

Virginia Soil and Water Conservation Board
Dam Safety Technical Advisory Committee Table 1 Subcommittee
July 6, 2006
Schnabel Engineering
Glen Allen, Virginia

Subcommittee Members Present

Douglas L. Davis, Waynesboro Police Department
Peter Rainey, Lake of the Woods
Paul D. Castle, Lakefront Royal Property Owners Association
William G. Browning, Department of Conservation and Recreation
Joseph S. Haugh
Dave Campbell, Schnabel Engineering
Richard Jacobs, Culpeper Soil and Water Conservation District

DCR Staff Present

David C. Dowling, Director of Policy, Planning and Budget
Christine Watlington, Policy, Planning and Budget Analyst
Jim Robinson, Dam Safety Program Manager
Michael R. Fletcher, Director of Development
Ryan Brown, Office of the Attorney General

Mr. Dowling thanked members for attending and said that the topic of discussion for the meeting would be Table 1. He noted that the Department had prepared a strawman discussion draft (copy attached as Attachment #1).

Mr. Dowling noted that the meeting was being recorded and that minutes would be produced as with other TAC meetings.

He said that staff had taken Table 1 and made some suggested modifications for the subcommittee's discussion and consideration.

Mr. Dowling asked Dr. Rainey to review the questions he had raised in the document that been e-mailed to members. A copy of this document is attached as Attachment #2.

As a first question, Dr. Rainey inquired whether Virginia should follow the federal guidelines regarding dam classification? Dr. Rainey noted that in the National Inventory of Dams that Virginia state regulated dams already are listed under the FEMA classification as high, significant, or low. He asked if someone from DCR was responsible for providing those designations.

Mr. Browning said that data submittal was an annual event that goes on in every state. States respond to a set of questions based on their program. He noted that there are questions that do not fit every state's program.

A member asked if it was assumed that in Virginia Class I would be high, Class II would be significant, and Classes III and IV would be low. Mr. Robinson indicated that this was the process for aligning Virginia's inventory with the National Inventory of Dams.

As a subsequent question, Dr. Rainey inquired whether for the purpose of differing EAP and SDF requirements should there be sub-classes within each Hazard Class? Should Virginia have four size classes, as does NC and GA, or continue with three?

It was noted that several of the states offer classifications as very large, large, medium and small.

Mr. Haugh said that there have always been questions about whether or not a dam meeting state requirements would go to full PMF if there was one house in the inundation zone. He said that he believed Canada had a classification called "very high" which would allow for a significant number of houses downstream.

It was noted that Dr. Rainey will make a presentation regarding PMF at the next full TAC meeting.

Mr. Dowling asked other members for comments or discussion topics.

Mr. Jacobs noted a concern about hazard classification and risk assessment. How is the determination made with regard to what is downstream? He said the level of risk should be balanced with the dam owner's ability to comply with the maximum design criteria. Mr. Jacobs noted that a more comprehensive, quantifiable risk assessment should be utilized.

Mr. Haugh said risk assessment can mean a variety of things. He said it could be argued that Table 1 is a risk assessment.

Mr. Castle asked when referring to risk assessment, how far downstream that applied. He noted that there is a dam above the city of Front Royal where the downstream affect will apply to the town four miles away. He asked how far the regulations should push the classification and flow of water.

Mr. Dowling said that the dam break inundation zone should be clearly defined.

Mr. Haugh said that regardless of the outcome of Table 1, there would be arbitrary decisions. He noted that it would not be beneficial to spend so much time on detail when decisions will be arbitrary. He suggested that where a range is specified for the SDF, it should be noted that the range is determined by the Department Director.

Chief Davis questioned whether hazard should be based on size.

A member asked if we could bring Virginia in-line with the federal government classification system?

A member said he had long been in agreement with the FERC approach to high hazard dam classification. A project where failure is likely to result in loss of life is designed for the PMF.

Dr. Rainey noted that Table 1 is preceded by a statement referencing “new” impounding structures. He asked if the committee would deal with a Table 1 format for all impounding structures.

Mr. Campbell noted the recommendation of the pre-NOIRA ad hoc committee was to deal with all impounding structures in the same manner.

Mr. Dowling asked if members felt it was a reasonable starting place to treat all impounding structures in the same manner.

Mr. Castle said that may not be reasonable. There are dams that were built years ago under one set of rules. The TAC is getting ready to establish a second set of rules that will supercede the first set. He said care should be taken in the process as it might result in owners being put in a position of having to drain dams.

Mr. Haugh asked what happened when the dam changed classifications in the future.

Chief Davis said that the committee should not overlook the impact on existing dams.

Mr. Dowling distributed copies of the Department strawman draft. (Attachment #1)

Following a detailed review and discussion of the strawman draft, the following recommendations were generated by the Table 1 subcommittee. It was agreed that the following discussion points would be incorporated into a revised draft and be presented to the TAC for consideration next week.

- 1) --Page 6, Table 1: Move from 4 classes of dams to 3 to mimic federal classification system (High, Significant, and Low)
 - Will need to revise the whole body of the regulations to address the removal of Class IV's
 - Revise the whole body of the regulations to use the terms “low”, “significant”, and “high”
- 2) --Page 6, Table 1: Restore 50-yr and 100-yr references in table 1 (delete suggested PMF values)
 - Restore 50-yr and 100-yr notes on lines 263 through 269
 - Add additional notes in these definitions that reference approximate PMF cross-reference values

- 3) --Page 6, Table 1: Change the term “height” in the table to a new definition, perhaps “design height” that would be measured at the upstream toe to the top of the impounding structure. This would be a more accurate characterization of the risk associated with the dam.
--Fix references to “height” on page 6, line 234 and other areas to reflect the new definition.
--Create a definition for “design height”
--Could remove the 6-foot height reference and just have “<40” and footnote to the regulated dam description note (line 259).
- 4) --Page 6, Table 1: In the High category, remove the large, medium, and small designations. Perhaps use “All” and footnote to the regulated dam description note (line 259).
- 5) --Page 24, line 989 change “Present, projected and potential future land-use” to “Present and planned land-use”
- 6) --Page 7, Line 248: PMF note to reference line 989
--Page 7, Line 236: SDF note to reference line 317
--Page 7, Lines 263 and 267: Notes on 50-yr and 100-yr to reference line 989
- 7) --Page 7, Line 256: Stay with the 6, 12, and 24 hr durations
--add text to clarify that the shorter storms are expected to apply to small (less than 10 sq mi) drainage basins
- 8) --Page 29: Add a section that speaks to additional references such as those related to EAP and Incremental methodology
- 9) --Page 21: Remove check marks in the EAP table next to the Class III as no decision has been reached on this yet.
- 10) --Page 7, Line 209: Strike “new”
- 11) Section 130 and 140
--Page 18, lines 701- 712, subsections 1 through 4 apply to all dams and move language to other areas as appropriate
--Lines 714 –717 – make sure they are fully incorporated into the new incremental methodology section setout on line 317 that applies to all dams
--Add to the incremental analysis section standards to maintain this designation (reasons by which it can be lost)
--Explore turning section 130 into a grandfathering statement for small high hazard dams that are currently less than a full PMF. This would only apply if they are already certified and they would still have to upgrade when they have to address other structural deficiencies.

--Explore turning section 130 into a grandfathering statement for dams that have not followed the preproportionalizing formula and may have been assigned a lower SDF value than the proposed process would allow

--Eliminate section 140

--Perhaps instead of grandfathering consider a Director's or Board's authority to allow certain deviations from Table 1 (bring to TAC's consideration)

--Establish a placeholder section that would provide for the Board's authority to allow for additional reductions in the SDF beyond the incremental analysis (this whole concept will be a discussion point at a later TAC meeting – “establish an alternative procedure (decision matrix) which would allow for the evaluation of spillway design floods (SDF) less than the probable maximum flood (PMF) where there would be no unreasonable or significant increase in hazard to life and property”

12) --Page 6, Table 1: remove hazard definition column from Table 1 and retain descriptive notes on classification

13) --Page 7, line 271: change “the following assumptions shall be made:” to “the following apply:”

14) --Page 6, Table 1: Class I, II, and III notes; change “likely” to “probably” on line 218 and restructure 228 to read “would result in no probable loss of life”.

--Addition of “personal property” in the definitions is reasonable.

15) --Page 6, Table 1: Remove Agriculture reference from Table 1 and add a footnote clarifying this and other exemptions.

--On line 53 of the definitions consider making agricultural exemptions only with the Director's or Board's approval. They need a check or a review.

--consider defining what the agricultural exemption applies to.

16) Renumber the Page 7, line 259 footnote #5 as note #1

17) Page 9, line 325 change the “one foot” references to “two feet”

18) Do not put any floor value on the incremental analysis. Feds utilize 100-yr but we should let engineering fall where it falls

Mr. Dowling thanked members for attending and reminded them that the next meeting of the full TAC would be Thursday, July 13 at the North Anna Nuclear Information Center in Mineral, Virginia.

The meeting adjourned at 2:30 p.m.

Attachment #1

DISCUSSION DRAFT – NOT APPROVED

1 **Version: Wednesday, July 05, 2006**
2 **VIRGINIA IMPOUNDING STRUCTURE REGULATIONS (§ 4 VAC 50-20)**
3

4 **Part I: General**
5

6 **4VAC50-20-10. Authority.**
7

8 This chapter is promulgated by the Virginia Soil and Water Conservation Board in
9 accordance with the provisions of the Dam Safety Act, Article 2, Chapter 6, Title 10.1 (§10.1-
10 604 et seq.), of the Code of Virginia.

11 Statutory Authority: §10.1-605 of the Code of Virginia.
12 Historical Notes: Derived from VR625-01-00 §1.1, eff. February 1, 1989.
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15 **4VAC50-20-20. General provisions.**
16

17 A. This chapter provides for the proper and safe design, construction, operation and
18 maintenance of impounding structures to protect public safety. This chapter shall not be
19 construed or interpreted to relieve the owner or operator of any impoundment or impounding
20 structure of any legal duties, obligations or liabilities incident to ownership, design, construction,
21 operation or maintenance.
22

23 B. Approval by the board of proposals for an impounding structure shall in no manner be
24 construed or interpreted as approval to capture or store waters. For information concerning
25 approval to capture or store waters, see Chapter 8 (§62.1-107) of Title 62.1 of the Code of
26 Virginia, and other provisions of law as may be applicable.
27

28 C. In promulgating this chapter, the board recognizes that no impounding structure can
29 ever be completely "fail-safe," because of incomplete understanding of or uncertainties
30 associated with natural (earthquakes and floods) and manmade (sabotage) destructive forces;
31 with material behavior and response to those forces; and with quality control during construction.
32

33 D. Any engineering analysis required by this chapter such as plans, specifications,
34 hydrology, hydraulics and inspections shall be conducted by and bear the seal of a professional
35 engineer licensed to practice in Virginia.
36

37 E. The official forms as called for by this chapter are available from the director.
38 [CHECK]

39 Statutory Authority: §10.1-605 of the Code of Virginia.
40 Historical Notes: Derived from VR625-01-00 §1.2, eff. February 1, 1989.
41
42

43 **4VAC50-20-30. Definitions.**
44

45 The following words and terms when used in this chapter shall have the following
46 meanings unless the context clearly indicates otherwise:

47
48 "Acre-foot" means a unit of volume equal to 43,560 cubic feet or 325,853 gallons (one
49 foot of depth over one acre of area).

50
51 "Agricultural purpose dams" means dams which are less than 25 feet in height or which
52 create a maximum impoundment smaller than 100 acre-feet and certified by the owner on official
53 forms as ~~constructed, maintained or~~ operated primarily for agricultural purposes.

54
55 "Alteration permit" means a permit required for changes to an impounding structure that
56 could alter or affect its structural integrity. Alterations requiring a permit include, but are not
57 limited to: changing the height, increasing the normal pool or principal spillway elevation,
58 changing the elevation or physical dimensions of the emergency spillway or removing the
59 impounding structure.

60
61 "Board" means the Virginia Soil and Water Conservation Board.

62
63 "Conditional operation and maintenance certificate" means a certificate required for
64 impounding structures with deficiencies.

65
66 "Construction permit" means a permit required for the construction of a new impounding
67 structure.

68
69 "Dam break inundation zone" means the area downstream of a dam that would be
70 inundated or otherwise directly affected by the failure of a dam.

71
72 "Department" means the Virginia Department of Conservation and Recreation.

73
74 "Design flood" means the calculated volume of runoff and the resulting peak discharge
75 utilized in the evaluation, design, construction, operation and maintenance of the impounding
76 structure.

77
78 "Design freeboard" means the vertical distance between the maximum elevation of the
79 design flood and the top of the impounding structure.

80
81 "Director" means the Director of the Department of Conservation and Recreation or his
82 designee.

83
84 "Drill" means an emergency action plan exercise that tests, develops, or maintains skills
85 in a single emergency response procedure. During a drill, participants perform an in-house
86 exercise to verify telephone numbers and other means of communication along with the dam
87 owner's response. A drill is considered a necessary part of ongoing training. A drill is the
88 lowest level emergency action plan exercise.

89
90 "Emergency Action Plan or EAP" means a formal document that identifies potential dam
91 emergency conditions and specifies preplanned actions to be followed to minimize loss of life

92 and property damage. The EAP specifies actions the dam owner must take to minimize or
93 alleviate safety issues at the dam. It contains procedures and information to assist the dam owner
94 in issuing early warning and notification messages to responsible emergency management
95 authorities. It shall also contain dam break inundation zone maps as required to show emergency
96 management authorities the critical areas for action in case of emergency.

97
98 “Emergency Action Plan Exercise” means an activity designed to promote emergency
99 preparedness; test or evaluate EAPs, procedures, or facilities; train personnel in emergency
100 management duties; and demonstrate operational capability. In response to a simulated event,
101 exercises consist of the performance of duties, tasks, or operations very similar to the way they
102 would be performed in a real emergency.

103
104 "Height" means the structural height of an impounding structure. If the impounding
105 structure spans a stream or watercourse, height means the vertical distance from the natural bed
106 of the stream or watercourse measured at the downstream toe of the impounding structure to the
107 top of the impounding structure. If the impounding structure does not span a stream or
108 watercourse, height means the vertical distance from the lowest elevation of the outside limit of
109 the barrier to the top of the impounding structure.

110
111 "Impounding structure" means a man-made device, whether a dam across a watercourse
112 or other structure outside a watercourse, used or to be used to retain or store waters or other
113 materials. The term includes: (i) all dams that are 25 feet or greater in height and that create an
114 impoundment capacity of 15 acre-feet or greater, and (ii) all dams that are six feet or greater in
115 height and that create an impoundment capacity of 50 acre-feet or greater. The term "impounding
116 structure" shall not include: (a) dams licensed by the State Corporation Commission that are
117 subject to a safety inspection program; (b) dams owned or licensed by the United States
118 government; (c) dams constructed, maintained or operated primarily for agricultural purposes
119 which are less than 25 feet in height or which create a maximum impoundment capacity smaller
120 than 100 acre-feet; (d) water or silt retaining dams approved pursuant to §45.1-222 or §45.1-
121 225.1 of the Code of Virginia; or (e) obstructions in a canal used to raise or lower water.

122
123 "Impoundment" means a body of water or other materials the storage of which is caused
124 by any impounding structure.

125
126 ~~"Inundation zone" means an area that could be inundated as a result of impounding~~
127 ~~structure failure and that would not otherwise be inundated to that elevation.~~

128
129 "Life of the impounding structure" and "life of the project" mean that period of time for
130 which the impounding structure is designed and planned to perform effectively, including the
131 time required to remove the structure when it is no longer capable of functioning as planned and
132 designed.

133
134 "Maximum impounding capacity" means the volume in acre-feet that is capable of being
135 impounded at the top of the impounding structure.

137 "Normal impounding capacity" means the volume in acre-feet that is capable of being
138 impounded at the elevation of the crest of the lowest ungated outlet from the impoundment.
139

140 "Operation and maintenance certificate" means a certificate required for the operation and
141 maintenance of all impounding structures.
142

143 "Owner" means the owner of the land on which an impounding structure is situated, the
144 holder of an easement permitting the construction of an impounding structure and any person or
145 entity agreeing to maintain an impounding structure. The term "owner" includes the
146 Commonwealth or any of its political subdivisions, including but not limited to sanitation district
147 commissions and authorities. Also included are any public or private institutions, corporations,
148 associations, firms or companies organized or existing under the laws of this Commonwealth or
149 any other state or country, as well as any person or group of persons acting individually or as a
150 group.
151

152 "Tabletop Exercise" means an emergency action plan exercise that involves a meeting of
153 the dam owner and the state and local emergency management officials in a conference room
154 environment. The format is usually informal with minimum stress involved. The exercise
155 begins with the description of a simulated event and proceeds with discussions by the
156 participants to evaluate the EAP and response procedures and to resolve concerns regarding
157 coordination and responsibilities.
158

159 "Top of the impounding structure" means the lowest point of the nonoverflow section of
160 the impounding structure.
161

162 "Watercourse" means a natural channel having a well-defined bed and banks and in
163 which water flows when it normally does flow.
164

165 Statutory Authority: §10.1-605 of the Code of Virginia.

166 Historical Notes: Derived from VR625-01-00 §1.3, eff. February 1, 1989; Amended, Virginia Register Volume 18,
167 Issue 14, eff. July 1, 2002.

168 Effect of Amendment: The July 1, 2002 amendment revised the definitions for "director" and "impounding structure".
169

170 **4VAC50-20-40. Classes of impounding structures.** 171

172 A. Impounding structures shall be classified in one of ~~four~~ three categories according to
173 size and hazard potential, as defined in ~~subsection B of this section and~~ Table 1. ~~Size~~
174 ~~classification shall be determined either by maximum impounding capacity or height, whichever~~
175 ~~gives the larger size classification.~~
176

177 B. For the purpose of this chapter, hazards pertain to potential loss of human life or
178 property damage downstream from the impounding structure in event of failure or faulty
179 operation of the impounding structure or appurtenant facilities.
180

- 181 ~~1. Impounding structures in the Class I hazard potential category are located where failure will~~
 182 ~~cause probable loss of life or serious damage to occupied building(s), industrial or commercial~~
 183 ~~facilities, important public utilities, main highway(s) or railroad(s).~~
 184
 185 ~~2. Impounding structures in the Class II hazard potential category are located where failure could~~
 186 ~~cause possible loss of life or damage to occupied building(s), industrial or commercial facilities,~~
 187 ~~secondary highway(s) or railroad(s) or cause interruption of use or service of relatively important~~
 188 ~~public utilities.~~
 189
 190 ~~3. Impounding structures in Class III hazard potential category are located where failure may~~
 191 ~~cause minimal property damage to others. No loss of life is expected.~~
 192
 193 ~~4. Impounding structures in Class IV hazard potential category are located where the failure of~~
 194 ~~the impounding structure would cause no property damage to others. No loss of life is expected.~~
 195

196 5 C. Such size and hazard potential classifications shall be proposed by the owner and
 197 shall be subject to approval by the director. Present and projected development of in the dam
 198 break inundation zones downstream from the impounding structure shall be considered in
 199 determining the classification.
 200

201 6 D. Impounding structures shall be subject to reclassification by the Board as necessary.
 202

203 Statutory Authority: §10.1-605 of the Code of Virginia.
 204 Historical Notes: Derived from VR625-01-00 §1.4, eff. February 1, 1989.
 205

206 **4VAC50-20-50. Performance standards required for impounding structures.**
 207

208 A. Impounding structures shall be constructed, operated and maintained such that they
 209 perform in accordance with their design and purpose throughout the life of the project. For new
 210 impounding structures, the spillway(s) capacity shall perform at a minimum to safely pass the
 211 appropriate spillway design flood as determined in Table 1.
 212

213 **TABLE 1--Impounding Structure Regulations**
 214

<u>Hazard</u> Dam ¹	<u>Class of</u> Dam	<u>Hazard Potential</u> # <u>Impounding Structure</u> <u>Fails with Dam</u> <u>Failure</u>	<u>SIZE CLASSIFICATION</u>		<u>Spillway</u> Design Flood (SDF) ^{b 3}
			<u>Maximum Capacity (Ac-Ft)^{a 2}</u>	<u>Height(Ft)^{a 2}</u>	
<u>HIGH</u>		<u>Probable Likely Loss</u> of Life; Excessive Economic Loss	Large ≥ 50,000 Medium ≥ 1,000 & <50,000 Small ≥ 50 15 & < 1,000 ⁵ <u>Agricultural < 100 or</u>	≥ 100 ≥ 40 & < 100 ≥ 25 6 & < 40 <u>< 25</u>	PMF ^{e-4} PMF 1/2 PMF to PMF <u>Exempt</u>

SIGNIFICANT II	Possible Loss of Life; Appreciable Economic Loss	Large $\geq 50,000$ Medium $\geq 1,000$ & $< 50,000$ Small ≥ 50 <u>15</u> & $< 1,000$ <u>Agricultural < 100</u> or	≥ 100 ≥ 40 & < 100 ≥ 25 <u>6</u> & < 40 <u>< 25</u>	PMF 1/2 .50 PMF to PMF 100-YR .20 PMF to 1/2 .50 PMF <u>Exempt</u>
LOW III	No -Loss of Life <u>Not</u> Expected; Minimal Economic Loss	Large $\geq 50,000$ Medium $\geq 1,000$ & $< 50,000$ Small ≥ 50 <u>15</u> & $< 1,000$ <u>Agricultural < 100</u> or	≥ 100 ≥ 40 & < 100 ≥ 25 <u>6</u> & < 40 <u>< 25</u>	1/2 .50 PMF to PMF 100-YR .20 PMF to 1/2 .50 PMF 50-YR^d .15 PMF to 100-YR^e .20 PMF <u>Exempt</u>
IV	No Loss of Life Expected; No Economic Loss to Others	≥ 50 -(non-agricultural) ≥ 100 -(agricultural)	≥ 25 (both)	50-YR to 100-YR

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1. Hazard classes of dams are as follows:

I. High Hazard Potential is defined where an impounding structure (dam) failure will likely cause the loss of life and/or serious economic damage to occupied building(s), industrial or commercial facilities, primary public utilities, major public roadways, railroads or personal property.

II. Significant Hazard Potential is defined where an impounding structure (dam) failure may cause the loss of life and/or appreciable economic damage to occupied building(s), industrial or commercial facilities, secondary public utilities, secondary public roadways, railroads or personal property.

III. Low Hazard Potential is defined where an impounding structure (dam) failure would not likely cause the loss of life and would cause no more than minimal economic damage to occupied building(s), industrial or commercial facilities, secondary public utilities, secondary public roadways, railroads or personal property.

a 2. The factor determining the largest size classification shall govern. The appropriate size classification is determined by the largest size associated with the maximum capacity and height of the impounding structure.

b 3. The spillway design flood (SDF) represents the largest flood that need be considered in the evaluation of the performance for a given project. The impounding structure shall perform so as to safely pass the appropriate SDF. Where a range of SDF is indicated, the magnitude that most closely relates to the involved risk should be selected. ~~proportionalize the height and maximum capacity within the appropriate size classification and apply the maximum proportion within the SDF range to determine the appropriate SDF. The establishment in this chapter of rigid design flood criteria or standards is not intended. Safety must be evaluated in the light of peculiarities and local conditions for each impounding structure and in recognition of the many factors involved, some of which may not be precisely known. Such can only be done by competent, experienced engineering judgment, which the values in Table 1 are intended to supplement, not supplant.~~

248 e 4. PMF: Probable maximum flood. ~~This means~~ is the flood that might be expected from
249 the most severe combination of critical meteorologic and hydrologic conditions that are
250 reasonably possible in the region. The PMF is derived from the current probable maximum
251 precipitation (PMP) available from the National Weather Service, NOAA. ~~In some cases local~~
252 ~~topography or meteorological conditions will cause changes from the generalized PMP values;~~
253 ~~therefore, it is advisable to contact local, state or federal agencies to obtain the prevailing~~
254 ~~practice in specific cases. Any deviation in the application of established developmental~~
255 ~~procedures must be explained and justified by the owner's engineer. The owner's engineer must~~
256 ~~run the PMF for 6, 12 and 24 hour durations, using the inflow hydrograph that creates the largest~~
257 ~~peak inflow for non-failure and failure analyses.~~

258
259 5. A small impounding structure shall be regulated if the dam is 25 feet or greater in
260 height and creates an impoundment capacity of 15 acre-feet or greater, or the dam is six feet or
261 greater in height and creates an impoundment capacity of 50 acre-feet or greater.

262
263 d. 50-Yr: 50-year flood. ~~This means the flood magnitude expected to be equaled or~~
264 ~~exceeded on the average of once in 50 years. It may also be expressed as an exceedence~~
265 ~~probability with a 2.0% chance of being equaled or exceeded in any given year.~~

266
267 e. 100-Yr: 100-year flood. ~~This means the flood magnitude expected to be equaled or~~
268 ~~exceeded on the average of once in 100 years. It may also be expressed as an exceedence~~
269 ~~probability with a 1.0% chance of being equaled or exceeded in any given year.~~

270
271 B. When there is a road across the dam or below the dam, the following assumptions
272 shall be made:

273 1. If the road is public, state maintained, or used by several families, then the dam is to be
274 classified at a minimum as a Significant (II) Hazard Class; and

275 2. If the road is private, not maintained by the state and only used by the owner, owner's
276 family and guests then the dam is to be classified at a minimum as a Low (III) Class.

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278 Statutory Authority: §10.1-605 of the Code of Virginia.

279 Historical Notes: Derived from VR625-01-00 §1.5, eff. February 1, 1989; Amended, Virginia Register Volume 18,
280 Issue 14, eff. July 1, 2002.

281 Effect of Amendment: The July 1, 2002 amendment corrected the "greater than" and "equal than" signs in Table 1.

282

283 **4VAC50-20-54. Dam break inundation zone mapping.**

284

285 A. All dam owners must provide inundation maps representing the impacts that would
286 occur should their dam fail. High Hazard and Significant Hazard dams shall provide detailed
287 maps, listing first floor elevations of all inhabited dwellings, road elevations and elevations of
288 other pertinent structures influencing the Hazard Classification. Low Hazard dams shall require
289 simple map demonstrating the general inundation that results from a dam failure.

290

291 B. The requirements for a dam break inundation map for High and Significant Hazard
292 dams are as follows:

293 1. Maps shall be developed for both the sunny day failure condition and the Spillway
294 Design Flood failure condition to show the expected extremes in peak water surface elevations,
295 travel times of the front of the dam break flood wave to critical locations, and distances
296 downstream between the two scenarios. ~~For a sunny day failure, the water level of the reservoir~~
297 ~~should be assumed to be the crest of the lowest open spillway that could not be plugged by~~
298 ~~debris.~~ A sunny day failure must be modeled starting the reservoir at normal pool and assuming
299 that the total failure will take between 0.5 and 3 hours with a failure width of ½ to twice the
300 height of the dam and side slopes of less than H/V and failure beginning when the reservoir is
301 near the storm generated peak reservoir elevation. Inundation mapping should extend
302 downstream until the breach flood wave would be non-damaging.

303 2. The map(s) shall be developed at a scale sufficient to graphically display downstream
304 inhabited areas and structures on the map within the identified inundation area that may be
305 subject to possible danger. To the maximum extent practicable, the inundation maps should be
306 supplemented with water surface profiles at critical areas showing the water surface elevation
307 prior to failure and the peak water surface elevation after failure. The list of downstream
308 residents with their telephone numbers should whenever possible be plotted on the map for easy
309 reference in the case of emergencies.

310 3. Since local officials are likely to use the maps for evacuation purposes, a note should
311 be included on the map to advise that, because of the method, procedures, and assumptions used
312 to develop the flooded areas, the limits of flooding shown and flood wave travel times are
313 approximate and should be used only as a guideline for establishing evacuation zones. Actual
314 areas inundated will depend on actual failure conditions and may differ from areas shown on the
315 maps.

316
317 **4VAC50-20-58. Incremental damage assessment.**

318
319 Once the owner's engineer has determined the required spillway design flood through
320 application of Table 1, further analysis may be performed to evaluate the incremental damage
321 assessment. This assessment may be used to lower the spillway design flood to the flood that
322 would not cause additional death or property damage due to a dam failure over that which would
323 occur without failure. This analysis will require detailed computer modeling that produces water
324 surface elevations at each structure that may be impacted downstream of the dam. Water depths
325 greater than one foot and flow velocities greater than three feet per second shall be used to
326 determine impacts to persons or property. Water depth changes less than one foot and flow
327 velocities less than three feet per second may be considered as ineffective to structures
328 downstream of the dam.

329
330 **Part II: Permit Requirements**

331
332 **4VAC50-20-60. Required permits.**

333
334 A. No person or entity shall construct or begin to construct an impounding structure until
335 the board has issued a construction permit.
336

337 B. No person or entity shall alter or begin to alter an existing impounding structure in a
338 any manner which would potentially affect its structural integrity until the board has issued an
339 alteration permit, or in the case of an emergency, authorization is obtained from the director. The
340 permit requirement may be waived if the director determines that the alteration of improvement
341 will not substantially alter or affect the structural integrity of the impounding structure.
342 Alteration does not mean normal operation and maintenance.

343
344 C. When the board receives an application for any permit to construct or alter an
345 impounding structure, the director shall inform the government of any jurisdiction which might
346 be affected by the permit application.

347
348 D. In evaluating construction and alteration permit applications the director shall use the
349 most current design criteria and standards referenced in 4VAC50-20-320 of this chapter.

350

351 Statutory Authority: §10.1-605 of the Code of Virginia.
352 Historical Notes: Derived from VR625-01-00 §2.1, eff. February 1, 1989.

353

354 **4VAC50-20-70. Construction permits.**

355

356 A. Prior to preparing the complete design report for a construction permit, applicants are
357 encouraged to seek approval of the project concept from the director. For this purpose the
358 applicant should submit a general description of subdivisions 1 through 4 of subsection B of this
359 section and subdivisions 1 and 2 of this subsection:

360

361 1. Proposed design criteria and a description of the size, ground cover conditions, extent
362 of current development of the watershed, jurisdictional comprehensive planning for development
363 of the watershed, and the geologic and the geotechnical engineering assumptions used to
364 determine the foundations and materials to be used.

365

366 2. Preliminary drawings of a general nature, including cross sections, plans and profiles
367 of the impounding structure, proposed pool levels and types of spillway(s).

368

369 B. An applicant for a construction permit shall submit a design report on official forms.
370 The design report shall be prepared in accordance with 4VAC50-20-240 and shall include the
371 following information:

372

373 1. A description of the impounding structure and appurtenances and a proposed
374 classification conforming with this chapter. The description shall include a statement of the
375 purposes for which the impoundment and impounding structure are to be used.

376

377 2. A description of properties located in the dam break inundation zone downstream from
378 the site of the proposed impounding structure, including the location and number of residential
379 structures, buildings, roads, utilities and other property that would be endangered should the
380 impounding structure fail.

381
382 3. A statement from the governing body of the local political subdivision or other
383 evidence confirming that body is aware of the proposal to build an impounding structure and of
384 the land use classifications applicable to the dam break inundation zone.
385

386 4. Maps showing the location of the proposed impounding structure that include: the
387 county or city in which the proposed impounding structure would be located, the location of
388 roads, access to the site and the outline of the impoundment. Existing aerial photographs or
389 existing topographic maps may be used for this purpose.
390

391 5. A report of the geotechnical investigations of the foundation soils or bedrock and of
392 the materials to be used to construct the impounding structure.
393

394 6. Design assumptions and analyses sufficient to indicate that the impounding structure
395 will be stable during its construction and during the life of the impounding structure under all
396 conditions of reservoir operations, including rapid filling and rapid drawdown of the
397 impoundment.
398

399 7. Evaluation of the stability of the reservoir rim area in order to safeguard against
400 reservoir rim slides of such magnitude as to create waves capable of overtopping the impounding
401 structure and confirmation of rim stability during seismic activity.
402

403 8. Design assumptions and analyses sufficient to indicate that seepage in, around, through
404 or under the impounding structure, foundation and abutments will be reasonably and practically
405 controlled so that internal or external forces or results thereof will not endanger the stability of
406 the impounding structure.
407

408 9. Calculations and assumptions relative to design of the spillway or spillways. Spillway
409 capacity shall conform to the criteria of Table 1.
410

411 10. Provisions to ensure that the impounding structure and appurtenances will be
412 protected against deterioration or erosion due to freezing and thawing, wind and rain or any
413 combination thereof.
414

415 11. Other pertinent design data, assumptions and analyses commensurate with the nature
416 of the particular impounding structure and specific site conditions, including when required by
417 ~~the director~~ this chapter, a plan and profile of the dam break inundation zones.
418

419 12. Erosion and sediment control plans to minimize soil erosion and sedimentation during
420 all phases of construction, operation and maintenance. Projects shall be in compliance with local
421 erosion and sediment control ordinances.
422

423 13. A description of the techniques to be used to divert stream flow during construction
424 so as to prevent hazard to life, health and property. Such diversion plans shall also be in
425 accordance with applicable environmental laws.

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14. A plan of quality control testing to confirm that construction materials and methods meet the design requirements set forth in the specifications.

15. A proposed schedule indicating construction sequence and time to completion.

16. Plans and specifications as required by 4VAC50-20-310.

17. An emergency action plan ~~on official forms~~ developed in accordance with 4VAC50-20-175 and evidence that ~~a copy~~ the required copies of such plan ~~has~~ have been filed with the Department, the local organization for emergency management and the State Department of Emergency Management. The plan shall include a method of providing notification and warning to persons downstream, other affected persons or property owners and local authorities in the event of a flood hazard or the potential or impending failure of the impounding structure.

18. A proposed impoundment and impounding structure operation and maintenance plan on official forms certified by a licensed professional engineer. This plan shall include a safety inspection schedule and shall place particular emphasis on operating and maintaining the impounding structure in keeping with the project design, so as to maintain its structural integrity and safety during both normal and abnormal conditions which may reasonably be expected to occur during its planned life.

19. Placeholder for stormwater construction permit requirement language.

20. Placeholder for cultural and historic resources?????????

C. The director or the applicant may request a conference to facilitate review of the applicant's proposal.

D. The owner shall certify in writing that the operation and maintenance plan as approved by the board will be adhered to during the life of the project except in cases of unanticipated emergency requiring departure therefrom in order to mitigate hazard to life and property. ~~At such time~~ In the case of an emergency, the owner's engineer, and the director, and other specified contacts shall be notified in accordance with the emergency action plan developed in accordance with 4VAC50-20-175.

E. If the submission is not acceptable, the director shall inform the applicant within 60 days and shall explain what changes are required for an acceptable submission.

F. Within 120 days of receipt of an acceptable design report the board shall act on the application.

G. Prior to and during construction the owner shall notify the director of any proposed changes from the approved design, plans, specifications, or operation and maintenance plan.

470 Approval shall be obtained from the director prior to the construction or installation of any
471 changes that will affect the stability of the impounding structure.

472

473 H. The construction permit shall be valid for the construction schedule specified in the
474 approved design report. The construction schedule may be amended by the director for good
475 cause at the request of the applicant.

476

477 I. Construction must commence within two years after the permit is issued. If
478 construction does not commence within two years after the permit is issued, the permit shall
479 expire, except that the applicant may petition the board for extension of the two-year period and
480 the board may extend such period for good cause.

481

482 J. The director may revoke a construction permit if any of the permit terms are violated,
483 or if construction is conducted in a manner hazardous to downstream life or property. The
484 director may order the owner to eliminate such hazardous conditions within a period of time
485 limited by the order. Such corrective measures shall be at the owner's expense. The applicant
486 may petition the board to reissue the permit with such modifications as the board determines to
487 be necessary.

488

489 K. The owner's licensed professional engineer shall advise the director when the
490 impounding structure may safely impound water. The director shall acknowledge this statement
491 within 10 days after which the impoundment may be filled under the engineer's supervision. The
492 director's acknowledgement shall act as a temporary operation and maintenance certificate until
493 an operation and maintenance certificate has been applied for and issued in accordance with
494 4VAC50-20-110.

495

496 Statutory Authority: §10.1-605 of the Code of Virginia.

497 Historical Notes: Derived from VR625-01-00 §2.2, eff. February 1, 1989; Amended, Virginia Register Volume 18,
498 Issue 14, eff. July 1, 2002.

499 Effect of Amendment: The July 1, 2002 amendment, in the second sentence of subsection A, changed "items" to
500 "subdivisions" twice, inserted "of this section" and "of this subsection", and deleted "below" after "1 and 2"; in
501 subsections B and K, and in paragraph B 16, deleted "of this chapter" after the VAC citation; and, in paragraph B 17,
502 inserted "organization for emergency management", inserted "the" before "State Department", and changed "Services"
503 to "Management" after "Emergency".

504

505 **4VAC50-20-80. Alterations permits.**

506

507 A. Application for a permit to alter an impounding structure in ways which would
508 potentially affect its structural integrity shall be made on official forms. The application shall
509 clearly describe the proposed work with appropriately detailed plans and specifications.

510

511 B. Alterations which would potentially affect the structural integrity of an impounding
512 structure include but are not limited to changing its height, increasing the normal pool or
513 principal spillway elevation, changing the elevation or physical dimensions of the emergency
514 spillway or removing the impounding structure.

515

516 C. Where feasible an application for an alteration permit shall also include plans and
517 specifications for a device to allow for draining the impoundment if such does not exist.
518

519 D. If the submission is not acceptable, the director shall inform the applicant within 60
520 days and shall explain what changes are required for an acceptable submission.
521

522 E. Within 120 days of receipt of an acceptable application, the board shall act on the
523 application.
524

525 Statutory Authority: §10.1-605 of the Code of Virginia.
526 Historical Notes: Derived from VR625-01-00 §2.3, eff. February 1, 1989.
527

528 **4VAC50-20-90. Transfer of permits.** 529

530 Prior to the transfer of ownership of a permitted impounding structure the permittee shall
531 notify the director in writing and the new owner shall file a transfer application on
532 official forms. The new owner shall amend the existing permit application as necessary
533 and shall certify to the director that he is aware of and will comply with all of the
534 requirements and conditions of the permit.
535

536 Statutory Authority: §10.1-605 of the Code of Virginia.
537 Historical Notes: Derived from VR625-01-00 §2.4, eff. February 1, 1989.
538

539 **Part III: Certificate Requirements**

540 **4VAC50-20-100. Operation and maintenance certificates.** 541

542 A. A Class I Operation and Maintenance Certificate is required for a Class I Hazard
543 potential impounding structure. The certificate shall be for a term of six years. It shall be
544 updated based upon the filing of a new reinspection report certified by a licensed
545 professional engineer every two years.
546

547 B. A Class II Operation and Maintenance Certificate is required for a Class II Hazard
548 potential impounding structure. The certificate shall be for a term of six years. It shall be
549 updated based upon the filing of a new reinspection report certified by a licensed
550 professional engineer every three years.
551

552 C. A Class III Operation and Maintenance Certificate is required for a Class III Hazard
553 potential impounding structure. The certificate shall be for a term of six years.
554

555 D. The owner of a Class I, II or III impounding structure shall provide the director an
556 annual owner's inspection report on official forms in years when no licensed professional
557 reinspection is required and may be done by the owner or his representative.
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E. If an Operation and Maintenance Certificate is not updated as required, the board shall take appropriate enforcement action.

F. The owner of a Class I, II or III impounding structure shall apply for the renewal of the six year operation and maintenance certificate 90 days prior to its expiration in accordance with 4VAC50-20-120 of this chapter.

G. A Class IV impounding structure will not require an operation and maintenance certificate. An inventory report is to be prepared as provided in 4VAC50-20-120 B and filed by the owner on a six-year interval, and an owners inspection report filed annually.

H. The owner of any impounding structure, regardless of its hazard classification, shall notify the board immediately of any change in either cultural features downstream from the impounding structure or of any change in the use of the area downstream that would present hazard to life or property in the event of failure.

I. The owner of any impounding structure shall meet the emergency action plan submittal requirements setout in 4VAC50-20-175.

Statutory Authority: §10.1-605 of the Code of Virginia.
Historical Notes: Derived from VR625-01-00 §3.1, eff. February 1, 1989.

4VAC50-20-110. Operation and maintenance certificate for newly constructed impounding structures.

A. Within 180 days after completion of the construction of an impounding structure, the owner shall submit:

1. A complete set of as-built drawings certified by a licensed professional engineer and an as-built report on official forms.
2. A copy of a certificate from the licensed professional engineer who has inspected the impounding structure during construction certifying that, to the best of his judgment, knowledge and belief, the impounding structure and its appurtenances were constructed in conformance with the plans, specifications, drawings and other requirements approved by the board.
3. A copy of the operation and maintenance plan ~~and emergency action plan~~ submitted with the design report including any changes required by the director. The emergency action plan shall also be updated as necessary and resubmitted at this time.

602 B. If the director finds that the operation and maintenance plan or emergency action plan
603 developed in accordance with 4VAC50-20-175 is deficient, he shall return it to the owner
604 within 60 days with suggestions for revision.
605

606 C. Within 60 days of receipt of the items listed in subsection A above, if the board finds
607 that adequate provision has been made for the safe operation and maintenance of the
608 impounding structure, the board shall issue an operation and maintenance certificate.
609

610 Statutory Authority: §10.1-605 of the Code of Virginia.
611 Historical Notes: Derived from VR625-01-00 §3.2, eff. February 1, 1989.
612

613 **4VAC50-20-120. Operation and maintenance certificates for existing impounding**
614 **structures.**
615

616 A. Any owner of an impounding structure other than a Class IV impounding structure
617 which has already filed an inventory report that does not have an operation and
618 maintenance certificate or any owner renewing an operation and maintenance certificate
619 shall file an application with the board.
620

621 B. The application for an operation and maintenance certificate shall be on official forms
622 and shall include:
623

624 1. A reinspection report for Class I and II impounding structures. The reinspection
625 report shall include an update of conditions of the impounding structure based on
626 a previous safety inspection as required by the board, a previous reinspection
627 report or an as-built report.
628

629 2. An inventory report for Class III impounding structures. The inventory report
630 shall include:
631

632 a. The name and location of the impounding structure and the name of the
633 owner.
634

635 b. The description and dimensions of the impounding structure, the
636 spillways, the reservoir and the drainage area.
637

638 c. The history of the impounding structure which shall include the design,
639 construction, repairs, inspections and whether the structure has ever been
640 overtopped.
641

642 d. Observations of the condition of the impounding structure, reservoir,
643 and upstream and downstream areas.
644

645 e. Any changes in the impounding structure, reservoir, and upstream and
646 downstream areas.

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f. Recommendations for remedial work.

3. An impoundment and impounding structure operation and maintenance plan certified by a licensed professional engineer. This plan shall place particular emphasis on operating and maintaining the impounding structure in keeping with the project design in such manner as to maintain its structural integrity and safety during both normal and abnormal conditions which may reasonably be expected to occur during its planned life. The safety inspection report required by the board should be sufficient to serve as the basis for the operation and maintenance plan for a Class I and Class II impounding structure. For a Class III impounding structure, the operation and maintenance plan shall be based on the data provided in the inventory report.

4. An emergency action plan developed in accordance with 4VAC50-20-175 and evidence that ~~a copy~~ the required copies of such plan ~~has~~ have been filed with the Department, the local organization for emergency management and the State Department of Emergency Management. The plan shall include a method of providing notification and warning to persons downstream, other affected persons or property owners and local authorities in the event of a flood hazard or the potential or impending failure of the impounding structure.

C. The owner shall certify in writing that the operation and maintenance plan approved by the board will be adhered to during the life of the project except in cases of emergency requiring departure therefrom in order to mitigate hazard to life and property, at which time the owner's engineer, ~~and the director~~, and other specified contacts shall be notified in accordance with the emergency action plan developed in accordance with 4VAC50-20-175.

D. If the director finds that the operation and maintenance plan or emergency action plan developed in accordance with 4VAC50-20-175 is deficient, he shall return it to the owner within 60 days with suggestions for revision to meet the specified minimum requirements.

E. Within 60 days of receipt of an acceptable application if the board finds that adequate provision has been made for the safe operation and maintenance of the impounding structure, the board shall issue an operation and maintenance certificate.

Statutory Authority: §10.1-605 of the Code of Virginia.

Historical Notes: Derived from VR625-01-00 §3.3, eff. February 1, 1989; Amended, Virginia Register Volume 18, Issue 14, eff. July 1, 2002.

Effect of Amendment: The July 1, 2002 amendment, in paragraph B 1, substituted "previous safety inspection as required by the board" for "Phase I or Phase II inspection as established by the U.S. Army Corps of Engineers"; in the third sentence of paragraph B 3, substituted "safety inspection report required by the board" for "Phase I Inspection Report"; and, in paragraph B 4, substituted "local organization for emergency management and the State Department of Emergency Management" for "local and State Department of Emergency Services".

694 **4VAC50-20-130. Existing impounding structures constructed prior to July 1, 1982.**

695

696 A. Many existing impoundment structures were designed and constructed prior to the
697 enactment of the Dam Safety Act, and may not satisfy current criteria for new
698 construction. The board may issue an operation and maintenance certificate for such
699 structures provided that:

700

701 1. Operation and maintenance is determined by the director to be satisfactory and
702 up to date;

703

704 2. Annual owner's inspection reports have been filed with and are considered
705 satisfactory by the director;

706

707 3. The applicant proves in accordance with the current design procedures and
708 references of 4VAC50-20-320 to the satisfaction of the board that the impounding
709 structure as designed, constructed, operated and maintained does not pose an
710 unreasonable hazard to life and property; and

711

712 4. The owner satisfies all special requirements imposed by the board.

713

714 B. When appropriate with existing impounding structures only, the spillway design flood
715 requirement may be reduced by the board to the spillway discharge at which dam failure
716 will not significantly increase the downstream hazard existing just prior to dam failure
717 provided that the conditions of 4VAC50-20-130 A have been met.

718

719 Statutory Authority: §10.1-605 of the Code of Virginia.

720 Historical Notes: Derived from VR625-01-00 §3.4, eff. February 1, 1989.

721

722 **4VAC50-20-140. Existing impounding structures constructed after July 1, 1982.**

723

724 The board may issue an operation and maintenance certificate for an impounding
725 structure having a construction permit issued after July 1, 1982, and shall not require
726 upgrading to meet new more stringent criteria unless the board determines that the new
727 criteria must be applied to prevent an unreasonable hazard to life or property.

728

729 Statutory Authority: §10.1-605 of the Code of Virginia.

730 Historical Notes: Derived from VR625-01-00 §3.5, eff. February 1, 1989.

731

732 **4VAC50-20-150. Conditional operation and maintenance certificate.**

733

734 A. During the review of any operation and maintenance application should the director
735 determine that the impounding structure has deficiencies of a nonimminent danger
736 category, the director may recommend that the board issue a conditional operation and
737 maintenance certificate.

738
739 B. The conditional operation and maintenance certificate for Class I, II and III
740 impounding structures shall be for a maximum term of two years. This certificate will
741 allow the owner to continue normal operation and maintenance of the impounding
742 structure, and shall require that the owner correct the deficiencies on a schedule
743 determined by the director.
744

745 C. A conditional certificate may be renewed in accordance with the procedures of
746 4VAC50-20-120 provided that annual owner inspection reports are on file, and the board
747 determines that the owner is proceeding with the necessary corrective actions.
748

749 D. Once the deficiencies are corrected, the board shall issue an operation and
750 maintenance certificate based upon any required revisions to the original application.
751

752 E. The owner of any impounding structure, whether under conditional certificate or
753 otherwise, shall meet the emergency action plan requirements setout in 4VAC50-20-175.
754

755 Statutory Authority: §10.1-605 of the Code of Virginia.
756 Historical Notes: Derived from VR625-01-00 §3.6, eff. February 1, 1989.
757

758 **4VAC50-20-160. Additional operation and maintenance requirements.**
759

760 A. The owner of an impounding structure shall not, through action or inaction, cause or
761 allow such structure to impound water following receipt of a written report from the
762 owner's engineer that the impounding structure will not safely impound water.
763

764 Statutory Authority: §10.1-605 of the Code of Virginia.
765 Historical Notes: Derived from VR625-01-00 §3.7, eff. February 1, 1989.
766

767 **4VAC50-20-170. Transfer of certificates.**
768

769 Prior to the transfer of ownership of an impounding structure the certificate holder shall
770 notify the director in writing and the new owner shall file a transfer application on
771 official forms. The new owner may elect to continue the current operation and
772 maintenance certificate for the remaining term or he may apply for a new certificate in
773 accordance with 4VAC50-20-120. If the owner elects to continue the existing certificate
774 he shall amend the existing certificate application as necessary and shall certify to the
775 director that he is aware of and will comply with all of the requirements and conditions of
776 the certificate.
777

778 Statutory Authority: §10.1-605 of the Code of Virginia.
779 Historical Notes: Derived from VR625-01-00 §3.8, eff. February 1, 1989.
780

781 **4VAC50-20-175. Emergency Action Plans.**
782

783 A. In order to minimize the loss of life and property damage during potential emergency
conditions at a dam, and to ensure effective, timely action is taken should a dam emergency

784 occur, an EAP shall be required for each impounding structure. The emergency action plans
785 shall be coordinated with the Department of Emergency Management in accordance with §44-
786 146.18. The plans required by these regulations shall be incorporated into local and inter-
787 jurisdictional emergency plans pursuant to §44-146.19.

788 B. It is the dam owner's responsibility to develop, maintain, exercise, and implement a
789 site-specific EAP.

790 C. An EAP shall be submitted every six years. For a Class I, II, or III impounding
791 structure, the EAP shall be submitted with the dam owner's renewal of their operation and
792 maintenance certificate application.

793 D. It is imperative that the dam owner furnish all holders of the EAP section updates to
794 the EAP immediately upon becoming aware of necessary changes to keep the EAP workable.
795 Should a dam be reclassified, an emergency action plan in accordance with this section shall be
796 submitted.

797 E. A drill shall be conducted annually for each Class I, II, or III impounding structure. A
798 table-top exercise shall be conducted once every 3 years for Class I and II structures. Owners
799 shall certify to the Department annually that an exercise has been completed and the statement
800 shall include a critique of the exercise and any revisions or updates to the plan or a statement that
801 no revisions or updates are needed.

802 F. Dam owners shall test existing monitoring, sensing, and warning equipment at
803 remote/unattended dams at least twice per year and maintain a record of such tests.

804 G. An EAP shall contain the following seven basic elements unless otherwise specified in
805 this subsection.

806 1. Notification chart - A notification chart shall be included for all classes of dams that
807 shows who is to be notified, by whom, and in what priority. The notification chart shall include
808 contact information that assures 24-hour telephone coverage for all responsible parties.

809 2. Emergency Detection, Evaluation, and Classification - The plan shall include a
810 discussion of the procedures for timely and reliable detection, evaluation, and classification of an
811 emergency situation to ensure that the appropriate course of action is taken based on the urgency
812 of the situation. Where appropriate, the situations should address dam breaks that are imminent
813 or in progress, a situation where the potential for dam failure is rapidly developing, and a
814 situation where the threat is slowly developing.

815 3. Responsibilities - The plan shall specify a determination of responsibility for EAP-
816 related tasks. The EAP shall also clearly designate the responsible party for making the decision
817 that an emergency condition no longer exists at the dam.

818 4. Preparedness - The plan shall include a section that describes preparedness actions to
819 be taken both before and following development of emergency conditions.

820 5. Dam Break Inundation Maps - The plan shall include an inundation map that
821 delineates the areas that would be flooded as a result of a dam failure. All properties identified
822 within the dam break inundation zone shall be incorporated into the EAP's dam break inundation
823 zone map to ensure the proper notification of persons downstream and other affected persons or
824 property owners in the event of a flood hazard or the impending failure of the impounding
825 structure. Such maps shall be developed in accordance with 4VAC50-20-54..

826 6. Appendices - The appendices shall contain information that supports and supplements
827 the material used in the development and maintenance of the EAP such as analyses of dam break

828 floods; plans for training, exercising, updating, and posting the EAP; and other site-specific
 829 concerns.

830 7. Certification – The plan shall include a section that is signed by all parties involved in
 831 the plan, where they indicate their approval of the plan and agree to their responsibilities for its
 832 execution.

833 Table X: Emergency Action Plan Requirement Summary

<u>Class</u>	<u>Notification Chart</u>	<u>Emergency Detection, Evaluation, and Classification</u>	<u>Responsibilities</u>	<u>Preparedness</u>	<u>Dam Break Inundation Maps</u>	<u>Appendices</u>	<u>Certification</u>	<u>Drill</u>	<u>Table Top Exercise</u>
<u>Class I</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>
<u>Class II</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>
<u>Class III</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	

835
 836 H. The development of the EAP shall be coordinated with all entities, jurisdictions, and
 837 agencies that would be affected by a dam failure or that have statutory responsibilities for
 838 warning, evacuation, and post-flood actions. Consultation with state and local emergency
 839 management officials at appropriate levels of management responsible for warning and
 840 evacuation of the public is essential to ensure that there is agreement on their individual and
 841 group responsibilities.

842 I. The EAP shall at a minimum be filed with the Department, the local organization for
 843 emergency management, and the State Department of Emergency Management. Two copies
 844 shall be provided to the Department.

845 J. The following format shall be used as necessary to address the requirements of this
 846 section.

847 Title Page/Cover Sheet

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866

867

Part IV: Procedures

868

869 **4VAC50-20-180. Inspections.**

870

871 The director may make inspections during construction, alteration or operation and
872 maintenance as deemed necessary to ensure that the impounding structure is being
873 constructed, altered or operated and maintained in compliance with the permit or
874 certificate issued by the board. The director shall provide the owner a copy of the
875 findings of these inspections. This inspection does not relieve the owner from the
876 responsibility of providing adequate inspection during construction or operation and
877 maintenance. Periodic inspections during construction or alteration shall be conducted
878 under the supervision of a licensed professional engineer who shall propose the frequency
879 and nature of the inspections subject to approval by the director. Periodic inspections
880 during operation and maintenance shall be conducted under the supervision of a licensed
881 professional engineer at an interval not greater than that required to update the operation
882 and maintenance certificate. At a minimum, an annual owner's inspection shall be
883 conducted when a professional inspection is not required. Every owner shall provide for
884 an inspection by a licensed professional engineer after overtopping of the impounding
885 structure. A copy of the findings of each inspection with the engineer's recommendations
886 shall be filed with the board within a reasonable period of time not to exceed 30 days
887 subsequent to completion of the inspection.

888

889 Statutory Authority: §10.1-605 of the Code of Virginia.

890 Historical Notes: Derived from VR625-01-00 §4.1, eff. February 1, 1989.

891

892 **4VAC50-20-190. Right to hearing.**

893

894 Any owner aggrieved by an action taken by the director or by the board without hearing,
895 or by inaction of the director or the board, under the provisions of this chapter, may
896 demand in writing a formal hearing.

897

898 Statutory Authority: §10.1-605 of the Code of Virginia.

899 Historical Notes: Derived from VR625-01-00 §4.2, eff. February 1, 1989.

900

901 **4VAC50-20-200. Enforcement.**

902

903 Any owner refusing to obey any order of the board or the director pursuant to this chapter
904 may be compelled to obey and comply with such provisions by injunction or other
905 appropriate remedy obtained in a court proceeding. Such proceeding shall be instituted by
906 the board or in the case of an emergency, by the director in the court which granted

907 approval to the owner to impound waters or, if such approval has not been granted, the
908 proceeding shall be instituted in any appropriate court.

909
910 Statutory Authority: §10.1-605 of the Code of Virginia.
911 Historical Notes: Derived from VR625-01-00 §4.3, eff. February 1, 1989.

912

913 **4VAC50-20-210. Consulting boards.**

914

915 A. When the board needs to satisfy questions of safety regarding plans and specifications,
916 construction or operation and maintenance, or when requested by the owner, the board
917 may appoint a consulting board to report to it with respect to those questions of the
918 impounding structure's safety of an impounding structure. Such a board shall consist of
919 two or more consultants, none of whom have been associated with the impounding
920 structure.

921

922 B. The costs and expenses incurred by the consulting board, if appointed at the request of
923 an owner, shall be paid by the owner.

924

925 C. The costs and expenses incurred by the consulting board, if initiated by the board,
926 shall be paid by the board.

927

928 Statutory Authority: §10.1-605 of the Code of Virginia.
929 Historical Notes: Derived from VR625-01-00 §4.4, eff. February 1, 1989.

930

931 **4VAC50-20-220. Unsafe conditions.**

932

933 A. No owner shall have the right to maintain an impounding structure which
934 unreasonably threatens the life or property of another person. The owner of any
935 impounding structure found to have deficiencies which could threaten life or property if
936 uncorrected shall take the corrective actions needed to remove such deficiencies within a
937 reasonable period of time.

938

939 B. Imminent danger. When the director finds that an impounding structure is unsafe and
940 constitutes an imminent danger to life or property, he shall immediately notify the State
941 Department of Emergency Management and confer with the owner and ensure that the
942 emergency action plan has been implemented if appropriate to do so. The owner of an
943 impounding structure found to constitute an imminent danger to life or property shall take
944 immediate corrective action to remove the imminent danger as required by §10.1-608 of
945 the Code of Virginia.

946

947 C. Nonimminent danger. The owner of an impounding structure who has been issued a
948 report by the board containing findings and recommendations for the correction of
949 deficiencies which threaten life or property if not corrected, shall undertake to implement

950 the recommendations for correction of deficiencies according to a schedule of
951 implementation contained in that report as required by §10.1-609 of the Code of Virginia.

952 Statutory Authority: §10.1-605 of the Code of Virginia.

953 Historical Notes: Derived from VR625-01-00 §4.5, eff. February 1, 1989; Amended, Virginia Register Volume 18,
954 Issue 14, eff. July 1, 2002.

955 Effect of Amendment: The July 1, 2002 amendment, in subsection B, changed "Emergency Services" to "Emergency
956 Management"; and, in subsection C, changed "director" to "board", following "issued a report by the".
957

958
959 **4VAC50-20-230. Complaints.**

960
961 A. Upon receipt of a complaint alleging that the person or property of the complainant is
962 endangered by the construction, maintenance or operation of impounding structure, the
963 director shall cause an inspection of the structure, unless the data, records and inspection
964 reports on file with the board are found adequate to determine if the complaint is valid.

965
966 B. If the director finds that an unsafe condition exists, the director shall proceed under the
967 provisions of §§10.1-608 and 10.1-609 of the Code of Virginia to render the extant
968 condition safe.

969 Statutory Authority: §10.1-605 of the Code of Virginia.

970 Historical Notes: Derived from VR625-01-00 §4.6, eff. February 1, 1989.
971

972
973 **Part V: Design Requirements**

974
975 **4VAC50-20-240. Design of structures.**

976
977 A. The owner shall complete all necessary investigations prior to submitting the design
978 report. The scope and degree of precision required is a matter of engineering judgment
979 based on the complexities of the site and the hazard potential classification of the
980 proposed structure.

981
982 B. Surveys shall be made with sufficient accuracy to locate the proposed construction site
983 and to define the total volume of storage in the impoundment. Locations of center lines
984 and other horizontal and vertical controls shall be shown on a map of the site. The area
985 downstream and upstream from the proposed impounding structure shall be investigated
986 in order to delineate the areas and extent of potential damage in case of failure or
987 backwater due to flooding.

988
989 C. The drainage area shall be determined. Present, projected and potential future land-use
990 conditions shall be considered in determining the runoff characteristics of the drainage
991 area. The most severe of these conditions shall be included in the design calculations
992 which shall be submitted as part of the design report.

993
994 D. The geotechnical engineering investigation shall consist of borings, test pits and other
995 subsurface explorations necessary to adequately define the existing conditions. The

996 investigations shall be performed so as to define the soil, rock and ground water
997 conditions.
998

999 E. All construction materials shall be adequately selected so as to ensure that their
1000 properties meet design criteria. If on-site materials are to be utilized, they shall be located
1001 and determined to be adequate in quantity and quality.

1002
1003 Statutory Authority: §10.1-605 of the Code of Virginia.
1004 Historical Notes: Derived from VR625-01-00 §5.1, eff. February 1, 1989.
1005

1006 **4VAC50-20-250. Design flood.**
1007

1008 The minimum design flood to be utilized in impounding structure evaluation, design,
1009 construction, operation and maintenance shall be commensurate with the size and hazard
1010 potential of the particular impounding structure as determined in 4VAC50-20-50 and
1011 Table 1. Competent, experienced, ~~professional~~ engineering judgment by a licensed
1012 professional engineer shall be used in applying those design and evaluation procedures
1013 referenced in 4VAC50-20-320 of this chapter.

1014
1015 Statutory Authority: §10.1-605 of the Code of Virginia.
1016 Historical Notes: Derived from VR625-01-00 §5.2, eff. February 1, 1989.

1017

1018 **4VAC50-20-260. Emergency spillway design.**
1019

1020 A. Every impounding structure shall have a spillway system with adequate capacity to
1021 discharge the design flood without endangering the safety of the impounding structure.
1022

1023 B. An emergency spillway shall be required.
1024

1025 C. Vegetated earth or an unlined emergency spillway may be approved when the
1026 applicant demonstrates that it will pass the spillway design flood without jeopardizing the
1027 safety of the impounding structure.
1028

1029 D. Lined emergency spillways shall include design criteria calculations, plans and
1030 specifications for open channel, drop, ogee and chute spillways that include crest
1031 structures, walls, panel lining and miscellaneous details. All joints shall be reasonably
1032 water-tight and placed on a foundation capable of sustaining applied loads without undue
1033 deformation. Provision shall be made for handling leakage from the channel or under
1034 seepage from the foundation which might adversely affect the structural integrity and
1035 structural stability of the impounding structure.

1036

1037 Statutory Authority: §10.1-605 of the Code of Virginia.
1038 Historical Notes: Derived from VR625-01-00 §5.3, eff. February 1, 1989.
1039

1040 **4VAC50-20-270. Principal spillways and outlet works.**

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A. It will be assumed that principal spillways and regulating outlets provided for special functions will operate to normal design discharge capabilities during the spillway design flood, provided appropriate analyses show:

1. That control gates and structures are suitably designed to operate reliably under maximum heads for durations likely to be involved and risks of blockage by debris are minimal;
2. That access roads and passages to gate regulating controls would be safely passable by operating personnel under spillway design flood conditions; and
3. That there are no other substantial reasons for concluding that outlets would not operate safely to full design capacity during the spillway design flood.

B. If there are reasons to doubt that any of the above basic requirements might not be adequately met under spillway design flood conditions, the "dependable" discharge capabilities of regulating outlets shall be assumed to be less than 100% of design capabilities, generally as outlined in the following subsections C through G of this section.

C. Any limitations in safe operating heads, maximum velocities to be permitted through structures or approach channels, or other design limitations shall be observed in establishing "dependable" discharge rating curves to be used in routing the spillway design flood hydrograph through the reservoir.

D. If intakes to regulating outlets are likely to be exposed to dangerous quantities of floating ~~drift~~ debris, sediment depositions or ice hazards prior to or during major floods, the dependable discharge capability during the spillway design flood shall be assumed to be zero.

E. If access roads or structural passages to operating towers or controls are likely to be flooded or otherwise unusable during the spillway design flood, the dependable discharge capability of regulating outlets will be assumed to be zero for those period of time during which such conditions might exist.

F. Any deficiencies in discharge performance likely to result from delays in the operation of gates before attendants could be reasonably expected to reach the control for in estimating "dependable" discharge capabilities to be assumed in routing the spillway design flood through reservoir. Reports on design studies shall indicate the allowances made for possible delays in initiating gate operations. Normally, for projects located in small basins, where critical spillway design flood inflows may occur within several hours after intense precipitation, outflows through any regulating outlets that must be opened

1084 after the flood begins shall be assumed to be zero for an appropriate period of time
1085 subsequent to the beginning of intense rainfall.

1086
1087 G. All gates, valves, conduits and concrete channel outlets shall be designed and
1088 constructed to prevent significant erosion or damage to the impounding structure or to the
1089 downstream outlet or channel.

1090
1091 Statutory Authority: §10.1-605 of the Code of Virginia.
1092 Historical Notes: Derived from VR625-01-00 §5.4, eff. February 1, 1989.

1093

1094 **4VAC50-20-280. Drain requirements.**

1095
1096 All new impounding structures regardless of their hazard potential classification, shall
1097 include a device to permit draining of the impoundment within a reasonable period of
1098 time as determined by the owner's licensed professional engineer, subject to approval by
1099 the director.

1100
1101 Statutory Authority: §10.1-605 of the Code of Virginia.
1102 Historical Notes: Derived from VR625-01-00 §5.5, eff. February 1, 1989.

1103

1104 **4VAC50-20-290. Life of the impounding structure.**

1105
1106 Components of the impounding structure, the impoundment, the outlet works, drain
1107 system and appurtenances shall be durable in keeping with the design and planned life of
1108 the impounding structure.

1109
1110 Statutory Authority: §10.1-605 of the Code of Virginia.
1111 Historical Notes: Derived from VR625-01-00 §5.6, eff. February 1, 1989.

1112

1113 **4VAC50-20-300. Additional design requirements.**

1114
1115 A. Flood routings shall start at or above the elevation of the crest of the lowest ungated
1116 outlet.

1117
1118 B. All elements of the impounding structure and impoundments shall conform to sound
1119 engineering practice. Safety factors, design standards and design references that are used
1120 shall be included with the design report.

1121
1122 C. Inspection devices may be required by the director for use by inspectors, owners or the
1123 director in conducting inspections in the interest of structural integrity during and after
1124 completion of construction and during the life of the impounding structure.

1125
1126 Statutory Authority: §10.1-605 of the Code of Virginia.
1127 Historical Notes: Derived from VR625-01-00 §5.7, eff. February 1, 1989.

1128

1129 **4VAC50-20-310. Plans and specifications.**

1130

1131 The plans and specifications for a proposed impounding structure shall consist of a
1132 detailed engineering design report that includes engineering drawings and specifications,
1133 with the following as a minimum:

1134

1135 1. The name of the project; the name of the owner; classification of the
1136 impounding structure as set forth in this chapter; designated access to the project
1137 and the location with respect to highways, roads, streams and existing
1138 impounding structures and impoundments that would affect or be affected by the
1139 proposed impounding structure.

1140

1141 2. Cross-sections, profiles, logs of test borings, laboratory and in situ test data,
1142 drawings of principal and emergency spillways and other additional drawings in
1143 sufficient detail to indicate clearly the extent and complexity of the work to be
1144 performed.

1145

1146 3. The technical provisions, as may be required to describe the methods of the
1147 construction and construction quality control for the project.

1148

1149 4. Special provisions, as may be required to describe technical provisions needed
1150 to ensure that the impounding structure is constructed according to the approved
1151 plans and specifications.

1152

1153 Statutory Authority: §10.1-605 of the Code of Virginia.

1154 Historical Notes: Derived from VR625-01-00 §5.8, eff. February 1, 1989.

1155

1156 **4VAC50-20-320. Acceptable design procedures and references.**

1157

1158 The following are acceptable as design procedures and references:

1159

1160 1. The design procedures, manuals and criteria used by the United States Army
1161 Corps of Engineers.

1162

1163 2. The design procedures, manuals and criteria used by the United States
1164 Department of Agriculture, Natural Resources Conservation Service.

1165

1166 3. The design procedures, manuals and criteria used by the United States
1167 Department of the Interior, Bureau of Reclamation.

1168

1169 4. The design procedures, manuals and criteria used by the United States
1170 Department of Commerce, National Weather Service.

1171

1172 5. Other design procedures, manuals and criteria that are accepted as current,
1173 sound engineering practices, as approved by the director prior to the design of the
1174 impounding structure.

1175
1176 Statutory Authority: §10.1-605 of the Code of Virginia.
1177 Historical Notes: Derived from VR625-01-00 §5.9, eff. February 1, 1989; Amended, Virginia Register Volume 18,
1178 Issue 14, eff. July 1, 2002.
1179 Effect of Amendment: The July 1, 2002 amendment, in paragraph 2, changed "Soil" to "Natural Resources" before
1180 "Conservation"; and, in paragraph 3, changed "or Interior" to "of the Interior".

1181

1182 **FORMS**

1183

1184 Dam Owner's Annual Inspection Form, DCR 199-098 (rev. 12/01).

1185

1186 Operation and Maintenance Application Class I, II and III Impounding Structures, DCR
1187 199-099 (rev. 12/01).

1188

1189 As-Built Report for Class I, II and III Impounding Structures, DCR 199-100 (rev. 12/01).

1190

1191 Design Report for the Construction/Alteration of Impounding Structures, DCR 199-101
1192 (rev. 12/01).

1193

1194 ~~Emergency Action Plan for Class I, Class II and Class III Impounding Structures, DCR~~
1195 ~~199-103 (rev. 12/01).~~

1196

1197 Inventory Report for Class III and Class IV Impounding Structures, DCR 199-104 (rev.
1198 12/01).

1199

1200 Reinspection Report for Class I and II Impounding Structures, DCR 199-105 (rev.
1201 12/01).

1202

1203 Agricultural Certification for Impounding Structures, DCR 199-106 (rev. 12/01).

1204

1205 Transfer Application for Impounding Structures, DCR 199-107 (rev. 12/01).

1206

1207

1208

1209

1210 Spillway Flow Reduction Parking Lot Items

1211 Full scale exercise (every 2 years) and functional exercise (every 6 years) might be part of a
1212 reduction process.

1213 Inundation maps updated more frequently

1214 Functioning I-Flow System or other observation system

1215 Proactive – Inundation maps driving future zoning

1216 DCR in-depth review of the EAP require \$\$\$'s

1217 Automated warning/ notification system

1218

1219 Functional and full scale exercises shall be considered comprehensive exercises and shall only be

1220 required pursuant to section xxxx (spillway design reduction strategies).

Attachment #2

While planning for our meeting on 6 July, I have asked myself the following questions.

Peter G. Rainey

CLASSIFICATION

National Hazard Potential Classification system is HIGH, SIGNIFICANT and LOW; defined in FEMA 333

While currently Virginia does not follow the Federal classification system, somebody in the state inputs the dams in Virginia into the National Inventory of Dams (NID) which does follow the Federal system.

Should Virginia follow the Federal Guidelines?

SUB-CLASSES

The span of dam storage capacity and height is not significantly different between classes. The inundation zone land use is what determines the Hazard class. The Hazard class can change as necessary, 4VAC50-20-40 B.6.

For the purpose of differing EAP and SDF requirements, should there be sub-classes within each Hazard Class?

Should Virginia have four classes, as does NC and GA, or continue with three?

SDF

North Carolina requires Large dams, $\geq 7,500$ and $< 50,000$ acre-ft. or ≥ 50 and < 100 ft. high, SDF = $\frac{3}{4}$ PMF. Georgia requires Large dam, $> 1,000$ and $< 50,000$ acre-ft. or > 35 and < 100 ft. high, SDF = $\frac{1}{2}$ PMF

Should Virginia distinguish between the sub-classes as does NC and GA; i.e. monotonic reduction in SDF for lower sub-classes?

Should Virginia continue to require 1 PMF for dams less than 50,000 acre-ft and less than 100 ft high?

NC requires $\frac{3}{4}$ PMF, GA requires $\frac{1}{2}$ PMP

PMF

Many states define the PMF as due to the 6 hour PMP, Virginia regulations are silent on the storm duration. The drainage basin is generally understood to be the actual watershed, however, Virginia (4VAC50-20-240 C) requires the design to be calculated based on the potential future land-use conditions, if they are more severe.

Should Virginia stipulate PMF to be calculated on basis of 6 hr PMP in the present drainage area?

SDF REQUIREMENT MAY BE REDUCED

Federal Guidelines for Dam Safety include procedures for Selecting and Accommodating Inflow Design for Dams, FEMA 94. "The maximum inflow design flood (IDF) is always the PMF, but in many cases the IDF` will be substantially less than the PMF."

Should 4VAC50-20-130 be changed to apply to all dams? "The spillway design flood (SDF) may be reduced by the board to the spillway discharge at which dam failure will not significantly increase the downstream hazard existing just prior to dam failure provided that the conditions of 4VAC50-20-130A have been met."

RESOLVE EAP ISSUES

Should EAP be required of current class 3 and 4, LOW Hazard dams?