be developed using methods described in 690-020-100(2) and must be reviewed and approved by the department.~~

**(1) A design report or multiple design reports must be submitted with the drawings and specifications by the engineer of record for all new dam construction. Design reports may be completed by other engineers registered to practice in Oregon.**

**(2) The design report(s) for new dam construction must include the following elements:**

**(a) Site suitability evaluation as provided in OAR 690-020-0036;**

**(b) Hydrology and inflow design flood as provided in OAR 690-020-0037;**

**(c) Dam structure design (embankment, concrete or other) as applicable and as provided in OAR 690-020-0038 – [690-020-0041](#);**

**(d) Spillway design as provided in OAR 690-020-0042;**

**(e) Design for penetrating conduit(s) as provided in OAR 690-020-0043;**and****

**(f) Methods for determining whether a dam is operating properly based on the hazard rating of the dam as provided in OAR 690-020-0044 (monitoring and instrumentation).**

**(3) If multiple reports are submitted, each must be stamped by the engineer who prepared the report; and the engineer of record must compile and understand reports for preparation of drawings and specifications.**

#### 690-020-0036

##### Site Suitability and/or Geotechnical Evaluation

The design for new dam construction shall characterize the soil and rock at and around the dam site and shall include the following elements:

**(1) A description of the general and local geology and geomorphology at and around the dam and reservoir. Field investigation by a geotechnical engineer and/or engineering geologist is required for all high hazard dams and also for significant hazard dams where landslides, faults, dispersive soils or liquefiable soils could reasonably be expected near the dam site. All such features shall be shown on a map of the dam site, and described as necessary for design of the dam. For dams on rock, mapping of discontinuities relevant to safety of the dam and evaluation of the need for grouting is required.**

**(2) Subsurface investigation to determine distribution of relevant earth materials. This investigation shall include borings or test pits; identification of springs, seeps and groundwater encountered at the dam site; and evaluation of the potential for landslides into the dam or reservoir.**

**(a) All materials shall be logged by the Unified Soil Classification System; blow counts (for borings only); and description of samples taken for testing.**

**(b) Subsurface investigations for High Hazard dams shall include drilling to a minimum depth 1.5 times the height of the dam or at least 10 feet into bedrock, whichever is less.**

**(3) Soil and or rock evaluation and testing of relevant materials. This evaluation may include: proctor compaction testing from all borrow areas; estimation or testing the permeability of soils to be used in dam construction; and an assessment for the presence of dispersive soils.**

**(a) An analysis of materials in the foundation and proposed embankment shall be completed if materials are prone to liquefaction or significant settlement.**

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(b) Where suitable materials can be collected, strength tests shall be required for all high hazard dams, and may be required by the State Engineer for significant hazard dams.

(c) ~~Simple cyclic shear or other~~ Testing of dynamic soil properties may be required for high hazard dams in areas with large ground acceleration potential from earthquake loading.

(4) Borrow area locations. Areas proposed for borrow shall be identified and shown on the drawings.

(5) Earthquake considerations. Seismic site characterization is required for high hazard dams, and may be required for significant hazard dams. A seismic site characterization shall include earthquake sources, ground motion hazard, peak ground acceleration, and recommended ground motions (time histories).

(6) Site preparation criteria. The site evaluation shall recommend a depth of stripping unsuitable materials, and also a minimum, and where necessary, maximum depth for the cutoff trench.

690-020-0037

#### -Hydrology and Inflow Design Flood

The design shall characterize flow into and through the reservoir and dam and shall include the following elements:

(1) A topographic map delineating the drainage area contributing to the dam, with the drainage area size labeled in square miles and showing the specific location of the proposed dam.

(2) For dams on stream channels, the name of the stream where the dam is located, the name of the principal watershed, and a determination of average annual inflow into reservoir and potential to fill the reservoir.

(3) Dam failure inundation analysis is required for any dam that might be high or significant hazard. The inundation analysis shall comply with OAR 690-020-0120.

(4) The inflow design flood that is the basis of hydraulic design for the dam shall be determined based on the hazard rating of the dam.

(a) The inflow design flood for a high hazard dam is the Probable Maximum Flood (PMF).

(b) The minimum inflow design flood for a significant hazard dam is the 0.2 percent annual exceedance probability flow.

(c) The minimum inflow design flood for a low hazard dam is a 1.0 percent annual exceedance probability flow.

(d) The inflow design flood for a lagoon or off channel reservoir is the maximum capacity of inflow pumps, ditches plus the maximum local storm precipitation over the lagoon.

(e) For watersheds under 30 square miles, the engineer may consider just the 24-hour storm to help determine the PMF, while **for** larger basins the engineer shall utilize at least a 72-hour storm **s** for calculating the PMF for a general storm.

(5) For a high hazard dam, the engineer of record may also propose to determine an inflow design flood based on a quantitative analysis of risk to people and property.

(6) Designs shall include a description of all hydrologic parameters and the method used to determine the inflow design flood hydrograph and the volume of the inflow design flood, which is to be determined considering basin size and other factors as appropriate to the watershed above the dam.

(7) The design report must include the information used to develop the stage and storage capacity curve for the reservoir, including the capacity with and without excavation for construction.

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690-020-0038

## Embankment Dam Structures

Designs for Embankment (soil and or rock) dams shall include the following elements:

- (1) A determination of embankment stability and stable embankment slope angles.
  - (a) Embankment dams shall be designed to have stable slopes during construction, and under all conditions of reservoir operation.
  - (b) Standard slopes of 3:1 upstream and 2:1 downstream may be used at the discretion of the engineer of record for low and significant hazard dams as long as low strength materials are not used in the embankment and conditions leading to elevated pore water pressures are not present.
  - (c) Dams that are rated high hazard must be designed as zoned embankment dams and/or include a chimney drain designed also as a filter.
  - (d) High hazard dams shall be analyzed for static and seismic slope stability, and also for deformation analysis. The State Engineer may require static and or seismic slope stability analysis for significant hazard dams. At a minimum, seismic analysis shall be based on full reservoir under steady state seepage conditions. Factors of safety shall be evaluated by slope stability analyses using appropriate strength parameters based on laboratory or insitu testing. For materials that can be reasonably tested either on site or in a laboratory, soil strength values may not be based on assumptions and must be made on strength testing of the appropriate soil or rock units.
  - (e) High Hazard dams shall be designed for the maximum credible earthquake. If the State Engineer requires seismic analysis of a significant hazard dam~~s~~, deformation analysis shall be designed for the 0.2 percent annual exceedance probability earthquake.
  - (f) Abrupt changes in depth of compressible foundation material shall be identified and where present, the design shall prevent significant differential settlement.
- (2) Analysis of seepage and leakage expected through the dam and design of measures to prevent internal erosion and excess leakage.
  - (a) Steady state seepage and internal drainage conditions beneath, around and through the dam shall be quantified for all high hazard dams, and may be required by the State Engineer for significant hazard dams.
  - (b) A core of low permeability material protected by a soil filter is required for all high hazard dams. A core and soil filter is required for any significant hazard dams where the engineer of record or State Engineer determines piping could potentially occur. All core and filter zones must be of a configuration with dimensions that can be readily constructed.
  - (c) Internal drains and/or soil filters shall be used as needed to drain water and prevent internal erosion of the dam. Toe drains shall be standard design practice for water storage facilities, but not for most wastewater lagoons.
  - (d) Internal drain pipes to collect and distribute seepage flows from internal filters and drains shall be comprised of material that is non-corrodible, designed to carry the overburden load, and be no smaller than 6 inches in diameter.
- (3) A safe and accessible dam crest.

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- (a) The dam crest shall be of sufficient width to be accessible by equipment and vehicles for emergency operations and maintenance, and shall have a road to allow crest access during periods when the spillway is flowing.
  - (b) The crest shall have a camber sufficient to maintain the design freeboard, based on the anticipated crest settlement, and in no case shall the camber be less than 0.5 feet.
  - (c) Roads located on the dam crest shall have appropriate surfacing to provide a stable base that resists rutting and provides adequate traction for access and safety in wet conditions.
  - (d) The crest shall have adequate cross slopes to prevent ponding.
- (4) Measures to control wave and surface erosion as needed.
- (a) For reservoirs large enough to generate significant waves, the design shall include a determination of minimum freeboard based on expected waves. The design shall also include slope protection for wave action if significant waves are likely.
  - (b) The downstream slope shall be provided with a well maintained cover of non-woody vegetative cover, or a gravel or rock surface, to prevent surface erosion. No woody vegetation shall be planted on the dam during the life of the structure unless specifically designed by the engineer of record, by demonstrating that cover plants will not affect critical dam functions.

690-020-0041

#### Concrete Dam Structures

Designs for concrete mass dams must be prepared by a structural engineer and a geotechnical engineer and/or engineering geologist. This rule does not apply to concrete flashboard dams. Designs for all other concrete dams shall include the following elements:

- (1) Concrete dams shall be specified as gravity, arch, arch-gravity, or buttress. Gravity dams can be of conventional mass concrete or roller compacted concrete.
- (2) Dams shall be designed to be stable during construction and under all conditions of reservoir operation.
  - (a) Headwater and tailwater elevations pertinent to the design shall be described with respect to both static and dynamic loading.
  - (b) Uplift pressure distributions assumed for design shall be provided.
  - (c) When foundation drains are used to reduce uplift, the assumed drain efficiency shall be indicated and permanent access shall be provided at the project to inspect and maintain the drains.
- (3) Sliding stability shall be evaluated at lift joint surfaces, at the dam foundation interface, and at discontinuities in the foundation materials beneath the dam and abutments.
  - (a) Factors of safety shall be based on limit equilibrium methods.
  - (b) For earthquake loadings, the critical acceleration (acceleration required to initiate sliding) may be less than the peak ground acceleration of the design earthquake. In such cases a permanent sliding displacement shall be determined in lieu of a sliding factor of safety.
  - (c) Overturning of the dam on its foundation shall be evaluated for static and seismic loading.
- (4) Seismic stability analysis is required for certain concrete dams and shall demonstrate the dam can withstand the design earthquake without loss of life or damage to property.
  - (a) High hazard dams shall be designed for the maximum credible earthquake based on current information from the US Geological Survey or a site specific seismic evaluation. A dynamic stress

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analysis that considers the dynamic characteristics of the dam and the ground motions of the design earthquake shall be provided for high hazard dams.

(b) Where the State Engineer requires seismic analysis on significant hazard dams, they shall be designed for the 0.2 percent annual probability of exceedance earthquake. The Department may require a dynamic stress analysis for significant hazard dams.

(5) When foundation grouting is needed, the design for the grout curtain and/or consolidation grouting of the foundation shall be required.

(6) Specific properties of mass concrete that can be important to design and construction include the compressive strength (at 28 days and one-year), modulus of elasticity, Poisson's ratio, shear strength, tensile strength, volume change during drying, thermal coefficient of expansion, specific heat, thermal conductivity, permeability and durability.

(a) As a minimum for static loadings, the assumed compressive and shear strengths for the parent concrete, lift joint surfaces, and the dam-foundation contact shall be provided.

(b) In addition, tensile strength assumptions for the aforementioned regions for dynamic loadings (seismic) shall also be provided.

(c) Air entraining agents shall be provided in the concrete mix to provide freeze-thaw protection and to improve the workability of lean mass concrete mixes. The quantity of air entrained in mass concrete shall be in the order of 5 percent.

(7) Mix design and construction methods used to minimize cracking due to temperature gradients between interior regions subject to heat of hydration effects and surfaces exposed to ambient temperatures shall be specified. Treatment of lift joint surfaces to achieve desired shear and tensile strengths shall be indicated. Treatment of contraction joints to prevent leakage and/or to transfer load between adjacent monoliths shall be described.

(8) When reinforcing steel is used, the strength properties of the reinforcement shall be provided and contract drawings shall clearly indicate the size, location, spacing, and cover requirements.

(9) The minimum crest width must be 15 feet unless otherwise approved. The dam crest and appurtenant structures shall be accessible by equipment and vehicles for emergency operations and maintenance.

690-020-0042

#### Spillways

All dams must have a spillway. Spillway(s) design shall include the following minimum elements:

(1) Utilization of inflow design flood. Determination of inflow design flood as described in OAR 690-020-0037 is required to determine the required spillway capacity.

(2) Hydraulic evaluation of flow through control section. Flood flow through the control section must be calculated and the minimum freeboard at the inflow design flood must be 1 foot for high hazard dams and 2 feet for significant and low hazard dams.

(3) Optional low elevation spillway. An interior spillway connected to the low level conduit may be used for low and significant hazard dams, and for high hazard dams only with specific approval by the State Engineer. The capacity of the low elevation spillway may be considered in design of the overflow spillway.

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(4) **Stable spillway control section.** The spillway control section must be hydraulically and structurally stable for the inflow design flood and have permanent features so that the control section is identifiable for re-measurement of cross section during routine inspections.

(5) **Spillway channel stability.** Spillways shall be designed to be structurally adequate and stable under all conditions of reservoir operation. Spillway structures of high hazard dams shall be designed for earthquake ground motions per OAR 690-020-0036.

(6) **Reinforced concrete specifications.** Structural elements of reinforced concrete shall be designed for both strength and serviceability. The 28 day strength of structural concrete shall be provided. The strength properties of the reinforcing materials shall also be provided and contract drawings shall clearly indicate the size, location, spacing, and cover requirements ~~shall be specified~~. Treatment of construction joints and contraction/expansion joints shall be described and special provisions for strength transfer and leakage prevention identified. Air entrainment shall be provided in cast-in-place concrete if needed for freeze-thaw protection, durability, and workability.

(7) **Debris booms.** For high and significant hazard dams, debris or log booms may be required. Where required, they shall be designed for the spillway approach where logs and other debris may block or damage the spillway structure. The design shall specify the necessary anchor capacity, and the design of the anchors.

(8) **Gates and Flashboards.** Detailed drawings and specifications are required for spillway gate structures or flashboards, if present on the proposed dam. Operations and maintenance manuals are required for any dam with a gated spillway, or where flashboards or stop-logs are used in the spillway.

(9) **Energy dissipation.** The design of stilling basins for high hazard dams, and where required by the State Engineer for significant hazard dams, shall be based on calculated hydraulic forces and designed to dissipate energy from the inflow design flood.

#### 690-020-0043

##### Penetrating Conduit (s) and Control of Flow Through Conduits

All new dams on stream channels must have a low level conduit. All other dams must have a low level conduit or other means to safely drain the reservoir. The conduit and related control structures must be designed to meet the following criteria:

(1) **Ability to lower the reservoir.** The minimum diameter of the conduit should be determined through analysis of the time required to drain the dam at average inflow.

(a) **The conduits for high hazard dams shall be capable of releasing the top five feet of the reservoir in five days.**

(b) **The conduits for significant and low hazard dams must be able to release the top five feet of the reservoir in ten days.**

(c) **All conduits must be of sufficient size to allow passage of inflows as needed. ~~to senior water right holders.~~**

(d) **In no case shall conduits be smaller than 8 inches in diameter.**

(2) **Durable and water-tight conduits.** Conduits must be made of medium to heavy gage durable materials. Pipe joints must be designed to seal and prevent leakage. Corrugated metal culverts are only acceptable for low hazard dams, and only when the conduits are encased in concrete.

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Encasement of conduits in concrete may be used to assist in the design of a durable conduit and to reduce the potential for seepage and erosion adjacent to the conduit.

(a) Diaphragms using materials designed as an effective soil filter are required for any conduits not designed as encased in concrete, and are required regardless of encasement for all high hazard dams.

(b) Seepage collars may not be used in any dam.

(3) Control Mechanisms. The design for the control mechanism must be sturdy, durable, allow for air venting when needed, and allow manual operation to drain the reservoir if hydraulic or other power controls are inoperable. Hydraulic controls must have redundancy if control relies on any submerged hydraulic hoses. Intake structures for outlet works must have trash racks unless the engineer of record shows trash racks are unnecessary, or unsafe to construct due to conditions at the dam site. For high and significant hazard dams, measures to prevent unauthorized use of the control mechanism must be included in this design.

(4) Outlet structure. The outlet structure must not be submerged when the inlet control gate or valve is fully closed. The outlet structure must be designed to protect the conduit from mechanical damage and convey water to the stream channel without channel erosion and cavitation near the gate structure.

(5) Pressurized operation. Conduits must be specified as suitable for pressurized operation if they are to be operated with controls other than at the inlet of the conduit. Conduits for dams with pressurized conduits shall have a guard gate installed at the upstream end of the conduit.

(a) Operations and maintenance manuals are required for any dam designed for pressurized operation, and the plans must include procedures for periodic inspections of the interior of any pressurized pipes.

#### 690-020-0044

##### Monitoring and Instrumentation

Designs must include methods for determining if the dam is operating properly based on the hazard rating of the dam, and include:

(1) Staff gage near controls for the conduit. The staff gage shall be clearly marked in feet and tenths of feet, and extend to within one foot of the crest of the dam. Markings and numbers on the gage rod shall be of sufficient size to be easily readable from the crest of the dam.

(2) Multiple and easily accessible outlets of all toe drains. Toe drains shall be designed to discharge into locations where flows can be evaluated and monitored. Multiple discharge points are required in order to isolate seepage to various sections of the dam and foundation. Discharge points must be located where routine dam maintenance is not likely to damage the drains.

(a) For high hazard dams, drains must have a measuring weir or other device, and a basin for settling drainage water so that internal erosion can be identified.

(b) Where drainage galleries are provided for concrete dams, seepage measuring devices should be provided and accessible for making the necessary readings.

(3) Unique Identification. All instrumentation and exterior drains shall be labeled with a unique identifying marker designed for durability and to withstand maintenance activities.

(4) All high hazard and where required by the engineer of record or State Engineer, significant hazard dams shall have the following instrumentation:

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- (a) Monuments that allow measurement of the horizontal and vertical movements of the dam. Control or benchmark monuments shall be placed in areas not subject to movement;
- (b) Piezometers to allow monitoring of the phreatic surface within the dam or for concrete dams, to determine uplift pressures.
- (c) Instrumentation to measure strong ground motions for dams in locations where the peak ground acceleration in the 0.2 percent annual probability of exceedance earthquake is greater than 0.4g.

690-020-0047

Geosynthetics

Geosynthetics shall not be used as the sole element employed to perform an essential dam safety function. Redundant design features are required whenever geosynthetics are used for essential dam safety functions.

690-020-0048

Modification of Standard Design Requirements

Exceptions to design standards may only be obtained with written approval from the State Engineer. Where the engineer of record requests design exceptions, the request must be in writing, be affixed with the engineer of record's professional stamp, and include a report describing why design standards are inapplicable to the safety of the dam.

690-020-0055

Design Drawings

The engineer of record shall submit applicable drawings when ~~the engineer believes~~**they believe** the design is ready for review and approval by the State Engineer.

(1) Drawings must accurately portray the work to be accomplished and be of sufficient detail to clearly define all features of the project. After all changes required by the State Engineer are made, final design drawings must be neatly and accurately drawn to a scale sufficiently large for the drawings to be readily interpreted.

(2) Drawings must be uncluttered and easy to understand for determination of design compliance by the contractor, the engineer of record, and the State Engineer.

(3) Drawings must be no larger than ~~24" X 36" inches~~. Other acceptable sizes for drawings are 17" X 22" and 22" X 34". All drawings must have a graphic scale bar so that scale can be determined after enlargement or reduction. Each sheet shall be numbered sequentially with the first sheet being sheet number one along with the total number of sheets; e.g., 1 of 6.

(4) Drawings shall include the following information:

- (a) An official dam name, which must ~~be~~ not have already been used for a dam as indicated in the Oregon dam safety database. This unique name must be affixed on each drawing;
- (b) The first drawing must include a location map with the drainage basin, the dam and reservoir, streams within the drainage area, and the location of the nearest access highway. This drawing must include legal location of the dam (~~Section~~, Township and Range ~~Section~~), and the location of the survey reference point with latitude, longitude, elevation, and datum elevation (NAVD1988);

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- (c) A contour map of the reservoir site showing the legal location of the dam with a contour intervals ~~not to exceed~~ no greater than 5 feet. A plan of the dam should be superimposed on this map. If scale permits, this drawing should show the location of the spillway(s), conduit inlet and outlet, and the location, distance and direction to a government land corner or other permanent survey marker;
  - (d) Area and storage capacity curves and information on the hydrology of the proposed reservoir drainage area in square miles;
  - (e) A profile of the dam site at the center of the dam;
  - (f) A cross section of the dam at maximum section;
  - (g) Plan view(s) of dam at maximum section, and other sections as needed;
  - (h) Cross section(s) of dam, including the maximum section with the official dam height;
  - (i) Spillway details, spillway approach control discharge, and energy dissipation;
  - (j) Low level conduit details, including diameter, material, encasement; and
  - (k) Slide gate or valve details including the trash rack, control stem, pedestal and wheel, or other control details, and air vent.
- (5) Elevations ~~that~~ must be clearly labeled on applicable drawings and include the:
- (a) Base of dam and official height of dam;
  - (b) Dam crest;
  - (c) Spillway control section;
  - (d) Base of spillway discharge; and
  - (e) Invert of the conduit at both the inlet and outlet.
- (6) All drawings must be dated and have sufficient space ~~location~~ for State Engineer's approval stamp, at least 3" x 3" near the lower right hand corner of the drawing.
- (7) Drawings must be designated as final design drawing or as-built drawings.

690-020-0060

#### Construction Specifications

All drawings for dams must be accompanied by construction and material specifications that include the following:

- (1) **Construction conditions.** Specifications must include the construction period based on typical weather for that location and in-stream work periods if applicable, and may include a process for the engineer of record to modify the construction period.
- (2) **Clearing of the dam site and reservoir.** Specifications must include the area to be submerged by the new or enlarged reservoir and specify that the submerged area shall be cleared of logs and debris prior to filling the reservoir. The specifications must require that the footprint of the dam shall be cleared of all soils containing organic materials, and that this material may not be used for dam construction.
- (3) **Cutoff trench requirements.** Specifications must include the minimum trench depth, width at base of the trench, and maximum side slope steepness. These specifications shall be based on the subsurface investigations and direct that the cutoff trench may not be filled if it contains standing water. A requirement not to begin filling the cutoff trench until approved by engineer of record, and where specified, by State Engineer or Dam Safety Engineer, must also be included in the specifications.

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(4) **Material specification standards.** The specifications shall include material and testing specifications for dam materials, conduits, control structures, and other appurtenant structures, using an ASTM standard methodology if available.

(5) **Soil Compaction.** The typical compaction specification is 95 percent of standard proctor density, though the engineer of record may use a different compaction standard. Specifications shall include the types of acceptable compaction equipment, by material source if necessary. Specifications shall also include maximum lift thickness. To reduce potential for leakage around the conduit, specifications shall prohibit soil compaction dry of optimum moisture content for materials placed immediately above or adjacent to the conduit. Specifications must also include verification testing of soils, with representative samples selected for testing by the engineer of record and not the contractor.

(6) **Concrete placement.** Specifications shall include means to prevent separation of aggregate and cement, air entrainment requirements if needed, methods for placement and vibration of concrete, required minimum 28 day strength, slump, moisture and temperature requirements for curing. Alkali reactive aggregate shall not be used in the concrete.

(7) **Conduit specifications.** Specifications must include the material, diameter, and thickness of the conduit, and the length of conduit required for the project. Methods for sealing joints must be specific. Specifications must require that all materials from a manufacture are certified to meet this test, or that the engineer of record has tested the materials directly.

(8) **Accepting and Rejecting Materials.** Specifications must include tolerances for acceptable departure from material specifications and a process for rejection of defective materials or workmanship.

(9) **Notification by the engineer of record to the State Engineer of changed conditions critical to the safety or operations of the dam.** Specifications shall include State Engineer notification if previously unidentified springs, slope movement or sand lenses are identified, or if storm or other damage occurs during construction.

(10) The specifications must require supervision by the engineer of record during construction and for inspection by the ~~d~~Director or ~~d~~Director's authorized representative at any time during the construction period;

(11) The specifications must also contain a provision to the effect that plans or specifications shall not be altered or changed without the written approval of the State Engineer.

690-020-0065

Dam Construction

The Engineer of record shall submit ~~to the State Engineer for approval~~ plans for administering the construction of the dam to the State Engineer for approval. Construction plans must include the following:

(1) Construction of the dam shall be observed and documented by the engineer of record and employees working for the engineer of record as applicable.

(2) The engineer of record or an inspector working for the engineer of record shall be on-site as needed for instructions to the contractor, approval of initial excavation, acceptance of materials, and general project administration.

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- (3) The dam owner shall cease construction activity if the engineer of record is no longer employed or for any reason cannot complete necessary construction administration activities. Construction may resume when a new engineer of record is employed, the State Engineer has been notified of the new engineer of record, and both engineers have discussed the project.
- (4) The engineer of record shall observe the construction of the dam. It is the engineer of record's responsibility to make periodic inspections to evaluate whether the construction is proceeding in accordance with the approved plans and specifications. The engineer of record shall endeavor to prevent defects and deficiencies in the construction of the dam and appurtenant structures, and shall disapprove or reject work identified that fails to conform to the approved plans and specifications.
- (5) The engineer of record shall confirm foundation design assumptions once surface materials have been stripped and the cutoff trench excavated. Changes in actual foundation conditions from assumptions made in the initial site evaluation shall be communicated to the ~~d~~Department.
- (6) The engineer of record shall maintain a record of construction that shall include:
- (a) logs of construction inspections whenever such inspections are made by the engineer or ~~their~~ the engineer's employee;
  - (b) all test results pertaining to construction;
  - (c) photographs; ~~and as well as~~
  - ~~(a)~~(d) construction problems and remedies.
- (7) The engineer of record shall complete as-built drawings and a final construction report, including statements that the observations are either consistent or inconsistent with the design drawings and specifications. If key elements of construction were not observed, the construction report shall detail those specific elements that were not observed.

#### 690-020-0070

##### Submittals and Notifications by the Engineer of Record

- (1) When necessary, the engineer of record must include an inundation analysis that complies with OAR 690-020-0120 prior to submitting the design report, plans and specifications, so that the ~~d~~Department can determine the hazard rating of the dam.
- (2) All final designs, drawings and specifications submitted to the State Engineer for approval must be prepared and stamped by a professional engineer licensed to practice in the State of Oregon. The first page of the drawings, the specifications, and the construction administration plan must be stamped by the engineer of record. All submitted materials must be addressed directly to the State Engineer and labeled as a dam safety submission.
- (3) Final drawings shall be submitted on full size paper. The design reports and specifications must be submitted as packaged 8.5 x 11 inch bound documents, with essential maps folded within.
- (4) A schedule of construction will be provided to the State Engineer prior to initiating construction of any significant or high hazard dam.
- (5) Prior to completion of the cutoff trench and all stripping of foundation and embankments the engineer of record shall notify the State Engineer to allow for State Engineer inspection of the excavation. The required notice to the State Engineer is as follows:
- (a) 48-hours for a low hazard dam;;
  - (b) 120-hours for a significant hazard dam;; and

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~~(a)~~(c) \_\_\_\_\_ for high hazard dams, 240-hours or the time specified in the approval, whichever is longer.

- (6) Any changes made to the designed location, height or width of the dam, or to materials used in dam construction shall be reported in writing immediately to the State Engineer.
- (7) If any slope instability is observed during construction in the embankment or adjacent to the dam or into reservoir, it shall immediately be reported to the State Engineer by phone.
- (8) If for any reason the engineer of record ceases construction administration work, the engineer of record must immediately notify the State Engineer of the situation, by phone and in writing.
- (9) For high hazard rated dams, the final emergency action plan and any additional inundation analysis required for the EAP as described in OAR 690-020-0400 must be submitted by the Engineer of Record prior to or concurrent with submission of the as-built drawings and the project completion report.
- (10) The engineer of record must submit as-built drawings and a project completion report. A project completion report must include the following:
- (a) As-built drawings, if possible on the same sheet as the initial design drawings. As-built drawings shall be submitted in the form of electronic copies of all applicable drawings;
  - (b) A completion report stating either that the dam has been built according to the drawings with changes to improve safety as documented in the as-built drawings, or that essential safety functions are unknown;
  - (c) A list of the days the engineer of record was on site, the number and location of material tests, and observations of all changed conditions;
  - (d) Test results (compaction, strength, permeability) must be summarized in the completion report;
  - (e) The completion report must document the observations and decisions made and communicated to the contractor or dam owner. Photographs of key stages of construction, including but not limited to photographs of the cutoff trench, borrow pit development, trenching and placement of the conduit, the spillway before and after placement of concrete; and
  - (f) The project completion report shall be stamped by the engineer of record.

#### 690-020-0080

##### Written Approval by State Engineer

- (1) Prior to commencing construction activity, all design reports, drawings of the dam and critical appurtenant structures, specifications, and plans for construction administration must be approved by the State Engineer as indicated by the State Engineer's stamp and a written letter of approval from the State Engineer.
- (2) The State Engineer's approval of design plans and specifications shall be valid only for five years. Upon request, written requests for time extensions may be granted in writing by the State Engineer.
- (3) The following ~~include features activities which~~ involved in the construction or operation of ~~the an~~ **existing permitted** dam that may impair the safety of ~~an existing permitted the~~ dam ~~and so~~ require State Engineer approval of engineered designs:

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- (a) any changes that affect storage capacity of the dam or increase dam height above that in the approved drawings for the dam, including all dam rises other than adding fill to restore crest height lost to settlement or erosion;
  - (b) any changes to or near the spillway that may affect spillway capacity or ability to pass flows safely;
  - (c) installation of any valve or gate on the downstream side of the dam;
  - (d) Removing and replacing or otherwise excavating into or near the dam to place or replace any ~~new~~ conduit or utility in the dam;
  - (e) replacement of the conduit control structure;
  - (f) installation of any valve on the downstream side of the low level conduit, or directly connecting irrigation pipe to the low level conduit; ~~and~~
  - (g) repair of damage which has already significantly weakened the dam;
  - (h) Any activity where at least 30 percent of fill material in the dam is impacted by that activity;  
and
  - ~~(g)(i)~~ Any other change to the dam that affects its safety as determined by the State Engineer.
- (4) Prior written approval will not be required for replacement or lining of toe drains, relining of conduits of low hazard dams, and for specific actions required in a ~~an~~ safety emergency. As built drawings may be sent to the State Engineer after completion of such projects to show these projects have been completed in a safe manner.
- (5) For pre-existing dams without a valid storage permit, the State Engineer may approve plans and specifications so that a permit may be issued only if the engineer of record provides the following:
- (a) Drawings of the dam as it exists during the engineer's evaluation and survey of the dam. These drawings should include all the critical features as described in OAR 690-020-0035, except for those elements that cannot be evaluated such as the cutoff trench;;
  - (b) Evaluation of any embankment distress, including erosion, seepage or leakage;;
  - (c) Condition and function of the conduit and its controls, capacity and stability of the spillway;;
  - (d) Any other safety information needed as determined by the State Engineer;;
  - (e) Designs as needed to bring the dam up to the current standards based on the hazard classification of that dam;;
  - (f) As improved drawings of the dam showing that all necessary modifications have been made with a report from the engineer describing the necessary work that was completed;; and
  - (g) The source of all information used to develop the ~~as-~~improved drawings must be documented in a report submitted by the engineer. This includes but is not limited to the engineer's measurements, engineer's observations, a photographic record, and testimony of individuals.
- (7) No newly constructed dam ~~may shall be permitted allowed to~~ store water until final written approval of necessary plans, specifications or other information is received from the Department.
- (a) Final approval may be obtained only after construction has been completed and ~~as-~~built drawings and a satisfactory project completion report have been submitted to and approved by the State Engineer.
  - (b) The State Engineer shall notify the Engineer of Record and dam owner in writing when final documents have been approved.

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## 690-020-0100

Hazard Rating of ~~Statutory~~ Dams

(1) ~~Dams shall be assigned a hazard ratings for “large dams” are classified by the department as “of high hazard”, “significant hazard”, or “low hazard” as follows:~~

(a) ~~High Hazard: This rating indicates that if the dam fails there is a strong plausibility for loss of life. The plausibility is established because of inhabited infrastructure (such as homes and business) downstream that would be inundated to such a degree see 690-020-0100(2)(d) for specific criteria that it would put the person who inhabits the structure in jeopardy. Any factor that puts a strong probability of people being downstream in an inundation area of a dam failure shall be considered. The department shall endeavor to inspect this class of dams on an annual basis.~~

(b) ~~Significant Hazard: This rating indicates that if a dam fails, infrastructure (such as roads, power lines or other largely uninhabited buildings) would be damaged or destroyed due to inundation and flooding. The department shall endeavor to inspect this class of dams at least once every three years.~~

(c) ~~Low Hazard: This rating indicates that if the dam fails there is little plausibility for loss of life, and human infrastructure that could be affected by inundation downstream is minor or non-existent. The department shall endeavor to inspect this class of dams at least once every six years.~~

(2) ~~The department shall utilize dam breach inundation of infrastructure study results analysis as a primary factor to determine the hazard rating of dams as described in OAR 690-020-0120. Methods and modeling acceptable for inundation of infrastructure studies include:~~

(a) ~~Hydraulic Modeling: Use of one, two, or three dimensional modeling software (such as HEC-RAS, FLO-2D or MIKE) and hydrologic, topographic, and other data to estimate inundation of infrastructure downstream of dams.~~

(b) ~~Hydrologic Routing Modeling: Use of modeling software such as HEC-HMS with hydrologic routing methods such as the Muskingum and Modified-Puls methods along with hydrologic and topographic data.~~

(c) ~~Simplified Methods such as SMPDBK and the Washington State Method: “Dam Breach Analysis and Downstream Hazard Classification” may be used. A dam owner may request information on these methods from the department. Use of these or other simplified methods is only to be used in hazard ratings for dams, not for emergency action planning.~~

(d)(3) ~~Depth of inundation to trigger different hazard ratings:~~ **Using the dam breach inundation analysis described in OAR 690-020-0120, the department shall make the final determination of any hazard rating using the following criteria:**

(a) An **inundation** depth **of flowing water** of at least two feet over the finished floors of **dwellings, and other frequently occupied buildings, or paved busy or road used by over 500 vehicles per day, or passenger railroad** surfaces **where a vehicle is likely to be present** of infrastructure is required to establishes a “high hazard” rating.

(b) Any **inundation** depth of water over the floorboards of **multiple** structural buildings **on property other than the dam owners and excluding small buildings such as pump houses or storage sheds** such as homes, barns, pump houses or storage sheds **can be used to** establishes a “significant hazard” rating.

(c) For **other roads railroads and vulnerable utilities**, an inundation depth of two feet or evidence of depth and velocity capable of creating damage establishes a “significant hazard” rating.

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~~(4) Exceptions to Hazard rating methods:~~

~~(a) Small dams are not assigned a hazard rating.~~

~~(d) (b) Situations in which there are heavy recreational or other frequent use occurs uses downstream, a dam may be rated as a “high hazard” rating shall be established to prevent probable loss of life. Such designation shall not depend on the presence of downstream infrastructure.~~

**(e) For water depths close to those listed in the subsections (a) and (c), the Department may also consider water velocity in its determination of hazard rating.**

~~(e) Specific data, methods and results for all methods must be reviewed and approved by the department prior to revising a hazard rating.~~

~~(3 4) The hazard rating of a dam shall remain in effect until the rating is revised by the Department using one of the methods described in section 2 the procedures described in OAR 690-020-0120. A dam owner may request that the Department revise a hazard rating. The owner must provide information in support of the request. If the supporting information includes results and/or analysis using the methods described in subsections 2(a) or (b), the information must be and prepared by an engineer licensed in Oregon and familiar with hydraulic and hydrologic modeling; if the information includes results and/or analysis using the methods described in subsection 2(c), the information must be prepared by a licensed engineer or a practicing hydrologist familiar with hydraulic and hydrologic calculations and using the procedures described in OAR 690-020-0120.~~

~~(4) Exceptions to Hazard rating methods:~~

~~(a) Small dams are not assigned a hazard rating.~~

~~(b) Situations in which there are heavy recreational or other uses downstream, a dam may be rated as “high hazard” because of probable loss of life regardless of downstream infrastructure presence.~~

#### **690-020-0120**

##### **Dam Breach Inundation Analysis**

**(1) A dam breach inundation analysis must be submitted with the design for any new dam, except only for dams in a remote location far enough from buildings, high use recreation sites or high use public roads so that damage or fatalities from a dam breach would be very unlikely as determined by the State Engineer.**

**(2) A dam breach inundation analysis is required to change the hazard rating of an existing dam.**

**(3) The dam breach inundation analysis must use a breach time based on dam materials and thickness and other factors that would influence the time it would take for the dam to breach from internal erosion, overtopping, or displacement.**

**(4) Any simplified and conservative hydraulic model may be used to show that a dam should be rated low hazard. The State Engineer may determine if the model was used appropriately and conservatively.**

**(54) Accepted and hydraulically consistent models must be used to conduct the inundation analysis for significant and high hazard dams, as these will be used in the event of an emergency at the dam. Models developed by the US Army Corps of Engineers including HEC-RAS are the preferred methods of analysis. Other models that use hydrodynamic equations checked for minimum tolerances such as FLO 2D are also acceptable for conducting dam breach inundation analysis.**

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(a) ~~(a)~~ Information on the specific model used for analysis, dam breach parameters and justification, and all assumptions made for the analysis must be included in the documentation for the inundation analysis.

~~(65)~~ Inundation analysis for hazard rating of high and significant hazard dams must be conducted with the reservoir at full pool and inflow equal to the 0.2 percent annual exceedance probability flood flow. The analysis must show on a map areas inundated, areas inundated by greater than 2 feet, and all frequently occupied structures.

~~(76)~~ The following additional information shall also be required for newly constructed or modified high hazard rated dams.

(a) A sunny day and a PMF inflow analysis as part of the emergency action plan.

(b) The inundation mapping must include cross sections with depth and times to flood wave arrival, and must be extended downstream to a location where no significant property damage exists.

#### 690-020-0150

##### Routine Inspection of Dams

1) The Department **shall maintain a program of inspecting dams and** may conduct routine safety inspections of dams with an inspection frequency based on the hazard rating of the dam and may specify modifications necessary to insure the safety of the works to prevent possible damage to life or property.

(2) The frequency of inspections may be based on the hazard classification of the dam. Inspections may occur as follows:

(a) Inspections for high hazard dams may be scheduled on an annual basis;

(b) Inspections for significant hazard dams may be scheduled every three years; **and**

(c) Inspections for low hazard dams may be scheduled every six years.

(3) Expedited inspections may be conducted if an urgent dam safety issue is identified or if there is a potential change in hazard classification.

(4) Following an inspection, the **D**epartment shall provide to dam owners a letter with the inspection observations and recommendations that **assists** the dam owner to ensure the safety of the dam.

#### 690-020-0200

##### Fees for Dams

(1) **Dam** owners **subject to dam safety regulations** of a large dam shall submit to the **D**epartment an annual fee in ~~the amount of and~~ on the basis established under ORS 536.050**(2)**.

(2) Dam owners who fail to pay an annual fee on or before six months after the billing date may be required to pay a late fee of \$100.

(3) If a dam owner fails to pay the annual fee or late fee charged by the **eD**epartment, the **eD**epartment may, after giving the dam owner notice by certified mail, place a lien on the real property where the dam is located for the fees owed by the dam owner.

~~(4) Dams that are subject to the annual fee include dams partially or wholly in the State of Oregon that meet the definition of "dam" under OAR 690-020-0020.~~

~~(5) Multiple large dams connected together and separated only by embankments or other manmade materials (common with sewage lagoons) will count as one dam for fee purposes.~~

~~(6) Owners Exempt from Fee Requirements include:~~

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~~(a) Owners of a “small dam”,~~

~~(b) Owners whose dams that are directly controlled or regulated for safety by an agency of the U.S. Federal Government and the agency that controls or regulates the dam has its own safety program that meets the following criteria:~~

~~(A) The program must allow for control of the design and construction process for dams under their control with licensed engineers designing and reviewing any major design or repair. Copies of all design drawings and construction records should be forwarded to the department for tracking and archival purposes.~~

~~(B) The program must have a regular dam inspection program that is either conducted by or directly supervised by a licensed engineer with expertise in dam safety. Formal documented dam inspections for high hazard dams should occur at least once per year. For significant hazard dams, inspections shall occur at least once every 3 years and for low hazard dams, once every 6 years. Other more frequent inspections and reports on dam conditions may be necessary depending on the condition of individual dams. Copies of mutually agreed upon inspections and reports should be forwarded to the department for archival and tracking purposes.~~

~~(C) The federal agency in charge of the dam via regulation or control must also have a regular maintenance program or be able to require maintenance activity from the regulated party that will address problems discovered in the inspection program.~~

~~(D) The federal agency must have a memorandum of understanding or agreement with the department that outlines how the federal agency meets the criteria in paragraphs (b)(A)–(C), and must agree to meet at least annually with the department to review the state of the federal program for continued exemption purposes.~~

**(5) The Department may use the dam safety fee to support dam safety inspections; conduct dam breach inundation analysis for existing dams; help dam owners complete emergency action plans for existing dams; conduct or support the technical analysis of the safety of specific dams; and other actions as needed to support the dam safety program.**

690-020-0250

Maintenance of ~~d~~**D**ams

**(1) When inspecting dams to insure the safety of the dam, the Department may consider whether the dam owner has conducted routine maintenance on dams as follows:**

- (a) Whether brush and trees have been removed and whether vegetation on the embankment or spillway has been mowed;**
- (b) Whether burrowing animals are controlled and animal burrows are filled;**
- (c) Whether surface erosion is effectively controlled;**
- (d) Whether freeboard and adequate crest width have been maintained;**
- (e) Whether the spillway is functioning correctly and that its capacity has not been reduced;**
- (f) Whether mechanical equipment has been properly cycled and lubricated;**
- (g) Whether cracked concrete structures have been properly patched, sealed, caulked or replaced to prevent deterioration;**
- (h) Whether debris, rock, or earth have been removed from outlet conduits, outlet channels or spillway channels;**

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- (i) Whether worn or damaged parts of conduit outlet valves or controls ~~to restore to functional condition~~ are in need of repair or replacement;
  - (j) Any other condition or activity that might affect safety of the dam.
- (2) The Department may find that a dam ~~is not safe~~will not insure the safety of the dam if large trees or large woody vegetation exists on the dam.
- (3) Maintenance deficiencies observed during periodic dam safety inspections shall be ~~contained~~ described in an inspection ~~report~~letter provided to the dam owner.

## 690-020-0300

Modification of Dams Requiring Notification and ~~/~~ Approval:

- (1) The ~~following~~ activities described in OAR 690-020-0080(3) are considered such significant modification of the dam so as to constitute new construction requiring approval of engineered designs prior to initiating these activities.
- ~~(a) Any activity on the dam or an appurtenant structure that will change storage capacity in the reservoir;~~
  - ~~(b) Repairing a dam after breach or overtopping of any dam;~~
  - ~~(c) Stabilization of any landslide in or adjacent to the embankment (temporary emergency actions are allowed without approval);~~
  - ~~(d) Alterations to the spillway that affect the spillway capacity or ability to pass the inflow design flood, or otherwise change the spillway's resistance to erosion from flood flows;~~
  - ~~(e) Installing a penetrating conduit through a dam;~~
  - ~~(f) Installing a valve at the outlet side of a low level conduit;~~
  - ~~(g) Excavation into the dam and replacement of a low level conduit; and~~
  - ~~(h) Ceasing use and sealing of low level conduit;~~
- (2) Any activity that will increase the volume or rate of water released during failure requires a new inundation analysis using methods described in OAR 690-020-0120 unless the dam is in a remote area with no downstream development or high recreational use areas that might be affected by a dam breach flood.
- (3) Certain repairs that may affect the safety of the dam require on site analysis by an engineer during the actual repair process in order to determine the specific repairs needed. Prior approval of drawings for these repairs will not be required, as conditions encountered on site are likely to deviate from plans. If done incorrectly, such repairs may affect the safety of the dam. Such repairs may be made after notification to the State Engineer. Therefore, Submission of an as-built drawing by the engineer of the following repairs indicating the repairs have ~~maintained~~been made correctly may be deemed as evidence of the safety of the dam:
- (a) Slip lining of existing conduits that does not involve excavation into the dam and does not result in a significant reduction in the time required for the conduit to empty the reservoir;  
and
  - (b) Replacement of toe drains; and
  - ~~(b)(c)~~ Any other such repairs as determined by the State Engineer.

## 690-020-0350

## Operations and Maintenance Plans

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- (1) ~~The Department may make inspection of the operation of works to insure the safety of the works and shall require a~~ **As part of the plans submitted with the design, the engineer shall dam owner to** provide to the Department operations and maintenance plans for new significant and high hazard dams, and for any **new** dam with a gate or flashboard as part of the spillway. The dam owner shall be responsible for implementation of operations and maintenance plans, **and compliance with these may be reviewed during dam safety inspections.**
- (2) Operations and maintenance plans ~~shall may~~ **include but are not limited to:**
- Procedures for operation of all gates and valves;
  - Specified frequency for cycling of the slide gate and/or valves;
  - The time of year flashboards are allowed in the spillway;
  - Removal of trees and shrubs, and mowing other vegetation as needed;
  - Routine inspections, including evaluation of seepage flow, and visual identification of any turbid seepage;
  - Water release plan in the event of a flood forecast when reservoir is above a certain level; and
  - Measurement frequency for all monitoring instrumentation installed at the dam.

#### 690-020-0400

##### Emergency Action Plans (EAP) and Emergencies

- (1) **Draft** Emergency Action Plans are required prior to completion of new dam construction or modification as described in OAR 690-020-0300(1), **and final EAP's must be submitted prior to filling the reservoir. This-The final** emergency action plan must be reviewed and approved by the State Engineer. **EAPs for dams constructed after March 2015 must be updated at least once every two years, including but not limited to ensuring all notification contacts are current.**
- (2) Dam owners are encouraged to complete emergency action plans for their existing high hazard dams.
- (3) An EAP shall contain, as a minimum, the following key elements:
- Emergency condition detection;
  - Emergency level determination;
  - Notification and communication lists ~~and flowcharts~~ applicable to each of the emergency levels;
  - Expected actions to prevent a dam failure incident or to help reduce the effects of a dam failure and facilitate response to an emergency;
  - Inundation mapping that normally includes both a sunny day and a probable maximum flood failure; and
  - Procedures for termination of the emergency.
- (4) Dam owners of High or Significant Hazard dams shall immediately notify the State Engineer of potential or actual dam failure situations.
- (5) Dam owners shall notify the State Engineer of any breach of any dam subject to these regulations.
- (6) If the ~~ed~~ Department observes evidence of a dam at risk of imminent failure and a risk to life or property, local public safety officials shall be notified of the situation.

#### 690-020-0500

##### Enforcement

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(1) ~~The department shall maintain a program of inspecting existing dams.~~ When any structure **dam** is found to be in violation of the terms and conditions of the [water right](#) permit or certificate or directly threatens life or property, or when any structure is found where lack of maintenance or unauthorized alterations could lead to a direct threat to life or property, the ~~d~~Department shall notify the owner in writing of the violation and the action necessary and specified time allowed to bring the structure up to design, operation, or maintenance standards.

(2) Failure by the owner to perform the required action may result in proceedings for one or more of the following:

(a) Notice and opportunity for a contested case hearing as provided for in ORS 540.350(5).

~~Cancellation of the permit.~~

(b) Posting of the structure to prevent storage or to limit operation until the owner has complied with the requested action required to fulfill conditions of the permit or certificate.

(c) Instituting legal action by the District Attorney or Attorney General to have the facility declared a public nuisance.

(d) Issuance of an order to prevent storage or to breach the embankment as provided for in ORS 540.370.

(e) Any other enforcement action permitted by law.

**(3) Engineering work that is inconsistent with any rules in this Division may be referred to the Oregon State Board of Examiners for Engineering and Land Surveying, for appropriate actions.**

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## Summary of Public Comments and the Department's Responses

### I. Support for Proposed Rule Changes

*James Doane, P.E.*

- These are necessary rule changes. The proposed changes replace rules that have grown dated as the technology for dams has advanced.

*Eric Ward, P.E.*

- The proposed changes to these rules represent a much needed rewrite after nearly 20 years since the last significant update.

*Department Response: The Department agrees. Thank you for your comments.*

### II. Dams less than 9.2 acre-feet or 10 feet tall

*George Robison, P.E.*

- 690-020-0029 “Recommendations for Dams Under 10 Feet High or Storing less than 9.2 Acre-Feet”: Do not understand the deletion of this section.
- 690-020-0035 “Engineering Design Requirements”: Need to make distinction between very small dams and dams needing engineering approval more clear, not less clear.

*WaterWatch*

- Deletion of 690-020-0000(2): Concerned over the removal of dams exempted by statute from dam safety review.
- Deletion of 690-020-0022(15) “Large dam”: It is unclear why the WRD is suggesting the deletion of the definition of large and small dams (for the purposes of dam safety)
- Deletion of 690-020-0022(17) “Small dam”: It is unclear why the WRD is suggesting the deletion of the definition of large and small dams (for the purposes of dam safety).
- 690-020-0022(29) “Statutory Dam”: Strongly opposed to the term “statutory dam” since there are statutory requirements (i.e., water right permit requirements) for dams not subject to dam safety regulations.
- Changing 690-020-0025 title to “General Requirements”: Original title for this section is “General requirements for all dams.” Changing it to just “General Requirements” is a huge policy shift and relieves from the general requirements all existing dams.
- 690-020-0029 “Recommendations for Dams Under 10 Feet High or Storing less than 9.2 Acre-Feet”: There is no good reason to take out these voluntary measures that will help an applicant understand what they should do to construct a safe small dam.

*Department's Response: WRD does not have authority in the dam safety statutes for the design of dams formerly known as “small dams” under the dam safety statutes. Therefore, the definition of “large dam” is no longer needed to differentiate the two sizes of dams. Similarly, the proposed definition for “statutory dam” and any reference to this term has been deleted, as it seemed to lead to confusion. For clarity, the Department replaced all references to small dams with the phrase “dams under 10 feet high or storing less than 9.2 acre-feet.” Dams exceeding these thresholds are required to comply with dam safety statutes and rules.*

*The initial proposed rules deleted 690-020-0029 “Small Dams, Recommended Minimum Standards” due to lack of authority in the dam safety statutes over the construction of dams under 10 feet high or storing less than 9.2 acre-feet. While WRD cannot regulate design specifications for these dams, based upon comments received, the Department proposes to modify the rule to recommend that individuals constructing dams under 10 feet high or storing less than 9.2 acre-feet consider following the standard dam safety rules, utilizing an engineer, and that the Department may develop guidance for these dams. The changes made were consistent with DOJ review of statutory authority.*

### **III. Significant Dam Work**

*George Robison, P.E*

- Deletion of 690-020-0022(16) “Significant dam work”: Significant dam work has not been adequately defined in the new rules.

*WaterWatch*

- Deletion of 690-020-0022(16) “Significant dam work”: This definition was added in 2009 at the request of several irrigation districts to make clear what was meant by significant dam work. Deletion of this definition is a big scope change.
- 690-020-0080(3): The rule does not cover the previous definition of “significant dam work,” including the 30 percent change.
- 690-020-0300 Modification of Dams Requiring Notification and/or Approval: We think WRD should reinstate existing language that subjects any significant work to the same standards as new construction. It is not clear if “approval of engineered designs” includes the many requirements of new dams as laid out in these rules.
- 690-020-0300(1): The list provided in (1) (a) – (h) does not include all the factors that were previously found in the definition of “significant works to dams,” nor in new section 690-020-0080. These may conflict with 0080.

*Department’s Response: The pre-existing rules had defined the term “significant dam work” as “an activity to repair, rehabilitate, enlarge or otherwise alter a dam in which: 1) at least 30% of the fill material is impacted by the activity, 2) a spillway is being enlarged or repaired that affects the height or hydraulics of the spillway, 3) dam height and/or reservoir size is being increased, 4) a low level outlet conduit or inlet gate is being reworked with excavation, or 5) any other activity that could affect the integrity of the dam or its auxiliary works”. This term is no longer used in the definition rules. Rather, the activities outlined in this definition are now found in the proposed rules (690-020-0080(3)) specifying modifications to dams that require approval by the state engineer, and includes additional activities that could affect dam safety. Based on these comments, a reference to the activities in 690-020-0080(3) has been added to provide clarity for when activities are considered such significant modification to the dam so as to constitute new construction requiring approval of designs prior to initiation of these activities. Modifications only require engineering design work related to that modification, for example, in most cases a new site evaluation would be unnecessary. However, some provisions of 690-020-0300(1) (a-h) conflicted with 0080, so the rule has been changed to reference 0080(3) and the list provided in 0300(1) (a) – (h) was deleted.*

#### **IV. Conduits**

*George Robison, P.E*

- 690-020-0025(5): A conduit needs to be able to pass flows for instream as well as out of stream needs. The rules only specified the needs of senior water right holders.

*WaterWatch*

- 690-020-0025(5): Conduit size and its relationship to water releases have other purposes other than getting water to senior water rights holders. The existing language made clear that conduits needed to be sized to release water to meet downstream needs.
- 690-020-0043(1) (c): All conduits should be of sufficient size to pass inflows as required by the storage permit. In addition to senior water rights, this could include seasonally varying flows, minimum perennial streamflows, etc.
- 690-020-0043: Object to the narrowing of this section to require conduits only of new dams. All dams on stream channels should have a conduit, not just new dams.

*Department's Response: The rule has been modified to include instream and out-of-stream uses. The reference to "senior water rights" has been deleted. The Department does not have the legal authority to require conduits on already-existing dams unless the dam is unsafe. However, all dams are required in rule to have the means to safely drain the reservoir. The language in this rule is consistent with statutory authority.*

#### **V. Dam Safety Fee**

*WaterWatch*

- 690-020-0000(4): Concerned that the proposed amendments undercut OWRD funding by expanding the use of funds to pay for dam safety requirements that are the clear responsibility of the dam owner or applicant (specific to 690-020-0200).
- 690-020-0200(5): Very concerned with this attempt to shift fees that are currently directed to pay for WRD staff work in the dam safety program. This section should make clear that WRD can only use the dam safety fee to support WRD dam safety staff in fulfilling their responsibilities under the dam safety statutes and rules.

*Department's Response: The dam safety fee is used to assist with actions that cannot be required of the owner by statute, but are important for protecting people. All work described under this section is direct staff support or important work that cannot be required by law for existing dams. This includes the determination of an existing dam's correct hazard rating and development of emergency action plans. The limits of the Department's authorities were confirmed by DOJ.*

#### **V. Hazard Ratings**

*WaterWatch*

- 690-020-0022(22) "Low hazard rating" and 690-020-0022(25) "Significant hazard rating": The statutes do not distinguish between the owner's property or otherwise, thus the rules should not be so narrow.

Department's Response: Correct. The definition has been changed so there is no difference in treatment of the owner's property versus the property of people other than the dam owner. This now is consistent with the previous rules, where damage to the dam owner's own property was not distinguished from damage to others' property in the determination of a low or significant hazard rating.

*WaterWatch*

- 690-020-0100 "Hazard Rating of Dams": Very concerned that the changes to this section substantially undercut existing protections for the public.

Department's Response: The proposed rule revisions were not intended to weaken public protections. Rather, the changes were designed to streamline and clarify the rule language. Based on comments, additional changes have been made to simplify the rule language and to retain language similar to the previous rules. See comments below for more specific responses to individual sections of 690-020-0100.

*WaterWatch*

- 690-020-0100: Opposed to deletion of recreational uses downstream when reviewing a hazard rating for a dam. Under the proposed amendments anglers, rafters, kayakers, campers, hikers, and any other human that is below a dam but is not connected to a human built "structure" is not a life that is allowed to be considered under the newly proposed hazard rating.

Department's Response: The recreational uses was not deleted, but moved to part of the main list in rule (see 690-020-0100(3)(d)). The language was further clarified to make clear that a "high hazard" rating will be established wherever heavy recreational use occurs regardless of the presence of downstream infrastructure. This adds clarity to the previous rules.

*George Robison, P.E*

- 690-020-0100(3)(a): Use of the 500 vehicle threshold may be too specific and in some cases counterproductive.

*WaterWatch*

- 690-020-0100(3)(a): Concerned about the use of a 500 vehicle threshold and suggesting that paved roads are the standard.

Department's Response: The rules were changed to address these concerns. The comment is made in regards to dam hazard ratings, which are based on the risk of fatalities or property damage below the dam. One indicator may be road usage below the dam. Instead of a "road used by over 500 vehicles per day," the rule was changed to "road surfaces where a vehicle is likely to be present."

*WaterWatch*

- 690-020-0100(3)(a): This makes it so WRD can't rank a dam high hazard if there is a risk of death to a person who infrequently uses his/her property. Also, "frequently" is not defined.

*Department's Response:* "Frequently occupied buildings" is only one element of the rule. As with other rules dealing with the hazard ratings for dams, excess specificity that may not apply in many cases was removed. There are too many variables to describe all potential situations. WRD simplified language and removed excess detail in these rules to reflect current interpretation of the existing rules for hazard rating. For the sake of clarity, this section now reads "an inundation depth of flowing water of at least two feet over the finished floors of dwellings, other frequently occupied buildings, or road surfaces where a vehicle is likely to be present establishes a 'high hazard' rating." The Department believes that this adequately encompasses what is required for a "high hazard" rating.

*WaterWatch*

- 690-020-0100(3)(a): Nowhere in this section is the hazard rating tied to loss of life.

*Department's Response:* The definition of "high hazard rating" (see 690-020-0022(20)) clearly ties the definition to loss of life. The definition is: "High Hazard Rating" means that if a dam were to fail, loss of human life would be expected."

*WaterWatch*

- 690-020-0100(3)(b): Depth of water over floorboards has now been expanded to "multiple buildings" rather than one building, and is limited only to property that is not owned by the dam owner. This dilutes the existing standard.

*Department's Response:* Changes were made to address these concerns. Section now reads "Any inundation depth of water over the floorboards of structural buildings establishes a "significant hazard" rating.

*WaterWatch*

- 690-020-0300(2): This section's exemption for dams "in a remote area with no downstream development that might be affected by a dam breach flood" disregards life that could be lost if that life is not connected to a structure. This is of concern because thousands of people recreate on rivers below dams.

*Department's Response:* Based on this comment, the rule was changed so that a new inundation analysis is not required for those dams "in a remote area with no downstream development or high recreational use areas that might be affected by a dam breach flood." Therefore, if a dam breach is likely to affect recreational use areas, an inundation analysis would be required to be submitted with the design for a new dam.

## **VI. Water Rights and Permitting**

*WaterWatch*

- 690-020-0023(4): Prior to beginning construction the applicant must have a water right storage permit and all other applicable permits (i.e. removal fill, cultural resources, etc.). This section could be read to imply that all the proposed dam owner needs to do is submit designs. This is misleading and contrary to law.

- 690-020-0080: It should be clarified that these “dam safety requirements” are in addition and not in lieu of state water right requirements (i.e. need to have a storage permit in place) and other state/federal requirements.

*Department’s Response: The purpose of the Division 20 rules is set out clearly in the Purposes and Applicability section (690-020-0000) to focus on dam safety. Nothing in these rules changes or supplants requirements for water right permits or other programs.*

*WaterWatch*

- 690-020-0025(6): This is a significant shift from current permitting practices. This is a significant change in practice for determining storage. WRD should make very clear if the final specs are not approved, the final order and permit will be revoked.

*Department’s Response: There is no change other than for clarity in this rule. Storage is measured the same way it was before the rule change. Moreover, OAR 690-020-0025(7) for the first time specifies that plans and specs may not be approved until there is sufficient progress in the water right permitting process.*

*WaterWatch*

- 690-020-0035(2): It is unclear if bypass flows or fish passage facilities will be analyzed here.

*Department’s Response: This is not a dam safety issue. Bypass flows and fish passage are considered in the water right permitting process. The proposed rules make no changes to the water right permitting process or ODFW’s authorities for fish passage at dams.*

*WaterWatch*

- 690-020-0080(5): Make clear all dams require a water right permit and that it is not a loophole to allow a simpler engineering process for illegal dams.

*Department’s Response: Changed “existing” to “pre-existing.” This clarifies that this rule is only for old dams seeking a permit. Newly constructed dams without review and approval are not legal, and are not the subject of this rule. This language was reviewed by DOJ and reflects the opinion of legal authorities.*

## **VII. Other Technical Comments**

*George Robison, P.E*

- 690-020-0044(2)(b): Do all high hazard dams need piezometers (or other instrumentation)?

*Department’s Response: Yes, unless the engineer shows why they are not needed as allowed for in 690-020-0048.*

*WaterWatch*

- General Comment: These rules were amended in 2009 to meet current standards of practice. Have standards changed significantly since 2009?



*Department's Response: Rule modifications for the dam safety fee were made in 2009. The last time the rules for engineering, construction and maintenance of dams were significantly updated was about 20 years ago. Accepted dam safety practices have changed significantly over this time period, and the proposed rules codify current practice.*

*WaterWatch*

- 690-020-0000(1): The existing purpose section that was established in 2009 should be retained. The language proposed to be deleted was developed in 2009 and has an overall purpose of both dam safety (for large and small dams) and a clear directive that dam safety fees are to provide the department with the resources necessary to manage the dam safety program.

*Department's Response: The proposed rule language change is based on DOJ review of legal authorities. The language accurately and directly represents the scope, purpose and applicability of the Department's legal authority for the dam safety rules.*

*WaterWatch*

- 690-020-0000(5): It is unclear what is meant by "working for the department". If this means that the engineer is a staff member of the state, that is fine, however, we would not support the WRD paying a hired consultant to do this work.

*Department's Response: This is meant to reference an employee of the Oregon Water Resources Department.*

*WaterWatch*

- 690-020-0022(15): Is this a typo? "And in responsible charge" does not make sense.

*Department's Response: "In responsible charge" is a commonly used industry term. However, language changed to "is responsible to oversee" for clarity.*

*WaterWatch*

- 690-020-0023 "Process for Construction of Dams" title: This title is misleading and could lead the applicant to believe that this is the sum total of the process for dam construction.

*Department's Response: Title modified to "Dam Safety Process Requirements for Construction of Dams" for clarity.*

*WaterWatch*

- 690-020-0023(5): Any design changes must not only be described and justified to the WRD, the WRD must approve them. This needs to be clarified.

*Department's Response: Requirements for approval of these changes is made very clear in 690-020-0080.*

*WaterWatch*

- 690-020-0035 “Engineering Design Requirements”: Deleting the word “minimum” before “engineering design requirements” could be interpreted to limit current authority by stating these are the only requirements the WRD can impose.

*Department’s Response: The term “minimum” has been reinstated for clarity.*

*WaterWatch*

- 690-020-0080(2): There should be a standard for extensions, not just a provision stating the State Engineer can extend upon request.

*Department’s Response: There are many factors that need to be considered by the State Engineer in granting extensions, including changes in engineering practice over time, changes in hazard rating, changes in the engineer of record, or other personnel or technical changes. At this time, we cannot think of all the possibilities for changes, so we do not believe it is prudent to put these into rule. Note that current rules do not have a limit on the time frame in which designs are valid, so this is already an increased standard.*

*WaterWatch*

- 690-020-0080(4): Should make clear that “emergency” is related to a dam safety emergency, not things such as economic hardship, etc.

*Department’s Response: Correct. Rule was changed to refer to “safety emergency”.*

*WaterWatch*

- 690-020-0080(7): Should use the word “allowed” instead of “permitted” for the sake of clarity.

*Department’s Response: To address comment, rules were modified from “shall be permitted to store water” to “may store water.” This change was made based on advice from DOJ.*

*WaterWatch*

- 690-020-0150(1) & (2): Concerned that the term “may” is replacing “shall” in this section. The proposed language moves away from the goal of routine dam inspection. The proposed language only sets forth a permissive program that does not provide any direction to WRD, nor any clear understanding to the dam owner of how often his/her dam will face inspection.

*Department’s Response: Based on the comment, the term “shall” was added for the department to “maintain a program of inspecting dams”. Based on advice from DOJ, “may” is retained for frequency of inspection, which is generally based on the hazard rating of the dam, but may sometimes be expedited.*

*WaterWatch*

- 690-020-0150(4): Providing “recommendations” instead of requirements is wholly inadequate and does nothing to ensure the protection of life and property.

*Department's Response: Statutory authority only authorizes enforceable required actions when the condition is unsafe. If it is a safety issue, the enforcement provisions of 690-020-0500 are used. In most cases, the recommendations are issued well ahead of a safety issue.*

*WaterWatch*

- The “may” should be a “shall” so that the WRD shall make inspection of the operations of works to ensure the safety of the works. Moreover, all high hazard and significant hazard dams should be required to provide the WRD with operations and maintenance plans, not just “new” ones.

*Department's Response: The language has been significantly reworded to highlight that the operations and maintenance plans are part of the plans and specifications and also that compliance with these may be reviewed during dam safety inspections. The Department cannot require operations and maintenance plans for existing dams based on statutory authority.*

*WaterWatch*

- 690-020-0400: Concerned that a representative from the emergency management community was not included on the Rule Advisory Committee.

*Department's Response: WRD's State Engineer has worked directly with emergency managers and dam owners on the development and or maintenance of almost 50 emergency management plans. WRD has a very thorough understanding of emergency response and how it varies between the counties. We follow FEMA guidance on these issues, and so do local governments.*

*WaterWatch*

- 690-020-0400(1) & (2): Emergency action plans should be required for all dam owners. As written, the rules only require EAP's of new and/or modified dams.

*Department's Response: EAP's are required for all new high hazard rated dams, but cannot be required for existing dams under existing statute. The rules have been changed to require periodic EAP updates for any dams constructed after these rules become effective.*

*WaterWatch*

- 690-020-0500: The original rule begins this section with the sentence: “The director shall maintain a program of inspecting existing dams.” This is a critical sentence that puts an affirmative responsibility on WRD to have a program of inspecting existing dams.

*Department's Response: This sentence was moved to another location in these rules (see 690-020-0150(1)). It should have been shown as strikethrough here but was not. It is now shown correctly.*

October 3, 2014

Rules Coordinator  
Oregon Water Resources Department  
Salem Oregon

Subject: Comments on proposed rule revisions for Chapter 690, Division 20. Dam Safety

Greetings

My name is E. George Robison and I was formally the Dam Safety Coordinator/Engineer for the Oregon Water Resources Department the last time the rules were revised 5 years ago. I am currently a Senior Project Manager for an Engineering Firm based in Boise Idaho. Please understand these comments do not represent my firm but are from myself as a Professional Engineer Licensed in Oregon. Let me say that I am excited about these rules because previously the rules had very few "specific" standards regarding the design and construction of dams. Previously (or to this day), the program has relied heavily on the Design Engineers judgment on what kinds of issues need to be covered in a design along with dialog with the State Dam Safety Engineer. This left what needed to be undertaken rather nebulous and led to misunderstandings and excessive "negotiations" when someone wanted to design or repair a dam. It gave a great deal of discretion to a single individual the State's Dam Safety Engineer who often made important policy decisions on the fly for a dam without the aid of a rules committee or a deliberative process away from the urgency of a given design issue.

In 2009, the rule revisions focused on hazard classification standards and the implementation of the fee program that was being instituted. The hazard classification is extremely important because fees are based on level of hazard. The rules previous to 2009 had very little detail as to what constitutes a hazard level or the techniques to determine hazard levels and minimum levels of competency. These were about to become much more important because the annual fee varies by \$425 per year based on what hazard level is set at. Specific standards and competencies were given in order to complete an analysis to change a hazard rating. This was done to discourage dam owners from attempting to argue to have their dam downgraded unless it was justifiable using an acceptable method by a qualified individual. However in 2009, we largely left the design rules untouched because of the urgent need to better define hazard classification and implement the fee program.

As I go through the rules I do see some possible problem areas that OWRD or the Commission may want to address prior to adoption. I will list these here:

**15) "Large Dam"** This was excluded to use the term "statutory" vs. non statutory. However, this has several unintended consequences because even a "small dam" is subject to statutory requirements in terms of water rights and other issues. This definition was carefully crafted among a broad array of policy groups and I feel that changing to "Statutory" vs. non will create un-needed controversy, unintended consequences and is misguided. **See also 17) "Small dam."**

**16) "Significant Dam Work"** This previous definition was created to be in harmony with other agency criteria. I am concerned that this has not been adequately defined in the new rules since this was taken out.

**690-020-0023 1)...** If OWRD or the Commission keeps the small vs. large dam language this phrasing needs to be modified to "size and hazard." Anywhere statutory vs. is mentioned needs to be evaluated for rewording throughout.

*Robison comments 2014 Dam Safety Rule Revisions*

**690-020-0025 5) New Number, After** "...passage of flow " add : "to instream and out of stream water right holders or instream minimum releases" until "unless the engineer..." The reason for this change is that conduits are for instream as well as out of stream needs to satisfy water right or other regulatory releases.

**690-020-0029...** I do not understand this deletion nor the loss of the term small dams. These rules are unenforceable and are recommendations and I know that certain design engineering firms may not like them, but there are people that simply build their dams without design plans and process and some guidance would be helpful. It seems like this deletion merely weakens the help and guidance that can be given to people building small dams.

**690-020-0035** Once again the loss of the large small dam has made this a little more unclear. Because small dams are "non-statutory" (but actually they are for other things) they do not apply but it is not as clear as before. Shouldn't the rules go towards making this distinction clear and understandable not less so. Furthermore, what is the major problem that was unearthed that small vs. large dams needed to be deleted. Otherwise I like the specificity of these new rules.

**690-020-0044** All dams have the monitoring equipment listed? I think this should be something left to interaction on given dam designs. Does every high hazard earth dam need a piezometer for instance?

**690-020-120 a)** I think this rule is an example of a rules committee out smarting itself. Why the 500 vehicle limit? What if three school buses cross at the point and it is a road with about 400 vehicles per day? There is a point when over specification becomes counterproductive.

Buried in the rules is an exclusion statement that essentially says that designs can require more if deemed necessary. When creating more prescriptive rules this concept must remain clear because the prescriptive language cannot cover every possible issue and engineers almost look at prescriptions as contracts. I would suggest repeating this near the beginning of the rules somewhere maybe even adding it to the goals statement or nearby.

Sincerely,



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E. George Robison  
5187 N. High Prairie Place  
Star, ID 83669  
Email: [egrobison60@gmail.com](mailto:egrobison60@gmail.com); Ph. 208-954-1715

## SPANSAIL Joshua A

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**From:** James Doane <thedoane@comcast.net>  
**Sent:** Monday, September 29, 2014 2:01 PM  
**To:** rule-coordinator  
**Cc:** 'James Doane'  
**Subject:** COMMENTS ON REVISIONS TO OREGON ADMINISTRATIVE RULES WATER RESOURCES DEPARTMENT CHAPTER 690 DIVISION 20 DAM SAFETY

Dear Rule Coordinator,

I have printed and reviewed the comments on the most recent revisions to OAR 690, Division 20, Dam Safety. I offer the following:

- I believe that the changes in the engineering design requirements will help clarify the roles and responsibilities of the "Owner" and "Engineer of Record".
- I believe that the new definitions of "high hazard rating" and "low hazard rating" remove many of the issues I had with the old rules.
- I believe that the new rules eliminated many of the ambiguities inherent in the rules they replace.
- The new rules clarify the need for an "Emergency Action Plan".
- The revised rules take into account recent changes in the technical understanding that the engineering profession has for successfully mitigating flood and seismic risks.
- Having been a former member of the Oregon State Board of Examiners for Engineering and Land Surveying, I am particularly pleased with the clarification in the requirements for a person to be an "Engineer of Record".

The proposed changes replace rules that had grown dated as the technology for dams advanced. The new rules will provide an added degree of safety to the citizens of Oregon.

Sincerely,

James L. Doane PE (OR 8366 expires 12/31/2015)  
19155 SW Oak St  
Beaverton, OR 97078

## SPANSAIL Joshua A

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**From:** Eric Ward <ericward@gmail.com>  
**Sent:** Wednesday, September 17, 2014 2:57 PM  
**To:** rule-coordinator  
**Subject:** Comment for Changes to OAR Chapter 690

To the Rule Coordinator:

Regarding the changes to OAR 690 (Dam Safety Administration, engineering design requirements...), I believe the changes to the rules are much needed to not only update and clarify dam design requirements, but to provide a better understanding of earthquake and flood risk associated with existing and proposed dams.

The proposed changes represent a much needed re-write of the rules, essential after nearly twenty years since the last significant update to the rules. I applaud the Water Resources Department and those on the rule writing committee for the significant work that must have gone into researching and writing the proposed changes.

Thank You,

Eric Ward, P.E.



October 2, 2014

Rules Coordinator Oregon  
Water Resources Department  
725 Summer Street NE, Suite A  
Salem, OR 97301-1271

Re: Comments, Division 20 Rulemaking Dam Safety

Dear Rules Coordinator,

WaterWatch is a river conservation group dedicated to restoring and protecting streamflows statewide. We appreciate the opportunity to provide comments on the proposed changes to the Division 20 rules which govern dam safety.

WaterWatch has a number of concerns about the proposed changes to the dam safety rules. In November 2013 WaterWatch requested to be part of any stakeholder group that developed the draft rules. See Attachment 2. WaterWatch was not appointed the RAC. Had we been on the RAC we would have made our concerns known prior to the hearing draft. However, at this juncture we are limited to providing written comment to the WRD and the WRC.

The scope of this rulemaking, as represented to the Water Resources Commission in multiple Directors' Reports over the past year, was to provide for "minor changes to improve clarity and specificity of dam safety rules." See e.g. Attachment 1. However, the rules that emerged from the Rules Advisory Committee (RAC) offer far more than the minimal changes that the WRD Reports suggested would occur. The rules have been almost wholly reworked.

Overall, it is unclear what provisions of the rules really need updating to better ensure the public's safety. The Notice of Proposed Rulemaking notes that the last time the Division 20 rules were significantly updated was about twenty years ago (which would be 1994), and since that time there had been major changes in the understanding of Oregon's earthquake and flood risk, and also major changes in national engineering practice regarding design and monitoring of dams.

However, in actuality, in 2009 the Division 20 rules were amended not only to implement a new statutory fee and associated hazard ratings, but also to update the dam safety provisions to meet current standards of practice as of 2009. See Attachment, WRD Staff Report to the Commission, Request for Adoption of Rules Regarding Updates Concerning Dam Safety and the Implementation of Fess for Dam Safety, OAR Chapter 690, Division 20, November 19, 2009, and relevant attachments. If engineering standards have changed significantly since 2009, we do not oppose the updating of those specific standards, however the proposed changes are not



limited to this. The actual scope digresses significantly from the stated purpose of ensuring the safety of dams, and instead in many areas affects policy issues broader than dam safety, as well as current WRD funding security. Moreover, rather than increasing dam safety, many of the changes actually appear to put the public more at risk.

While we will address each section of the proposed rules in order, at the outset we did want to identify some areas of significant concern, which include but are not limited to:

1. Fee shifting: The 2009 rules directed that the fees collected under the dam safety program pay for WRD staff time under WRD's dam safety program. The purpose was to "provide the department with the resources necessary to manage and support the construction and safe operation of dams in accordance with these rules". OAR 690-020-0000(1), existing. The 2014 proposed amendments undercuts Department funding by expanding the use of funds to pay for dam safety requirements that are the clear responsibility of the dam owner or applicant, such as the dam breach inundation analysis (applicant responsibility) and the dam owner's emergency action plans for existing dams (dam owner responsibility). See proposed OAR 690-020-0200(5). This not only undercuts WRD funding of the dam safety program, but flies in the face of recent efforts by the Water Resources Commission to stabilize Department funding through funding avenues similar to this.

Providing stable funding for the WRD's dam safety program was one of the primary goals of the 2009 rulemaking. As the WRD noted in the 2009: The fees will allow the Department to better address a backlog in inspections and public outreach and education. The total cost of the Dam Safety Program was recently estimated at \$450,000 per biennium which the fee would recover approximately \$40,000 or about 9% of the program cost. It makes no sense to move backwards in time to allow these fees to pay for the private costs of dam owners rather than the work of the WRD in ensuring the safety of all Oregonians. See Attachment, WRD Staff Report to the Commission, Request for Adoption of Rules Regarding Updates Concerning Dam Safety and the Implementation of Fess for Dam Safety, OAR Chapter 690, Division 20, November 19, 2009, including response to comments.

2. Hazard Ratings Criteria Diminished: Hazard ratings were established in the 2009 rulemaking. The proposed amendments significantly diminish existing criteria, especially as it relates to the criteria for rating dams as "high hazard". (See OAR 690-020-0100). The proposed changes could put scores of lives at risk and create liabilities for the state. Disturbingly, this change appears to be putting the financial considerations of dam owners above the safety of the public (fee amounts are tied to hazard ratings, with high hazard dams requiring the highest fee). See discussion in OAR 690-020-0100.
3. Statutory Dams: The WRD is defining a new term "statutory dam" that limits the class of dams that qualify as a statutory dam. This term is not found anywhere in statute or rule. This is inconsistent with Oregon law. Under Oregon statutes, all dams require a permit. Thus, all dams are statutory dams. This is a significant legal change that could have ramifications well beyond the dam safety rules. See discussion in related to OAR 690-020-000(29) below.

4. Conduit size and its relationship to policy decisions on releases: The proposed rules narrow the class of inflow that a conduit must be sized to release to only “senior water rights”. The previous rules recognized that conduits must be sized to allow for adequate release for downstream needs, including minimum perineal streamflows and other downstream uses. The proposed change not only attempts to set policy (dams only have to pass inflow equal to downstream senior rights), but is also inconsistent with on the ground permit conditions, i.e. water rights now require the bypassing of all inflow in the non-storage season, bypassing BiOp flows needed for federally listed fish, bypassing flows called for in Division 33 reviews, and (under SB 839) will require the bypass of seasonally varying flows if state funds are used to build storage projects. Related, the proposed rules delete the requirement that all in-channel dams (existing or new) have a conduit. The proposed change arguably undermines existing dam safety requirements. See discussion in OAR 690-020-0025.
  
5. Guidelines for small dams: In 2009 the WRD amended the rules to provide engineering guidelines for the construction of small dams. As these are not requirements under the dam safety statutes, these were just recommendations. That said, in 2009 the WRD felt they were an important addition to the rules to help ensure that small dam owners would understand the “standard of practice” to ensure dam safety and thus protect the public. Written materials from the WRD note that including these standards help to alleviate WRD’s and the public’s concerns about “small” dams that are excluded from the dam safety design process, but still cause public safety concerns, i.e. a dam that is less than 10 feet tall (small dam requirement #1) but holds over 1000 acre feet, or a dam that holds less than 9.2 acre feet (small dam requirement #2) but is 30 feet tall. The proposed rules delete the WRD’s recommended standards of practice in their entirety. Given the stated purpose of these rules is to ensure the safety of dams insofar that they may affect damage to life or property, the deletion of these voluntary measures is baffling and is a step backwards from the current rules. See discussion in OAR 690-020-0029 proposed strike out.

In addition to these substantive concerns, we wanted to register our concern at the make-up of the Rules Advisory Committee. Given that the charge is to ensure dam safety, the WRD should have ensured that someone from the Oregon Office of Emergency Management, or an equivalent position that specializes in local and/or statewide public safety (as opposed to engineering and dam ownership) was on the RAC. This was a huge oversight, especially in relation to proposed changes to the hazard rating criteria. Additionally, to the degree that the rules go beyond dam safety and try to change fee structures and/or water policy, stakeholder groups that asked to be on the RAC should have been included (including WaterWatch)<sup>1</sup>.

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<sup>1</sup> Note: WaterWatch served on the 2009 RAC and, as noted above, asked to serve on this RAC.

**Section by Section comments to proposed rule changes:** These comments are meant to be read side by side with the proposed rules (and in noted sections, the existing rules).

**Purpose and Applicability, 690-020-0000**

**Subsection (1):** The existing purpose section that was established in 2009 should be retained. The language proposed to be deleted was developed in 2009 has as an overall purpose both dam safety (for large and small dams) and a clear directive that dam safety fees are to provide the department with the resources necessary to manage the dam safety program. This rulemaking was not supposed to be about changing the purpose of the rules, but rather was only supposed to offer clarifying language and/or updates to engineering standards. The new “purpose” language narrows the scope of rules, the application of the rules, WRD authority and the clear direction of fees to the WRD.

**Subsections (2) & (3):** The proposed changes narrow the scope of the rules, and relates to our overall concern outlined in comment #5 above. The WRD should have in place standards of practice for small dams to help ensure public safety. There is no good reason to narrow the rules as proposed.

**Subsection(4):** The proposed language in sub (4), read with OAR 690-020-0200, undercuts funding to the WRD, which is of great concern to WaterWatch as outlined in comment #1 above. This section states that fees shall support the dam safety program as described in OAR 690-020-0200. This all sounds well and good, until you look at OAR 690-020-0200 which states that the WRD may use the dam safety fee to support periodic dam safety inspections (WRD duty), conduct dam breach inundation analysis (dam owner responsibility), help dam owners complete emergency action plans for existing dams (dam owner responsibility to develop these plans), conduct or support the technical analysis of the safety of specific dams (language is not limited to WRD analysis, but could include required dam owner analysis), and other actions to support the dam safety program. In a nutshell, when this section is read with section 020-0200, the language would allow the WRD to pay for actions that are required by rule of a dam owner or applicant, instead of using monies only to pay for dam safety work required of the WRD (i.e. dam safety inspections) that benefits the public at large. The whole purpose of the 2009 statute and the 2009 rules was to ensure that dam owners help pay for the WRD’s work to ensure the safety of dams. The statute was not intended as yet another funding source for dam owners. Given recent efforts of the Commission, the Governor’s office, stakeholders and others to provide avenues for secure funding for WRD programs, it is baffling to us that the WRD is recommending this change to the 2009 language that achieves just this. All provisions of the rules that attempt to shift fees from the WRD to the applicant/owner should be struck and/or amended to make clear that funds can only be used to fund WRD staff for dam safety work directly tied to protecting the public.

**Subsection (5):** Dam safety is the responsibility of the state. It is unclear what is meant by “working for the department”. If this means that the engineer is a staff member of the state that

is fine, however, we would not support the WRD paying a hired consultant to do this work (i.e. which could be seen as “working” for the department). This section needs clarity.

### **Definitions, OAR 690-020-0022**

**(15) Engineer of record:** there appears to be a typo as “and in responsible charge” does not make sense.

**(15) Large Dam (proposed deletion):** It is unclear why the WRD is suggesting that deletion of the definition of large and small dams (for the purposes of dam safety). While it is likely that this is tied to the narrowing of the rule scope so as to delete recommended standards of practice for small dams, as noted in comment #5 above, we think this is a step backwards.

**(22) Low Hazard Rating:** Ratings should be based on impacts, regardless of who owns the property. This is a change from the 2009 rules and does not make sense. As defined here, a dam that, if it failed, would wipe out the owner’s house, livestock, etc. would be classified a low hazard dam. The proposed change is inconsistent with general statutory guidance, which prohibits the construction of dams that that would, if they failed, result in damage to life or property. See e.g. ORS 540.360(1). The statutes do not distinguish between the owner’s property or otherwise, thus the rules should not be so narrowed.

**(25) Significant Hazard Rating:** Again, to be consistent with statute the rating should apply to impacts regardless of who owns the property. It is also unclear what is meant by “property”. The beds of streams, i.e. fish habitat, belong to the state and thus are “state property”. It would be helpful to clarify that a dam failure that results in damage to riverine habitat counts as damage to property (maybe add a definition of property that clarifies this). It is unclear what is meant by “extensive”.

**(16) Significant dam work (proposed deletion found after new (25)):** The existing rules apply design criteria to new and existing dams where there will be significant work. The definition of “significant dam work” was added in the 2009 rulemaking at the request COID, NUID and Swalley ID to make clear what was meant by significant dam work. The WRD’s proposed deletion of this definition ties into the larger issue of scope.

**(17) Small Dams (proposed deletion):** See comment under “large dams” above.

**(29) Statutory Dam:** WaterWatch strongly opposes this definition. All dams in Oregon are statutory dams. Under Oregon law all new ponds and reservoirs must have a permit. Oregon law allows for one very limited exception, but this only applies to reservoirs that store less than 9.2 af or have a dam height of less than 10 feet that were built before 1995 and registered with the WRD before 1997. ORS 537.405. If pond owners did not register by 1997, their ponds are illegal. Regardless, all reservoirs/ponds built after 1995 require a reservoir permit. Thus, dams that are less than ten feet and that store less than 9.2 acre feet of water require, by statute, a permit. All of this is clearly outlined in the statutes, thus all dams are “statutory dams”. The proposed language in the dam safety rules would define statutory dams as only those where the dam is greater than ten feet and stores more than 9.2 acre feet. The dam safety rules are not a place to introduce a new definition into Oregon rule that would most certainly be used to support

arguments elsewhere as to what constitutes a legal or illegal dam (similar to the use across the board of the definition of “injury” which is technically only found in the transfer statutes).

While we surmise that the WRD’s intent is to carve out the class of dams which are subject to ORS 540.350 to 540.390, as defined in 540.400, this particular politically loaded definition is not necessary to achieve that. The WRD has already laid out applicability of requirements, and ORS 540.400 does not define these as “statutory dams”. Again, we strongly oppose this definition. If the WRD wants to repeat what is found in the statute, we would suggest the term “applicable dams”, or something similar that is clearly tied to the dam safety rules.

**Process for Construction of Dams, 690-020-0023:** This title is misleading and could lead the applicant to believe that this is the sum total of the process for construction of dams. This small subsection is only in relation to “safety of dams”, and is in addition to permitting requirements, etc. This title should be changed to clarify this, something to the effect “Safety of Dams requirements prior to construction of dams” or “Requirements for safety of dams prior to construction”.

**Subsection (4):** Prior to beginning construction the applicant must have water right storage permit and all other applicable permits (i.e. removal fill, cultural resources, etc.). As with the comment at the outset, section (4) could be read to imply that all the proposed dam owner needs to do is submit designs. This is misleading and contrary to law.

**Subsection (5)(a):** Any design changes must not only be described and justified to the WRD, the WRD must approve them. This needs to be clarified in the rules.

**General Requirements, 690-020-0025**

The WRD was in error in not including in the hearings draft that suggested amendments to the original title of this section which is, “General Requirements for all dams” not just “General Requirements”. This is a huge policy shift, and relieves from the general requirements all existing dams. These types of changes, also, are not consistent with the stated intent to the Commission in the Director’s Reports, nor the public in the Hearings Notice. The hearing draft is defective as it omits noting this as a change.

**Subsection (56): Outlet conduits:** The proposed changes narrow the scope of the existing rules in many significant ways. First of all, the old rules applied to all dams not just new dams. The proposed changes undermine existing dam safety requirements of all dams; this is a huge step backwards and should be struck. This is wholly inconsistent with the notion of “safety of dams” and instead appears geared at minimizing regulation and/or costs to existing dam owners whose dams do not have required conduits.

Second, this section attempts to limit conduit size and/or releases only to inflow that is needed to meet downstream senior rights. The existing language made clear that conduits needed to be sized to release water to meet downstream needs. This is very important because this appears to set policy in conflict of general WRD authority to attach permit conditions to protect a wide variety of public interest needs. Moreover, all new on-stream storage projects are conditioned to require passage of all inflow outside the storage season.

This section should be amended to read:

An outlet conduit with a minimum diameter of 8" must be installed in any stream reservoir to permit drainage of the reservoir and for passage of flow downstream to meet senior water rights, minimum perennial streamflows, scenic waterway flows, federal BiOp flows and other downstream needs as required by state or federal agencies.

**Subsection (68):** This is a significant shift from current permitting practices and is not appropriate for a dam safety rulemaking. If the WRD is going to move towards a different permitting standard, this should be transparent in any rulemaking hearing notice and also, importantly, the WRD should make very clear if the final specs are not approved, the final order and permit will be revoked. As is, WaterWatch objects to water right permitting changes in this dam safety rulemaking.

**PROPOSED DELETION, 690-020-0029, Small Dams, Recommended Minimum Standard.**

The WRD is proposing to delete the recommended minimum standards set forth for small dams. As noted in our opening remarks, we object to the deletion of this section. These are voluntary measures that will help the applicant understand what he/she should do to construct a safe small dam. There is absolutely no good reason to take this out.

**Minimum-Engineering Design Requirements, 690-020-0035:** We object to the deletion of the word "minimum". Oregon statute's grant the WRD broad latitude to condition water right permits with any condition that it deems necessary to protect the public interest, health, safety, other water right holders, etc. The title, as proposed, could be interpreted to limit current authority by stating these are the only requirements the WRD can imposed.

Additionally, under the existing rules, the requirements currently apply to newly constructed dams and significant dam work. The amendments propose to limit application to newly constructed dams. WaterWatch strongly opposes this proposed change as it puts public safety at risk. All sections in the rules that state "new dam construction" should be amended to state "all new dam construction and significant dam work".

**Subsection (2)(b):** it is unclear if bypass flows are to be included this in analysis.

**Subsection (2)(c):** it is unclear if fish passage facilities (which is required of all new in channel dams) will be analyzed here.

**Subsections (1)-(3)** there is no reference for WRD approval of design reports, while this comes later in the rules it should somehow be noted here. **Subsection (3):** The engineer of record should have to sign off on and/or otherwise approve any reports. **Subsection (1):** it should be clarified that this must be submitted to the WRD.

**Penetrating Conduit(s) and Control of Flow through Conduits, 690-020-0043:**

We object to the narrowing of this section to require conduits only of new dams. All dams on stream channels should have a conduit, not just new dams. This is a significant step backwards from current rule, and is contrary to the stated intent of ensuring the public's safety.

**Subsection (1)(c):** All conduits should be of sufficient size to pass inflows as required by the storage permit. In addition to senior water rights, this could include seasonally varying flows, minimum perennial streamflows, all inflow outside the storage season, federal biop flows, water above their water storage right (Oregon is a one fill state), etc. By only requiring the passage of inflow for “senior water rights” the dam safety rules are in conflict with the permitting requirements, which will likely lead to legal challenges.

**Written Approval by State Engineering, 690-020-0080:** It should be clarified that these “dam safety requirements” are in addition and not in lieu of state water right requirements (i.e. need to have a storage permit in place) and other state/federal requirements.

**Subsection (2):** there should be a standard for extensions, not just a provision that states that the state engineer can extend upon request.

**Subsection (3): Work on existing dams:** This list of activities that will require approval of engineered designs does not match up with the list that was developed in 2009 under “significant dam work”. Both should require approval of engineered designs. Moreover, it is unclear exactly which engineering designs are required. All?

As a general matter, as noted earlier in our comments, we suggest that any place that the rules lay out requirements for new dams language should be amended back to what the previous rules required which was “new dams and significant work to dams” and re-institute the definition of significant work to dams, with updates to also include the list found in 0080.

And finally, section 690-020-0030 (modification of dams requiring notification and/or approval) appears somewhat in conflict with this section as the triggers are not identical.

As a larger issue, while we appreciate that the WRD is extending the rules to apply to new activities at currently permitted dams, it does not address permitted dams that are unsafe as built regardless of any new activity. As noted previously, the existing dam safety rules that were updated in 2009 had general requirements that attached to all dams and thus important safety components such as conduits had to be added to existing dams, regardless of whether it was an already permitted dam or not.

**Subsection (4):** The WRD should be clear that “emergency” is related to a dam safety emergency, not things such as economic hardship, etc.

**Subsection (5) Existing dams without a storage permit:** First of all, the WRD should make clear that all dams require permits. If there is an unpermitted dam, the rules should make clear that the WRD will institute enforcement actions against the dam owner. If the dam owner seeks to make the dam legal they must submit all the requirements of a new dam, not simply the subset as outlined in (5). By providing this loophole to existing standards, the WRD could be seen as incentivizing the building of illegal dams as the path to approval appears much less stringent. Second, the way the rules are written implies that the WRD will approve a permit if the list in (a) through (g) is met. This should be amended to make clear that the illegal dam owner would have to go through the regular permitting process, including a full public interest review, in addition to satisfying the dam safety requirements of these rules.

**Subsection (7):** The word “permitted” is confusing and could lead to conflicts with the permitting laws. Our guess is that what the WRD is intending is “allowed”. Under the permitting statutes, the dam owner would have to have the water right application in place long before the point of “storing water”. Moreover, here and throughout the rules “plans, specifications or other information” should be tied directly to the dam safety requirements. Again, the dam safety requirements are in addition to all the other state/federal permits a dam owner must obtain before building a dam, not the least of which is the state water right.

**Hazard Rating of Statutory Dams, OAR 690-020-0100:** The changes to this section are of great concern to WaterWatch as they substantially undercut existing protections for the public, and appear more geared at ensuring that dams are not rated high hazard (and thus do not cost dam owners \$500 per year) than at protecting life and property. Hazard rating is very important as it relates to frequency of inspection, with high hazard dams being inspected more frequently to ensure protection of life and property.

First, as noted previously we object to the definition of statutory dams. The word “statutory” should be struck here so the section simply reads “hazard rating of dams”, or “hazard ratings of applicable dams” (with a definition of applicable dams added in the definition section).

**Subsection (3) Hazard Ratings:** The existing hazard ratings were established a mere five years ago and are much more protective of public safety than the proposed amendments. For instance, the existing rules require the WRD to consider “any factor that puts a strong probability of people being downstream in an inundation area of a dam” when reviewing a dam to see if it is “high hazard”. Existing rules also state that in “situations in which there are heavy recreational or other uses downstream, a dam may be rated “high hazard” because of probable loss of life regardless of downstream infrastructure presence.” The amended rules delete these important provisions in whole. Under the proposed amendments anglers, rafters, kayakers, campers, hikers and any other human that is below a dam but is not connected to a human built “structure” is not a life that is allowed to be considered under the newly proposed hazard rating. There are many dams that exist that, if they failed, could lead to loss of life of hundreds of recreationalists. The state should consider these lives when evaluating a dam for a high hazard rating. Existing rule language relating to high hazard dam rating should be retained.

Moreover, even the proposed language relating to structures has been diminished significantly. Existing language was modified with a number of “qualifiers” that make it much easier not to be rated high hazard which puts the public at risk (and, coincidentally, lessens the likelihood that a dam owner would have to pay the higher dam safety fee). For instance,

- (a) **High hazard:** Nowhere in this section is there a tie to loss of life. This section needs to be clear that a high hazard rating is warranted if there is a likelihood of loss of life if the dam fails. Even just one life.

In addition to the language noted above that is tied risk to human life not associated with structures, the old rules set forth plausibility standards tied to inhabited structures. However, the proposed rules severely undercut application by inserting qualifiers and



asserting that the new property based inundation analysis is the basis by which the WRD must make the final determination as to high hazard rating (again, there is no reference to loss of life). As to the qualifiers, they will put scores of lives at risk. For instance, inundation of buildings now only applies to “frequently occupied” buildings rather than “buildings”. Thus, the WRD cannot rank a dam high hazard if there is a risk of death of a person who infrequently uses his/her property. It also doesn’t define frequently. Arguably, someone who only uses their cabin on weekends would not be considered, and thus a dam that could result in this person’s death if it failed would not warrant a “high hazard” designation. Moreover, “road” has now been changed to “paved road” “used by 500 vehicles per day”. This puts scores of people at risk. There are many many dirt roads that carry hundreds of people in Oregon where risk of loss of life would be high if a dam failed (i.e. Deschutes, Crooked below Bowman dam, etc.). As to the “500 cars a day”, is the WRD really suggesting that they cannot consider a dam “high hazard” if a dam failure would kill dozens/hundreds of people on a road that only carries 300 cars a day? These changes do nothing to further protect the public, and instead appear geared at ensuring that less dams are determined to be high hazard (and thus cost dam owners less).

- (b) **“Significant hazard” rating:** Depth of water over floorboards has now been expanded to “multiple buildings” rather than one building, and is limited only to property that is not owned by the dam owner. This dilutes the existing standard, and (as noted previously) is inconsistent with statutes that discuss damage to property period, not property that is not owned by the dam owner.
- (c) This section asserts that inundation of railroads that are not passenger railroads only warrants “significant” hazard, without mention of loss of life. Trains are commandeered by people. The existing dam safety rules protect all loss of life.

WaterWatch strongly opposed the proposed changes to the existing hazard ratings. These ratings were established a mere five years ago. These ratings were established to rank how often dams should be inspected to protect human life. The WRD provided a leadership role in the establishment of these strong standards. The proposed changes are a step backwards and appear geared at ensuring that less dam will be rated “high hazard”, which would result in less inspections and less cost to dam owners. This is not the direction the state should be going. The existing rule language regarding hazard ratings, which was established in 2009, should be retained in whole.

This section also deletes all provisions regarding WRD intent as to schedule of inspection. The WRD in 2009 felt it very important to indicate that its intent was to inspect dams. However, WRD did not want to put “shall” because they did not want to face legal liabilities if WRD resources didn’t allow them to meet the schedule, but they did not want the word “may” as that often results in inaction. Thus, existing rules stated that they would “endeavor to inspect this class of dams at least” on an annual schedule (high hazard), three year schedule (significant hazard) or six year (low hazard).<sup>2</sup> The WRD has deleted these directives here and instead, in new section OAR 690-020-0150, simply put that the WRD “may” do inspections on suggested

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<sup>2</sup> Note, WaterWatch served on the 2009 RAC so we were party to the WRD discussions on this.

schedules. WRD has also failed to include language anywhere in the rules the previous directive that states “the director shall maintain a program of inspecting existing dams” (note this doesn’t even show up as a deleted section of the rules, it is simply not there, see discussion under enforcement). Thus, all in all, the changes provide less certainty for public safety, not more.

Existing rules were established only five years ago. The proposed changes weaken existing standards. The WRD took a leadership role in developing the very specific sideboards adopted by the Commission in 2009<sup>3</sup>, and it is unclear why they would revert to less specific standards and/or requirements. The old rules should be retained in full, unless the WRD can make a concrete argument as to how lessening the stringency of the standard better protect life and property as required by statute.

Of further concern is the fact that the proposed rules lessen the standards for changing existing hazard ratings. See discussion under hazard rating above. Again, these rules appear more geared at helping existing high hazard dam owners get out from the fees/requirements that attach to these dams. This is not in the public interest and is not the direction the state should be going.

The existing rule language regarding dam breach inundation analysis should be retained in whole. The proposed changes should be rejected.

**Routine Inspection of Dams, 690-020-0200:**

The newly proposed language regarding inspection of dams is weaker than that that exists in rule today.<sup>4</sup> This section should be rejected and the state should reinstate, or even strengthen, the existing rule language.

The whole purpose of the dam safety program is to ensure that dams do not pose a risk to life or property. Routine inspection of dams is a key action needed to ensure this. The WRD in 2009 added language to make it clear that they would inspect dams and that this was a major goal of the program. The proposed language moves away from that and instead only sets forth a permissive program that does not provide any direction to the WRD, nor any clear understanding to the dam owner of how often his/her dam will face inspection. And, importantly, the rules change from a minimum number of inspections to a maximum, thus taking away WRD authority to do inspections as often as they feel is necessary to protect public safety.

As noted above, the existing rules state a few things that are now proposed to be deleted. Of most concern are the following directives that have been deleted:

- The director shall maintain a program of inspecting existing dams.
- The department shall endeavor to inspect this class of dams [high hazard] at least once annually

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<sup>3</sup> The 2009 rulemaking was led by George Robison (Ph.D, PE, D.WRE) who was WRD’s dam safety coordinator at the time and very knowledgeable in the subject.

<sup>4</sup> We would recommend that Water Resource Commission members read our comments alongside of the rules as they exist (attached, see section OAR 690-020-0100 hazard rating, and OAR 690-020-0050 enforcement) and the proposed rules to clearly see the difference in strength of language.

- The department shall endeavor to inspect this class of dams [significant hazard] at least once every three years.
- The department shall endeavor to inspect this class of dams [low hazard] at least once every six years.

**Subsection (1) and (2):** Under the proposed changes the department “may” (not shall) conduct routine safety of dams....and the inspections “may” be scheduled on an annual basis for high hazard dams (i.e. at the most), every three years for significant hazard dams (at the most) and every six years for low hazard dams (at the most). Again, this is a step backwards and moves away from ensuring public safety. This, combined with the deletion of the language that states that the director shall set up a program to inspect dams could legally allow zero inspections of high hazard dams. This passive approach does nothing to protect public safety.

**Subsection (4):** Additionally, under the proposed changes, the WRD only “may” (not shall) specify conditions necessary to insure the safety of the works to prevent possible damage to life or property. And, following an inspection that shall provide the dam owner a letter with observations and “recommendations” (not requirements!) to ensure the safety of the works. This is wholly inadequate and really does nothing to ensure the protection of life and property. If the WRD knows of a risk they should require specific action. Moreover, this new section is at odds with the enforcement section that does in fact require action if there is a threat to life/property.

**OAR 690-020-0200 Fees for Dams:**

**Subsection (5), use of fees:** As noted at the outset in comment #1, WaterWatch is very concerned with the rules attempt to shift fees that currently are directed to pay for WRD staff work in the dam safety program to the dam owner. The statute that was passed in 2009 was intended to help provide a stable funding source for the WRD’s dam safety program, not to provide yet another state fund to be used by private citizens to meet their regulatory responsibilities.

Subsection (5) should be struck in whole. Instead this section should make clear that the WRD can only use the dam safety fee to support WRD dam safety staff in fulfilling their responsibilities under the dam safety statutes and rules. The intent of the WRD in 2009 was that this money would pay for dam safety inspections. This should be made clear. See comment #1 for further discussion.

**OAR 690-020-0300 Modification of Dams Requiring Notification and or Approval:** As noted throughout this document, we think the WRD should reinstate existing language that subjects any significant work to the same standards as new construction. While we appreciate that this might be what the WRD is attempting here, it is not clear if “approval of engineered designs” includes the many requirements of new dams as laid out in these rules. Again, we think the existing rules are both clearer and stronger.

**Subsection (1):** Moreover, the list provided in (1)(a) through (h) does not include all the factors that were previously found in the definition of “significant work to dams”, nor in new section OAR 690-020-0080. Importantly this section also takes away discretion of the WRD to require

application to require the dam owner to meet regulatory standards for “any other activity that could affect the integrity of the dam or its auxiliary works.”

**Subsection (2):** Related to our comments in the hazard section, this sections exemption for dams “in a remote area with no downstream development that might be affected by a dam breach flood” disregards life that could be lost if that life is not connected to a structure. This should be of concern to the state, as thousands upon thousands of Oregonian’s recreate on rivers below dams. This exemption should be struck in whole.

**OAR 690-020-0350 Operations and Maintenance Plans:** The “may” should be a “shall” so that the WRD shall make inspection of the operations of works to ensure the safety of the works. Moreover, all high hazard and significant hazard dams should be required to provide the WRD with operations and maintenance plans, not just “new” ones.

**OAR 690-020-0400 Emergency Action Plans (EAP) and Emergencies**

**Subsection (1):** Emergency action plans should be required for all dam owners. As written, the rules only require EAPs of new and/or modified dams.

**Subsection (2):** Again, Emergency action plans should be required for all dam owners, especially high hazard dam owners. This section merely states “dam owners are encouraged to complete emergency action plans for their existing high hazard dams”.

**OAR 690-020-0500 Enforcement:** While most of this section is carried over from existing rule, the opening sentence of the existing rule is not included, nor is it noted as a deletion. The original language in the original rule begins this section with the sentence: “The director shall maintain a program of inspecting existing dams.” This is a critical sentence that puts an affirmative responsibility on the WRD to have a program of inspecting existing dams. The omission of this sentence renders the hearings draft deficient as there would be no way for a reviewer to know that this was omitted from the draft (there is no strike out). The WRD should carry the existing rule language forward.

**Conclusion:** WaterWatch believes that many of the proposed changes are inconsistent with the notice given to both the Commission and to the public. Both the Director’s Reports and the Hearing Notice downplay the significant shifts in policy, funding, and, importantly, dam hazard ratings. Because of the inadequate notice, it is likely that many stakeholders that would likely be interested in changes to fee directives, policy and hazard ratings did not even look at the rules.

Our recommendation is that the rulemaking be re-opened, that a new RAC be convened (that includes public safety officials), and that the directive to that RAC be limited to updating engineering standards (in a manner that would improve the safety of dams) where there have been changes since 2009. The RAC should not institute policy changes that are not related to dam safety, nor should the RAC be allowed to weaken dam hazard ratings so that it would be more likely that a dam would not be rated high hazard. The WRD should provide a leadership role to ensure that the dam safety rules become stronger, not weaker. The public is depending on the state to help ensure protection of their lives and property. Many of the proposed changes will move away from that goal, not further it.

If you have any questions please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "K. Priestley", with a stylized flourish at the end.

Kimberley Priestley  
Sr. Policy Analyst  
WaterWatch of Oregon  
213 SW Ash, Ste 208  
Portland, OR 97204

Enclosures

Last Revision: 10/04/13 , see also Director's Report 8/14

Water Resources Department  
Anticipated Rulemaking

Rule Division	Topic	Lead Staff	Rules Advisory Committee Anticipated	GWAC Input Anticipated	Target WRC Date	Status
New Division: SB 200 Implementation	Split a Permit into Multiple Ownerships..new program	Dwight	Yes	No	Early 2014	Underway
Division 51	Streamline hydroelectric protests with OAH	Dwight	Yes	No	Early 2014	Underway
Division 220	Extend reporting requirements for bentonite abandonment of water wells from Jan. 2014 to Dec. 2017	Brenda/van/ Enforcement	Yes	Yes	Mid 2014	Planned
Division 20	Minor changes to improve clarity and specificity of dam safety rules	Brenda/Keith	Yes	No	Late 2014	Planned
Division 350	Limited License Fees Update	Dwight/Tim	Yes	No	Mid 2014	Underway
New Division: SB 839 Implementation	1. SVF Approach 2. Rating / Evaluating Projects 3. Making Loans	1. Brenda 2. Brenda/Tracy 3. Tracy	1. Yes 2. Yes 3. Yes	1.No 2.No 3.No	1. Late 2014 2. Early 2015 3. Early 2015	1. Underway 2. Planned 3. Planned

Zimbra

[kjp@waterwatch.org](mailto:kjp@waterwatch.org)

**Fwd: rules coordinator?**

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**From :** Kimberley Priestley <[kjp@waterwatch.org](mailto:kjp@waterwatch.org)>

Thu, Oct 02, 2014 10:31 AM

**Subject :** Fwd: rules coordinator?

**To :** [kjp <kjp@waterwatch.org>](mailto:kjp@waterwatch.org)

----- Forwarded Message -----

From: "Brandi Elmer" <[brandi.m.elmer@state.or.us](mailto:brandi.m.elmer@state.or.us)>

To: "Brenda Bateman" <[brenda.o.bateman@state.or.us](mailto:brenda.o.bateman@state.or.us)>, "Kimberley Priestley" <[kjp@waterwatch.org](mailto:kjp@waterwatch.org)>

Cc: "Brandi Elmer" <[brandi.m.elmer@state.or.us](mailto:brandi.m.elmer@state.or.us)>

Sent: Tuesday, November 5, 2013 8:16:18 AM

Subject: RE: rules coordinator?

Hi Kimberley,

I have your request and will keep it on file for reference in the future.

Thank you,

Brandi Elmer  
Executive Support  
Oregon Water Resources Department  
725 Summer St. NE, Suite A  
Salem, OR 97301  
Phone: (503) 986-0875  
Fax: (503) 986-0903  
Email: [brandi.m.elmer@wrdd.state.or.us](mailto:brandi.m.elmer@wrdd.state.or.us)

-----Original Message-----

From: Kimberley Priestley [<mailto:kjp@waterwatch.org>]

Sent: Tuesday, November 05, 2013 6:14 AM

To: Brenda Bateman

Cc: Brandi Elmer

Subject: Re: rules coordinator?

Hi Brandi,

WaterWatch would like to be involved in any stakeholder discussions regarding the Division 20 rules, re: changing definitions of dams.

Thank you, Kimberley



# Oregon

Theodore R. Kulongoski, Governor

Water Resources Department  
North Mall Office Building  
725 Summer Street NE, Suite A  
Salem, OR 97301-1266  
503-986-0900  
FAX 503-986-0904

## MEMORANDUM

**TO:** Water Resources Commission  
**FROM:** Phillip C. Ward, Director  
**SUBJECT:** Agenda Item B, November 19, 2009  
Water Resources Commission Meeting

**Request for Adoption of Rules Regarding Updates Concerning Dam Safety and the Implementation of Fees for Dam Safety, OAR Chapter 690, Division 20**

### I. Issue Statement

The Commission is asked to adopt revisions to Oregon Administrative Rules Chapter 690 Division 20, Dam Safety Rules and implement fees to be used for Dam Safety purposes.

### II. Background

The 2009 Legislature passed Senate Bill 788 which contains the authority to charge an annual recurring Dam Safety fee based on a dam's "hazard rating." SB 788 was signed by the Governor on July 23, 2009. The hazard rating refers to the potential harm a dam failure can inflict to human life and property. The legislation authorized an annual fee of \$500 for dams with a high hazard rating, \$150 for dams with a significant hazard rating, and \$75 for dams with a low hazard rating.

In order to implement these fees, it became apparent that the Dam Safety Division 20 rules needed to be updated to address hazard rating and to clarify which dams are subject to the fee. In addition, the rules have not been updated since 1994, so there were several provisions that need to be updated to meet current standards of practice.

### III. Discussion

The proposed rules add definitions for a dam, hazard rating, large dams and small dams. Large dams, for dam safety purposes, would be dams 10 feet or more in height and storing 3,000,000 or more gallons of water. This matches the size criteria established by ORS 540.400(1). The proposed rules will establish how the Department measures a dam's height and volume to determine the applicability of this statute.



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November 19, 2009  
Page 2

The proposed rules add a section describing how hazard rating classifications for large dams are determined and provides a process for dam owners to request a revised hazard rating. The proposed hazard rating classifications match how the Department is currently determining a dam's hazard rating.

The proposed rules (Attachment 1) establish standards regarding which dams are specifically exempt from fees. SB 788 states that the fee is applicable to dam owners based on the dam's hazard rating. Historically, the Department has not assigned a hazard rating to dams less than 10 feet in height or impounding less than 3,000,000 gallons. By statute these small dams are also exempt from plan reviews. For these reasons, small dams are proposed to be exempted from the fee in rule. Secondly, dams that are inspected regularly by federal agencies such as Army Corp of Engineers, Federal Energy Regulatory Commission, or the Bureau of Reclamation are not regularly inspected by the Department. The rules would exempt dams directly controlled or regulated by an agency of the federal government from the fee where inspection and maintenance programs meet or exceed criteria utilized by the Department.

The rules overall are designed to only include fees for dams that have their plans reviewed by Department staff and are part of our regular inspection schedule.

The fees will allow the Department to better address a backlog in inspections and public outreach and education. The total cost of the Dam Safety Program was recently estimated at \$450,000 per biennium. The fees are estimated to generate about \$40,000 or about 9% of the costs incurred by the program.

#### **IV. Rulemaking Process**

A Rules Advisory Committee (RAC) was appointed by the Department to assist with the development of rules. The RAC met once on September 23, 2009. A hearing draft set of proposed rules was prepared by staff based on input from the RAC. The members of the RAC are given in Attachment 3.

The Department submitted a Notice of Proposed Rulemaking Hearing and Statement of Need and Fiscal Impact to the Secretary of State for publication on October 1, 2009 in the *Oregon Bulletin*.

The public comment period was open from October 1 until 5:00 pm on October 30, 2009. In addition to the opportunity to provide written comment, public hearings were held in Salem on October 22<sup>nd</sup> and in LaGrande on October 26<sup>th</sup>. There was no oral testimony at either hearing.

Eight letters with written comments were received and are provided in Attachment 4. A listing of all changes made to rules in response to public comments is given in Attachment 2. Agency responses and modifications to hearing draft of new rules in light of comments is given in Attachment 5.

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**V. Summary**

The proposed revisions to Chapter 690 Division 20 in Attachment I provide needed clarifications to manage a fee program on top of the other functions of the Dam Safety Program.

**VI. Alternatives**

The Commission may consider the following alternative actions:

1. Adopt the final proposed rules in Attachment I
2. Adopt modified final proposed rules
3. Not adopt the final proposed rules and request the Department further evaluate the issues.

**VII. Recommendation**

The Director recommends Alternative 1 that the Commission adopt the final proposed rules in Attachment I.

Attachments:

1. Final Proposed Rules
2. Listing of Proposed Changes from Hearing Draft to Commission Draft of rules
3. Rule Advisory Committee Makeup
4. Written Comments Received
5. Agency Responses to Comments

E. George Robison  
503-986-0840

Final Proposed Rules  
Chapter 690, Division 20  
November 19, 2009

**WATER RESOURCES DEPARTMENT**

**DIVISION 20**

**[APPROPRIATION AND USE OF SURFACE WATER ]**

*[Dams]*

**DAM SAFETY**

**690-020-00 [21] 00**

***[General Statement]***

*[The following Oregon Administrative Rules (OAR), 690-020-0022 through 690-020-0040, apply to construction of dams. For administrative purposes dams have been classified as "small" and "dams over the statutory limits". Information concerning small dams is found in 690-020-0029, and information concerning dams over the statutory limits is contained in 690-020-0035. Small dams are those that are either under ten feet in height or store less than 3,000,000 gallons (9.2 acre-feet). OAR 690-020-0040 is concerned with enforcement procedures.]*

**Purpose and Applicability**

- (1) These rules describe the standards and requirements under which the department will administer and enforce the design, construction, maintenance, inspection, and fees regarding dams in Oregon. The purpose is to provide the guidance necessary for dams to be constructed and operated in a manner that will ensure the protection of life and property and to provide the department with the resources necessary to manage and support the construction and safe operation of dams in accordance with these rules.**

Text in bold and underlined (**example**) indicates proposed new text to existing rule as contained in the public hearing draft.

Text in bold and double-underlined (**example**) indicates proposed new text to the public hearing draft.

Italicized, bold, and underlined text in brackets (***example***) indicates new text to existing rule as contained in the public hearing draft that is proposed to be removed

Italicized text in brackets (*example*) indicates existing rule text proposed to be removed.

Final Proposed Rules  
Chapter 690, Division 20  
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**(2) These rules apply to:**

- a. **Dams that are not subject to ORS 540.350 to 540.390 as described in ORS 540.400.**
- b. **Dams that are subject to ORS 540.350 to 540.390 and which exceed the statutory limits as described in ORS 540.400 (1) & (2).**

**(3) These rules do not apply to metal or reinforced concrete water storage tanks or various types of tanks that are part of water treatment facilities.**

Stat. Auth.: ORS 540.350 - ORS 540.400; **ORS 536.050**  
Stats. Implemented: ORS 183 [&]; ORS 540; **ORS 536**  
Hist.: WRD 12-1986, f. & ef. 10-3-86; WRD 12-1994, f. & cert. ef. 11-7-94

690-020-0022

**[Statutory Authority and] Definitions**

*[(1) Statutory authority for these rules is: ORS 537.130, 537.190, 537.211, 537.260, 537.410 through 537.450, 540.330 through 540.400.*

*[(2) The statutes in section (1) of this rule primarily provide for the protection of life and property, and for protection of other water rights. The following definitions are provided for the applicant's reference:]*

**The following definitions apply in OAR 690, Division 20:**

*[(a)] **(1) "Abutment" [:] means [A] a natural valley or canyon side against which the dam is built;***

*[(b)] **(2) "Acre-foot" [:] means [7] the equivalent volume of one acre covered with one foot of water (325,900 gallons);***

Text in bold and underlined (**example**) indicates proposed new text to existing rule as contained in the public hearing draft.

Text in bold and double-underlined (**example**) indicates proposed new text to the public hearing draft.

Italicized, bold, and underlined text in brackets [**example**] indicates new text to existing rule as contained in the public hearing draft that is proposed to be removed

.Italicized text in brackets [*example*] indicates existing rule text proposed to be removed.

Final Proposed Rules  
Chapter 690, Division 20  
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[(c)] **(3)** “Conduit” [:] **means** [A] **a** closed conveyance used to release water through a dam.

[(d)] Cutoff Collar: A thin collar placed at uniform intervals along an outlet conduit to retard water seepage;]

[(e)] [(d)] **(4)** “Cutoff Trench” [:] **means** [A] **a** trench excavated beneath the dam foundation and backfilled with **low permeability** [*impermeable*] material to retard water seepage;

[(e)] **(5)** “**Dam**” **means a hydraulic structure built above the natural ground grade line that is used to impound water. Dams include wastewater lagoons and other hydraulic structures that store water, attenuate floods, and divert water into canals [ , and store and treat wastewater];**

[(f)] **(6)** “Dam Crest” [:] **means** [T] **the top of the dam;**

[(g)] **(7)** “**Department**” **means the Oregon Water Resources Department;**

[(h)] **(8)** “**Director**” **means the Director of the Oregon Water Resources Department;**

[(g)]/[(i)] **(9)** “Embankment” [:] **means** [A] **an** engineered earth fill;

[(h)] [(i)] **(10)** “Emergency Spillway” [:] **means** [A] **an** overflow structure constructed to bypass flood water and prevent overtopping the dam crest. **Often, dams have two spillways. The lower elevation spillway that spills first is referred to as the principle spillway. The higher elevation spillway is referred to as the emergency spillway;**

[(i)] [(k)] **(11)** “Foundation” [:] **means** [T] **the** ground surface upon which a dam is constructed;

[(j)] [(l)] **(12)** “Freeboard” [:] **means** [T] **the** vertical distance between the designed high-water level in the reservoir and the dam crest; [*and*]

Text in bold and underlined (**example**) indicates proposed new text to existing rule as contained in the public hearing draft.

Text in bold and double-underlined (**example**) indicates proposed new text to the public hearing draft.

Italicized, bold, and underlined text in brackets [*example*] indicates new text to existing rule as contained in the public hearing draft that is proposed to be removed

Italicized text in brackets [*example*] indicates existing rule text proposed to be removed.

Final Proposed Rules  
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*[(k)] [(m)]* **(13) “Gate” or “Valve”** *[:]* **means [A] a permanent device for regulating water flow through the dam;**

*[(n)]* **(14) “Hazard Rating” means the rating established by the department for a large dam that pertains to the potential level and degree of damage to life and property downstream of a dam in the event dam failure results in a catastrophic release of water;**

*[(o)]* **(15) “Large Dam” for dam safety purposes, means a dam with a height of 10 feet or more and impounding [more than] 3,000,000 gallons (9.2 acre-feet) or more of water;**

**(16) “Significant dam work” means an activity to repair, rehabilitate, enlarge or otherwise alter a dam in which: 1) at least 30% of the fill material is impacted by the activity, 2) a spillway is being enlarged or repaired that affects the height or hydraulics of the spillway, 3) dam height and/or reservoir size is being increased, 4) a low level outlet conduit or inlet gate is being reworked with excavation or 5) any other activity that could affect the integrity of the dam or its auxiliary works;**

*[(p)]* **(17) “Small [d] Dam” for dam safety purposes, means a dam with a height of less than 10 feet or impounding less than 3,000,000 gallons (9.2 acre-feet) of water; and**

**(18) “Tank” means a fully-enclosed (bottom and sides) hydraulic structure made from metal, reinforced concrete, rigid fiberglass, or plastic that provides its own water-sealing and structural stability.**

Stat. Auth.: ORS 183 & ORS 540

Stats. Implemented: ORS 183 [ & ] ; ORS 540 ; ORS 536

Hist.: WRD 12-1986, f. & ef. 10-3-86

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690-020-0025

**General Requirements for all Dams**

- (1) The [Water Resources] [D] **director** may require any information or data in addition to that outlined herein which the [Water Resources] [D] **director** finds necessary for determining the safety of the proposed structure.
- (2) Whenever possible, precipitation [or rainfall] and runoff records shall be submitted **as part of the design for [a] new, [enlarged] or [rehabilitated structure] significant dam work on existing dams.** If records are not available for the basin in which the dam is located, the hydrological/hydraulic criteria used in the design shall be submitted.
- (3) The [Water Resources] [D] **director** may include as part of any permit to construct a [reservoir] **dam** limitations and conditions that pertain to construction, operation, maintenance, and the protection of lives and property. These limitations and conditions become, by reference, part of the certificate and remain in effect throughout the life of the water right.
- (4) Approved plans and specifications for construction are, by reference, considered limitations and conditions placed on the water right permit and water right certificate. The [Water Resources] [D] **director** retains the authority to place additional limitations and conditions on the water right relative to operation and maintenance.
- (5) Dams constructed or operated in violation of limitations and conditions included in the permit or certificate are subject to restricted use and permit cancellation procedures. The certificate affirms the applicant's right to store water subject to the limitations and conditions therein.
- (6) An outlet conduit with a minimum diameter of 8" must be installed in any instream reservoir to permit drainage of the reservoir and for passage of flow to downstream prior rights [if necessary]. The [D] **director** may waive this requirement if the Director determines that the conduit is not needed for dam safety and will not be needed to pass flow for the benefit of other water rights, minimum perennial streamflows, or if the Director determines an adequate alternative for passing flow is provided. Adequate

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alternatives must be capable of passing flow in sufficient quantity to satisfy downstream needs, and can include pumps, by-pass channels and siphons.

Conduit material should be chosen based on design and site condition requirements. Acceptable conduit materials include reinforced concrete cylinder pipe; cast-in-place, reinforced concrete; **appropriate PVC**; [*zinc-coated, fiber-treated, bituminous-coated corrugated steel; coal tar enamel-coated welded steel*] **concrete-encased corrugated metal pipe or plastic pipe**; ductile iron; and cast iron. All joints should be water tight. The conduit valve should be installed at the upstream end and should be industry-manufactured with specifications consistent to the applied usage. Special provisions should be made for pressure conduits gated on the downstream end.

**(7) The department shall determine the height of a dam by calculating the vertical distance (measured in feet) between the center point of the dam crest relative to and above the stream channel and the lower of either the natural soil surface that was in place prior to the construction of the dam or where a channel incision exists, the bottom of the channel incision. This measurement is to be taken at the maximum section along the dam's longitudinal axis.**

**(8) The department shall determine water impoundment volumes (in acre-feet or millions of gallons) as follows:**

**(a) For dams impounding water for an authorized beneficial use, the impoundment volume indicated in the area-capacity curve from the bottom of the reservoir to the [emergency] spillway crest. For dams with multiple spillways, 'spillway crest' is referring to the crest of the principle or lower elevation spillway.**

**(b) For [sewage] wastewater treatment lagoons, the impoundment volume indicated in the [sewage] wastewater lagoon plans and specifications, and**

**(c) For diversion or flood control dams, the impoundment volume calculated at full reservoir at the dam emergency (highest elevation) spillway crest level.**

Stat. Auth.: ORS 540.350 - ORS 540.400

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Stats. Implemented: ORS 183, ORS 536 & ORS 543  
Hist.: WRD 3, f. & ef. 2-18-77; WRD 12-1986, f. & ef. 10-3-86; WRD 12-1994, f. & cert. ef. 11-7-94

690-020-0029

**Small Dams, Recommended Minimum Standards**

The following information is presented for the applicant's assistance in constructing small earthfill dams [*less than ten feet in height or impounding less than 3,000,000 gallons (9.2 acre feet) (see Exhibit 1)*]:

- (1) **It is recommended that** [T] **the** The crest width of the dam [*should*] be not less than 8 feet.
- (2) **It is recommended that** [T] **the** upstream slope of the dam [*should*] be no steeper than 3:1.
- (3) **It is recommended that** [T] **the** downstream slope of the dam [*should*] be no steeper than 2:1.
- (4) **It is recommended that** [T] **the** spillway channel [*should*] be constructed around the dam, not over the top of the fill. The spillway is [*normally*] **commonly** excavated in natural material and, if necessary, lined to prevent erosion. The spillway should be large enough to pass the 50-year flood flow without overtopping the dam. Assistance is available from [*this*] **the department** [*or the watermaster*] in sizing the spillway. Flow passing through the spillway should be returned to the creek channel at a sufficient distance downstream to prevent erosion of the [*fill*] **dam's embankment**.
- (5) **It is recommended that** [A] **all** brush, stumps, roots, and organic matter should be cleared from the area to be occupied by the dam. All such material should also be removed from the borrow area.

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(6) *[A minimum of two cutoff collars should be constructed on the outlet conduit. These cutoff collars are normally constructed of concrete with a minimum thickness of 6 inches and should extend from the outside of the conduit a minimum of 24 inches in all directions. Prefabricated asphalt-dipped metal cutoff collars are acceptable, provided a watertight joint is obtained between conduit and collar.]* **It is recommended that [T] the outlet pipe [should] be encased with concrete or other method to allow for proper compaction and the prevention of uncontrolled seepage.**

(7) Embankment material should be spread parallel [e] with the dam axis in layers not exceeding eight inches in thickness and adequately compacted with sheepfoot roller or other similar equipment.

**(8) It is recommended that prior to construction the dam owner have the dam's potential hazard to downstream properties studied using methods listed in 690-020-0100. It is recommended that any dam with a potential significant or high hazard rating be designed by a registered engineer familiar with dam engineering. It is also advisable for any dam nearing or surpassing the dam height or storage thresholds for a "large dam" to be designed by a registered engineer.**

*[ED. NOTE: The Exhibit referenced in this rule is not printed in the OAR Compilation. Copies are available from the agency.]*

Stat. Auth.: ORS 183 & ORS 540  
Stats. Implemented: ORS 183 & ORS 540  
Hist.: WRD 12-1986, f. & ef. 10-3-86

690-020-0035

**[Dams Over the Statutory Limits] Large Dams; Minimum Engineering Design Requirements**

All maps, plans, and specifications for the construction [, *enlargement, repair, or alteration*] of [*all*] **new large dams or significant dam work for existing large dams** [*which are, or will be, 10 feet or more in height and will impound 3,000,000 gallons (9.2*

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*acre-feet) or more*], must be prepared by a professional engineer licensed to practice in the State of Oregon.

(2) Before initiating design, the engineer shall obtain design criteria from the [D] department.

(3) No newly constructed **large** dam [*that is 10 feet or more in height and impounds 3,000,000 gallons (9.2 acre-feet) or more*], shall be permitted to store water until written approval is received from the [*Water Resources*] [D] department. Approval will be given after construction has been completed and is certified by the supervising engineer to have been constructed in accordance with the approved plans and specifications.

(4) Design documents shall include the following:

(a) Plans:

(A) Plans for dams submitted for approval must accurately portray the work to be accomplished and be of sufficient detail to adequately define all features of the project. Plans must be submitted on good-quality mylar or vellum and must be neatly and accurately drawn to a scale sufficiently large, with an adequate number of views, for the drawing to be readily interpreted. **To meet the requirements of this subsection, the director may allow plans for dams to be submitted electronically. The format of the plans in terms of file type, projection and other details must be approved by the department.**

(B) Several sheets may be used to eliminate the necessity of large bulky drawings. No map or plan should be larger than 24 x 36 inches. The following information will be required:

(i) A contour map of the reservoir site which will show the location of the dam by quarter-quarter section, township, range and tax lot; and the name and location of the stream flowing through the reservoir. Government survey lines must be indicated on this map, along with a survey tie to the dam axis from a government land corner. Area and capacity curves and/or tables of the proposed reservoir must be shown;

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(ii) A map of the drainage basin showing the location of the dam and reservoir and the streams within the drainage area. This map may be prepared from existing reliable topographical maps and it must include: the number of square miles of drainage area; a brief description of the area; the percentage of bare and timbered lands; and general characteristics of the watershed, whether precipitous, rolling, or comparatively flat. **The estimated discharge as well as the spillway capacity at different reservoir water levels should also be provided in the plans or specifications. Extraneous information can also be included in specifications or a separate hydrology report as to not clutter up the map;**

(iii) A topographic map of the dam site with contour intervals [*of*] not to exceed 5 feet. A plan of the dam should be superimposed on this map showing the location of spillways, outlet conduits, and [*cutoff walls*] **other relevant auxiliary structures;**

(iv) A profile of the dam site taken on the axis of the dam and a profile of the spillway along its axis. The profile should also show the location of the outlet conduit and spillway. A log showing the classification of materials encountered below the surface as shown by test pits or borings [*should be included*];

(v) A cross section of the dam at maximum section showing complete details and dimensions;

(vi) Plans showing sections of the outlet conduit, control works, and spillways. These sections should be in sufficient number and detail to make definite all features of the structure.

(b) Specifications. All plans for dams must be accompanied by **construction and material** specifications:

(A) The specifications shall describe in detail the methods **and/or performance criteria** to be followed in performing each class of work and shall set forth the requirements for the various types of material to be used in [*the*] permanent construction;

(B) The specifications must contain a provision for supervision by the engineer during construction and for inspection by the [*D*] **director or director's authorized**

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representative [of the Water Resources Department] at any time during the construction period;

(C) The specifications must also contain a provision to the effect that plans or specifications shall not be altered or changed without the written approval of the [D] director [of the Water Resources Department] or the [D] director's authorized representative.

(5) Construction: Construction should be supervised by an engineer licensed to practice in Oregon. As a minimum the following notices and construction reports shall be submitted to the Department:

(a) Notice of beginning of construction;

(b) Notice of intent to begin placement of fill materials;

(c) Completion report including test results, "as-built" drawings, and certificate of completion in accordance with approved plans and specifications.

**(6) During the design process for any newly constructed [, enlarged or rehabilitated dam] dams or for significant dam work to existing dams that involves potentially changing the volume or rate of water released during failure, the dam owner or owner's representative must submit to the department an inundation analysis using methods described in 690-020-100. The department shall use this analysis to determine the hazard rating of the dam in accordance with 690-020-100.**

**(a) If a dam is rated as high hazard, an emergency action plan is required and the plan must be reviewed and approved by the department.**

**(b) The inundation/evacuation map for the dam must be developed using methods described in 690-020-100(2) and must be reviewed and approved by the department.**

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690-020-00 [39] 50

### Enforcement Procedures

The [*Water Resources*] [*D*] **director** [*will*] **shall** maintain a program of inspecting existing [*hydraulic structures*] **dams**. When any structure is found to be in violation of the terms and conditions of the permit or certificate or directly threatens life or property, or when any structure is found where lack of maintenance or unauthorized alterations could lead to a direct threat to life or property, the department shall notify the owner in writing of the violation and the action necessary to bring the structure up to design, operation, or maintenance standards. Failure by the owner to perform the required action may result in proceedings for one or more of the following:

- (1) Notice and opportunity for a contested case hearing as provided for in ORS 540.350(5).
- (2) Cancellation of the permit.
- (3) Posting of the structure to prevent storage or to limit operation until the owner has complied with the requested action required to fulfill conditions of the permit or certificate.
- (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 embankment as provided for in ORS 540.370.
- (6) Any other enforcement action permitted by law.

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Stat. Auth.: ORS 183 & ORS 540  
Stats. Implemented: ORS 183 & ORS 540  
Hist.: WRD 12-1986, f. & ef. 10-3-86

**690-020-0100**

**Hazard Rating**

**(1) Hazard ratings for “large dams” are classified by the department as “high hazard”, “significant hazard”, or “low hazard” as follows:**

- (a) High Hazard: This rating indicates that if the dam fails there is a strong plausibility for loss of life. The plausibility is established because of inhabited infrastructure (such as homes and business) downstream that would be inundated to such a degree [see 690-020-0100 (2)(d) for specific criteria] that it would put the person who inhabits the structure in jeopardy. Any factor that puts a strong probability of people being downstream in an inundation area of a dam failure shall be considered. The department shall endeavor to inspect this class of dams on an annual basis.**
- (b) Significant Hazard: This rating indicates that if a dam fails, infrastructure (such as roads, power lines or other largely uninhabited buildings) would be damaged or destroyed due to inundation and flooding. The department shall endeavor to inspect this class of dams at least once every three years.**
- (c) Low Hazard: This rating indicates that if the dam fails there is little plausibility for loss of life, and human infrastructure that could be affected by inundation downstream is minor or non-existent. The department shall endeavor to inspect this class of dams at least once every six years.**

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**(2) The department shall utilize inundation of infrastructure study results as a primary factor to determine the hazard rating of dams. Methods and modeling acceptable for inundation of infrastructure studies include:**

**(a) Hydraulic Modeling: Use of one-, two-, or three-dimensional modeling software (such as HEC-RAS, FLO-2D or MIKE) and hydrologic, topographic, and other data to estimate inundation of infrastructure downstream of dams.**

**(b) Hydrologic Routing Modeling: Use of modeling software such as HEC-HMS with hydrologic routing methods such as the Muskingum and Modified-Puls methods along with hydrologic and topographic data.**

**(c) Simplified Methods such as SMPDBK and the Washington State Method: “Dam Breach Analysis and Downstream Hazard Classification” may be used. A dam owner may request information on these methods from the department. Use of these or other simplified methods is only to be used in hazard ratings for dams, not for emergency action planning.**

**(d) Depth of inundation to trigger different hazard ratings: A depth of at least two feet over the [floorboard] finished floors of buildings or road surface of infrastructure is required to establish a “high hazard” rating. Any depth of water over the floorboards of structural buildings such as homes, barns, pump houses or storage sheds can establish a “significant hazard” rating. For roads, a depth of two feet or evidence of depth and velocity capable of creating damage can be used to establish a “significant hazard” rating.**

**(e) Specific data, methods and results for all methods must be reviewed and approved by the department prior to revising a hazard rating.**

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**3. The hazard rating of a dam shall remain in effect until the rating is revised by the department using one of the methods described in section 2. A dam owner may request that the department revise a hazard rating. The owner must provide information in support of the request. If the supporting information includes results and/or analysis using the methods described in subsections 2(a) or (b), the information must be prepared by an engineer licensed in Oregon and familiar with hydraulic and hydrologic modeling; if the information includes results and/or analysis using the methods described in subsection 2(c), the information must be prepared by a licensed engineer or a practicing hydrologist familiar with hydraulic and hydrologic calculations.**

**4. Exceptions to Hazard rating methods:**

**(a) Small dams are not assigned a hazard rating.**

**(b) Situations in which there are heavy recreational or other uses downstream, a dam may be rated as "high hazard" because of probable loss of life regardless of downstream infrastructure presence.**

**Stat. Auth.: ORS 183 & ORS 540**

**Stats. Implemented: ORS 183 & ORS 536, 540**

**Hist.:**

**690-020-0200**

**Fees for Dams**

**(1) Owners of a large dam shall submit to the department an annual fee in the amount and on the basis established under ORS 536.050.**

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(2) Dam owners who fail to pay an annual fee on or before six months after the billing date may be required to pay a late fee in the amount established under ORS 536.050.

(3) If a dam owner fails to pay the annual fee or late fee charged by the department, the department may, after giving the dam owner notice by certified mail, place a lien on the real property where the dam is located for the fees owed by the dam owner.

(4) Dams that are subject to the annual fee include dams partially or wholly in the State of Oregon that meet the definition of "dam" under OAR 690-020-0020.

(5) Multiple large dams connected together and separated only by embankments or other manmade materials (common with sewage lagoons) will count as one dam for fee purposes.

(6) Owners Exempt From Fee Requirements include:

(a) Owners of a "small dam",

(b) Owners whose dams [are part of a networks of dams] that are directly controlled or regulated for safety by an agency of the U.S. Federal Government and the agency that controls or regulates the dam has its own safety program that meets the following criteria:

(A) The program must allow for control of the design and construction process for dams under their control with licensed engineers designing and reviewing any major design or repair. Copies of all design drawings and construction records should be forwarded to the department for tracking and archival purposes.

(B) The program must have a regular dam inspection program that is either conducted by or directly supervised by a licensed engineer with expertise in dam safety. Formal documented dam inspections for high hazard dams should occur at least once per year. For significant

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**hazard dams, inspections shall occur at least once every 3 years and for low hazard dams, once every 6 years. Other more frequent inspections and reports on dam conditions may be necessary depending on the condition of individual dams. Copies of mutually agreed upon inspections and reports should be forwarded to the department for archival and tracking purposes.**

**(C) The federal agency in charge of the dam via regulation or control must also have a regular maintenance program or be able to [coerce] [require] maintenance activity from the regulated party that will address problems discovered in the inspection program.**

**(D) The federal agency must have a memorandum of understanding or agreement with the department that outlines how the federal agency meets the criteria in paragraphs (b)(A) – (C), and must agree**

**to meet at least annually with the department to review the state of the federal program for continued exemption purposes.**

**Stat. Auth.: ORS 536.050**

**Stats. Implemented: ORS 536.050**

**Hist.:**

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Combined comments and agency response and actions taken

**General Comments regarding entire rule package or large conceptual issues:**

**I. There should be no fees for the following reasons**

- a. This puts a burden on rural small businesses during an economic downturn
- b. The value of the program is not worth the fee to individual dam owners.

Selected Quotes from Comments: *(note: full comments are given in Attachment 4)*

*"Dam inspections have been done through the recent years on a regular basis in cooperation with Oregon Water Resources Department with very few changes in findings from year to year. Although it is somewhat helpful to have another organization inspect the projects from time to time, our staff and directors work very closely with the dams and are therefore always conducting inspections looking for necessary maintenance and improvements. Therefore an annual fee for this service will not be a good investment of the patrons' funds that could be better used improving the dams directly. To have such a fee would amount to over seven percent of the annual budgeted operation and maintenance rates for each of the two dams which is a drastic increase with no recognizable benefit to the district or the facilities inspected.*

*In conclusion it is the opinion of the Powder Valley Water Control District that any new fees on district dams would have a significant negative effect on the local producers who are already struggling during this difficult economic time. Therefore the district strongly urges you to not put such a burden on the local agricultural communities."*

**Agency Response:**

**Discussion/Action**

The fee is being instituted to cover a portion of the Department's expense for providing oversight of large dams. It is in the public interest that dams are properly built and maintained to reduce the potential loss of life and property damage.

The fee is being implemented to allow for more timely inspections as well as other program improvements and will not cover the cost of the dam safety program. The cost to the state general fund is estimated at approximately \$450,000 per biennium while the fee would recover approximately \$40,000 or about 9% of the program cost. Oregon has a smaller dam safety program than surrounding states and in terms of equivalent full time staff per dam inspected is one of the lowest in the nation. Based on 2007 statistics, Oregon has one full time staff equivalent per 584 dams while the average of its surrounding states is 167 dams per full time staff.

It is understandable that when a dam is in good condition and functioning properly the dam safety program seems like an unnecessary expense. However over time, all dams are likely to have problems. Having a functional dam safety program reduces the

probability that a poorly maintained or improperly designed and constructed dam will fail.

While noting the burden that is being put on dam owners, in light of all considerations, no modifications to rules or action are taken.

2. Dams exempt from the fee should be different than what is currently in the proposed rules:

- a. There is a concern that municipal water treatment facilities and tanks would come under the program and be subject to fees therefore explicit language is necessary to not have an unintended consequence of this happening..

Selected Quote from comments:

*“The Division 20 rules should be clear in their applicability. In that respect, we are concerned that the draft definition of “dam” may be interpreted to include facilities that are in fact not dams and should not be subject to the requirements of the Division 20 rules. These facilities, such as reinforced concrete and metal storage tanks, wastewater aeration basins, and wastewater clarifiers, are not currently subject to the Department’s dam inspection program and are subject to the regulatory authority of other agencies.”*

Agency Response

Discussion/Action

The Department shares this concern and proposes the insertion of the following clause into the rules under OAR 690-020-0000 (3):

*690-020-0000 (3) These rules do not apply to metal or reinforced concrete water storage tanks or various types of tanks that are part of water treatment facilities.*

There was also a comment regarding changing the proposed definition of dam to mean an “artificial barrier” versus a hydraulic structure to further protect water storage tanks from being included. However, the statutes use the term hydraulic structures in several cases and do not use the term artificial barrier. Furthermore, staff has a concern that off-channel reservoirs that pose a hazard and are currently part of the program might have grounds for an exemption under such language. For this reason, staff recommends that the proposed definition for dam retain the term “hydraulic structure”. We also feel the specific exclusion given above prevents metal tanks and other types of tanks to be included in the program. Related to this change metal tanks are explicitly defined in 690-020-0022 (18)

*“(18) “Tank” means a fully enclosed ( bottom and sides) hydraulic structure made from metal or reinforced concrete or rigid fiberglass or plastics that provides its own water sealing and structural stability.”*

- b. There is a concern that “small dams” that could pose a downstream hazard are being excluded from design requirements and other program requirements.

Selected Quote:

*"provide for the protection of life and property"... "How can you say that ODWR is doing this when it is possible to have a 1000 acre foot dam that is 9.8 feet high or a 30-foot high dam that stores 9.1 acre feet that is not required by ODWR to be designed by a registered engineer and the drawings, specifications and design documentation submitted to ODWR for review?"*

Agency Response

Discussion/Action

Department staff shares this concern. However, Oregon statute excludes dams less than 10 feet in height or impounding less than 3,000,000 gallons of water (9.2 acre feet) from the design process. (see ORS 540.400 (1)). For this reason, we do not require a hazard classification determination for dams that we do not review. Furthermore, since we do not review plans and specifications for these dams we cannot verify if they were done by a registered engineer. However, what we can do is make some recommendations regarding small dams that will set a "standard of practice" and we have added some specific language to this in light of these comments. It should be noted that all dam owners are responsible for their structures and can be liable for damage caused by a failure.

*OAR 690-020-029-(8) "It is recommended that prior to construction the dam owner has the dams potential hazard to downstream properties studied using methods listed in 690-020-0100 . It is also recommended that any dam with a potential significant or high hazard rating be designed by a registered engineer familiar with dam engineering. It is also advisable for any larger dam nearing or surpassing the dam height or storage thresholds to be designed by a registered engineer."*

- c. The exclusion for Federal dams is not exhaustive enough. For instance why does it have to be a network of dams and why is their a requirement that Federal dam entities have to do anything when they have sovereign responsibility for these dams.

Selected Quote:

*"The Districts are of the view that if a dam is subject to the safety program of a federal agency, and particular, the U.S. Bureau of Reclamation's dam safety program then not only should the dam be exempt from fee restrictions as proposed in OAR 690-020-0200(b), but the dam should simply be exempt from the entire Division 20 rules."*

Agency Response

Discussion/Action

The Department has amended the proposed rules taking out the clause in OAR 690-020-0200 regarding "network of dams." Staff agrees that no Federal Agency controls just one dam and the language is not necessary.

Agency staff does not agree that Federal agencies should be wholly exempt from Division 20 rules. Oregon has statutory responsibility for all dams that meet height and volume thresholds regardless of ownership (see ORS 540-350). Federal agencies have the same responsibility to construct and maintain dams to protect public safety. The

proposed rules do not exempt any Federal Agency from design and construction requirements. If a Federal Agency meets certain criteria for inspection and maintenance that exceed state requirements, they would be exempt from the fee requirement because the Department does not conduct regular inspections. As an example, the Department considers the current Reclamation program to exceed all our requirements. Reclamation makes regular detailed inspections of their dams with a team of experts. They have strong dam tender training and maintenance programs and repairs are made when needed.

Another minor change was suggested and made regarding changing word "coerce" to "require" for clarity in 690-020-0200 (6) (b) (C).

No changes are proposed to exempt Federal Agencies from the Division 20 rules.

- d. Waste Treatment lagoons should be exempt from fees and their inclusion represents a new activity for the Department.

Selected Quote:

*"In a departure from current rules, it appears that the Department is attempting to exert authority over wastewater storage and treatment facilities as part of its proposed amendments to its Division 20 rules. Not only is such regulation not required by statute but such facilities are already thoroughly regulated by the Oregon Department of Environmental Quality ("DEQ"). Moreover, Senate Bill 788 (2009), which according to the Departments notice of rule making is the recently adopted bill that is necessitating the current rulemaking effort, is largely a fee bill and says nothing about the Department being authorized or otherwise needing to extend its jurisdiction to include wastewater facilities."*

Agency Response

Discussion/Action

The regulatory activity regarding Dam Safety for Wastewater treatment storage facilities has been ongoing for decades. The Department currently reviews plans and conducts inspections of wastewater lagoons that exceed the statutory size limits. The authority for this activity is found in ORS 540-350. If a hydraulic structure meets criteria of size and is not used for log driving or diking on the the owners own property etc., it is part of the types of structures this program has jurisdiction over. One of the most high profile dam failures in recent years in Oregon was a wastewater lagoon (Simplot - 2006).

DEQ does not include a review for dam safety as part of their permitting process. While they do review the potential for emissions of water pollution of such facilities they do not consider total catastrophic failure. One comment asked for changes in wording from wastewater facilities to sewage lagoons. Staff could change "facilities" to "lagoon" but realized that sewage is too narrow in that it refers to waste carried through a sewer system. Therefore sewage could not be used.

Change new Dam Definition OAR 690-020-0022(e) to:

*“(5) “Dam” means a hydraulic structure built above the natural ground grade line that is used to impound water. Dams include wastewater lagoons and other hydraulic structures that store water, attenuate floods, divert water into canals.*

For OAR-020-0025 (8) (b) replace term “sewage” with “wastewater”

3. “The proposed rules should be revised to define enlargement, rehabilitation, repair and alteration.”

Selected Quote: (See above)

Agency Response

Discussion/Action

Staff shares this position. This is a good opportunity to update the rules and establish standards for significant dam work. Staff has developed a term and definition for “significant dam work” based on language developed by the Oregon Department of Fish and Wildlife.

The proposed additional clarifying language is added as noted below.

New: OAR 690-020-022 “(16) “*“Significant Dam Work” means repair, rehabilitation, enlargement or other alteration to a dam in which 1) at least 30% of the fill material is impacted by the activity, 2) a spillway is being enlarged or repaired that effects the height or hydraulics of the spillway, 3) dam height and/or reservoir size is being increased 4) a low level outlet conduit or inlet gate is being reworked with excavation or 5) any other activity that could affect the integrity of the dam or its auxiliary works”*”

OAR 690-020-025 (2) *Whenever possible, precipitation [or rainfall] and runoff records shall be submitted as part of the design for new or significant dam work on existing dams.*

“OAR 690-020-035 (1) *“All maps, plans, and specifications for the construction of new large dams or significant dam work for existing large dams”*”

OAR 690-020-035 (6) *“During the design process for any newly constructed dams or for significant dam work to existing dams that involves potentially changing the volume or rate of water released during failure, the dam owner or owner’s representative must submit to the department an inundation analysis using methods described in 690-020-100. The department shall use this analysis to determine the hazard rating of the dam in accordance with 690-020-100.”*

Line by line comments (in chronological order of the rules)

**Comment:** 690-020-0022, page 2: It appears that the upper-level numerical headings (1) and (2) are being removed. Will the **Definitions** section have a numerical heading (1) or jump directly to letters (a)– (p)?



**Response/Action: Changed to numbering to be consistent.**

**Comments:** Page 2, (e)(d) ...backfilled with impermeable material... this should be "lower permeability material". And

690-020-0022, page 2, (d): "backfilled with impermeable material" should read "backfilled with low permeability material".

**Response/Action: Changed to be "low permeability material"**

**Comment:** Page 3, General Requirements (2) ...design shall be submitted. Add ... "submitted with the design documentation".

690-020-0025, page 3, (2): Add "with the design documentation" to the end of the last sentence in this section. We want to clarify that this should not clutter the drawings and specifications (or plans).

**Response/Action: No action taken – Staff feel the current language is clear and the wording does not force cluttering on design drawings.**

**Comment:** 690-020-0022, page 3, (l) "Freeboard" definition: The designed "high-water level" during large storm events is higher than the principal spillway elevation. We propose defining "Freeboard" as "the vertical distance between the principal spillway elevation and the dam crest", or "vertical distance between emergency spillway and dam crest".

**Response/Action: No action taken. Freeboard is more complicated than this. It represents the difference in water level to top of dam during a design storm.**

**Comment:** 690-020-0022, page 3, (n): Remove the word "large". We will further explain our reasoning for this later in this letter. Basically, we think small dams can be hazardous.

**Response/Action: Staff agrees. Owners are responsible for damage caused by failure. Action taken elsewhere, see what was done regarding general comment for small dams.**

**Comment:** 690-020-0022, page 3, (p): Capitalize the "d" in "Small dam" definition.

**Response/Action: Capitalized "D".**

**Comments:** Page 4, (4) ...Approved plans and specifications... This should be approved drawings and specifications. The drawings and specifications constitute the "Plans". The word plans should not be used in lieu of drawings.

690-020-0025, page 4, (4): For engineering submittals, the word "plans" typically means "drawings and specifications". Further references to these items should be consistent with these terms. Possibly define dam plans as the set of dam drawings and dam specifications.

**Response/Action: No changes as current terminology is consistent with statute.**

**Comments:** 690-020-0025, page 4, (6): The first instance of the word "should" shows up. We believe that the word "shall" is intended. Search and replace all uses of "should" with "shall". We think that in many cases it would be best to use "shall".

Page 4 (6) There are a couple of comments here. To start, the word "should" shows up at least 5 times in this paragraph. Thou "Shall Not" use "should". The correct word is

"shall". This shows up numerous places in the rest of the document. Hopefully a word search with your word processor can find them all for you and change them.

**Response/Action:** From a statutory perspective the agency lacks authority to "prescribe" regarding small dams. They are specifically exempt from review. The Department does however provide some guidance and standards for practice. Changed the word "should" generally to "it is recommended"

**Comments:** 690-020-0025, page 4, (6): We do not believe it is necessary to specify types of pipe that are allowable to be used in construction in the rule. We recommend deleting the sentence starting with "Acceptable conduit materials include...". If you keep the sentence in you should include steel with alum. coating and types of appropriate PVC. Second item, regarding pipe. You might check with a couple of pipe manufacturers on this. I do not think fiber-treated bituminous-coated corrugated steel pipe is available anymore. This is probably due to the environmental hazards of the dip tank. An alternate is Aluminized Type II Coating meeting AASHTO M-274. There may be a newer polymer type coating available in addition to this. Check with Contech or the pipe plant at Eugene, OR.

**Response/Action:** We have removed some of the pipe types that are more exotic. This listing is not meant to be exhaustive. We have also added concrete encased corrugated metal pipe or plastic pipe because the encasement makes these materials acceptable.

**Comment:** 690-020-0025, page 4, (7): Add the word "maximum" in front of "vertical distance", and replace "between the center point of the dam crest..." with "between the centerline of the dam crest and the native ground". Alternatively, the "height of dam is maximum vertical distance of crest of dam to original native ground".

**Response/Action:** The following clause is added at end to ensure that the measurement is taken at the maximum section: "This measurement is to be taken at the maximum section along the dam's longitudinal axis."

**Comments:** Page 4, (8) Insert "for classification purposes" in the first sentence after "volumes".

690-020-0025, page 4, (8): Add "for classification purposes" after "(in acre-feet or millions of gallons)" and before "as follows".

**Response/Action:** No action taken. Not sure what is meant by classification. May want to incorporate, I assume this is for determining large or small dams,

**Comments:** Page 4, (8)(a) ...bottom of the reservoir to the emergency spillway... Do you mean principal spillway? This would be consistent with the storage volume used in a permit application.

690-020-0025, page 4, (8) (a): Replace "emergency spillway crest" with "principal spillway elevation or normal full water elevation".

**Response/Action:** Changed language to incorporate multiple elevation spillways on a dam with the principal spillway being the standard. Added information to the definition of emergency spillway that distinguishes between principal and emergency spillways.

**Comments:** 690-020-0025, page 4, (8) (c): Replace “dam crest level” with “emergency spillway level”....Flood control dams need volume at flood levels.

Page 4, (8)(c) ...full reservoir at the dam crest... Do you mean spillway crest?

**Response/Action:** **Changed to emergency spillway crest. Please note that concrete detention dams and some storage dams overtop and the crest is the emergency spillway.**

Page 5, (1) ...should... This should be "shall". Top width, picky point, but with current construction equipment it is difficult, at best, to construct an 8-foot top width. Ten feet should be the minimum.

**Response/Action:** **See comments regarding small dams in general section – replaced should with recommends in general.**

**Comments:** 690-020-0029, page 5, (4): Insert a specification for the minimum acceptable amount of freeboard in this section. Is the construction of a small dam “to pass the 50-year flood flow without overtopping” conservative enough? We believe this should be a minimum of 100-year flood flow unless some type of hazard analysis is done. Possibly use 50-yr flood and specify a minimum freeboard. Replace the last word of this section “fill” with the words “dam embankment”.

Page 5, (4) ...to pass the 50 year flood flow without overtopping. My opinion this should be a minimum of 100-year unless some type of hazard analysis is done.

**Response/Action:** **Changed the 50 year without topping to 50 year with 2 feet of freeboard to top of dam embankment. Replaced fill with “dam’s embankment.”**

**Comments:** 690-020-0035, pages 6 and 7: Additional uses of “plans” along with “specifications” but not “drawings”. We think it should be consistent that plans equal the drawings and the specifications. The text seems inconsistent.

Page 6, (4)(a) "Plans" should be "Drawings". Also in (A) "plans" shows up in two places. If you mean the drawings and specifications this is ok. If you mean the drawings only then the words should be changed to drawings.

**Response/Action:** **No action taken as the terms plans is in statute and this should remain consistent with statutes.**

**Comment:** 690-020-0035, page 7, (4) (a) (B) (ii): In the second sentence after “square miles” add “or acres”. In the last sentence of this section, replace the words “at different water levels” with “at different flow events”. We believe some of the descriptive information specified in this section to be placed on a map is better placed in the design report. The hydrology data should not be in plans, but should be in the design report.

**Response/Action:** **Added the phrase: “*Extraneous information can also be included in specifications or a separate hydrology report as to not clutter up the map.*”** Staff added the term “reservoir” in front of term “*water level*” to help clarify.

**Comment:** Page 7, (ii) You might add "or acres" after "square miles" (3rd line). Also There should be a period after "square miles". The items listed after that ie " a brief description of the area...percentage of bare and timbered...general watershed characteristics" should be included in the design documentation with the hydrology documentation. The purpose of the drawings is to provide the contractor direction in what is to be constructed. Extraneous materials such as this should NOT be on the drawings.

Obviously, they are important and should be include in the design documentation as noted.

**Response/Action:** See immediate comment above for moving information off map. No other action taken.

**Comments:** 690-020-0035, page 7, (4) (a) (B) (iii): In the second sentence replace "cutoff walls" with "cutoff collars".

Page 7, (iii) ...cutoff walls... If you mean cutoff collars than say so to be consistent with earlier uses of this term.

**Response/Action:** Removed cutoff walls however did not replace with cutoff collars as newer dam literature discourages their use.

**Comment:** Page 7, (b) add "material" after " construction" so that it reads "construction and material specifications

**Response/Action:** Added word material..

**Comments:** 690-020-0035, page 7, (4) (b) (A): The wording for "specifications shall describe in detail the methods to be followed" is not flexible enough to allow engineers to use "performance specifications" in addition to or in place of "method specifications". We suggest rewording this sentence to allow both "method" and "performance" specifications. We do not think requiring all methods specifications is prudent.

Page 7, (A) ...describe in detail the methods... This is a big no-no. The means and methods are up to the contractor. If the Engineer describes the means and methods and they do not work then he is responsible. If you require the Engineer to do that then you may be responsible. Certainly the types of material can be specified (ie concrete, toe drain rock etc.). One can also to some extent the type of construction equipment can be specified (such as a sheepsfoot roller as opposed to a smooth roller etc). But in any case one has to be extremely careful about spelling out means and methods.

**Response/Action:** Added the clause after method "*and/or performance criteria.*" No other action is taken. This is existing rule language and has not been an issue over the last 15 years.

**Comment:** Page 8, (5)(c) "plans" should be "drawings.

**Response/Action:** None: This is existing rule language and has not been an issue over the last 15 years. The Department understands the distinction between plan and drawing but, changing the terminology for this step will create more confusion and create inconsistency between rules and statutes.

**Comment:** Page 8, (6) ..."any newly constructed"... this implies that the inundation analysis can be submitted after the dam is constructed. I would assume that the intent is to have the inundation analysis completed as part of the design process so that the hazard rating can affect the design. This section needs to be reworded.

**Response/Action:** Reworded for other reasons to include dams that are being modified. Department does not see the problem it says "during design process" so the dam should not be already constructed? The newly constructed does not imply the dam is already built but to distinguish it from significant work to existing dams.

**Comment:** 690-020-0035, page 8, (6) (a) and (b): Combine section (b) into section (a) or place the words “If a dam is rated as a high hazard, the inundation...” at the beginning of section (b).

**Response/Action:** No action taken. These were previously combined and then separated during rule advisory process.

**Comment:** Page 9, Hazard Ratings.

Barry and George, I guess 27 years with SCS, even though that was 25 years ago, has permanently warped my mind. Where other criteria has been established for 50+ years why not try to be consistent with it. SCS (NRCS) has their a, b and c ratings as low, intermediate and high (in that order) your a, b and c are in reverse order. A really picky point, but why not try to avoid the potential confusion!!

**Response/Action:** No action taken. There is inconsistency among states as well as Federal Agencies. These hazard ratings match current agency practice.

**Comment:** 690-020-0100, page 10, (2): Subsections (a), (b), and (c) are all methods or models acceptable for studies. Subsections (d) and (e) are not methods or modeling but rather definitions or additional information. Can the information in subsections (d) and (e) be placed in the main paragraph of section (2) prior to listing the three methods in (a) – (c)? We also believe that the order of these three methods should be reversed with the “simplified” methods as paragraph (a).

**Response/Action:** No action taken. To clarify, any method can be right or wrong based on site specific conditions. That is why the analysis needs approval from the Department.

**Comment:** 690-020-0100, page 10, (2) (d): Replace the word “floorboard” with the words “finished floor”.

**Response/Action:** Made wording change.

**Comment:** 690-020-0100, page 11, (4) (a): We firmly believe that small dams should be assigned a hazard rating. A simplified hazard analysis method can be utilized or a qualitative analysis of downstream receptors of a small dam can be completed to determine a hazard rating for a small dam. Small dams that are classified as “Significant Hazard” or “High Hazard” would then have to meet the design criteria for large dams.

**Response/Action:** No action taken. Department practice has been not to assign a hazard rating to small dams.

**Comment:** 690-020-0200, page 11, (1): Although there is a reference to “annual” fees in this section, there are currently no fees documented in ORS 536.050. We assume that ORS is going to be revised at the same time.

**Response/Action:** The fees were established by legislation and will be included in the next publication of statutes.

**Comment:** As a final comment, Oregon’s engineer licensing board (OSBEELS) has determined that any dam design is engineering. We believe Division 20 is an appropriate location to note that all dam design is required by statute to be done by a registered engineer with the exception of a small dam that has no public danger constructed on private property and designed by the property owner. This requirement should be included in the small dam section of Division 20.

**Response/Action:** See point regarding Comment to 690-020-0200 above and overall comment regarding small dams done in general comments. We cannot create rules beyond our statutory authority.

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*Department Modifications to Public Hearing Draft (in Division 20 rule order)*

690-020-00 [21] 00

Purpose and Applicability

- 690-020-00 [21] 00 (3): Added the following clause to make sure metal and concrete tanks used in water treatment processes are exempt in response to public comments: “These rules do not apply to metal or reinforced concrete water storage tanks or various types of tanks that are part of water treatment facilities.”

690-020-0022

*[Statutory Authority and] Definitions*

- 690-020-0022 (1-18): Changed small letters to numbers for consistency in response to public comment.
- 690-020-0022 (4): Term “low permeability” replaces “impermeable” because material is not impermeable as per public comment.
- 690-020-0022 (5): Clause “store and treat wastewater” replaced with “wastewater lagoon” in response to concern by public comment that this may cause jurisdictional encroachment into new areas.
- 690-020-0022 (8): Added the following phrase: “Often, dams have two spillways. The lower elevation spillway that spills first is referred to as the principle spillway. The higher elevation spillway is referred to as the emergency spillway.” This was done in response to public comment asking for more clarity in defining spillways.
- 690-020-0022 (15): Added the phrase “or more” after “gallons” to ensure that it is understood that Large applies to all dams over that size not just ones that equal that size.
- 690-020-0022 (16): Added the following definition: “Significant dam work” means an activity to repair, rehabilitate, enlarge or otherwise alter a dam in which: 1) at least 30% of the fill material is impacted by the activity, 2) a spillway is being enlarged or repaired that affects the height or hydraulics of the spillway, 3) dam height and/or reservoir size is being increased, 4) a low level outlet conduit or inlet gate is being reworked with excavation or 5) any

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other activity that could affect the integrity of the dam or its auxiliary works.” This was done in response to public comments that we need to better define what constitutes dam work that requires engineering. The 30% criteria is consistent with ODFW rules.

- 690-020-0022 (17): Capitalized word “Dam” for consistency in this context.
- 690-020-0022 (18): Added the following definition: “Tank” means a fully enclosed (bottom and sides) hydraulic structure made from metal or reinforced concrete or rigid fiberglass or plastics that provides its own water sealing and structural stability.” This was part of response to concern in public comments that water treatment tanks be exempt.

690-020-0025

#### General Requirements for all Dams

- 690-020-0025 (2) replaced phrase “a new, enlarged, or rehabilitated structure” with “significant dam work on existing dams” to better clarify what constitutes dam alteration work that requires engineering oversight.
- 690-020-0025 (6) deleted phrase “zinc coated, fiber treated, bituminous-coated corrugated steel; coal tar enamel welded steel;” and replaced with “concrete encased corrugated metal pipe or plastic pipe” because the former is not commonly available anymore according to public comment.
- 690-020-0025 (7) added phrase: “This measurement is to be taken at the maximum section along the dam’s longitudinal axis.” This is to clarify where measurement is to be taken in response to public comment.
- 690-020-0025 (8) (a) Added clarifying language at end of sentence “For dams with multiple spillways this is to the principle or lower elevation spillway crest.” This done to clarify in response to public comment.
- OAR-020-0025 (8) (b) replace term “sewage” with “wastewater” to be consistent with other sections.
- 690-020-0025 (8) (c) Added the phrase: “emergency (highest elevation) spillway” to clarify volume calculation for flood control dams in response to public comment.



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690-020-0029

**Small Dams, Recommended Minimum Standards**

- 690-020-0029 (1-6): The term “**should**” was deleted and the clause “**It is recommended**” replaced it where appropriate to clarify the fact the department claims no statutory authority to enforce standards on small dams. Clarification requested in public comments.
- 690-020-0029 (4) : replaced term “**fill**” with “**dam’s embankment**” for clarification in response to public comment.
- 690-020-0029 (8): Added the following in response to two public comments that stated with significant justification that small dams should be engineered if they pose any hazard to the public: “**It is recommended that prior to construction the dam owner has the dams potential hazard to downstream properties studied using methods listed in 690-020-0100 . It is recommended that any dam with a potential significant or high hazard rating be designed by a registered engineer familiar with dam engineering. It is also advisable for any dam nearing or surpassing the dam height or storage thresholds for a “large dam” to be designed by a registered engineer.**”

690-020-0035

**[Dams Over the Statutory Limits] Large Dams; Minimum Engineering Design Requirements**

- 690-020-0035 : Replaced “enlargement, repair, or alteration” with phrase “**of new large dams or significant dam work for existing**” as part of response to public comment that we needed to better define what alterations to existing dams require engineering.
- 690-020-0035 (4) (a) (B) (ii) added phrase: **Extraneous information can also be included in specifications or a separate hydrology report as to not clutter up the map;** to clarify that information can be included elsewhere if it clutters the drawing too much as per public comment.
- 690-020-0035 (4) (a) (B) (ii) added term “**reservoir**” in front of term “*water level*” to help clarify in response to public comment.
- 690-020-0035 (4) (b): Added term: “**and material**” for clarification in response to public comment.

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- 690-020-0035 (4) (b) (A): Added clause: “and/or performance criteria” after the word methods to respond to concern in public comments that simply using “method” constrains the engineer in creating specifications for the contractor.
- 690-020-0035 (6): Deleted phrase “*enlarged or rehabilitated dam*” with “dams or for significant dam work to existing dams that involves potentially changing the volume or rate of water released during failure.” To better clarify when work requires this extra effort in reply to public comments.

690-020-0100

Hazard Rating

- 690-020-0100 (2) (d): Replaced “floorboard” with “finished floors of buildings” for clarification in response to comments.
- 690-020-0100 (6) (b): Deleted “are part of a network of dams” in response to public comment that this was unnecessarily narrowing the criteria for exemption.

690-020-0200

Fees for Dams

- 690-020-0200 (6) (b) (c) : term “coerce” replaced by “require” for clarity in response to public comment.



► The Oregon Administrative Rules contain OARs filed through August 15, 2014 ◀

**QUESTIONS ABOUT THE CONTENT OR MEANING OF THIS AGENCY'S RULES?**  
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## WATER RESOURCES DEPARTMENT

### DIVISION 20

#### DAM SAFETY

690-020-0000

#### Purpose and Applicability

(1) These rules describe the standards and requirements under which the department will administer and enforce the design, construction, maintenance, inspection, and fees regarding dams in Oregon. The purpose is to provide the guidance necessary for dams to be constructed and operated in a manner that will ensure the protection of life and property and to provide the department with the resources necessary to manage and support the construction and safe operation of dams in accordance with these rules.

(2) These rules apply to:

(a) Dams that are not subject to ORS 540.350–540.390 as described in 540.400.

(b) Dams that are subject to ORS 540.350–540.390 and which exceed the statutory limits as described in ORS 540.400(1) & (2).

(3) These rules do not apply to metal or reinforced concrete water storage tanks or various types of tanks that are part of water treatment facilities.

Stat. Auth.: ORS 540.350 - 540.400, 536.050

Stats. Implemented: ORS 183, 540, 536

Hist.: WRD 12-1986, f. & ef. 10-3-86; WRD 12-1994, f. & cert. ef. 11-7-94; Renumbered from 690-020-0021, WRD 7-2009, f. 12-7-09, cert. ef. 1-1-10

690-020-0021 [Renumbered to 690-020-0000]

690-020-0022

#### Definitions

The following definitions apply in OAR 690, Division 20:

- (1) "Abutment" means a natural valley or canyon side against which the dam is built;
- (2) "Acre-foot" means the equivalent volume of one acre covered with one foot of water (325,900 gallons);
- (3) "Conduit" means a closed conveyance used to release water through a dam;
- (4) "Cutoff Trench" means a trench excavated beneath the dam foundation and backfilled with low permeability material to retard water seepage;
- (5) "Dam" means a hydraulic structure built above the natural ground grade line that is used to impound water. Dams include wastewater lagoons and other hydraulic structures that store water, attenuate floods, and divert water into canals;
- (6) "Dam Crest" means the top of the dam;
- (7) "Department" means the Oregon Water Resources Department;
- (8) "Director" means the Director of the Oregon Water Resources Department;

- (9) "Embankment" means an engineered earth fill;
- (10) "Emergency Spillway" means an overflow structure constructed to bypass flood water and prevent overtopping the dam crest. Often, dams have two spillways. The lower elevation spillway that spills first is referred to as the principle spillway. The higher elevation spillway is referred to as the emergency spillway;
- (11) "Foundation" means the ground surface upon which a dam is constructed;
- (12) "Freeboard" means the vertical distance between the designed high-water level in the reservoir and the dam crest;
- (13) "Gate" or "Valve" means a permanent device for regulating water flow through the dam;
- (14) "Hazard Rating" means the rating established by the department for a large dam that pertains to the potential level and degree of damage to life and property downstream of a dam in the event dam failure results in a catastrophic release of water;
- (15) "Large Dam" for dam safety purposes, means a dam with a height of 10 feet or more and impounding 3,000,000 gallons (9.2 acre-feet) or more of water;
- (16) "Significant dam work" means an activity to repair, rehabilitate, enlarge or otherwise alter a dam in which: 1) at least 30% of the fill material is impacted by the activity, 2) a spillway is being enlarged or repaired that affects the height or hydraulics of the spillway, 3) dam height and/or reservoir size is being increased, 4) a low level outlet conduit or inlet gate is being reworked with excavation or 5) any other activity that could affect the integrity of the dam or its auxiliary works;
- (17) "Small dam" for dam safety purposes, means a dam with a height of less than 10 feet or impounding less than 3,000,000 gallons (9.2 acre-feet) of water; and
- (18) "Tank" means a fully-enclosed (bottom and sides) hydraulic structure made from metal, reinforced concrete, rigid fiberglass, or plastic that provides its own water-sealing and structural stability.

Stat. Auth.: ORS 183 & 540

Stats. Implemented: ORS 183 & 540, 536

Hist.: WRD 12-1986, f. & ef. 10-3-86; WRD 7-2009, f. 12-7-09, cert. ef. 1-1-10

690-020-0025

#### General Requirements for all Dams

- (1) The director may require any information or data in addition to that outlined herein which the director finds necessary for determining the safety of the proposed structure.
- (2) Whenever possible, precipitation and runoff records shall be submitted as part of the design for new or significant dam work on existing dams. If records are not available for the basin in which the dam is located, the hydrological/hydraulic criteria used in the design shall be submitted.
- (3) The director may include as part of any permit to construct a dam limitations and conditions that pertain to construction, operation, maintenance, and the protection of lives and property. These limitations and conditions become, by reference, part of the certificate and remain in effect throughout the life of the water right.
- (4) Approved plans and specifications for construction are, by reference, considered limitations and conditions placed on the water right permit and water right certificate. The director retains the authority to place additional limitations and conditions on the water right relative to operation and maintenance.
- (5) Dams constructed or operated in violation of limitations and conditions included in the permit or certificate are subject to restricted use and permit cancellation procedures. The certificate affirms the applicant's right to store water subject to the limitations and conditions therein.
- (6) An outlet conduit with a minimum diameter of 8" must be installed in any instream reservoir to permit drainage of the reservoir and for passage of flow to downstream prior rights. The director may waive this requirement if the director determines that the conduit is not needed for dam safety and will not be needed to pass flow for the benefit of other water rights, minimum perennial streamflows, or if the director determines an adequate alternative for passing flow is provided. Adequate alternatives must be capable of passing flow in sufficient quantity to satisfy downstream needs, and can include pumps, by-pass channels and siphons. Conduit material should be chosen based on design and site condition requirements. Acceptable conduit materials include reinforced concrete cylinder pipe; cast-in-place, reinforced concrete; appropriate PVC; concrete-encased corrugated metal pipe or plastic pipe; ductile iron; and cast iron. All joints should be water tight. The conduit valve should be installed at the upstream end and should be industry-manufactured with specifications consistent to the applied usage. Special provisions should be made for pressure conduits gated on the downstream end.

(7) The department shall determine the height of a dam by calculating the vertical distance (measured in feet) between the center point of the dam crest relative to and above the stream channel and the lower of either the natural soil surface that was in place prior to the construction of the dam or where a channel incision exists, the bottom of the channel incision. This measurement is to be taken at the maximum section along the dam's longitudinal axis.

(8) The department shall determine water impoundment volumes (in acre-feet or millions of gallons) as follows:

(a) For dams impounding water for an authorized beneficial use, the impoundment volume indicated in the area-capacity curve from the bottom of the reservoir to the spillway crest. For dams with multiple spillways, 'spillway crest' is referring to the crest of the principle or lower elevation spillway.

(b) For wastewater treatment lagoons, the impoundment volume indicated in the wastewater lagoon plans and specifications, and

(c) For diversion or flood control dams, the impoundment volume calculated at full reservoir at the dam emergency (highest elevation) spillway crest level.

Stat. Auth.: ORS 540.350 - 540.400

Stats. Implemented: ORS 183, 536 & 543

Hist.: WRD 3, f. & ef. 2-18-77; WRD 12-1986, f. & ef. 10-3-86; WRD 12-1994, f. & cert. ef. 11-7-94; WRD 7-2009, f. 12-7-09, cert. ef. 1-1-10

**690-020-0029**

#### **Small Dams, Recommended Minimum Standards**

The following information is presented for the applicant's assistance in constructing small earthfill dams:

(1) It is recommended that the crest width of the dam be not less than 8 feet.

(2) It is recommended that the upstream slope of the dam be no steeper than 3:1.

(3) It is recommended that the downstream slope of the dam be no steeper than 2:1.

(4) It is recommended that the spillway channel be constructed around the dam, not over the top of the fill. The spillway is commonly excavated in natural material and, if necessary, lined to prevent erosion. The spillway should be large enough to pass the 50-year flood flow without overtopping the dam. Assistance is available from the department in sizing the spillway. Flow passing through the spillway should be returned to the creek channel at a sufficient distance downstream to prevent erosion of the dam's embankment.

(5) It is recommended that all brush, stumps, roots, and organic matter should be cleared from the area to be occupied by the dam. All such material should also be removed from the borrow area.

(6) It is recommended that the outlet pipe be encased with concrete or other method to allow for proper compaction and the prevention of uncontrolled seepage.

(7) Embankment material should be spread parallel with the dam axis in layers not exceeding eight inches in thickness and adequately compacted with sheepfoot roller or other similar equipment.

(8) It is recommended that prior to construction the dam owner have the dam's potential hazard to downstream properties studied using methods listed in 690-020-0100. It is recommended that any dam with a potential significant or high hazard rating be designed by a registered engineer familiar with dam engineering. It is advisable for any dam nearing or surpassing the dam height or storage thresholds for a "large dam" to be designed by a registered engineer.

Stat. Auth.: ORS 183 & 540

Stats. Implemented: ORS 183 & 540

Hist.: WRD 12-1986, f. & ef. 10-3-86; WRD 7-2009, f. 12-7-09, cert. ef. 1-1-10

**690-020-0035**

#### **Dams Over the Statutory Limits; Minimum Engineering Design Requirements**

All maps, plans, and specifications for the construction of new large dams or significant dam work for existing large dams, must be prepared by a professional engineer licensed to practice in the State of Oregon.

(2) Before initiating design, the engineer shall obtain design criteria from the department.

(3) No newly constructed large dam shall be permitted to store water until written approval is received from the department. Approval will be given after construction has been completed and is certified by the supervising engineer to have been constructed in accordance with the approved

plans and specifications.

(4) Design documents shall include the following:

(a) Plans:

(A) Plans for dams submitted for approval must accurately portray the work to be accomplished and be of sufficient detail to adequately define all features of the project. Plans must be submitted on good-quality mylar or vellum and must be neatly and accurately drawn to a scale sufficiently large, with an adequate number of views, for the drawing to be readily interpreted. To meet the requirements of this subsection, the director may allow plans for dams to be submitted electronically. The format of the plans in terms of file type, projection and other details must be approved by the department.

(B) Several sheets may be used to eliminate the necessity of large bulky drawings. No map or plan should be larger than 24 x 36 inches. The following information will be required:

(i) A contour map of the reservoir site which will show the location of the dam by quarter-quarter section, township, range and tax lot; and the name and location of the stream flowing through the reservoir. Government survey lines must be indicated on this map, along with a survey tie to the dam axis from a government land corner. Area and capacity curves and/or tables of the proposed reservoir must be shown;

(ii) A map of the drainage basin showing the location of the dam and reservoir and the streams within the drainage area. This map may be prepared from existing reliable topographical maps and it must include: the number of square miles of drainage area; a brief description of the area; the percentage of bare and timbered lands; and general characteristics of the watershed, whether precipitous, rolling, or comparatively flat. The estimated discharge as well as the spillway capacity at different reservoir water levels should also be provided in the plans or specifications. Extraneous information can also be included in specifications or a separate hydrology report as to not clutter up the map;

(iii) A topographic map of the dam site with contour intervals not to exceed 5 feet. A plan of the dam should be superimposed on this map showing the location of spillways, outlet conduits, and other relevant auxiliary structures;

(iv) A profile of the dam site taken on the axis of the dam and a profile of the spillway along its axis. The profile should also show the location of the outlet conduit and spillway. A log showing the classification of materials encountered below the surface as shown by test pits or borings;

(v) A cross section of the dam at maximum section showing complete details and dimensions;

(vi) Plans showing sections of the outlet conduit, control works, and spillways. These sections should be in sufficient number and detail to make definite all features of the structure.

(b) Specifications. All plans for dams must be accompanied by construction and material specifications;

(A) The specifications shall describe in detail the methods and/or performance criteria to be followed in performing each class of work and shall set forth the requirements for the various types of material to be used in permanent construction;

(B) The specifications must contain a provision for supervision by the engineer during construction and for inspection by the director or director's authorized representative at any time during the construction period;

(C) The specifications must also contain a provision to the effect that plans or specifications shall not be altered or changed without the written approval of the director or the director's authorized representative.

(5) Construction: Construction should be supervised by an engineer licensed to practice in Oregon. As a minimum the following notices and construction reports shall be submitted to the Department:

(a) Notice of beginning of construction;

(b) Notice of intent to begin placement of fill materials;

(c) Completion report including test results, "as-built" drawings, and certificate of completion in accordance with approved plans and specifications.

(6) During the design process for any newly constructed dams or for significant dam work to existing dams that involves potentially changing the volume or rate of water released during failure, the dam owner or owner's representative must submit to the department an inundation analysis using methods described in 690-020-100. The department shall use this analysis to determine the hazard rating of the dam in accordance with 690-020-100.

(a) If a dam is rated as high hazard, an emergency action plan is required and the plan must be reviewed and approved by the department.

(b) The inundation/evacuation map for the dam must be developed using methods described in 690-020-100(2) and must be reviewed and approved by the department.

Stat. Auth.: ORS 540.350 - 540.400

Stats. Implemented: ORS 183, 536 & 540

Hist.: WRD 3, f. & ef. 2-18-77; WRD 12-1986, f. & ef. 10-3-86; WRD 12-1994, f. & cert. ef. 11-7-94; WRD 7-2009, f. 12-7-09, cert. ef. 1-1-10

690-020-0039 [Renumbered to 690-020-0050]

690-020-0050

#### Enforcement Procedures

The director shall maintain a program of inspecting existing dams. When any structure is found to be in violation of the terms and conditions of the permit or certificate or directly threatens life or property, or when any structure is found where lack of maintenance or unauthorized alterations could lead to a direct threat to life or property, the department shall notify the owner in writing of the violation and the action necessary to bring the structure up to design, operation, or maintenance standards. Failure by the owner to perform the required action may result in proceedings for one or more of the following:

(1) Notice and opportunity for a contested case hearing as provided for in ORS 540.350(5).

(2) Cancellation of the permit.

(3) Posting of the structure to prevent storage or to limit operation until the owner has complied with the requested action required to fulfill conditions of the permit or certificate.

(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 embankment as provided for in ORS 540.370.

(6) Any other enforcement action permitted by law.

Stat. Auth.: ORS 183 & 540

Stats. Implemented: ORS 183 & 540

Hist.: WRD 12-1986, f. & ef. 10-3-86; Renumbered from 690-020-0039, WRD 7-2009, f. 12-7-09, cert. ef. 1-1-10

690-020-0100

#### Hazard Rating

(1) Hazard ratings for "large dams" are classified by the department as "high hazard", "significant hazard", or "low hazard" as follows:

(a) High Hazard: This rating indicates that if the dam fails there is a strong plausibility for loss of life. The plausibility is established because of inhabited infrastructure (such as homes and business) downstream that would be inundated to such a degree see 690-020-0100(2)(d) for specific criteria that it would put the person who inhabits the structure in jeopardy. Any factor that puts a strong probability of people being downstream in an inundation area of a dam failure shall be considered. The department shall endeavor to inspect this class of dams on an annual basis.

(b) Significant Hazard: This rating indicates that if a dam fails, infrastructure (such as roads, power lines or other largely uninhabited buildings) would be damaged or destroyed due to inundation and flooding. The department shall endeavor to inspect this class of dams at least once every three years.

(c) Low Hazard: This rating indicates that if the dam fails there is little plausibility for loss of life, and human infrastructure that could be affected by inundation downstream is minor or non-existent. The department shall endeavor to inspect this class of dams at least once every six years.

(2) The department shall utilize inundation of infrastructure study results as a primary factor to determine the hazard rating of dams. Methods and modeling acceptable for inundation of infrastructure studies include:

(a) Hydraulic Modeling: Use of one-, two-, or three-dimensional modeling software (such as HEC-RAS, FLO-2D or MIKE) and hydrologic, topographic, and other data to estimate inundation of infrastructure downstream of dams.

(b) Hydrologic Routing Modeling: Use of modeling software such as HEC-HMS with hydrologic routing methods such as the Muskingum and Modified-Puls methods along with hydrologic and topographic data.

(c) Simplified Methods such as SMPDBK and the Washington State Method: "Dam Breach Analysis and Downstream Hazard Classification" may be used. A dam owner may request information on these methods from the department. Use of these or other simplified methods is only to be used in hazard ratings for dams, not for emergency action planning.

(d) Depth of inundation to trigger different hazard ratings: A depth of at least two feet over the finished floors of buildings or road surface of infrastructure is required to establish a "high hazard" rating. Any depth of water over the floorboards of structural buildings such as homes, barns, pump houses or storage sheds can establish a "significant hazard" rating. For roads, a depth of two feet or evidence of depth and velocity capable of creating damage can be used to establish a "significant hazard" rating.

(e) Specific data, methods and results for all methods must be reviewed and approved by the department prior to revising a hazard rating.

(3) The hazard rating of a dam shall remain in effect until the rating is revised by the department using one of the methods described in section 2. A dam owner may request that the department revise a hazard rating. The owner must provide information in support of the request. If the supporting information includes results and/or analysis using the methods described in subsections 2(a) or (b), the information must be prepared by an engineer licensed in Oregon and familiar with hydraulic and hydrologic modeling; if the information includes results and/or analysis using the methods described in subsection 2(c), the information must be prepared by a licensed engineer or a practicing hydrologist familiar with hydraulic and hydrologic calculations.

(4) Exceptions to Hazard rating methods:

(a) Small dams are not assigned a hazard rating.

(b) Situations in which there are heavy recreational or other uses downstream, a dam may be rated as "high hazard" because of probable loss of life regardless of downstream infrastructure presence.

Stat. Auth.: ORS 183 & 540

Stats. Implemented: ORS 183 & 536, 540

Hist.: WRD 7-2009, f. 12-7-09, cert. ef. 1-1-10

690-020-0200

#### Fees for Dams

(1) Owners of a large dam shall submit to the department an annual fee in the amount and on the basis established under ORS 536.050.

(2) Dam owners who fail to pay an annual fee on or before six months after the billing date may be required to pay a late fee in the amount established under ORS 536.050.

(3) If a dam owner fails to pay the annual fee or late fee charged by the department, the department may, after giving the dam owner notice by certified mail, place a lien on the real property where the dam is located for the fees owed by the dam owner.

(4) Dams that are subject to the annual fee include dams partially or wholly in the State of Oregon that meet the definition of "dam" under OAR 690-020-0020.

(5) Multiple large dams connected together and separated only by embankments or other manmade materials (common with sewage lagoons) will count as one dam for fee purposes.

(6) Owners Exempt from Fee Requirements include:

(a) Owners of a "small dam",

(b) Owners whose dams that are directly controlled or regulated for safety by an agency of the U.S. Federal Government and the agency that controls or regulates the dam has its own safety program that meets the following criteria:

(A) The program must allow for control of the design and construction process for dams under their control with licensed engineers designing and reviewing any major design or repair. Copies of all design drawings and construction records should be forwarded to the department for tracking and archival purposes.

(B) The program must have a regular dam inspection program that is either conducted by or directly supervised by a licensed engineer with expertise in dam safety. Formal documented dam inspections for high hazard dams should occur at least once per year. For significant hazard dams, inspections shall occur at least once every 3 years and for low hazard dams, once every 6



years. Other more frequent inspections and reports on dam conditions may be necessary depending on the condition of individual dams. Copies of mutually agreed upon inspections and reports should be forwarded to the department for archival and tracking purposes.

(C) The federal agency in charge of the dam via regulation or control must also have a regular maintenance program or be able to require maintenance activity from the regulated party that will address problems discovered in the inspection program.

(D) The federal agency must have a memorandum of understanding or agreement with the department that outlines how the federal agency meets the criteria in paragraphs (b)(A)–(C), and must agree to meet at least annually with the department to review the state of the federal program for continued exemption purposes.

Stat. Auth.: ORS 536.050

Stats. Implemented: ORS 536.050

Hist.: WRD 7-2009, f. 12-7-09, cert. ef. 1-1-10

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