

# SESSION 3

## Maintenance of Dams and Spillways



# Objectives for Session

- Importance of maintenance
- Development of an operation and maintenance plan



# Why is maintenance important?



“Maintenance is needed to continue to realize local benefits and to keep the dams safe.”

- ▶ National Watershed Coalition, 2010



Regardless of the type of dam,  
all dams must be properly  
operated, maintained, and  
inspected by owners



# Good maintenance program

- Will protect against deterioration and will prolong life
- Will protect the owner and as well as the public
- Will have a small cost compared to costs of major repairs, loss of life and property, and litigation



# Development of an operation and maintenance (O&M) plan



**How do I start a plan?**



# O&M Plan

- Contains different maintenance needs for the dam
- Contains inspection schedules



# O&M Plan

- This session will address different maintenance issues, show photos of each issue, and provide recommendations



# Operation and Maintenance Plan

- Maintenance inspection at least every 3 months, more often if possible
- Check for vegetation, cracking, spalling, rutting and low areas, animal activity, erosion, instability, seepage, pipe deterioration, and toe drains, if they exist



# Vegetation



# Vegetation

- All small trees (less than 4 inches in diameter), brush, vines, briars, and bamboo should be cut and removed from the dam at least yearly (fall or winter)
- Mow the grass on the dam, if possible, at least two times a year.



# Vegetation

- Remove all trees and brush from earth-cut spillways
- Remove vegetation from around inlets.
- Remove trees and brush from around concrete structures and pipes.
- Care should be taken to avoid damage to the concrete during removal.







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# Cracking



# Cracking

- Desiccation cracks
  - Cover cracks with top soil and re-vegetate area.
- Longitudinal and transverse cracking
  - An engineer may need to be retained if significant cracking to determine the cause of the cracking and to make recommendations for correction



# Cracking and open joints

- Cracks in concrete structures should be monitored for movement. If movement is occurring, an engineer should be consulted
- For small cracks and narrow open joints, the cracks and joints should be cleaned and sealed with a flexible, water resistant sealant
- For large joint openings, an engineer should be consulted to determine the cause for the movement



# Cracking and Spalling

- Spalling generally requires an engineer's evaluation to determine cause and method to repair
- Readings need to be taken on measuring equipment until engineer determines that no additional readings are necessary.













# Rutting and Low Areas



# Rutting

- Drain any standing water
- Regrade and re-compact fill
- Slope crest to upstream slope
- Periodically regrade



# Low Areas

- Low areas on large and intermediate size dams
  - Install monuments to determine if settlement is occurring. Take readings on time frame recommended by engineer
  - Engineer should evaluate readings



# Low Areas

- Low areas on small dams
  - Determine if low areas are the result of collapse of animal dens
  - Remove material from crest if from animal dens
  - Fill in low areas and re-compact
  - Re-vegetate areas







# Animal Activity



# Animal Control

- Take measures to eliminate the burrowing animals; i.e., beavers, nutria, badgers, weasels, or gophers and feral hogs
- Texas Wildlife Services Program
  - State office 210/472-5451
  - [www.aphis.usda.gov/wildlife\\_damage](http://www.aphis.usda.gov/wildlife_damage)



# Repair of Animal Activity

- For burrows/dens, excavate, backfill, compact, and seed. Also, you can fill hole with grout, cover with soil, and seed or re-vegetate
- For livestock trails, fill with soil and compact and then re-vegetate
- For hog damage, re-vegetate the damaged area after repairs











# Erosion



# Erosion

- Wave Action erosion
  - Reestablish slope protection including bedding material. An engineer may be required to design the slope material
  - Extensive damage may require flattening the slope before replacement of the slope protection



# Erosion

- Erosion gullies
  - Restore the slope by repairing the area with competent material and compacting material
  - Address the cause for the erosion
  - Cover the repaired area with topsoil
  - Re-vegetate the repaired area



# Erosion

- Repair erosion channels or gullies in spillways as soon as possible. Use good compacted fill and cover with rock riprap or a high performance turf reinforcement mat.
- Establish a good grass cover in repaired areas
- Erosion around inlets and along conduits will require an engineer to determine the problem and recommend a correction



# Erosion beneath concrete or at outlets

- Undermining or undercutting of concrete or outlet structures can cause collapse of the structure and will require an engineer to determine the most appropriate method of repair
- May require construction of a cutoff wall, properly placed compacted fill, and some type of erosion protection such as rock riprap
- An undermined structure may have to be replaced















# Instability



# Instability

- ▶ Check for leaning utility poles, guard rails, sprinkler heads, and slumps on slope
- ▶ If a slide is located, an engineer needs to be retained.



# Slide

- Engineer should evaluate cause of slide and recommend correction
- May require lowering the lake level
- May require slide area to be stabilized with lime













# Seepage



# Seepage

- Monitor seepage regularly to determine if flow is increasing or if soil material is being carried in the flow.
- If quantity of flow is increasing or the flow becomes muddy, an engineer should be retained to evaluate the condition and make recommendations for further action
- May require lowering the lake level



# Seepage

- If a boil develops along the downstream toe, an engineer needs to be retained as soon as possible
- Repairs may include a dike of sand bags or earth around the boil to control the water flow before more extensive work can be done
- May require lowering the lake level



# Seepage or drainage systems

- Monitor any flow from under a concrete spillway and any flow from any drainage system
- If flow increases or there is soil material in the flow, contact your engineer for recommendations for correction
- If the flow increases rapidly or the amount of soil increase, the reservoir may need to be lowered under the direction of your engineer and make notification under your emergency action plan











JUL 18 2012





# Toe Drain Systems



# Toe Drains

- Clear vegetation around the drain and well outlets
- Measure and monitor flow from outlets
- Keep outlet clear of algae, especially those with flap gates
- Have engineer evaluate data from drains and wells







# Spillway Debris



# Debris and other blockage of spillway channels and inlets

- Remove beaver dams from entrances to spillways
- Remove debris from inlets and trashguards
- Remove fences from spillway channels. If one is required due to stocking with grass carp, the fence needs to be a distance away from the spillway crest to allow unobstructed flow



# Debris and other blockage of spillway channels and inlets

- Remove all obstacles from spillway channels
- Don't allow construction in the spillway channel







# Pipe Deterioration



# Pipe deterioration

- Will require an engineer to determine the method for repair
- May require replacement of the pipe or slip-lining the pipe with a smaller pipe and grouting between the two pipes



# Pipe deterioration

- Pipe deterioration is usually associated with a corrugated metal pipe (CMP)
- If the pipe is replaced, do not replace with another CMP. CMPs should not be used in dams
- This will require an engineer and should be undertaken as soon as possible to avoid erosion of the dam







# Gates



# Gates

- Debris
- Corrosion
- Member strength
- Drains
- Lubrication
- Skin Plates
- Seals









12/03/2008





DEC 17 2008







Insufficient drain hole







Unused  
Lubrication  
Fittings







# Instrumentation



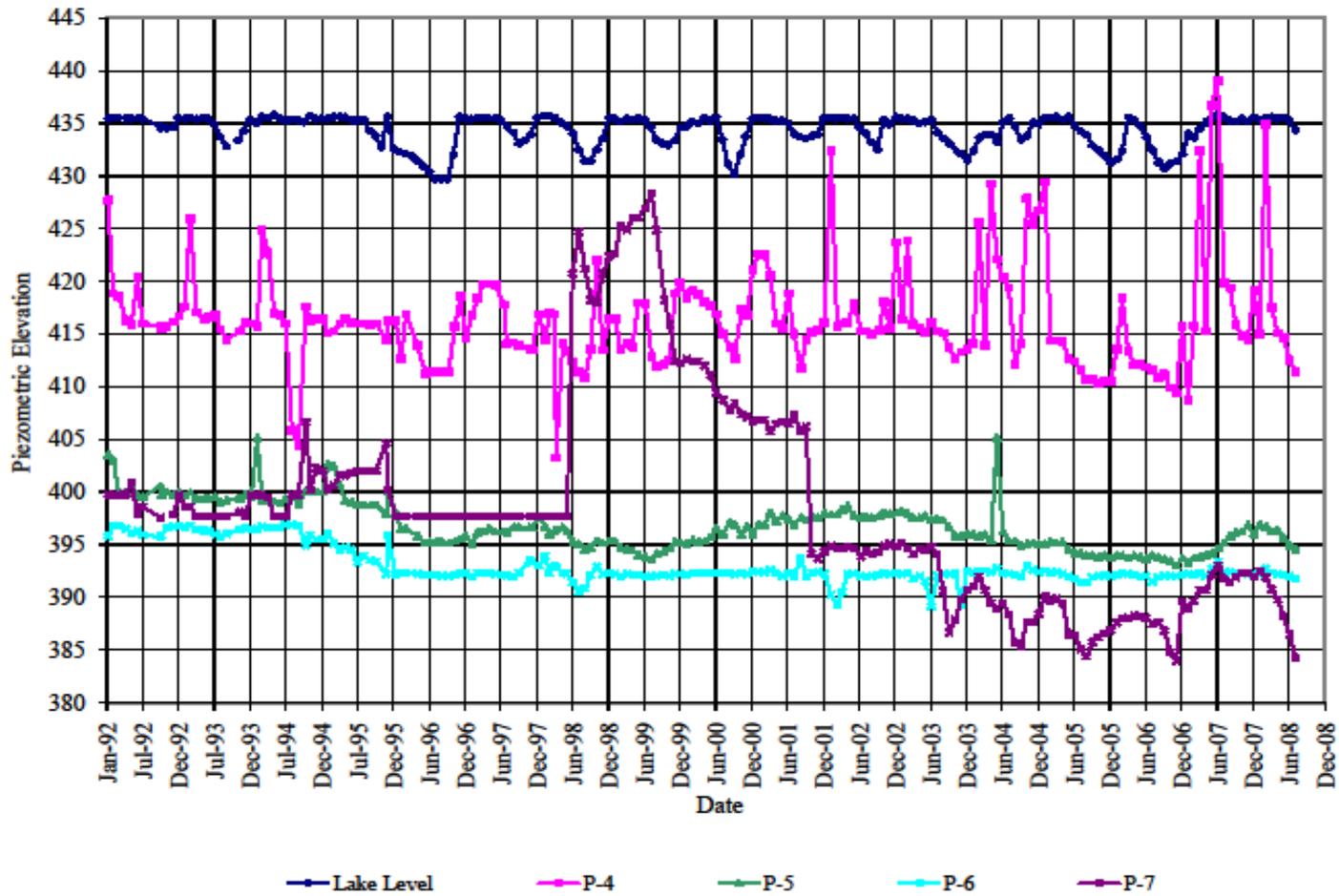
# Instrumentation

- Have engineer evaluate instrumentation data to determine if the instrument is still working and if there is a problem
- Collect data on schedule provided by your engineer
- Protect instrumentation from damage during maintenance activities









# Inspections



# Engineering Inspections

- High Hazard dams -- every 5 years
- Significant hazard dams -- every 5 years
- Large low hazard dams -- every 5 years
- Small and intermediate size low hazard dams -- as requested by the owner, as a result of a complaint, or following an emergency
- Exempt dams -- only as requested by the owner or a result of a complaint



# Owner inspections

- Maintenance inspections by the owner -- at least once a year. Recommend that inspections be done either monthly or quarterly
- Other inspections following significant rainfall events or during emergency events
- Document conditions with photographs





# Web Site

- ▶ The web site for the rules and the guidelines is:

- ▶ <http://www.tceq.state.tx.us/field/damsafetyprog.html>



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# Questions

