

**14. Fishways.** The Introduction (Chapter 1) for these design data collection guidelines contains additional information concerning: preparing a design data collection request, design data collection requirements, and coordinating the design data collection and submittal.

**A. General Map Showing:**

- (1) A key map locating the general map area within the State.
- (2) Location of the structure site.
- (3) County, township, range, and section lines.
- (4) Existing towns, highways, roads, railroads, public and private utilities, transmission lines, substations, canals, rivers, streams, and stream-gauging stations.
- (5) Locations of sites for required construction facilities.
- (6) Sources of natural construction materials, location of commercial quarries, and disposal areas for waste material.
- (7) Existing or potential areas or features having a bearing on the design, construction, operation, or management of the project feature such as: housing and building areas; and areas of paleontological, archeological, historical or mining interest.
- (8) Sources of construction power and power for operation.
- (9) Scale of the general map should be adequate to clearly show listed details.
- (10) North arrow.

**B. Topographic Maps.** Generally, both a map and an electronic file, in AutoCAD or compatible format, of the topography covering the structure site should be provided. A contour interval of 1 foot is required in the immediate vicinity of the structure. Elsewhere, larger contour intervals may be acceptable. Details to be shown are:

- (1) Existing dam and appurtenant structures.
- (2) Proposed fish ladder(s) location(s).
- (3) Location of existing features such as highways, railroads, public and private utilities, canals, and any other features that may affect the location and cost of the fish ladder.

- (4) Existing right-of-way. Proposed acquisition of additional right-of-way should be discussed.
- (5) Below water contours should be included

**C. General Description of Local Conditions Covering:**

- (1) The capabilities of and constraints imposed by local shipping and transportation facilities.
- (2) Names and telephone numbers of local utilities and irrigation districts and contacts within those organizations.
- (3) Name and brief description of similar construction in the area or region. Preferable to use Reclamation projects if possible.
- (4) Previous applicable studies.
- (5) Climatic conditions of site (e.g., icing or freezing of river).
- (6) Seismic conditions.
- (7) River trash loading.

**D. Survey Control.** The survey can be tied to the township and range system or an existing coordinate system is acceptable but tying to the State plane coordinate system is recommended.

- (1) Right-of-way surveys are required to locate government owned property at the structure site. This will assist in coordinating and determining future land acquisition.

**E. Foundation Data.** Sufficient data on rock and soil at the proposed structure site must be included to determine the type of materials that the foundation of the fish ladder will encounter. Logs of all drill holes, auger holes and exploration pits will be included. Generally, both a map and electronic file of the surface geology overlaying the topography should be included. Major soil types should be identified, including such significant factors as expansive and low-density soils, erosive or dispersive soils, rock, and high water tables. Limited tests may be required to identify some of these problem soils.

**F. Biological Data:**

- (1) Fish species targeted.
- (2) Fish species swimming abilities.
- (3) Behavior.

- (4) Fish migration season.
- (5) Age of fish targeted.
- (6) Minimum and maximum size of the species.
- (7) Run size.
- (8) Biological requirements of the species (e.g., spawning, rearing or foraging habitats that require protection).
- (9) Source(s) of fish ladder water.

**G. Hydrological Data:**

- (1) Range of river flows.
- (2) Percent exceedence curves for flows.
- (3) River water surfaces at dam tied to downstream gauge.
- (4) Both tailwater and forebay rating curves over range of flows.
- (5) River velocities.
- (6) Diversion amounts and dates, if applicable.
- (7) Provide seasonal 1-year, 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year river flow rates and water surfaces for evaluating construction related structures such as cofferdams and bypasses.

**H. Agency Coordination:**

- (1) List of agencies to coordinate with.
- (2) Review of designs by other agencies, including the findings of the Fish and Wildlife Coordination Act Report (if available).
- (3) The need for a field conference to resolve critical environmental problems with participation of other agencies.
- (4) Agency criteria which is required to be complied with.

**I. Sedimentation Data:** Sufficient data on the soil at the proposed structure site(s) must be included to determine whether sedimentation will be a problem.

**J. Existing Structure Data.** As-built structural, mechanical and electrical drawings of the existing dam and appurtenant structures should be included.

**K. Fishways Data:**

- (1) Type of fishways considered:
  - (a) Pool-type ladder.
    - Vertical slot.
    - Pool and weir ladder.
    - Weir and orifice ladder .
    - Full width stream weir.
  - (b) Baffled channel.
    - Riprap channel with boulder weirs.
  - (c) Roughened chute ladder.
    - Alaska Steeppass.
    - Denil.
    - Roughened stream channel.
    - Pool-chute fish ladder.
  - (d) Low gradient channel.
  - (e) Vertical lift.
- (2) Range of river flows to design for.
- (3) Fishway design flow.
- (4) Maximum and minimum head loss or drop through the slots, orifice, and weirs.
- (5) Maximum and minimum fishway floor slope.
- (6) Minimum water depth.
- (7) Minimum clear opening between vertical trashrack bars.
- (8) Minimum spacing of horizontal trashrack bars.
- (9) Maximum velocity through trashrack.
- (10) Minimum fishway pool volume.

- (11) Energy Dissipation Factor (EDF).
- (12) Capacity based on fish run size.
- (13) Location of fishway exit from dam crest, spillways or any river outlet gates, etc.
- (14) Requirement for stoplog slots or gates to be provided for dewatering the ladder.
- (15) Requirement for entire fishway, including entrance and exit structures, to be covered with grating.
- (16) Predation issues.
- (17) Provision for future dam raise.

**L. Fish Entrance Areas (or Pools):**

- (1) Field observations and sketches of flow patterns above and below the barrier should be made, especially at high flows.
- (2) Observations of fish location and orientation when attempting to pass a barrier.
- (3) Entrance flow.
- (4) Type of fishway entrance (e.g., suppressed weir, contracted weir, vertical slot or orifice).
- (5) Number and dimension(s) of entrance(s).
- (6) Fishway entrance(s) location(s) and alignment(s).
- (7) Minimum flow depth through gate.
- (8) Minimum depth and radius of pool outside of entrance gate.
- (9) Design head loss across entrance gate.
- (10) Minimum velocity in the gate flow contraction.
- (11) Requirement for instrumentation.
- (12) Need for jet attraction pipes.
- (13) Design flow of jet attraction pipe where applicable.

- (14) Velocity of jet attraction pipes where applicable.
- (15) Location of attraction pipe outlet and orientation to the river flow.

**M. Auxiliary Water Systems:**

- (1) Flow required.
- (2) Vertical or horizontal diffuser grating.
- (3) Maximum clear opening between bars of diffuser grate.
- (4) Design flow per gross wetted area of diffuser grate.
- (5) Maximum clear opening of vertical bars of intake trashrack.

**N. Other Features:**

- (1) Equipment needed to determine fish movement by telemetry or other means where applicable.
- (2) Need for trap and evaluation facility.
- (3) Requirements for supplemental lighting.
- (4) Location of access required by fishery interests.

**O. Construction Data:**

- (1) Construction window to complete all work.
- (2) Restrictions on in-water work.

**P. Operating and Maintenance Data:**

- (1) Plan of operation for fish ladder facilities, dam and canal.
- (2) Portion of year structures should be designed to operate.
- (3) O&M access requirements.

**Q. Environmental Considerations.** Design data should include, as a minimum, the environmental issues and/or requirements that would affect a fish ladder design and a brief description of the environmental resources that could be affected by the proposed development. The emphasis should be on those areas within the range of alternatives open to the designers in developing a structural design. The following items should also be considered in preparing design data:

- (1) The environmental setting, photographs, both black and white and color are helpful.

- (2) Cultural (historical, archeological, architectural, and paleontological) resources in the area of the fish ladder.
  - (3) Background on the need for fish ladder.
  - (4) The need for blending structures with the surroundings, restoring borrow areas, and reseeded spoil banks.
  - (5) The need for a field conference to resolve critical environmental problems with participation of other agencies.
  - (6) Anticipated public use around the structure.
  - (7) Any threatened and/or endangered critical habitat in or adjacent to the fish ladder.
  - (8) Existing or potential wetland areas.
- R. **Cost Data.** Cost data developed in planning and appraisal estimates should be included.