NATURAL RESOURCES CONSERVATION SERVICE
MONTANA CONSERVATION PRACTICE STANDARD

AQUATIC ORGANISM PASSAGE (MILE)

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 fish-way entrances and exits in areas that will obstruct function, increase harassment or predation, or result in excessive operation and maintenance requirements.

Evaluate target species life history requirements and determine whether it is ecologically appropriate to provide aquatic passage.

Design Requirements

All designs shall meet the requirements of the associated engineering practice standards. These include but are not limited to the following:

a. 560 – Access Road

b. 578 – Stream Crossing

c. 582 – Open Channel

d. 326 – Clearing and Snagging

e. 580 – Streambank and Shoreline Protection

f. 584 – Stream Channel Stabilization

g. 587 – Structure for Water Control

h. 326 – Clearing and Snagging

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.

NRCS, MT
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NOTE: This type of font (AaBbCcDdEe 123..**)** indicates NRCS National Standards.
This type of font (AaBbCcDdEe 123..) indicates Montana Supplement.

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.

Use trash racks on culverts or fish ways only if required or necessary. Ensure that trash racks 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 in-stream 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. **Where low water crossings are needed in order to allow livestock and equipment to cross, refer to Engineering Technical Note No. MT-13, "Livestock Water Access and Ford Stream Crossings."**

Replacing or removing an existing in-stream 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 conservation practice standards Channel Stabilization – Code 584 and Grade Stabilization Structure – Code 410).

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, **and cannot be fully mitigated, this practice should not be applied.**

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. **The Denil Fish ladder can be used for passage around a diversion structure. Fish ladder slopes shall not exceed 1:6.67 (15%) and can be typically set at 1:12 (8.3%). To assure passage during low flows, set the fish ladder elevation 6" below the sill elevation. One source for Denil Fish Ladder design can be found in the Food and Agriculture Organization, (FAO) "Fish Passes, Dimensions, and Monitoring."**

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. **In the case of situations where federal threatened**

and endangered species are affected, then passage may actually outweigh water management objectives.

Consider upstream and larger watershed issues that may affect passage. Common solutions may include maintaining or restoring adequate in-stream 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 stream flow 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 tide gates 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 in-stream crossings (see Stream Crossing, Code 578).

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):

- Location map and plan view of site, description of design flows, and a short summary of operating criteria.
- Detailed construction drawings showing existing and planned site conditions including elevations, typical profiles, and cross-sections of planned structures.
- Construction specifications describing materials, logistics (including erosion control), and timing.
- Guidance for post-construction evaluation and monitoring to assess structural integrity and compliance with design criteria.

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. At a minimum, operation and maintenance items should include:

- Specifying what entity 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 trash racks 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.

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