

## DOCUMENTATION REQUIREMENTS

### Pond - 378

### Embankment

#### I. Reference Materials

The following reference materials will be used for the planning, design, and construction of embankment ponds.

- a. Technical Guide, Section IV, Practice Standard 378, Ponds
- b. Engineering Field Manual (EFM), Chapters 1, 2, 3, 4, 5, 6, 11, and 17
- c. ND Supplement to Engineering Field Manual (NDSEFM), Chapters 2, 3, 4, 11
- d. Agricultural Handbook 590, Ponds - Planning, Design, Construction
- e. Hydrology Manual for ND
- f. County Soil Survey Report
- g. ND Construction and Material Specifications for Conservation Practices
- h. Technical Release 62, Engineering Layout, Notes, Staking, and Calculations
- i. National Operation and Maintenance Manual
- j. National Engineering Handbook, Section 19, Construction Inspection
- k. Suitable Computer Software:
  - Hydraulics (e.g. Ohio Program)
  - Watershed Hydrology (e.g. EFM2, EFH2, TR55)
  - Excel Spreadsheet Hydrology (e.g. ND-ENG-12e)
  - Excel Spreadsheet Yardage (e.g. ND-ENG-1e)
  - Design software (e.g. SITES)

#### II. Site Investigation/Data Collection

The following information shall be obtained:

- a. Purpose (livestock, wildlife, irrigation, etc.)
- b. Pond size, volume, depth, etc. requirements
- c. Watershed characteristics
  1. Drainage area
  2. Watershed slope, flow length, T<sub>c</sub> (Time of Concentration)
  3. CN (Soil - Cover Complex Number)
  4. Base flow conditions
- d. Job approval authority
- e. Soils/geologic investigation
  1. Planned by individual with job approval.
  2. Conduct a preliminary screening of the site with information from the county soil survey report.
  3. Test hole logs and samples.
    - (a) Unified Soil Classification System
    - (b) Embankment centerline and offsets (when necessary)
    - (c) Emergency spillway centerline and offsets (when necessary)

- (d) Borrow areas
  - (e) Reservoir areas (borrow and permeable layers)
  - (f) Groundwater and water for construction
4. Sedimentation - Consult with geologist when investigation and analysis are necessary.
  5. Soil resistivity measurements when needed for the design of cathodic protection for buried metal pipe.
- f. Locations of overhead and buried utilities.

### III. Design Surveys

- a. Survey notes shall be kept in loose-leaf or bound field notebooks. The notes will be kept in a format similar to that shown in Technical Release 62, and Chapter 1, Engineering Field Manual. Electronic survey notes will be documented in a format that allows complete checking by others.
- b. Embankment: The embankment foundation will be cross-sectioned at intervals sufficiently close to accurately define the earthwork volumes. In no case will the spacing between cross sections exceed 100 feet.
- c. Emergency Spillway: A profile along the centerline of the emergency spillway will be obtained for the purpose of spillway layout for hydraulic design. The need for cross sections will be determined by the person having job approval for the site.
- d. Reservoir Area: The need for a topographic survey of the reservoir will be determined by the person having job approval for the site. Reservoir surveys shall be performed when accurate storage volumes are needed for permits or for reservoir flood routing and when needed for identifying inundated areas. Reservoir surveys should extend to at least the top of the dam.
- e. Outlet Channel: A profile of the outlet channel will be surveyed for a minimum distance of 500 feet downstream of the embankment. The profile will be used for setting outlet elevations for principal and emergency spillways.
- f. Surveys shall include the locations of all affected utilities (buried or overhead).

### IV. Design Plans and Specifications

The design of embankment ponds will be in accordance with Standard and Specification 378 Pond, Section IV, Technical Guide.

Where reservoir storage volume is considered in the design of the dam, refer to the user's manual for the SITES computer program, other approved pond design computer program, or North Dakota Hydrology Manual, Appendix C.

The following steps shall be followed for the design of embankment ponds where spillway capacity is based on peak inflow (i.e., reservoir storage volume is not considered in sizing the spillway).

- a. Delineate and measure drainage area on USGS Quad map, aerial photo, or other suitable map.

- b. Determine runoff curve number (CN) Use Forms ND-ENG-12 or ND-ENG-31 for computations. Specific References: 1) Hydrology Manual for ND, Chapters 2-3  
2) EFM, Chapter 2  
3) NDSEFM, Chapter 2
- c. Determine average watershed slope and flow length from USGS Quad maps or field measurements. Specific References: 1) ND Hydrology Manual, Chapter 5  
2) EFM, Chapter 2
- d. Determine required principal and emergency spillway design frequencies.  
Specific References: 1) ND Hydrology Manual, Chap 1, Table 1-7  
2) NDSEFM, Chapter 2, Table 2-2
- e. Determine required 24 hr. rainfall depths.  
Specific References: 1) ND Hydrology Manual, Fig.1-2 thru 1-8  
2) NDSEFM, Chapter 2, Table 2-3
- f. Determine the required peak discharge rates by the procedures outlined on Forms ND-ENG-8 or ND-ENG-31.  
Specific References: 1) ND Hydrology Manual, Chapter 5  
2) EFM, Chapter 2  
3) NDSEFM, Chapter 2
- g. Determine required permanent pool elevation in accordance with "Pond Size" requirements contained in the ND Technical Guide, Section IV, Practice Standard 378, Ponds.
- h. Size the principal spillway to pass the required design discharge.  
Specific References: 1) NDSEFM, Chapter 3  
2) Ohio Engineering Computer Programs
- i. Determine the minimum acceptable elevation of the emergency spillway crest as the higher of: 1) One foot above the crest of the principal spillway, or 2) The reservoir elevation required to pass the principal spillway design discharge.
- j. Size the emergency spillway to pass the required design discharge. The velocity in the emergency spillway exit channel shall not exceed the permissible velocity for the soil and cover types shown in the Technical Guide, Section IV, Practice Standard 378, Ponds. Specific References: 1) NDSEFM, Chapter 3, 3S.41 thru 3S.56
- k. Determine the minimum acceptable elevation of the top of dam as the higher of:
  - 1) One foot above the water surface in the reservoir with the emergency spillway flowing a design depth ( $H_p + 1$  ft) or
  - 2) A minimum depth of two feet between the emergency spillway crest and the top of dam.
- l. Record all pertinent data on Form ND-ENG-16, Hydraulic Data Sheet.

#### V. Material and Construction Requirements

At least 3 sets of drawings and specifications will be prepared and distributed to the cooperator, contractor, and NRCS cooperator's file. For most jobs, Form ND-ENG-16e may be used. For more complex jobs, site specific drawings and other approved drawings will be used. In addition to drawings and specifications, the cooperator will be provided an O&M Plan.

Items to be included on the drawings:

- a. Location map showing the embankment, principal and emergency spillways, borrow areas, work limits (if needed), reservoir area, utilities, and any other necessary information.
- b. Typical cross section of the dam showing:
  1. Embankment top width, side slopes, berms, overfill requirements, elevations
  2. Foundation stripping requirements
  3. Cutoff trench bottom width and side slopes
  4. Layout of the principal spillway if space permits. Otherwise, a separate detail of the principal spillway layout is required.
- c. Profile along centerline of the embankment showing:
  1. Original ground line and stationing
  2. Soils logs and groundwater
  3. Cutoff trench depth
  4. Locations, elevations, and dimensions of principal and emergency spillways
  5. Settled top of embankment and overfill (allowance for settlement)
- d. Profile along centerline of emergency spillway showing:
  1. Original ground line and stationing
  2. Soils logs and groundwater
  3. Finished grades for spillway
  4. Requirements for overexcavation and replacement with topsoil
- e. Details of the principal spillway shall include:
  1. Details of inlet
    - (a) Type (drop/riser, hood, weir box, etc.)
    - (b) Material (corrugated metal, concrete, plastic, etc.)
    - (c) Dimensions (diameter, height, stub locations, material thickness)
    - (d) Special coatings (polymer coated pipe)
    - (e) Footing/riser base (material, dimensions)
    - (f) Details of drawdown pipe
  2. Details of barrel
    - (a) Material (c.m., concrete, plastic)
    - (b) Dimensions (diameter, elbows, material thickness)
    - (c) Special coatings
  3. Appurtenances
    - (a) Plunge pools/riprap
    - (b) Pipe support (concrete, metal, timber)
    - (c) Seepage control along pipe
      - (1) Filter and drainage diaphragm (Sand) - use is encouraged in place of antiseep collars.
      - (2) Antiseep collars - The number of collars shall be computed as  $n = 0.075 \times l/v$  where:  
 $n$  = number of collars  
 $l$  = length of barrel within the dam  
 $v$  = vertical projection of the collar

- (d) Cathodic protection when needed
- (e) Antivortex device on inlet
- (f) Trash rack on inlet
- f. Construction notes - The drawings will include all notes necessary to clarify construction and material requirements for the job.
- g. Quantities - Estimated quantities based on field surveys and design layout shall be shown on the drawings. All quantities shall be checked by another person.
- h. Job approval - Drawings shall be signed by the designer, checker, and person with required job approval authority (NRCS personnel).
- i. Specifications - Construction and material specifications shall be prepared for all embankment ponds. The following references shall be used:
  - 1. ND Construction Specification ND-9, Pond (Embankment)
    - (a) shall be used for small, simple sites
    - (b) shall include the following, as notes on the drawings or as Section 13, Construction Details of this spec.
      - (1) Moisture and compaction requirements for earth fill
      - (2) Details of the principal spillway
      - (3) Details of foundation or embankment drainage
      - (4) Details of concrete
      - (5) Details of vegetation
      - (6) Details of fencing
      - (7) Other site specific instructions to the contractor
  - 2. North Dakota Handbook of Construction and Material Specifications for Conservation Practices or National Engineering Handbook, Section 20, shall be used for more complex sites.
- j. Assist the landowner in completing applications for required state and federal permits (water rights, 404, etc.).

## VI. Layout and Installation Procedures

Layout surveys will be recorded in loose-leaf or bound survey books. Survey notes will be kept in the format shown in the Engineering Field Manual, Chapter 1, and Technical Release 62. Centerline and slope stakes will be set for the embankment and emergency spillway. When necessary, centerline and grade/slope stakes will be set for the principal spillway and outlet channel. Electronic survey notes will be documented in a format to allow complete checking by others.

## VII. Checkout

Refer to the Engineering Field Manual, Chapter 17, and NEH-19 for guidance on methods of inspection and testing. NEH-19 contains inspection checklists covering all major items of work. Records of all materials and testing will be placed in the cooperator's file.

As a minimum, as-built measurements should include:

- a. Cutoff trench centerline profile
- b. Principal spillway
  - 1. Location (station)
  - 2. Inlet and outlet elevations
  - 3. Lengths and dimensions as needed
- c. Embankment
- d. Centerline profile
  - 1. Cross sections as needed (maximum cross section as a minimum - for larger dams, one approximately every 300 ft.)
- e. Emergency spillway
  - 1. Centerline profile
  - 2. Cross sections as needed (at least one on the level crest and one on the outlet channel)
- f. Miscellaneous
  - 1. Topsoil (area and depth)
  - 2. Seeding (area, species, etc.)
  - 3. Fencing (length, type, post spacing, etc.)

Record as-built measurements and quantities on Form ND-ENG-16e or other appropriate drawings. Record statement of compliance on "as-built" plans - that construction is complete according to plans and specifications, and adequacy or status of vegetation and topsoil placement. Date and sign by individual making determination.