Dam Safety Inspection Report Guidelines (BLM)

Course No: G02-010
Credit: 2 PDH

Allen Hughes, P.E.

Continuing Education and Development, Inc.

P: (877) 322-5800
info@cedengineering.com

HANDBOOK H-9177-1
DAM SAFETY INSPECTION REPORT GUIDELINES

H-9177-1 Handbook

A. Procedure

1. Qualifications

See Bureau Manual 9177 for the Bureau requirements for being a qualified inspector.

2. Method

Inspections should be performed through use of this Handbook in coordination with the Bureau of Land Management *Dam Condition Assessment Checklist*. The Bureau *Dam Condition Assessment Checklist* is for use when performing inspections on earth embankment dams, as are common across the majority of the Bureau. Items to be measured under the Dimensional Data heading should be measured consistently across the Bureau. Methods to be used are taught in training classes as required under the qualifications for being an inspector, in addition to the guidance provided in this Handbook.

B. CRACKS

1. Transverse Cracks:

Transverse cracks, or cracks through the structure from front slope to back slope, are usually of the greatest concern, as they can provide a path for seepage from the reservoir to the face of the dam. Transverse cracks can result from a compressible foundation under the central portion of the dam coupled with incompressible rock foundation and abutments at the end portions of the dam (Figure 4).

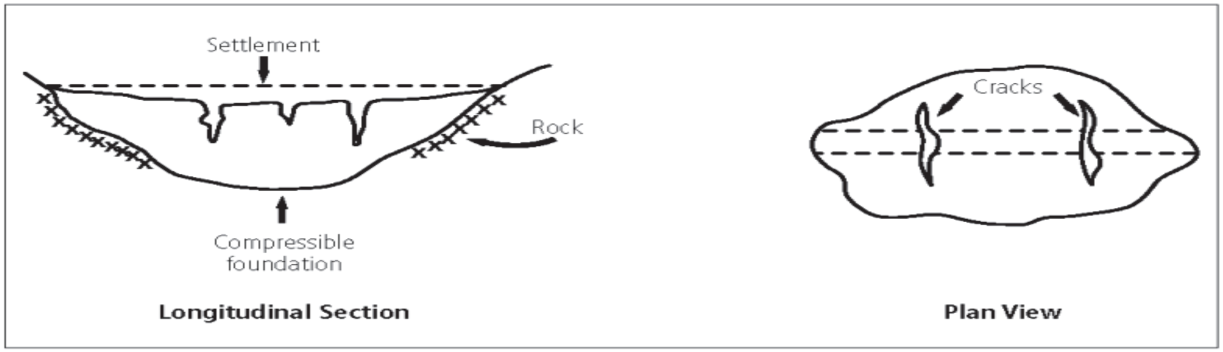


Figure 4. Transverse Cracks

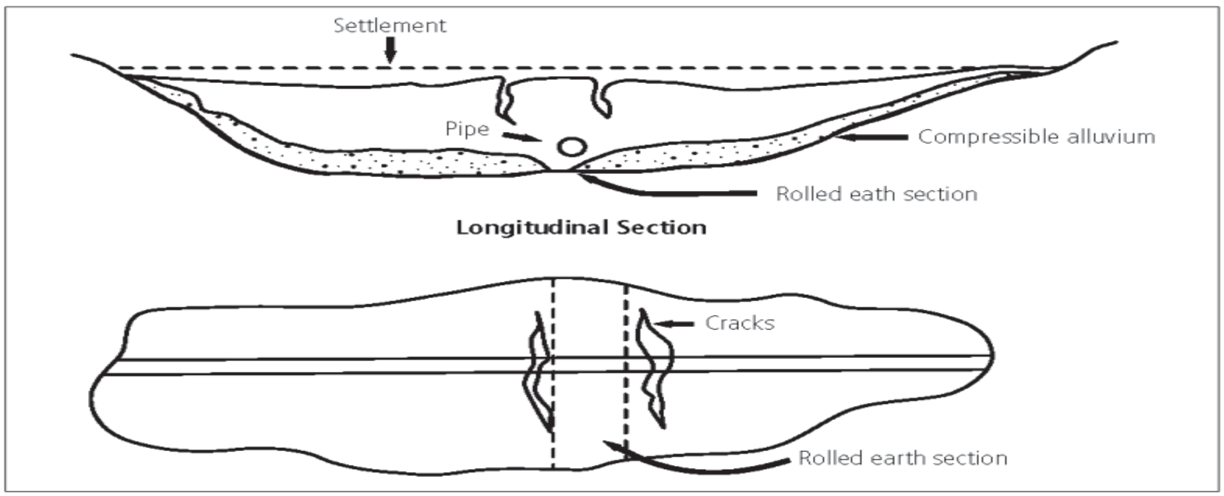


Figure 5. Transverse Cracks

B. CRACKS

2. Horizontal Cracks:

Horizontal cracks below the crest of the dam can occur in structures built in narrow valleys with rock abutments. Arching may occur in the upper portion of the embankment; this prevents the crest of the embankment from settling as much as the foundation. Horizontal cracks may then occur at the bottom of the arched portion of the embankment (Figure 6).

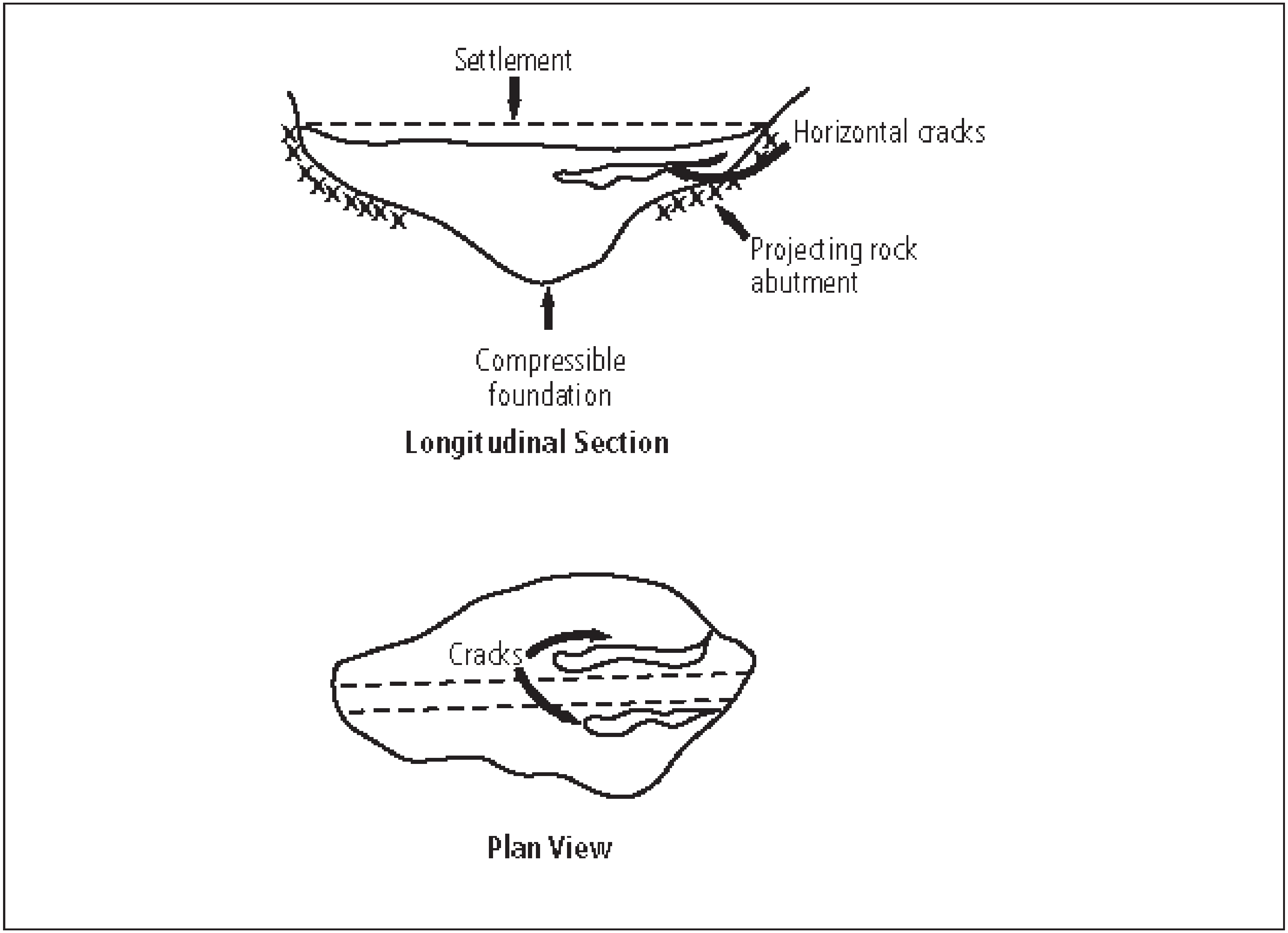


Figure 6. Horizontal Cracks

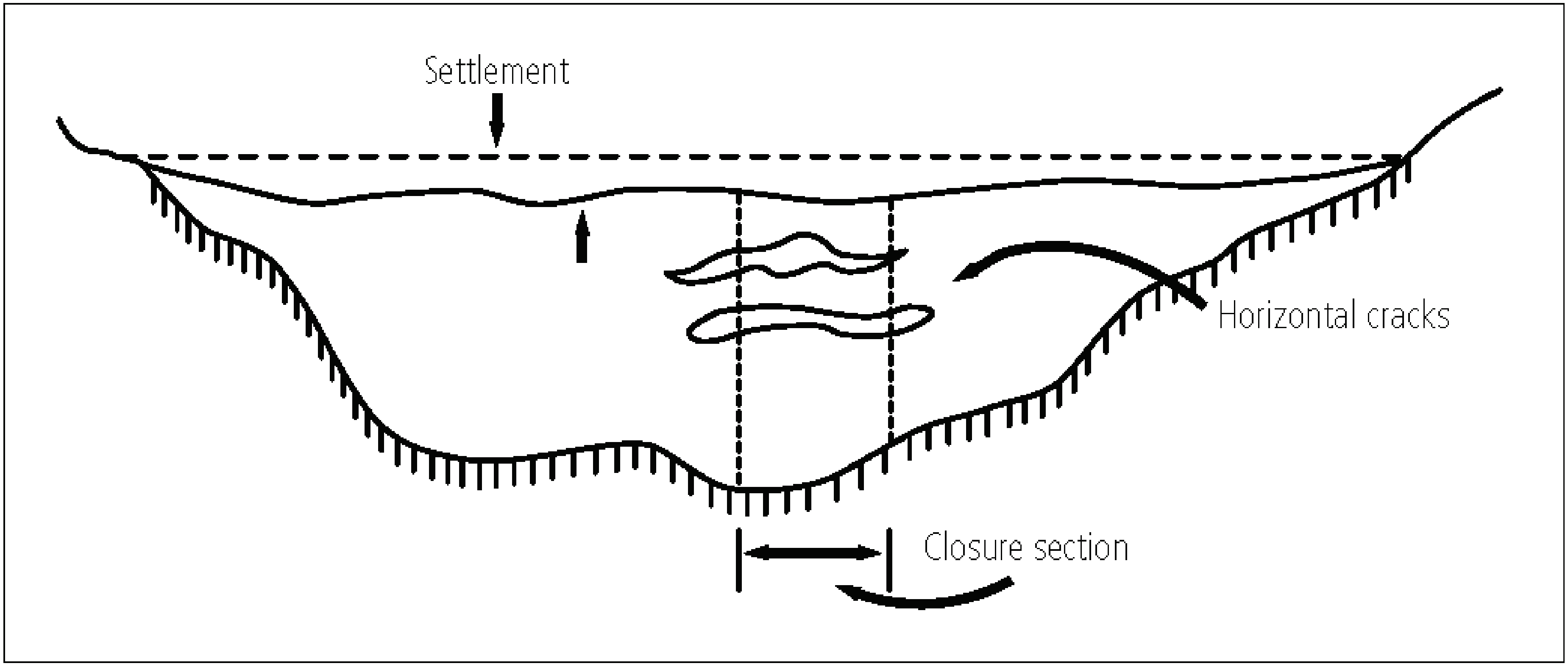


Figure 7. Horizontal Cracks

B. CRACKS

3. Longitudinal Cracks:

Longitudinal cracks by themselves are not normally dangerous; however, the presence of longitudinal cracks on the surface can be an indication of more serious internal problems; for example, hidden inclined transverse cracks.
Longitudinal cracking can occur in conjunction with rolled earth cutoffs. The slopes of the embankment, which are over a more compressible natural foundation, settle more than the crest of the dam, which is located over the less compressible rolled earth cutoff section. As the slopes settle, longitudinal cracks appear at the outer limits of the less compressible foundation section (Figure 8).

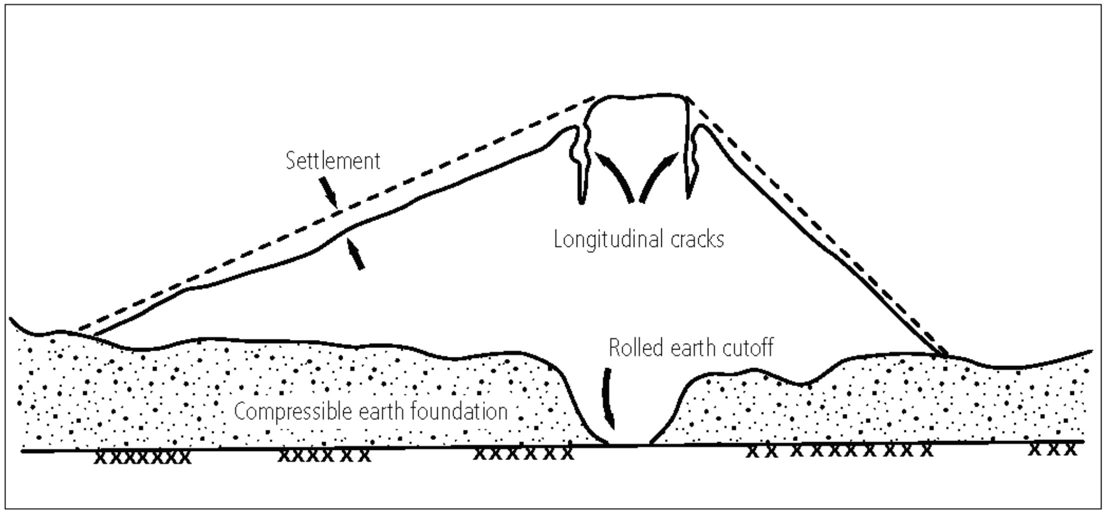


Figure 8. Longitudinal Cracks

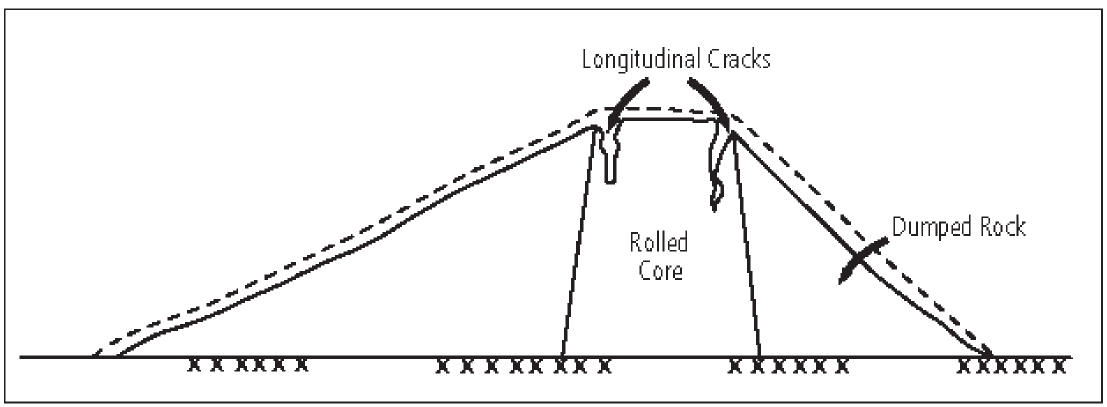


Figure 9. Longitudinal Cracks

Picture 1 - Horizontal Cracks

B. CRACKS

4. Interior Cracks

Interior cracking cannot be seen on the face of the dam, but may be suspected if certain areas of the dam show signs of greater settlement than surrounding sections. An example of this would be in dams constructed with a narrow vertical central core of compressible impervious material and outer slopes of relatively less compressible materials. The core tends to compress, forming a depression at the crest of the dam. As a portion of the core weight is transferred to the outer shell through shearing and arching, interior horizontal cracks may occur in the core (Figure 10).

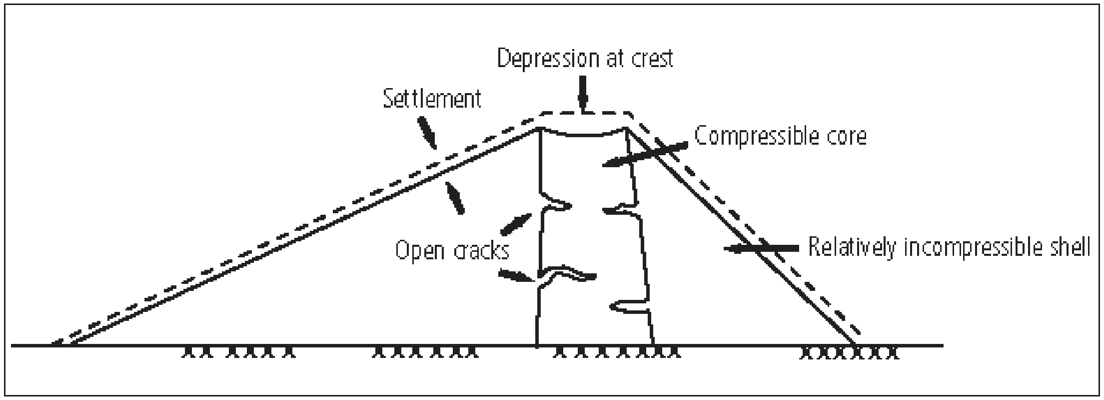


Figure 10. Interior Cracks

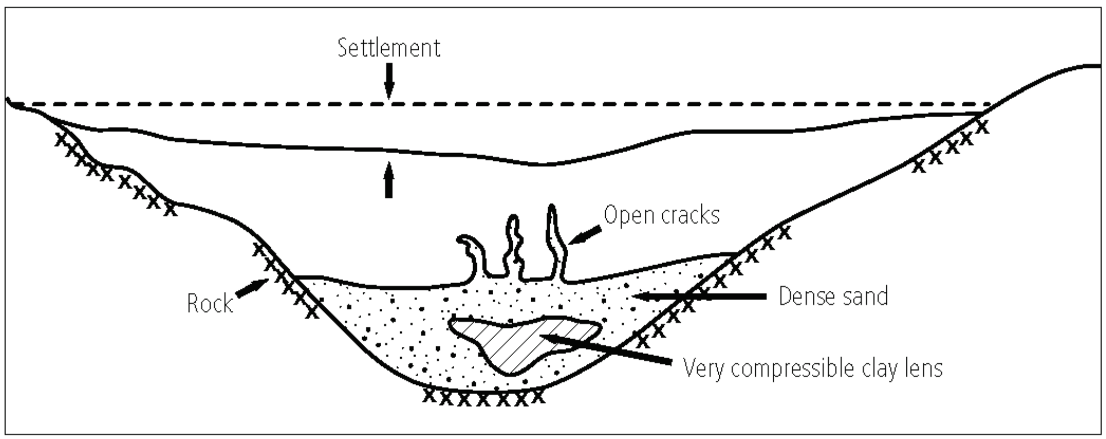


Figure 11. Interior Cracks

5. Surface Drying Cracks

Cracks due to surface drying can occur during both construction and the operational life of the dam. Surface drying of one or more levels of the embankment during construction can be caused by construction delays or suspensions that expose the embankment to the wind and the sun. Fine-grained soils are especially vulnerable to surface drying and cracking; the permeability of the embankment material may be greatly increased.

Embankments constructed of homogeneous, clayey soils are especially prone to surface drying and cracking after construction is completed and during the operation life of the dam. These cracks usually seem to be more severe in areas influenced by tensile stress (at the top of the embankment slope, for example). This type of surface drying and cracking is often caused or exacerbated by hot, dry climatic conditions during a period when the reservoir is very low or empty. This type of cracking can be described as Desiccation Cracking.

C. SLIDING AND SLUMPING

Stability problems in dam embankments are evidenced by cracks, displacements, sloughing and sliding, bulges, and creeping. Look for sags and misalignments in parapet walls, guardrails, and conduits; bulges at the toe of the dam or in the ground below the toe; longitudinal cracking near the crest; and other indications that the embankment is moving. Sliding or slumping of either or both the upstream and downstream embankment slopes can occur during construction or rehabilitation of a structure. This type of sliding or slumping can be slow (time-scale on the order of days or weeks) or rapid (time-scale on the order of minutes). Landslides and slumps in dam embankments are mechanically similar to mass movements in natural soils. Slides in earthen dam embankments tend to be a slump or series or slumps, rather than planar shearing and sliding or mass falls.

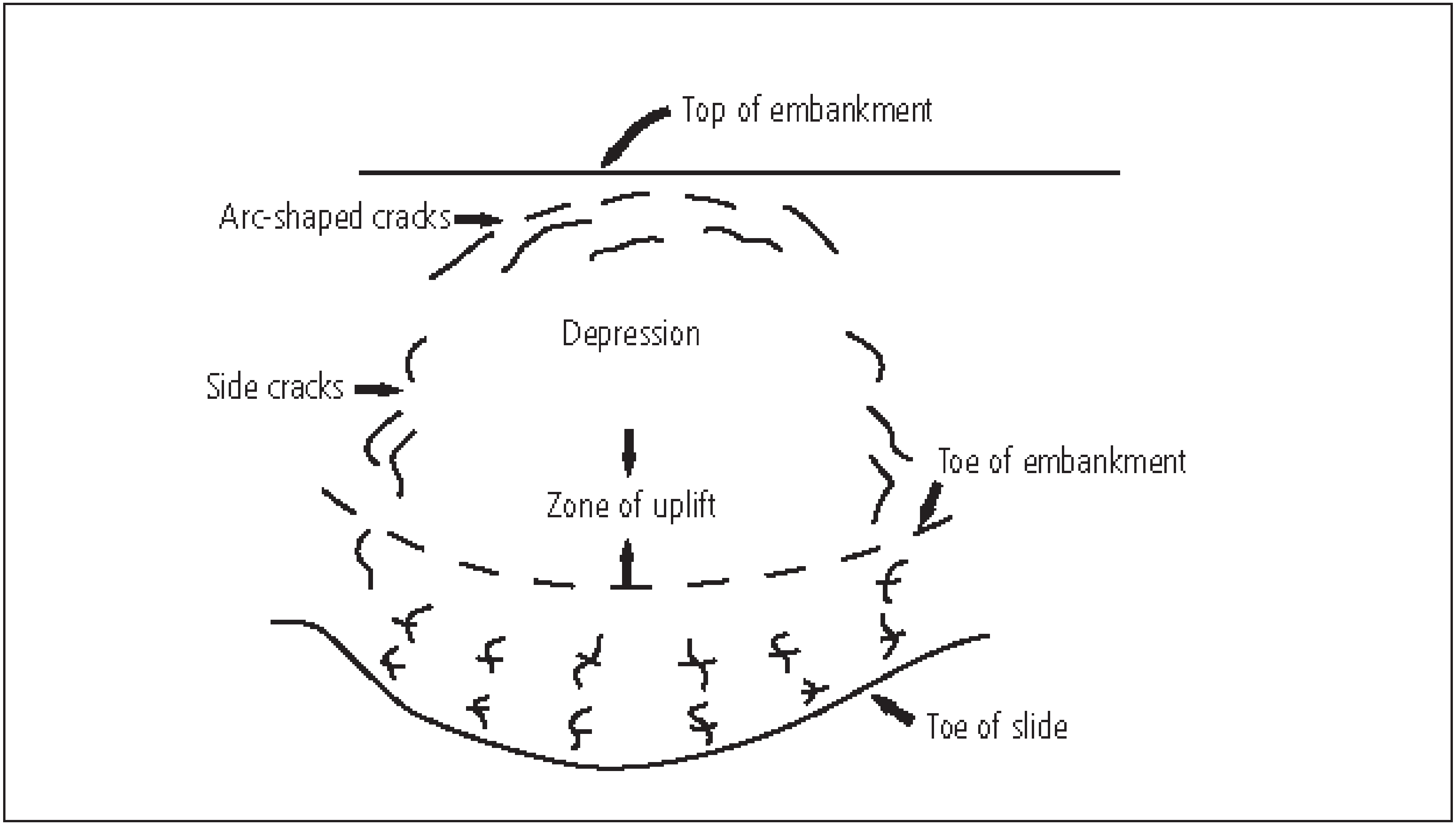


Figure 12. Pattern Cracks (face of slope)

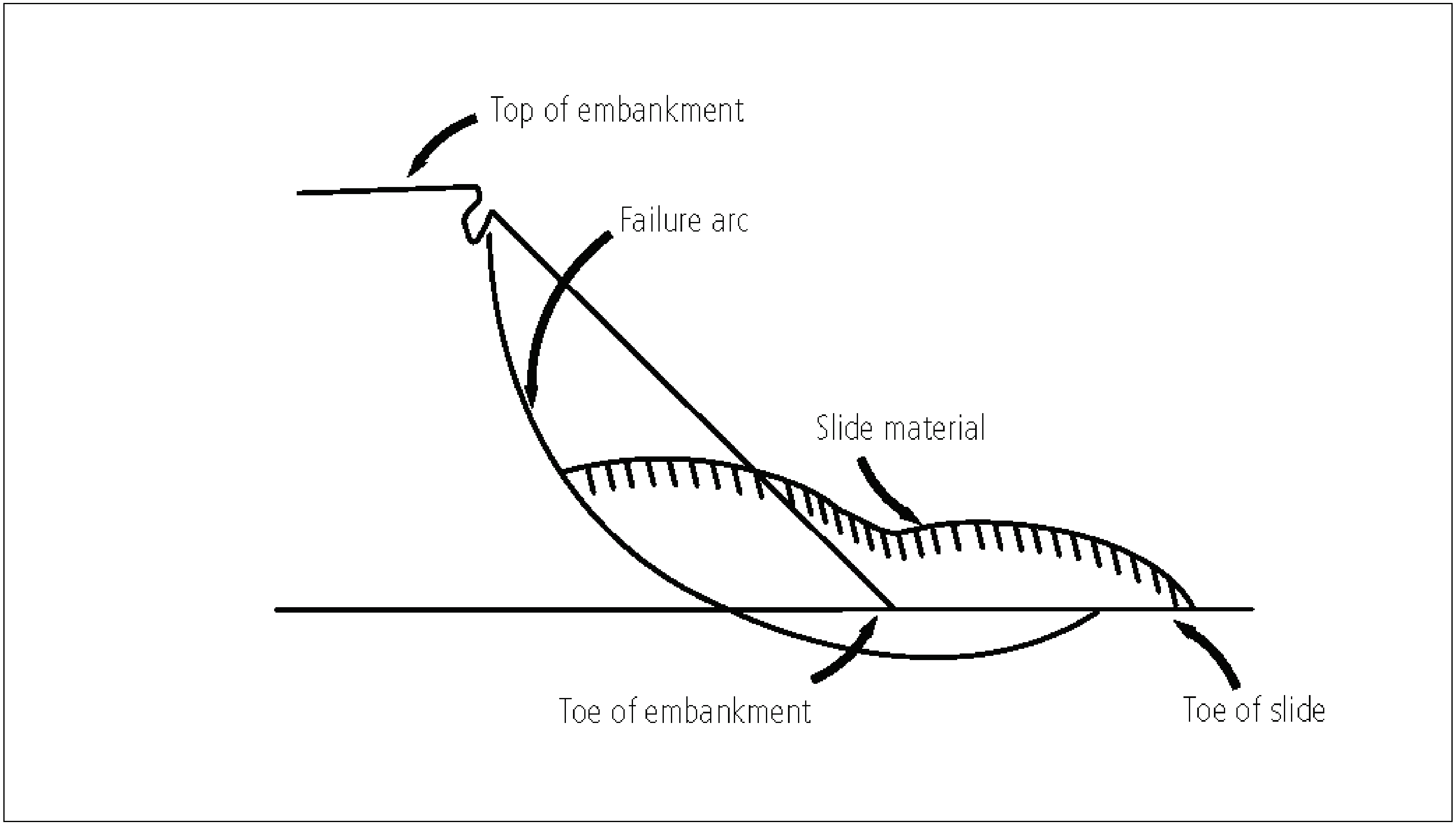


Figure 13. Slumping (cross-section)

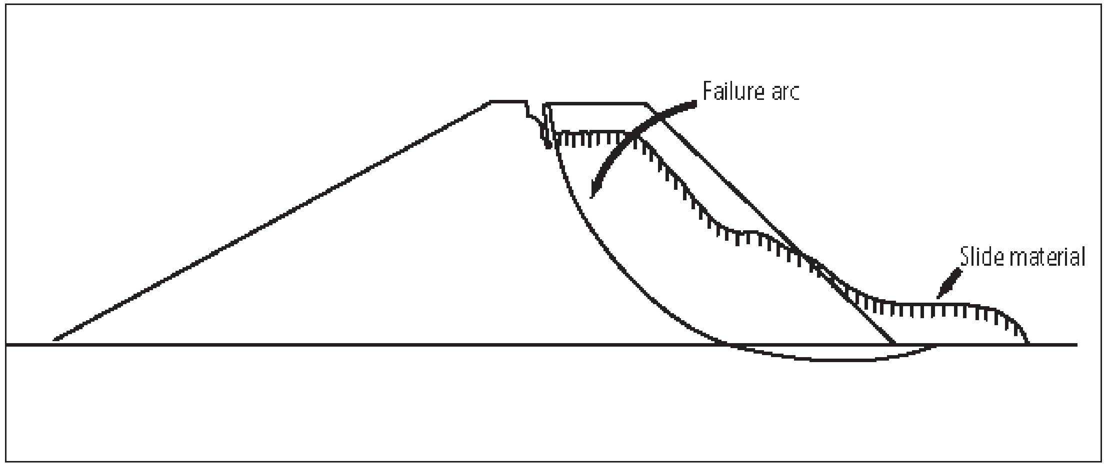


Figure 14. Slow Slump (cross-section)

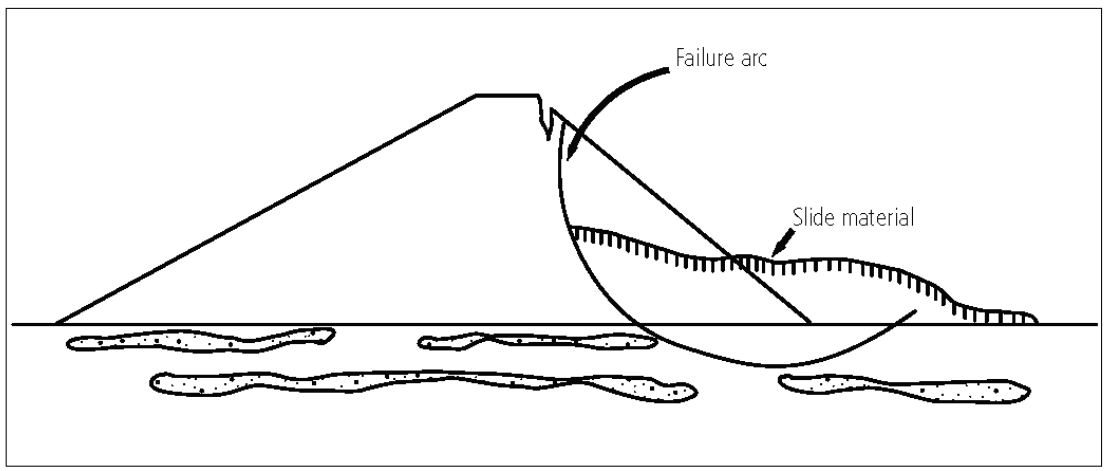


Figure 15. Rapid Slide (cross-section)

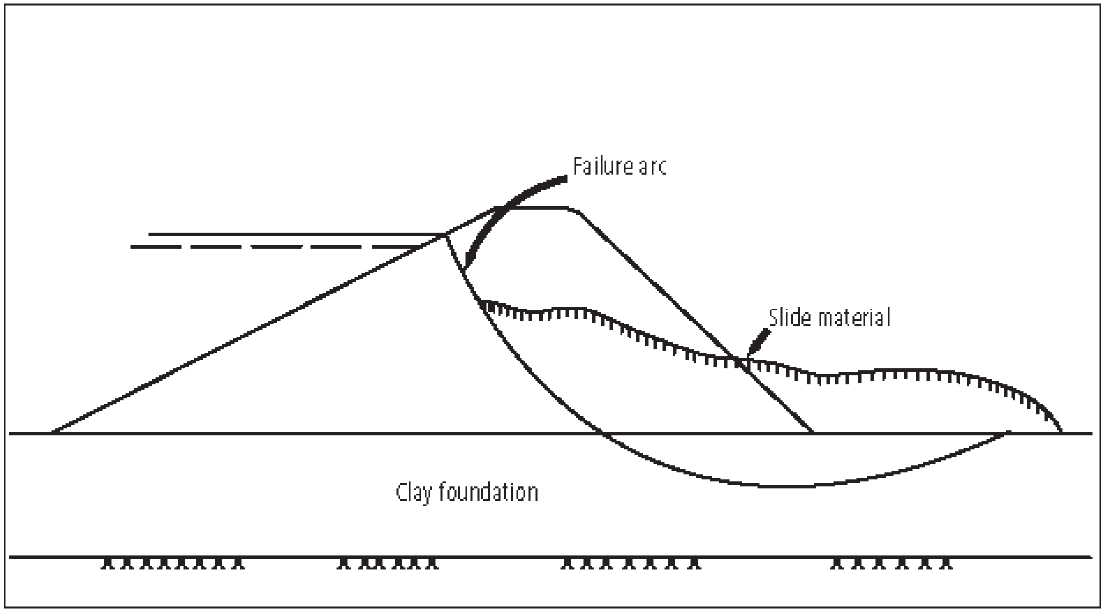


Figure 16. Deep Slide (cross-section)

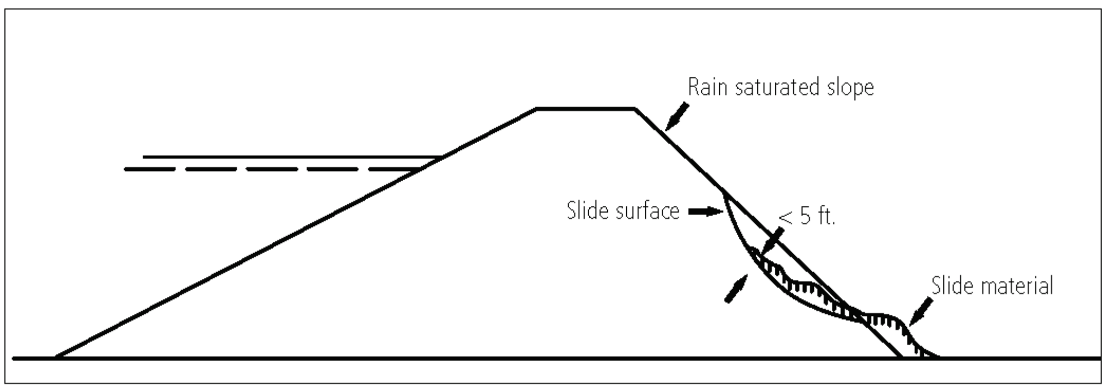


Figure 17. Shallow Slide

DRAWDOWN SLIDES

- Sliding can also occur after or during reservoir drawdown.
- Slope instability caused by removal of the overlying reservoir load and by elevated internal pore water pressures within the embankment.
- If the upstream portion of the embankment is constructed of free-draining materials such as rock or gravel, the water will flow out of the pores in the embankment as the reservoir is lowered; thus, the pore pressure will be lowered as rapidly as the reservoir load is removed.
- The likelihood of this type of slide relates to the fineness of the embankment soils. Soils with an average grain size (D50) of 0.006 to 0.02 mm seem to be particularly susceptible to drawdown slumping or sliding.
- Drawdown slides are most likely to occur the first time the reservoir level is lowered after filling.

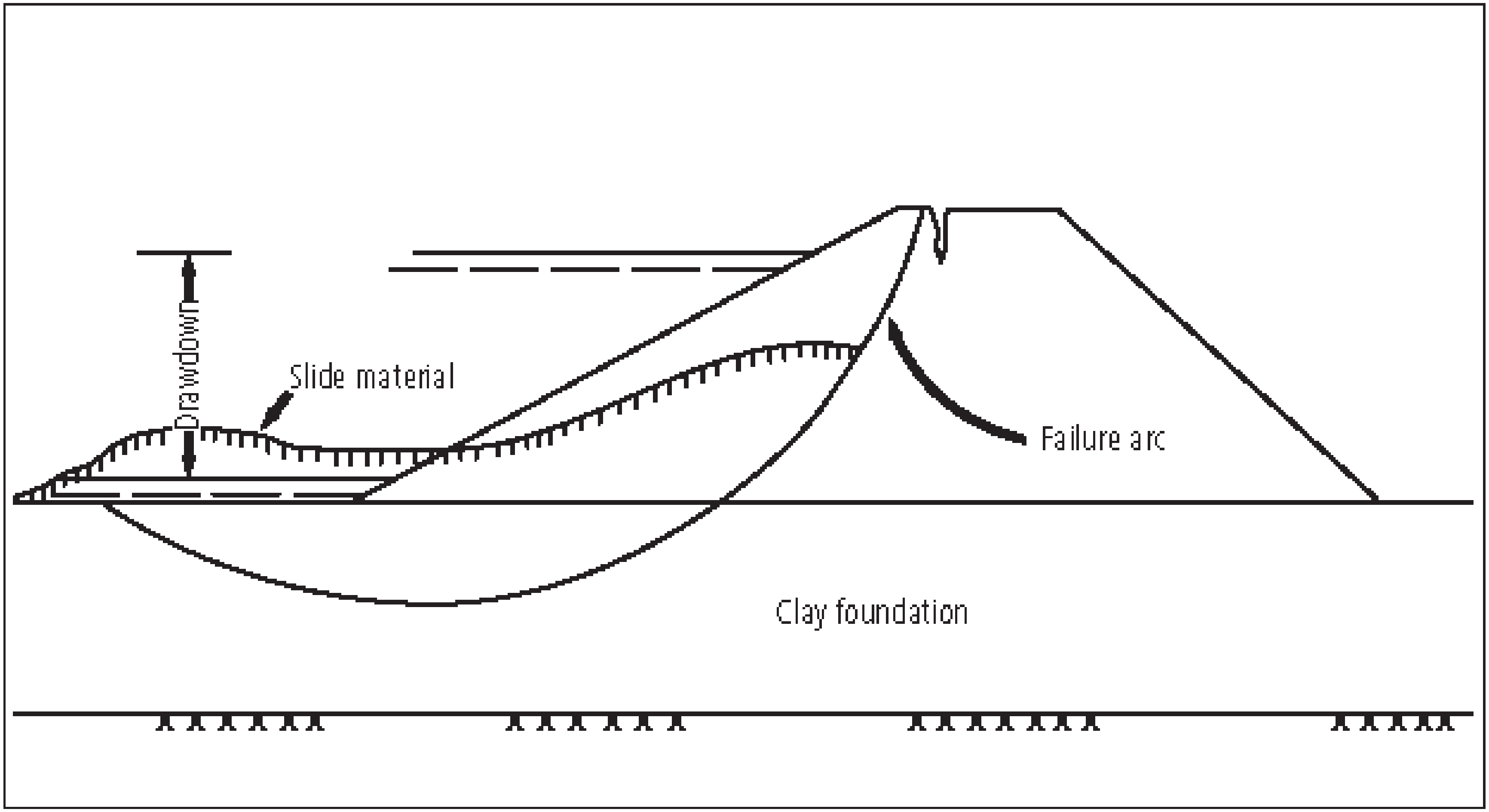


Figure 18. Drawdown Slide (cross-section)

Picture 2 - Drawdown Slide

D. SEEPAGE PROBLEMS

- Uncontrolled seepage through an embankment dam can cause the movement of soil to unprotected exits, creating voids and leading to "piping" failures.
- Improper compaction; differential settlements; pervious embankment materials; or the presence of ice lenses, roots, stumps, or debris in an embankment resulting from inadequate construction control can cause excessive seepage through the embankment.
- Settlement cracks caused by a compressible material in the embankment or foundation can also provide seepage paths. Other causes of excessive seepage are animal burrows, root systems of large trees, and leakage along or through conduits in an embankment.
- The adverse effects of seepage in a zoned earthfill dam are usually controlled by a filter to prevent the piping of embankment or foundation material.

1. Piping Through Embankment Piping is the progressive erosion of the embankment caused by concentrated seepage, resulting in the development of channels through the embankment.

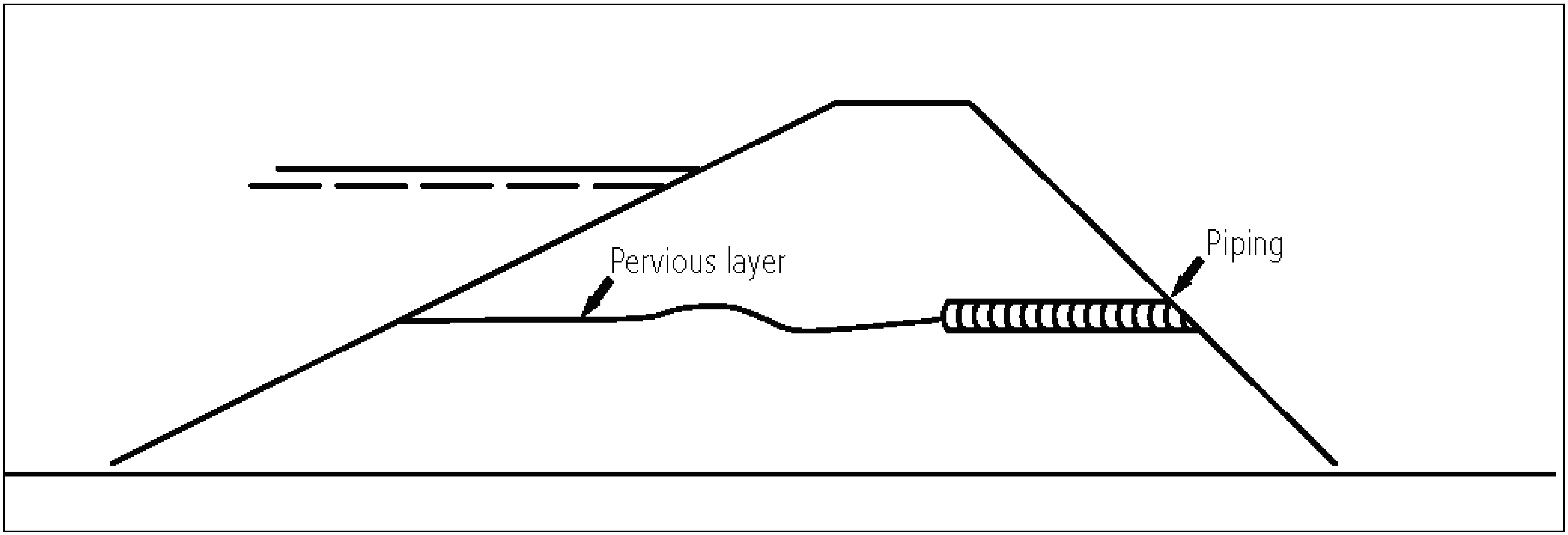


Figure 19. Piping Through Embankment (cross-section)

SEEPAGE PROBLEMS

- 2. Piping Along Outlet Works
- 3. Piping Through the Abutments
- 4. Piping Through Foundation
- 5. Seepage Through Embankment
- 6. Seepage Due to Water-Soluble Materials
- 7. Seepage and Vegetation Growth
- 8. Burrowing Animals

Picture 3 - Seepage

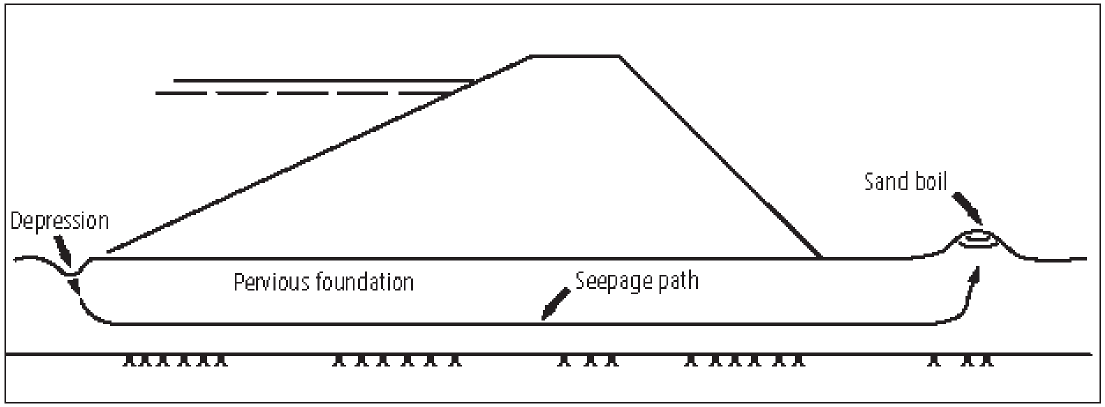


Figure 20. Piping Through Foundation (cross-section)

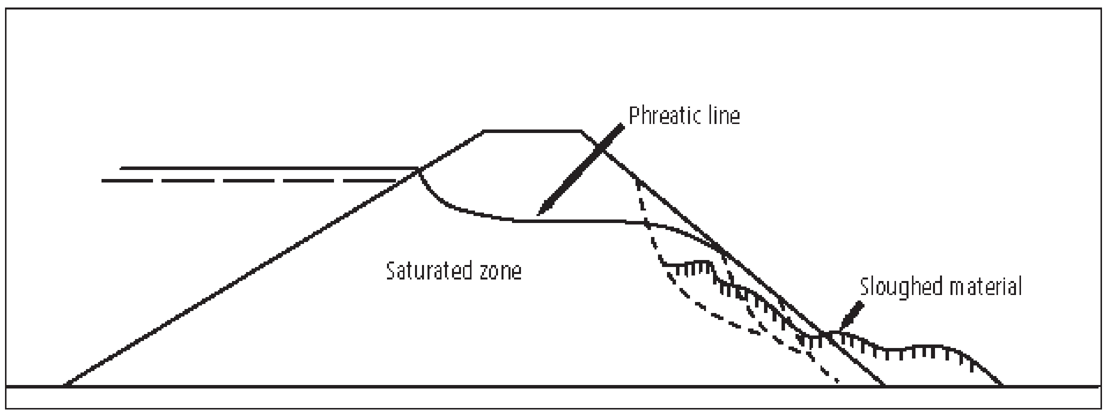


Figure 22. Sloughing of Saturated Embankment (cross-section)

Picture 4 - Sloughed Material

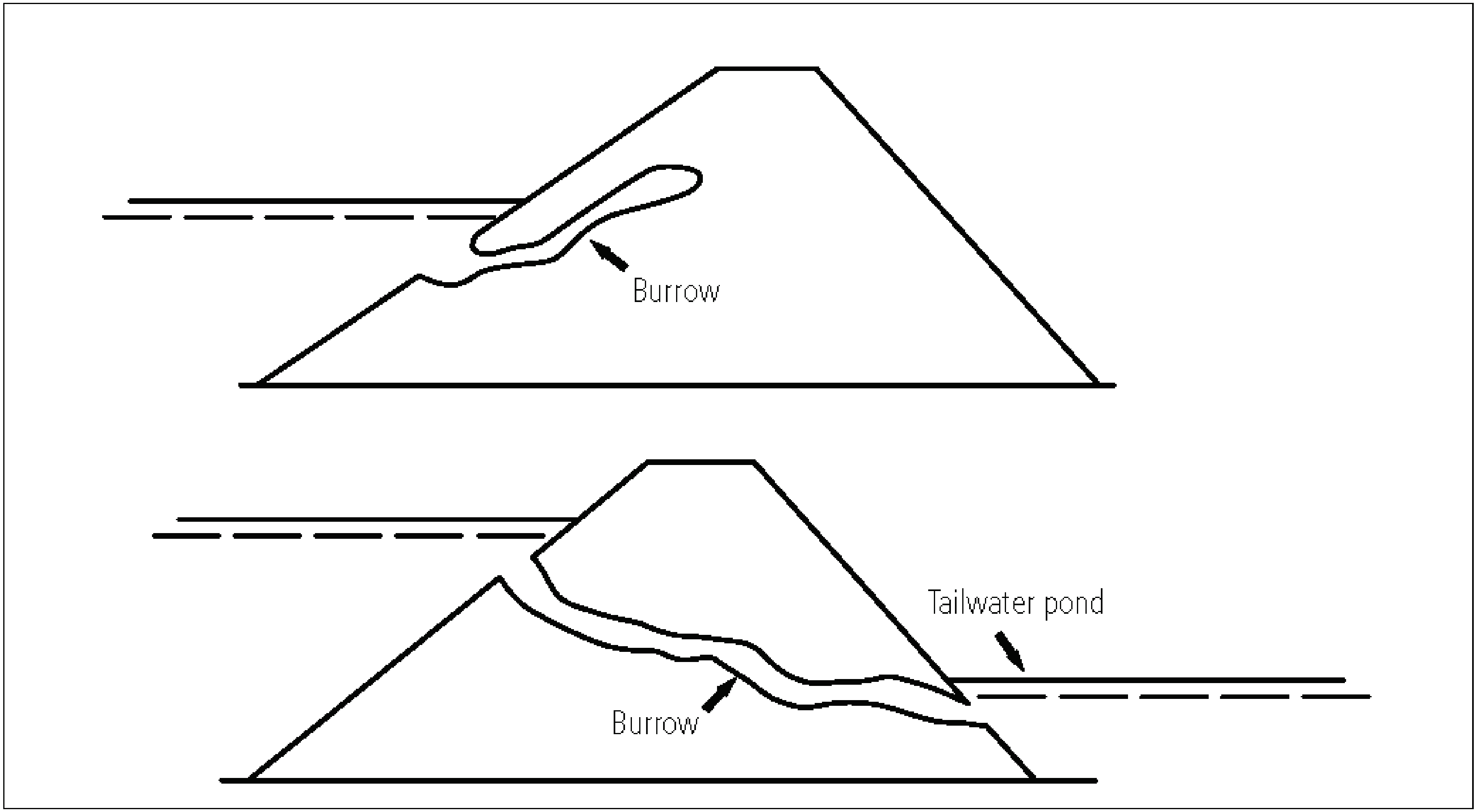


Figure 23. Muskrat Burrows (cross-section)

EROSION PROBLEMS

- Proper erosion control measures are necessary for preventing loss, displacement, or deterioration of upstream embankment facing; crest damage and breaching; and erosion of the downstream face.

Picture 5 - Embankment Erosion

FOUNDATION PROBLEMS

Reaction of structures often reflects foundation changes. Visual surface displacements in the crest, backslope, or foreslope of the dam should be noted. Depressions or sags in the crest or slopes of an embankment dam might reflect embankment or foundation consolidation, solutioning, or piping.

Appurtenant structures that have settled or are out of plumb may indicate foundation yielding or compression.

Picture 6 - Surface Displacement

SPILLWAYS AND OUTLETS

- Spillways or outlet works can be defective because of hydraulic inadequacy, structural inadequacy, or operational malfunctions. Spillways and outlets should be checked to ensure that they are in good condition, free of obstructions, and capable of carrying the volume of flow for which they were designed. Verify the type, number, location, and dimensions of all spillways and outlets at the time of inspection.

Picture 7 - Spillways and Outlets

Picture 8 - Spillways and Outlets

Picture 9 - Saturation Zone

PHOTOGRAPHS AND SKETCHES

1. View of embankment and crest from left abutment (upstream face).
2. View of embankment and crest from left abutment (downstream face).
3. View of embankment and crest from right abutment (upstream face).
4. View of embankment and crest from right abutment (downstream face).
5. View of embankment crest from right abutment.
6. View of embankment crest from left abutment.
7. View of reservoir looking upstream from top and center of dam embankment.
8. View of reservoir looking downstream from top and center of dam embankment.
9. View of emergency spillway from crest looking upstream.
10. View of emergency spillway from crest looking downstream.
11. View of principle spillway inlet (if applicable).
12. View of principle spillway outlet (if applicable).
13. View of principle spillway stilling basin (if applicable).
14. View that identifies the project monument from a distance that can be used to locate the marker in the future.
15. View that includes the reservoir that includes the embankment and as much of the impoundment as possible.
16. Remainder views shall photograph those items that are necessary to adequately describe/define a deficiency or problem with the dams.

Classification Information for Dams

The hazard classification for a dam is based on the potential for loss of life and property downstream from the dam. A dam may be hazard classified only if it 1) is 25 feet or more in hydraulic height, or 2) impounds 50 acre-feet or more of water.

Size Classification	Hydraulic Height	Retention–Detention Capacity
Minor Dam (M)	6 to 25 feet	15 to 50 acre-feet
Small Dam (S)	26 to 40 feet	51 to 1,000 acre-feet
Intermediate Dam (I)	41 to 100 feet	1,001 to 50,000 acre-feet
Large Dam (L)	>100 feet	>50,000 acre-feet

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

Picture 10 - Hazard Potential

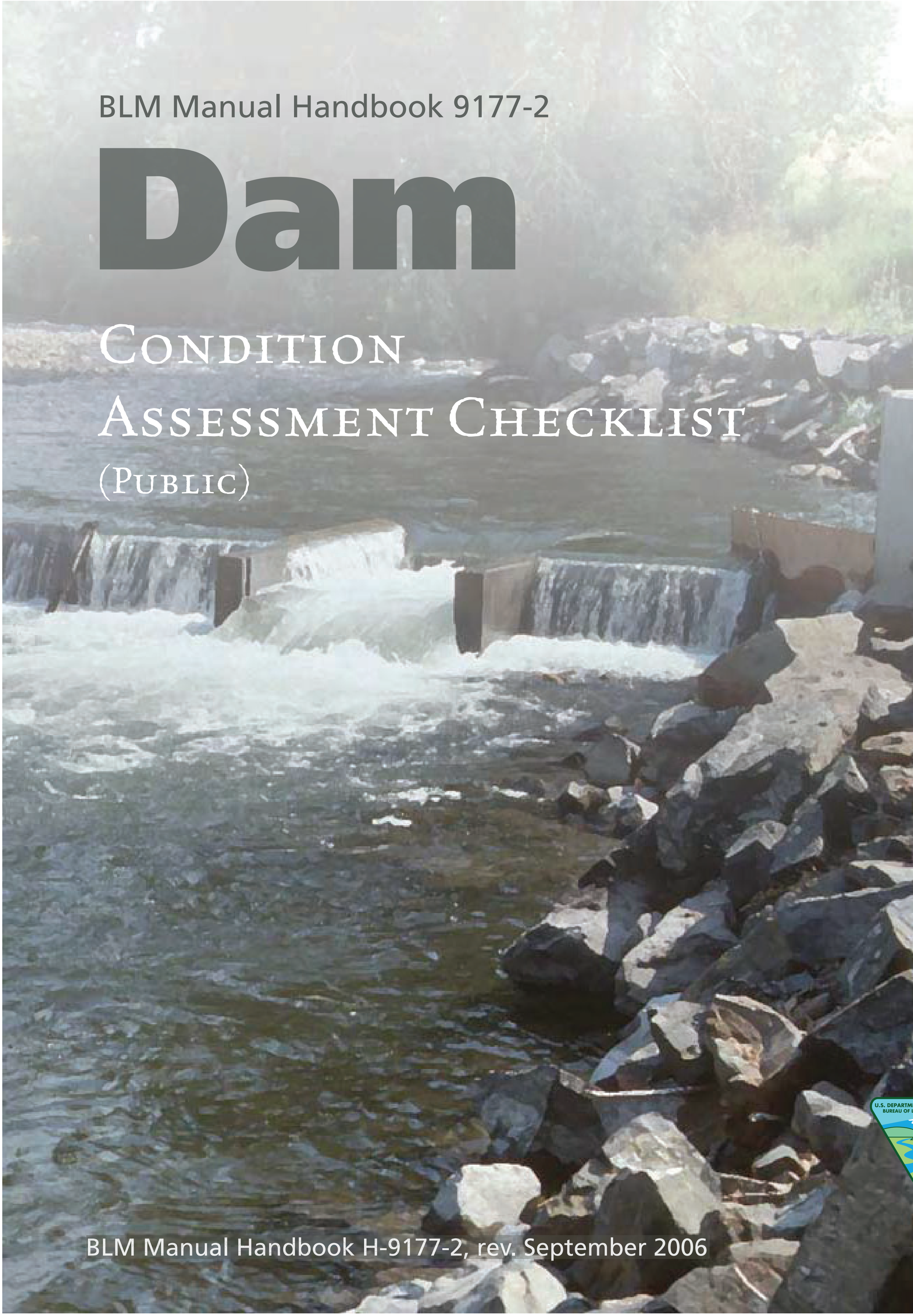
THE END

BLM Manual Handbook 9177-2

Dam

Condition Assessment Checklist

(Public)



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BLM

BLM manuals and handbooks are online at:
http://www.blm.gov/nhp/efoia/index.htm

Suggested citation:
Bureau of Land Management. 2006. Dam Condition Assessment Checklist. BLM Manual Handbook 9177-2. Denver, Colorado. Release x-xxxx. 9 sheets.

NAME OF DAM:

Geographical Data	Classification Data	Inspector Data
	Current Hazard Class (L/S/H):	Date of Inspection:
Administrative State:	Population at Risk (High Hazard Only):	Inspector Name:
Geographic State (if diff):		Weather:
County:		
Field Office:	Size Class (Minor/Small/Inter/Large):	Date of Last Inspection:
Section: T: R:	Type of Dam (if not earth):	Safety issues and warnings for inspectors:
Aliquot Part:	Condition Rating Code: [1]	
Latitude at Benchmark (nearest 10th)	River/Stream Crossed:	Driving Directions to Dam:
Longitude at Benchmark (nearest 10th):	Seismic PGA (high haz only):	
Meridian:	Date Dam Constructed:	
BLM ID No.:	Date Dam Modified:	
Equip. No.:	Plan/Section Dwg No.:	

Notes:

For High Hazard dams, note any low water crossings, private land crossings, locked gates, poor roads, etc:

Describe any development within 3 miles downstream since the last inspection. If none, write “None”:

Describe any active County, State, or Federal roads, active railroads, or utilities within 3 miles downstream. If none, write “None.” For County roads, list the number of vehicles per day:

[1] Condition Rating Code (See Appendix). Give numeral (0–9) and discriptive term (good, poor,etc.).

Dimensional Data

Benchmark Elevation:	Station ____________	A		Slope of Upstream Face (H:V):		O	
Dam Crest Elevation (max):	Station ____________	B		Principal Spillway Outlet Invert Elevation:	Station ____________	P	
Dam Crest Elevation (minimum):	Station ____________	C		Principal Spillway Outlet Diameter:		Q	
Emergency Spillway Crest Elevation:	Station ____________	D		Low-Level Gated Outlet Outlet Invert Elevation:	Station ____________	R	
Principal Spillway Inlet Invert Elevation:	Station ____________	E		Lowest Point on the Downstream Toe Elevation:	Station ____________	S	
Principal Spillway Inlet (Riser) Diameter:		F		Distance From Centerline of Dam to Outlet of Principal Spillway:		T	
Principal Spillway Material: (m/c/p)				Distance From Centerline of Dam to Outlet of Low-Level Gated Outlet:		U	
Principal Spillway Drop Inlet Height (Riser):		G		Distance From Centerline of Dam to Lowest Point on Downstream Face:		V	
Water Level at Survey Date Elevation:	Station ____________	H		Slope of Downstream Face (H:V):		W	
Lowest Point on the Upstream Toe Elevation:		I		Crest Width:	Station ____________	X	
Low-Level Gated Outlet Inlet Invert Elevation:	Station ____________	J		Dam Crest Length Along Centerline of the Dam:		Y	
Low-Level Gated Outlet Diameter:		K		Emergency Spillway Width at the Crest:		Z	
Low-Level Gated Outlet Material: (m/c/p)				Emergency Spillway Length at the Crest:		AA	
Distance From Centerline of Dam to Inlet of Low-Level Gated Outlet:		L		Emergency Spillway Sideslope on Left (H:V):		BB	
Distance From Centerline of Dam to Lowest Point on Upstream Face:		M		Emergency Spillway Sideslope on Right (H:V):		CC	
Distance From Centerline of Dam to Inlet of Principal Spillway:		N		Reservoir Surface Area (Acres) at Emergency Spillway Crest:		DD	

Calculated Data			
Calc1. Hydraulic Height (D-S):		Calc7. Principal Spillway Outlet Pipe Length (T+N):	
Calc2. Structural Height (B-S):		Calc8. Low-Level Gated Outlet Pipe Length (U+L):	
Calc3. Minimum Freeboard (C-D):		Calc9. Estimated Max Reservoir Storage ((DD · Calc6.) / 3) :	
Calc4. Normal Storage Depth (E-I):		Calc10. Volume of Embankment: (((Calc2. · Y) · (X + ((Calc2. · O)/2] + ((Calc2. · W)/2))) / 54)	
Calc5. Actual Storage Depth (H-I):		Other:	
Calc6. Maximum Storage Depth (D-I):		Other:	

Notes:

See Figure for definition of dimensions.

Indicate all dimensions in feet unless otherwise noted.

If reservoir is dry at time of inspection, actual storage depth is 0.

Datum for permanent benchmark shall be elevation 100’.

For Calc10. dimensions O and W are slope ratios and all other parameters are in feet. The answer is in cubic yards.

Inspector Signature ______________________________ Date ______________________________

NAME OF DAM: ______________

DATE INSPECTED: ______________

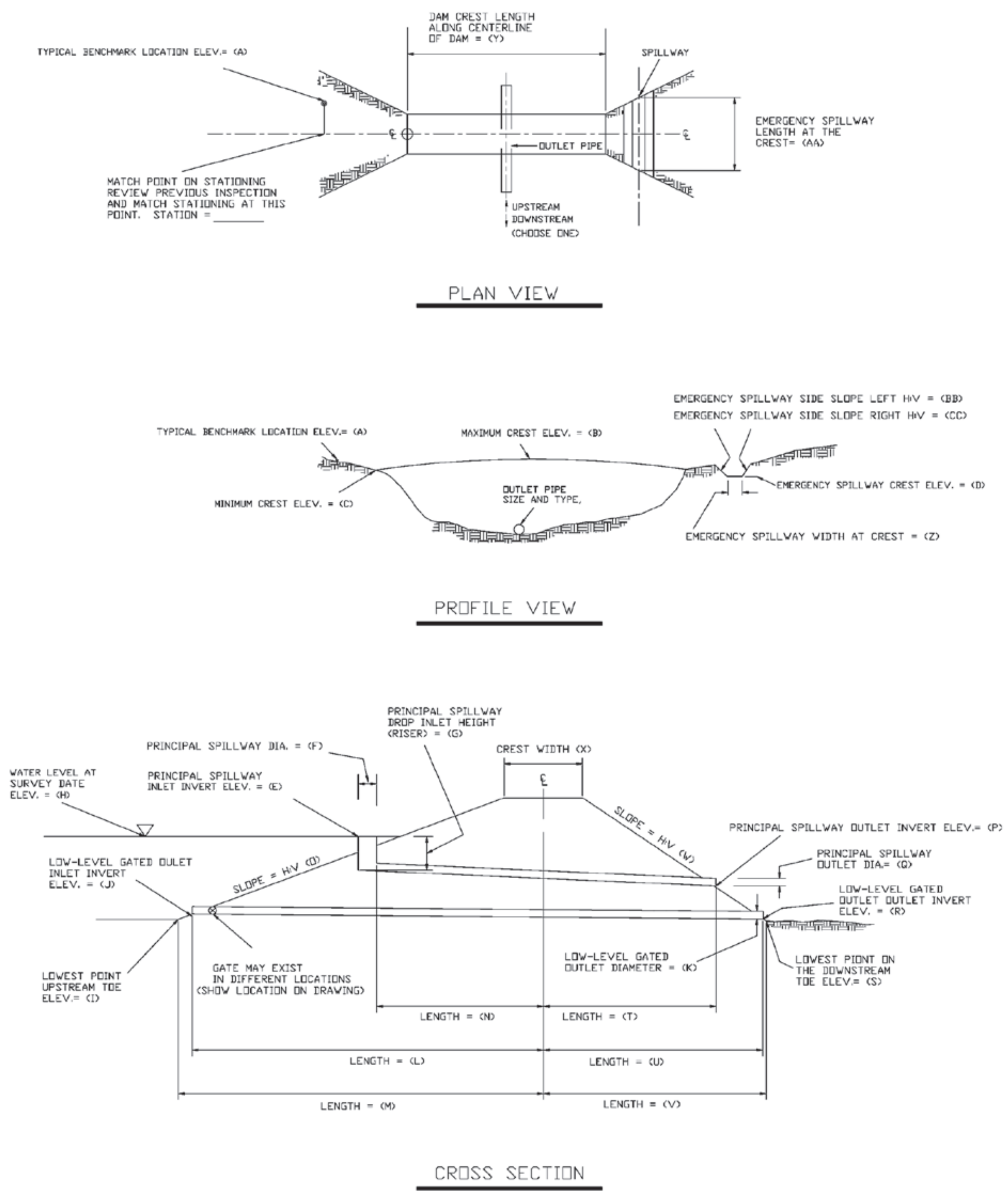

Figure. Definition of Dimensions.

Notes:

Show location on the Plan View of Station 0+00.

Use the back of this page to draw a plan view sketch of the reservoir and dam (DD).

DAM CONDITION ASSESSMENT CHECKLIST

NAME OF DAM: ______________________________ DATE INSPECTED: __________________ Directions:

1 Check the N/A, YES/NO, or Corrective Action Recommended (CAR[1]) columns as required.
2 Use the same flag number if quantities for similar items will be calculated and grouped together in the Recommended Work Summary.
3 Use item numbers to identify items on the Recommended Work Summary.

Item No.	Item	N/A	Y	N	CAR[1] RIM	Flag No.	Remarks
	EMBANKMENT						
1.	CREST						
a.	Any visual settlements						
b.	Cracking						
c.	Lateral movement						
d.	Visible sinkhole						
e.	Erosion						
f.	Trees & brush						
g.	FAMS road on crest						
h.	Rodent holes						
2.	UPSTREAM SLOPE						
a.	Erosion						
b.	Trees & brush						
c.	Longitudinal cracks						
d.	Transverse cracks						
e.	Visual depression or bulges						
f.	Visual settlements						
g.	Visible sinkhole						
h.	Debris						
i.	Rodent holes						
3.	DOWNSTREAM SLOPE						
a.	Erosion						
b.	Trees & brush						
c.	Longitudinal cracks						
d.	Transverse cracks						
e.	Visual depressions or bulges						
f.	Visual settlements						
g.	Visible sinkhole						
h.	Boils present at toe						

Item No.	Item	N/A	Y	N	CAR RIM	Flag No.	Remarks
i.	Seepage present						
j.	Rodent holes						
k.	Is toe drain dry						
4.	ABUTMENT CONTACTS						
a.	Erosion						
b.	Visual differential movement						
c.	Cracks						
d.	Seepage present						
e.	Trees & brush						
5.	GROIN						
a.	Erosion						
b.	Visual differential movement						
c.	Cracks						
d.	Seepage present						
e.	Trees & brush						
6.	RESERVOIR CONTROL						
a.	Recent downstream development						
b.	Slides in reservoir area						
c.	Change in reservoir operation						
d.	Other large impoundments u/s						
e.	Evidence or recreational use						
7.	INSTRUMENTATION						
a.	List any instrumentation present						
b.	Is instrumentation functional						
c.	Record measurements						
(see page 58 of *Dam Condition Assessment Guidelines for Embankment Dams*)—EMBANKMENT SAFETY RATING:							
PRINCIPAL SPILLWAY OR OUTLET							
8.	INTAKE STRUCTURE						
a.	Debris present						
b.	Concrete surface condition						
(1)	Spalling						
(2)	Cracking						
(3)	Erosion						
(4)	Scaling						
(5)	Exposed reinforcement						
(6)	Other, list						

Item No.	Item	N/A	Y	N	CAR RIM	Flag No.	Remarks
c.	Joint condition						
(1)	Displacement or offset						
(2)	Loss of joint material						
(3)	Leakage						
d.	Metal appurtenances						
(1)	Corrosion present						
(2)	Breakage present						
(3)	Anchor system secure						
9.	CONDUIT						
a.	Is conduit concrete						
b.	Concrete surface condition						
(1)	Spalling						
(2)	Cracking						
(3)	Erosion						
(4)	Scaling						
(5)	Exposed reinforcement						
(6)	Displacement or offset						
(7)	Leakage						
(8)	Other, list						
c.	Metal conduit condition						
(1)	Corrosion present						
(2)	Protection coating adequacy						
(3)	Conduit misalignment						
(4)	Leakage						
d.	Plastic conduit condition						
(1)	Displacement or offset						
(2)	Leakage						
(3)	Crushed or broken						
e.	Conduit trashrack condition						
(1)	Operational						
(2)	Plugged						
(3)	Corrosion or damage present						
10.	GATES						
a.	Flood gate condition						
(1)	Broken or bent						
(2)	Corroded or rusted						

Item No.	Item	N/A	Y	N	CAR RIM	Flag No.	Remarks
(3)	Regularly maintained						
(4)	Gates operational						
c.	Is there a low-level gate						
d.	Is low-level gate operational						
(see page 54 of *Dam Condition Assessment Guidelines for Embankment Dams*)—PRINCIPAL SPILLWAY or OUTLET WORKS SAFETY RATING:							
EMERGENCY SPILLWAY or OUTLET WORKS							
11.	STILLING BASIN						
a.	Concrete surface condition						
(1)	Spalling						
(2)	Cracking						
(3)	Erosion						
(4)	Scaling						
(5)	Exposed reinforcement						
(6)	Other, list						
b.	Joint condition						
(1)	Displacement or offset						
(2)	Loss of joint material						
(3)	Leakage						
c.	Energy dissipater condition						
(1)	Deterioration						
(2)	Covered with debris						
(3)	Other, list						
d.	Channel condition						
(1)	Eroding or backcutting						
(2)	Sloughing						
(3)	Obstructed						
(4)	Undercut by released water						
(5)	Embankment erosion by water						
e.	Gabion condition						
(1)	Corroded						
(2)	Basket misaligned						
(3)	Basket settlement						
(4)	Brush growing in gabions						
f.	Riprap condition						
(1)	Erosion undercut or settlement						

Item No.	Item	N/A	Y	N	CAR RIM	Flag No.	Remarks
(2)	Vegetation						
(3)	Extent of riprap adequacy						
(4)	Migration of riprap						
12.	SPILLWAY or OUTLET WORKS						
a.	Spillway concrete condition						
(1)	Spalling						
(2)	Cracking						
(3)	Erosion						
(4)	Scaling						
(5)	Exposed reinforcement						
(6)	Concrete undercut						
(7)	Settlement						
(8)	Other, list						
(9)	Trees and brush—obstructed						
b.	Joint condition						
(1)	Displacement or offset						
(2)	Loss of joint material						
(3)	Leakage						
c.	Energy dissipater condition						
(1)	Signs of deterioration						
(2)	Covered with debris						
(3)	Riprap dissipater						
(4)	Missing						
d.	Excavated earth spillway condition						
(1)	Slopes eroding						
(2)	Slopes sloughing						
(3)	Headcutting						
(4)	Trees and brush—obstructed						
e.	Natural earth spillway condition						
(1)	Slopes eroding						
(2)	Slopes sloughing						
(3)	Headcutting						
(4)	Trees and brush—obstructed						

Item No.	Item	N/A	Y	N	CAR RIM	Flag No.	Remarks
f.	Damage from released water						
(1)	Eroded embankment						
(2)	Undercutting of outlet						
(3)	Recent discharge						
(4)	Other damage, list						
g.	Is weir in good condition						
h.	Is control at weir						
(see page 56 of *Dam Condition Assessment Guidelines for Embankment Dams*—EMERGENCY SPILLWAY or OUTLET WORKS SAFETY RATING:							
OVERALL SAFETY RATING:		See page 60 of *Dam Safety Inspection Report Guidelines for Embankment Dams*					

[1] UNDER THE CAR/RIM COLUMN—DETERMINE WHAT IS THE CORRECTED ACTION RECOMMENDED (CAR)—REPAIR (R), INVESTIGATE (I),MONITOR (M) OR "NO" IF NO CORRECT ACTION IS NECESSARY

DO YOU RECOMMEND A HAZARD CLASSIFICATION REASSESSMENT? EXPLAIN:

OTHER REMARKS / NOTES FOR PHOTOS:

DAM CONDITION ASSESSMENT CHECKLIST

NAME OF DAM: ______________________

DATE INSPECTED: ______________

CALCULATIONS

List Flag Numbers from checklist and comment as needed. Group similar items, calculate estimated quantities, and enter totals on Summary.

NOTE: Recommended work items listed below were discovered during the field inspection.

Inspector Signature ______________________

Date ______________________

DAM CONDITION ASSESSMENT CHECKLIST

NAME OF DAM: ______________________________ DATE INSPECTED: __________________

RECOMMENDED WORK SUMMARY

ITEM NO.	ITEM[1]	WORK TYPE[2]	EST QTY	UOM[3]	REMARKS

[1] Include only work items for which a FAMS unit cost has been approved and developed.
[2] Work Types are to be classified as: A = Annual Maintenance, D = Deferred Maintenance, CI = Capital Improvement.
[3] UOM = Unit of Measure.

DAM CONDITION ASSESSMENT CHECKLIST

NAME OF DAM: ________________________________ DATE INSPECTED: ____________________

REMARKS:

DAM CONDITION ASSESSMENT CHECKLIST

Coordinator, Safety of Dams Signature ___________________________ Date___________________

NAME OF DAM: ______________________________ Date Inspected:____________________

Photos:

Insert description of photographs on this page. Identify the feature, item, or deficiency that is captured by the photograph, and identify the direction in which the photograph is taken; i.e., “Main embankment from the west abutment looking east.” Add a text box for each photograph included. Provide additional photographs, as needed.

DAM CONDITION ASSESSMENT CHECKLIST

Coordinator, Safety of Dams Signature ___________________________ Date___________________

NAME OF DAM: ______________________________ Date Inspected:____________________

Photos:

Insert description of photographs on this page. Identify the feature, item, or deficiency that is captured by the photograph, and identify the direction in which the photograph is taken; i.e., "Main embankment from the west abutment looking east." Add a text box for each photograph included. Provide additional photographs, as needed.

Appendix. Condition Rating Code:

Numeral (0–9) and Descriptive Term (GOOD, POOR, etc.)[1]

N Not applicable.

9 EXCELLENT—No deficiencies.

8 VERY GOOD—No noticeable or noteworthy deficiencies that affect the condition or operation.

7 GOOD—Concrete surfaces have shrink cracks, light scaling, and insignificant spalling that does not expose reinforcing steel.

6 SATISFACTORY—Minor deterioration or initial disintegration, minor chloride contamination, cracking with some leaching, or spalling on concrete.

5 FAIR—Moderate deterioration or disintegration, extensive cracking and leaching, or spalling on concrete.

4 POOR—Major spalling, heavy scaling, wide cracks, or exposed rebar in concrete.

3 SERIOUS—Any condition described in code 4 that is excessive in scope.

2 CRITICAL—Advanced deterioration of primary structural elements.

1 "PARTIAL FAILURE"—Dam is out of service; or
"IMMINENT FAILURE"—Dam will fail if not taken out of service.

0 FAILED—Dam has failed. Replacement of the entire structure is necessary.

Good (codes 7–9)	Fair (codes 5–6)
Poor (codes 2–4)	Unsatisfactory (codes 0–1)

[1] Condition Rating Codes are from Manual Handbook H-9177-1, Dam Condition Assessment Guidelines for Embankment Dams.