NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

AQUATIC ORGANISM PASSAGE

(Mi.)

CODE 396

DEFINITION

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

PURPOSE

Improve or provide passage for aquatic organisms.

CONDITIONS WHERE PRACTICE APPLIES

All aquatic habitats where barriers impede passage of 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.

Mitigate undesirable 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, to the extent possible.

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 must be performed by a qualified individual.

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

Design passage structures according to known swimming and leaping capabilities of target species or a similar species with comparable swimming abilities. Utilize hydraulic computations to document how designs satisfy the physiological requirements of target organisms.

Design passage structures to mimic channel geometry and morphology referenced from an adjacent reach or analog stream when the swimming and leaping abilities of target species are unknown, or when a project will benefit multiple aquatic organisms.

At a minimum, design and evaluate passage structures for hydraulic performance and structural integrity at the bankfull and 25-year peak flow events.

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.

Design culvert crossings in accordance with Virginia Conservation Practice Standard *Stream Crossing (Code 578).*

Use the criteria in Virginia Conservation Practice Standard *Structure for Water Control (Code 587)* to design flow devices such as gates, orifices and valves.

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

Select construction materials that are non-toxic and resistant to degradation.

Plan construction logistics, methods, and sequencing to minimize adverse effects to aquatic organisms, riparian areas, and instream habitat.

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 often provides better passage conditions, and is more economical than designing, constructing, operating, and maintaining many new passage structures.

Culverts or bottomless arches designed using the stream simulation approach (USFS 2008) 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.

Retain as much riparian and streambank vegetation as possible during project access and construction activities to maintain shade, riparian continuity, and sources of nutrient and structural inputs for aquatic ecosystems. Where appropriate, consider removing access roads or trails and restoring native vegetation representative of the site.

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 *Structure for Water Control (Code 587).*

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.

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 through the use of additional floodplain relief culverts.

Assess 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 may injure or kill aquatic species. Prevent fish entrainment or impingement, particularly of 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).

Barrier removal, especially dams and road crossings, can significantly affect wetlands, flooding potential, existing infrastructure, and social and cultural practices and resources. 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. 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. Use the Virginia Conservation Practice Standard *Stream Crossing (Code 578)* to design a low-water crossing.

PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared for each site. Record all required information in Aquatic Organism Passage Job Sheet and in an engineering field book, on a plan sheet or design computation sheet, or other appropriate location. Plans and specifications shall be reviewed by staff with appropriate training in design and implementation of wetland creation.

DESIGN DATA

1. Completed Environmental Evaluation and subsequent requirements.
2. Aquatic Organism Passage Job Sheet.
3. Survey and plot data: profile, cross-sections, topography, as needed.
4. Design computations, including purpose of practice and references used.
5. Plan view of site with existing and planned features, including dimensions, distances, etc.
6. Standard Cover Sheet (VA-SO-100A).
7. Materials and quantities needed. Identify borrow material and/or spoil area, as needed.
8. Vegetation and/or ground cover requirements.
9. Identification of needed Erosion & Sediment Control measures.
10. Supplemental practices required.
11. Virginia Conservation Practice Specifications (700 Series).
12. Operation and Maintenance Plan

CHECK DATA

1. As-built survey.
2. As-built plans including dimensions, types and quantities of materials installed, and variations from design. Include justification for variations.
3. Locations of appurtenant practices.
4. Adequacy of vegetation and/or ground cover.
5. Completed as-built section of Cover Sheet.

Use the practice job sheet to plan and certify this practice.

OPERATION AND MAINTENANCE

The Aquatic Organism Passage Job Sheet included the Operation and Maintenance Plan for the standard. The O&M Plan contains a list of the management and monitoring activities needed to ensure the continued success of the passage. A Maintenance and Monitoring schedule will be prepared as part of the O&M Plan. All appurtenant practices associated with the wetland creation will meet the requirements of the appropriate Conservation Practice Standard. The Operation and Maintenance Plan for each of these practices will be appended to the Job Sheet.

At a minimum, operation and maintenance items should include:

- Clearly identify who is responsible for the daily operation and maintenance of a passage structure.
- Annual, seasonal, and/or daily operating activities necessary to ensure proper function of the structure:
  - Check passage structure at regular intervals to ensure it is operating within design criteria.
  - 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 gages or other flow metering devices for accuracy.
  - Annually inspect passage structures for structural integrity and disrepair.

- 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. 290 p.

Clay, C.H. 1995. *Design of Fishways and Other Fish Facilities*. Second Edition. CRC Press, Inc. Boca Raton, FL. 248 pp.

Jungwirth, M., S. Schmutz, and S. Weiss, editors. 1998. *Fish Migration and Fish Bypasses.* Fishing News Books, Oxford, UK. 438 pp.

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. 100 electronic pp.

United States Forest Service (USFS). 2006. Low water crossings: Geomorphic, biological, and engineering design considerations. 0625 1808, SDTDC, San Dimas, CA.

USFS. 2008. Stream Simulation: An ecological approach to providing passage for aquatic organisms at road-stream crossings. 0877 1801P, NTDP, San Dimas, CA.

Washington Department of Fish and Wildlife (WDFW). 2000. Fishway guidelines for Washington State. Olympia, WA. 57 pp.

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. 158 pp.