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 construction access road and 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. Both a map and a 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 structures. Elsewhere, larger contour intervals may be acceptable. These site maps normally will be on a scale of 1 inch equals 50 feet. Exploration holes should be located on the maps. Aerial photographs of the proposed structure site should also be provided if available.

C. Site Plan Drawing. Both a drawing and an electronic file, in AutoCAD or compatible format, should be provided. The following should be shown:

(1) Existing dam and appurtenant structures.

(2) Proposed fish ladder location.

(3) Highways, roads, railroads and canals.

(4) Right-of-way and easement lines.

(5) North arrow and land survey lines.

(6) Existing utility lines within the right-of-way and requirements for relocation.

(7) Fences.

(8) Contours.

D. 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) Access to the site.

(6) Availability or accessibility of public facilities or utilities such as: water supply; sewage disposal; telephone utility; fire protection services; and electric power for construction.

(7) Climatic conditions that will affect construction and operation procedures such as: amount, rate, and distribution of rain and/or snow; ice conditions; summer and winter temperatures, with extremes; and extreme wind velocities and prevailing directions. (Extensive tabulations are not necessary.)

(8) Any construction restrictions such as timeframe restrictions, climatic restrictions, blasting limitations, etc.

(9) Photographs of construction site and existing features which may effect design.

(10) Seismic conditions.

(11) River trash loading.

E. Survey Control. Use of an existing coordinate system or tying to the township and range system is acceptable, but tying to the State or national system is recommended if practical.

F. Foundation Data:

(1) **General Engineering Requirements.** The data for Specifications design is very similar to that for Feasibility design. They differ only in ***greater accuracy, detail, and completeness*** of investigation and testing, particularly for specific conditions (e.g., ground water, very soft or unstable foundation materials, and zones of rock excavation). If only minor additions or revisions are involved in the descriptions, interpretation, and geological sections previously submitted for feasibility design, the new data may be submitted as a supplement; otherwise completely revised new text, sections, and profiles should be prepared.

The need for additional foundation data should be established by originating office personnel with assistance from the region and TSC representatives. For major structures, it is recommended that a field conference be held, including an inspection of the site. This conference should result in a geologic investigations program outlining the need for and extent of surface and subsurface studies, and other requirements. The geologic investigations program must be based on site conditions, type of structure, and the time and funds available for the study and will make maximum use of existing data. The complexity of the site will determine the detail of the investigation.

Sufficient data on foundation conditions must be included to determine type of excavation materials that will be encountered. Logs of all drill holes, auger holes, and exploration pits will be included. Major soil types should be identified, including such significant factors as expansive and low-density soils, rock, and high-water tables.

G. Geologic Data. The following list of geologic design data provides general guidelines for the collection and reporting of geologic information. The geologist should apply these guidelines with good judgment and sound reasoning, elaborating upon them as required by the particular geologic setting and engineering requirements. Because the collection of geologic data is a dynamic process and often continues into the preparation of final designs, all stages of the specification design geologic exploration program must be constantly coordinated with the designer through the appropriate geology office. The TSC geologic and geophysical staff will provide necessary assistance and guidance in the gathering of these design data.

(1) Compilation, summary, and reporting of Reclamation and non-Reclamation geologic information on the area, with attention being paid to the sequence of explorations and historical geologic events.

(2) Surface geologic map of the fish ladder site showing location of explorations. Locations of all existing explorations should be indicated by coordinates or stationing of the permanent survey control system for the canal.

(3) Specific foundation exploration at fish ladder site to explore particular geologic problems such as soft foundations or low-density material.

(4) Factual narrative description of surficial deposits with attention being paid to engineering geologic matters, such as swelling minerals, low-density material, presence of gypsum and other sulfates, caliche, erodibility (see *Earth Manual*).

(5) Factual narrative description of bedrock with attention being paid to engineering geologic matters such as swelling minerals, presence of gypsum and other sulfates; and to depth, weathering, joints, faults, and other planes of weakness.

(6) Selected determination of engineering properties of surficial deposits and bedrock by laboratory or field tests (in-place density, penetration resistance, permeability, shear strength, gradation, and consolidation or expansion characteristics, etc.). The type and number of samples and tests required should be determined in cooperation with the TSC.

(7) Photographs, preferably in color, of representative or particular geologic conditions.

(8) Summary and data of exploration geophysical surveys (seismic, resistivity, etc.), if performed.

(9) Determine ground water conditions with attention being paid to water levels and their seasonal fluctuation, occurrence of unconfined and confined aquifers, potential leakage, water-producing capabilities including permeability tests, chemistry, and land subsidence.

(10) Logs of exploration. Logs of drill holes advanced by churn drilling, chop and wash, or other methods which result in less than adequate sample recovery should be augmented by borehole electric (geophysical) logs where appropriate.

(11) Evaluation of landslide, snowslide, and rockfall conditions. If it is relevant, include a map of possible slide areas with as much detail as practicable.

(12) If threat to life is significant, determine age of faulting in vicinity, especially if suspected to be late Pleistocene or Holocene.

(13) Document past, present, and possible future petroleum, water, and mineral extraction operations in vicinity.

(14) Determine geologic conditions which may affect construction methods such as, boulders on ground surface, marshes, cemented zones in surficial materials, etc. Any potential surface water runoff problems should be brought to the attention of a regional hydrologist.

(15) Samples of foundation materials and ground water should be obtained and tested to determine any possible chemical reaction with the concrete or metalwork.

H. Corrosion Survey:

(1) In situ electrical resistivity measurements of geologic materials in the area of construction. Additional measurements should be made in the areas where there is a pronounced change in type of geologic materials, drainage, and/or moisture conditions.

(2) Performance history of materials of construction that have been used in the area.

(3) List of structures in the vicinity of (within ¼ mile) the proposed structure and appurtenant features. Determine if buried structures in the vicinity have corrosion protection and, if so, the type of corrosion protection.

(4) List location, output, and purpose of the direct-current sources in the earth situated within ¼ mile of the proposed structure and appurtenant features. If the purpose of the direct current is for cathodic protection, describe the structure protected and its location.

(5) Chemistry of geologic materials, ground water, and/or product water.

I. Construction Materials Data Including:

(1) An earth materials report containing complete detailed information on those potential sources of soils and rocks that have been selected for final consideration. (See *Earth Manual*.)

(2) Information on concrete aggregates. (See “Final Investigations” in *Concrete Manual*).

(3) Information on sources and character of acceptable road surfacing materials, if required.

(4) References to service history of materials if used previously and to results of sampling and analysis, including previous tests in the central Reclamation laboratories.

(5) Environmental impacts associated with removing or obtaining construction material.

(6) Dispersive soil analyses.

J. 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.

K. Hydrological Data:

(1) Range of river flows.

(2) Percent exceedance 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.

L. 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.

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

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

O. Fishways Data:

(1) Type of fishway selected:

(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.

P. 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.

Q. 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.

R. 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.

S. Construction Data:

(1) Construction window to complete all work.

(2) Restrictions on in-water work.

T. 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.

U. Miscellaneous Information:

(1) Prevalence of any unusual local pest action such as termites, dry rot, and marine borers; local practices for combating same.

(2) Special requirements and locations of safety devices such as guardrailing, security lighting and fences in populated areas.

V. Environmental Considerations. Implementation of design features should be consistent with the environmental commitments as described in the NEPA compliance document. Implementation of design features should be consistent with agreements reached between Interior bureaus, Federal agencies, and other governmental agencies.

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 reseeding spoil banks.

(5) The need for a field conference to resolve critical environmental problems with participation of other agencies.

(6) Review of designs by other agencies, including the findings of the Fish and Wildlife Coordination Act Report (if available).

(7) Anticipated public use around the structure.

(8) Any threatened and/or endangered critical habitat in or adjacent to the fish ladder.

(9) Existing or potential wetland areas

W. Operating Data Including:

(1) Source(s) of fish ladder water.

(2) Plan of operation for fish ladder..

(3) Percent of design capacity that the fish ladder is expected to carry each month, and probable dates that it may be taken out of service for maintenance each year.

(4) For fish ladders operated in subfreezing weather: minimum temperatures, lengths of time freezing may occur, average and maximum ice depths, conditions to be anticipated as to alternate freezing and thawing, and probability of fish ladders drifting full of snow.

(5) Character of water to be conveyed with respect to probable sediment deposition.

(6) Type of maintenance machinery contemplated.

(7) Type of communications system contemplated.

X. Electrical Data. Data listed below will be required to initiate design. After designs of the facility have progressed enough to develop details of electrical system needs, designers will prepare a list of additional data required to complete final design of electrical installation.

(1) Name and telephone numbers of electrical power suppliers and contacts within those organizations.

(2) Location of point where connection to power supply will be made.

(3) System voltage at which power will be supplied, number of phases, and whether service will be overhead or underground.

(4) Electrical system reliability criteria.

(5) Discuss requirements for an alternate power source. If an alternate supply is required, indicate:

(a) If required by State or local authority.

(b) If source should be an engine-generator.

(c) If a threat to life or property will result if normal power supply is lost.

(d) Loads requiring service from alternate source.

(6) Requirements for remote monitoring of conditions at the facility. Discuss location of remote station, and items required to be monitored.

(7) Requirements for supervisory control, including location of station from which supervisory control is exercised.

(8) Requirements for voice and data communications between the supervisory master station and the remote facilities.