

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

FISH PASSAGE

(Mi.)

CODE 396

DEFINITION

Modification or removal of barriers that restrict or impede movement or migration of fish or other aquatic organisms.

PURPOSE

Improve or provide upstream and downstream passage for fish and other aquatic organisms.

CONDITIONS WHERE PRACTICE APPLIES

All aquatic habitats where barriers impede passage for fish and other aquatic organisms.

CRITERIA

Planning and Evaluation

Evaluate sites for variations in stage and discharge, tidal influence, hydraulics, geomorphic impacts, sediment transport and continuity, and organic debris movement. Design passage features to account for the known range of variation resulting from this evaluation.

Minimize any foreseeable channel plan or profile shifts resulting from the modification or removal of a passage barrier.

Plan and locate passage for compatibility with local site conditions and stream geomorphology.

Avoid locating fishway entrances and exits in areas that will obstruct function, increase harassment or predation, or result in excessive operation and maintenance requirements.

Design Requirements

Design computations shall be performed by a qualified individual.

Design passage to accommodate present and reasonably anticipated changes in watershed conditions.

Design passage structures according to swimming and leaping capabilities of target species. Utilize hydraulic computations to document how designs satisfy the physiological requirements of target organisms.

Design and evaluate passage structures for hydraulic performance and structural integrity at a minimum of the 25-year peak flow event. Design channel for stability upstream and downstream of the structure.

Design passage features to minimize or avoid energy deficits, physical stress, and harm to migratory organisms.

Design passage features to minimize or avoid excessive delays during migration periods.

Provide adequate attraction flow into a passage facility across the full range of discharge during which target species will move.

Culvert crossings shall be designed in accordance with Virginia Conservation Practice Standard *Stream Crossing (Code 578)*.

Use trashracks on culverts only if required or necessary. Ensure that trashracks are self-cleaning and/or easily maintained.

Select construction materials and methods that are non-toxic, minimize adverse consequences to aquatic organisms, and are resistant to degradation.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service [State Office](#) or visit the [electronic Field Office Technical Guide](#).

NRCS, VA, October 2007

Replacing or removing an existing instream structure may trigger channel adjustments (e.g., aggradation and/or degradation) upstream and/or downstream of the work site. Install grade controls or other slope modifications to mitigate adverse physical or ecological consequences. See Virginia Conservation Practices *Channel Stabilization (Code 584)* and *Grade Stabilization Structure (Code 410)*.

Reporting Requirements

Miles of fish passage whether involving streams, lakes or ponds will be reported according to Subpart D, Part 640 of the National Biology Handbook.

CONSIDERATIONS

Develop or adopt a quantitative method to identify and evaluate passage barriers (see References). Information derived from this method can assist planning and budgeting activities.

Consider removing a passage barrier before installing or retrofitting a new facility or structure. Complete or partial barrier removal usually provides better passage conditions, and is more economical than designing, constructing, operating, and maintaining many passage structures.

Culverts or bottomless arches that incorporate natural streambed substrates throughout their length are preferred over other culvert configurations for passage purposes. Natural streambeds provide numerous passage and habitat benefits to many life stage requirements for fish and other aquatic organisms compared to man-made surfaces.

Design and locate features to improve or provide passage for as many different aquatic species and age classes as possible.

Analyze any potentially negative interactions, including hybridization, disease, competition, or predation, between target and aquatic nuisance species when passage is provided above a barrier. If serious consequences are likely, take steps to minimize adverse effects.

Where possible, consider the habitat requirements of other aquatic or terrestrial species that may be affected by a passage

project. Some passage facilities may improve survival for terrestrial vertebrates by providing safe migration routes under roadways.

Consider the amount of habitat upstream and downstream of a barrier to evaluate into project feasibility, cost effectiveness, and/or potential for connecting fragmented habitats. Using a watershed approach whenever possible provides a framework for project planning.

Fish passage facilities are often associated with water diversions or intakes that injure or kill aquatic species. Prevent fish entrainment, particularly juveniles, into diversions, penstocks, or pumps by installing screens.

Passage projects can affect water management practices such as diversion, power generation, or storage. Strive to balance aquatic organism passage with other water management objectives.

Consider upstream and larger watershed issues that may affect passage. Common solutions may include maintaining or restoring adequate instream flow and/or other water quality parameters (e.g., temperature, dissolved oxygen).

At sites where fish passage is provided, consider vegetative plantings to protect streambanks and water quality at or near fish passage sites.

Consider the potential impacts to cultural resources both for structures and adjacent lands.

Barrier removal, especially dams and road crossings, can significantly affect wetlands, flooding potential, existing infrastructure, and social and cultural practices. Evaluate and address the full range of impacts when planning or designing barrier removal projects.

Floodplain and water development often alter historic river channel pattern and location. Consider bypassing a barrier by restoring streamflow to former, stable natural channels.

Passage facilities can assist population recovery and management. Where applicable, consider local, state, or federal brood stock collection and species management initiatives when planning passage features.

Consider using self-regulating tidegates in marine environments. These structures can be adjusted to automatically regulate saltwater intrusion into estuaries, and often improve estuarine functions and passage conditions.

In the case of low-water crossings, water quality impacts from vehicular pollutants and erosion caused by tire action can be severe. Where possible, reroute roadways or install hardened instream crossings. The Virginia Conservation Practice Standard *Stream Crossing (Code 578)* shall be used to design a low-water crossing.

PLANS AND SPECIFICATIONS

Provide site-specific plans for this practice. Plans will specify passage structure design, layout, and overall objectives, and include (at a minimum):

Design Data

- Completed Environmental Evaluation (Form VA-1) and subsequent requirements
- Project objectives (moved higher up page)
- Target species
- Location map and plan view of site
- Documentation of fish passage barriers
- Stream longitudinal profiles and cross-sections
- Soils investigation auger logs to determine any special construction needs
- Detailed construction drawings showing site elevations (including headwater and tailwater fluctuations), drainage area, description and analyses of design flows and velocities, and structural operating criteria
- Construction specifications describing materials, logistics (including erosion control), and timing. Use the Virginia 700 Series Construction Specifications
- For fishways, an agreed-to operation schedule and water management plan to provide upstream and downstream fish passage
- Record seeding and stabilization requirements.

- Virginia Standard Cover Sheet and signatures

Check Data

- Guidance for post-construction evaluation and monitoring to assess structural integrity and compliance with design criteria
- Statement of adequacy of seeding
- As-built drawings to show completed structure
- Measurement of material and quantities

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan for all applications of this standard. Within the plan, provide for periodic inspection and corrective action should passage conditions become impaired because a structure is damaged or inoperable. Typical operation and maintenance items:

- Specify what entity is responsible for the daily operation and maintenance of a passage structure.
- Check a passage structure at regular intervals to ensure it is operating within design criteria.
- Operate fishways according to the approved operation schedule and water management plan.
- Clean trashracks and debris collectors or remove debris accumulations regularly.
- Adjust gates, orifices, valves, or other control devices as needed to regulate flow and maintain a passage structure within operating criteria.
- Periodically check staff gauges or other flow metering devices for accuracy.
- Annually inspect passage structures for structural integrity and disrepair.
- Annually inspect vegetation used to stabilize banks at or near a fish passage site to ensure vegetation is functioning as desired; replant as necessary.
- Inspect gate and valve seals for damage.

- Replace worn or broken stoplogs, baffles, fins, or other structural components.
- Remove sediment accumulations from within passage structure where applicable.

REFERENCES

Aquatic Nuisance Species Information. 2006. (per Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 [16 U.S.C. 4701]).

Bell, M.C. 1990. Fisheries Handbook of Engineering Requirements and Biological Criteria. United States Army Corps of Engineers, Fish Passage Development and Evaluation Program, Portland, OR.

Clay, C.H. 1995. Design of Fishways and Other Fish Facilities. Second Edition. CRC Press, Inc. Boca Raton, FL.

Jungwirth, M., S. Schmutz, and S. Weiss, editors. 1998. Fish Migration and Fish Bypasses. Fishing News Books, Oxford, UK.

Lang, M., M. Love, and W. Trush. 2004. Improving fish passage at road crossings. Final report to the National Marine Fisheries Service, produced in cooperation with

Humboldt State University Foundation under NMFS contract 50ABNF800082. Arcata, CA.

NRCS. 2006. Fish passage and screening designs. Technical Supplement 14-N to NEH-654 – Stream Restoration Design Handbook.

Taylor, R.N. and M. Love. 2003. Fish passage evaluation at stream crossings. Part IX *in*: California Stream Habitat Restoration Manual, 3rd edition, 1998. Prepared by G. Flosi, S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. Sacramento, CA.

Virginia NRCS FOTG, Section IV

Virginia Standard Detail Drawings

Washington Department of Fish and Wildlife (WDFW). 2000. Fishway guidelines for Washington State. Olympia, WA.

WDFW. 2000. Fish passage barrier and surface water diversion screening and prioritization manual. WDFW Habitat Program, Environmental Restoration Division, Salmon Screening, Habitat Enhancement and Restoration Section, Olympia, WA.

WDFW. 2003. Design of road culverts for fish passage. Olympia, WA.

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