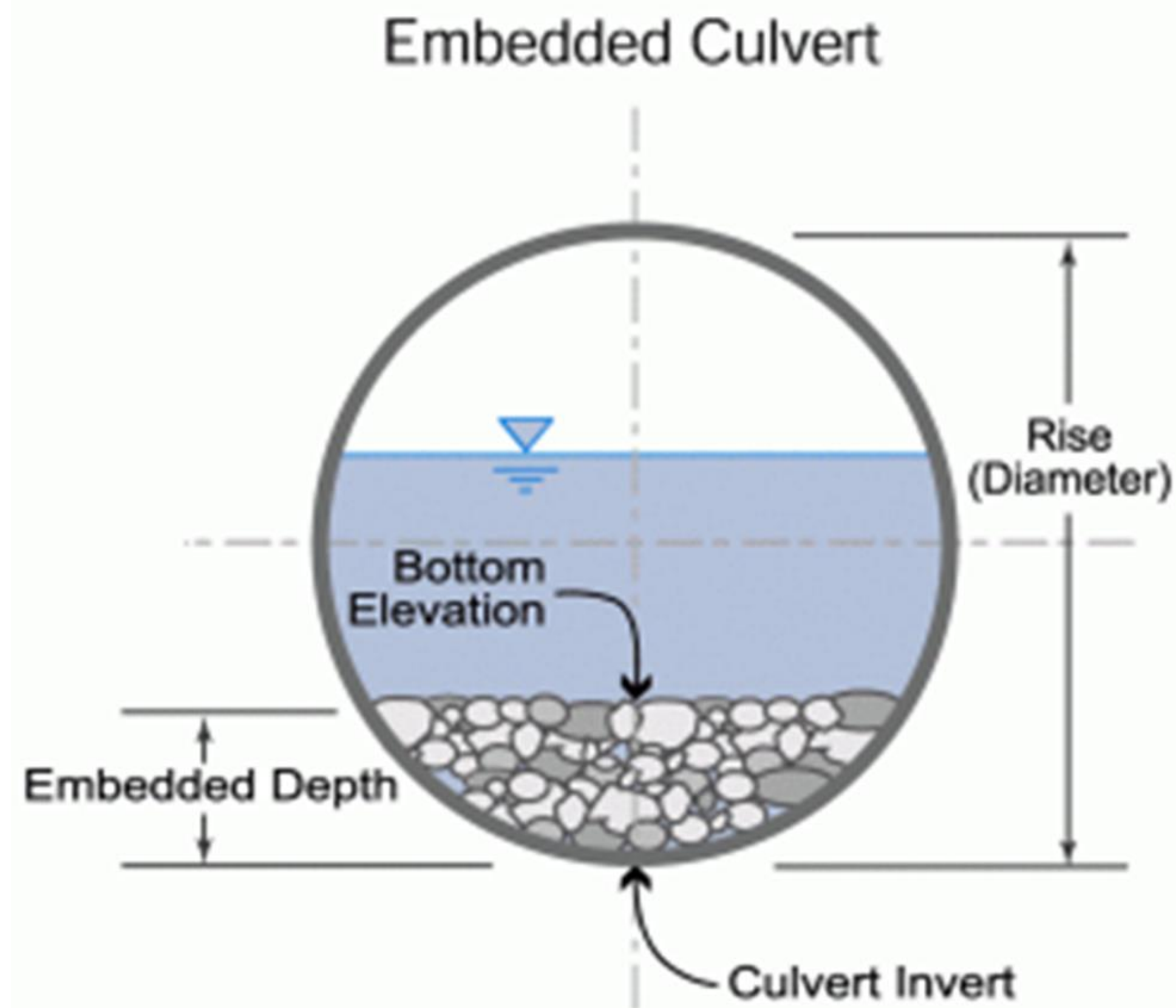


Assessment of Embedded Culverts and Performance during Low Flow Conditions

PROBLEM STATEMENT

In 2010, New Hampshire adopted new rules for the permitting of stream crossings. One aspect of the rules was that new culvert installations should be geomorphically sized and preferably have natural materials placed in the stream crossing bed to better accommodate aquatic organism passage (AOP). In culverts that are not open bottom, this means oversizing the culvert and partially filling the bottom with natural material. This partially filled culvert is known as an embedded culvert. While culverts are recommended to be embedded, the practice is criticized for its impact on aquatic habitat.



PROJECT OBJECTIVE

The goal was to inspect and assess previous installations, synthesize current knowledge, and modify design protocols, as necessary, for successful embedded culvert installations that provide AOP. The study included evaluation of a condition known as "hyporheic" where the material used for an embedded culvert is so coarse that during low stream flows, the stream disappears into those sediments, reducing or eliminating AOP.

UNH Project Researchers:

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Culvert outlet performing adequately at low flow conditions, located in eastern NH



Culvert outlet exhibiting loss of bed material, located in northern NH



Culvert outlet in hyporheic condition, located in southern NH

METHODS

The approach to addressing the problem:

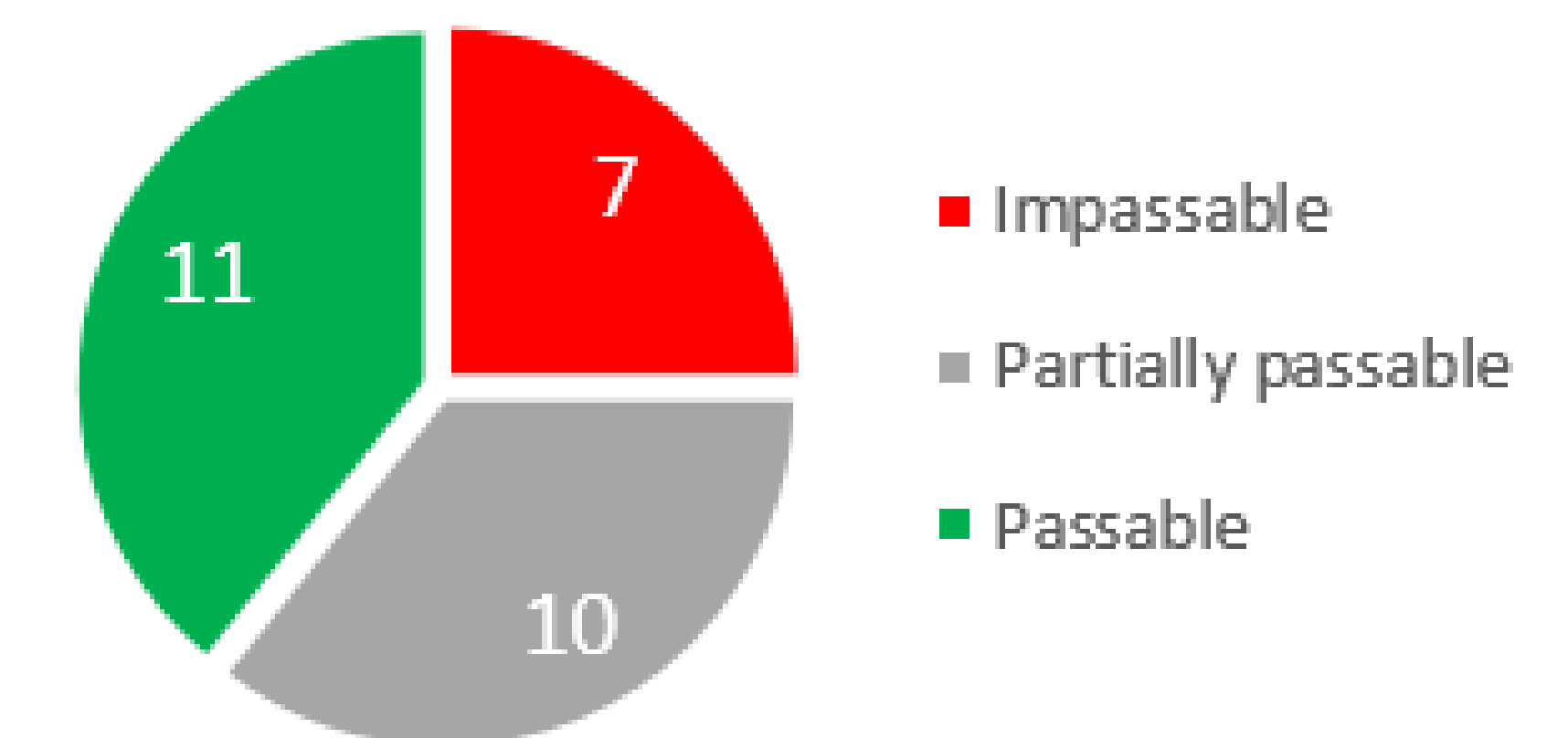
- Field study constructed embedded culverts
- Nationwide literature review of culvert embedment practices and prior research on hyporheic condition
- Determining the fundamental reason for lack of AOP performance
- Modifying design protocols as warranted

The research team evaluated 28 embedded culverts identified by NHDOT, NH Fish & Game, and other sources. At each site, longitudinal profiles, culvert dimension measurements, stream gauging, bed sediment sampling, and aquatic organism passage assessments were performed.

PROJECT OUTCOMES

Most sites with bottom topography, such as baffles, did not have hyporheic or sediment issues. Steeper culvert channel slopes exhibited hyporheic conditions or loss of sediment. Some of these steeper culvert slopes mimicked a steeper natural stream bed, therefore loss of embedment sediments may be related to inadequately sized bed material.

Aquatic Organism Passage for Identified Embedded Culverts



None of the field or design variables of this study could statistically describe with confidence why some culverts were hyporheic.

Link to NHDOT Research Project Page:

<https://www.nh.gov/dot/org/projectdevelopment/materials/research/projects/26962y.htm>