

Aquatic Organism Passage at Road-Stream  
Crossings Assessment  
Tahoe National Forest  
FY 2010



**Tributary of Haskell Creek at Road 09-B crossing**

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## **Executive Summary**

During fiscal year 2010, sixty-one culverts were surveyed on the Tahoe National Forest using *the National Inventory and Assessment Procedure for Identifying Barriers to Aquatic Organism Passage at Road-Stream Crossings* (USDA Forest Service 2005) protocol. This protocol assessed whether or not juvenile and adult salmonids could pass through the culverts during low stream flow. Between 77 and 90% of the culverts surveyed were assessed as impassable using the California Department of Fish and Game criteria and the Region 1 Forest Service criteria. Using gradient the amount of available habitat above and below each surveyed culvert was calculated. The ten culverts with the most available habitat, as determined by gradient, above the crossing are listed in Table 6. Future surveys are needed to assess other perennial stream crossings on the Forest. Snorkel surveys coupled with culvert surveys could assist in updating the Forest's fish distribution layer.

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## Methods

Aquatic Organism Passage surveys were carried out during the summer of 2010 on the Tahoe National Forest. Sixty-one culverts were surveyed using this protocol. Funding for this project came from the Capital Maintenance and Legacy Roads BLI (CMLG). *The National Inventory and Assessment Procedure for Identifying Barriers to Aquatic Organism Passage at Road-Stream Crossings* (USDA Forest Service 2005) protocol developed by the USDA Forest Service San Dimas Technology and Development Center was used for this assessment.

## Site Selection

Culverts were selected for the FY 2010 surveys using two criteria: 1) aquatic species 2) culverts within the action area of future projects. Crossings within tributaries to the North Fork, Middle Fork and South Fork of the Yuba River were prioritized. The Yuba River historically contained Chinook salmon, an Endangered Species Act (ESA) listed species, and the Yuba River and its tributaries may serve as future sites for Chinook salmon reintroduction (Table 2). Crossings on streams that currently support Lahontan cutthroat trout, a species listed as “Threatened” under the ESA were also prioritized. Additionally, culverts in watersheds where ground disturbing projects are proposed to occur were also prioritized for surveys. It was then determined how many stream crossings occurred within these selected watersheds by using GIS stream and road coverages. Perennial streams were intersected with roads to estimate the number potential survey sites. The total number of road crossings on perennial streams across the Forest on National Forest system roads is estimated to be about 719. Further field verification confirmed the presence of bridges, fords, and other non-culvert crossings. These non-culvert crossings were not surveyed using the San Dimas protocol but were photographed and catalogued when encountered.

**Table 1. ESA Listed and Forest Service Sensitive aquatic species of the Tahoe National Forest**

Species	Status*	Ranger District			
		American River	Yuba River	Sierraville	Truckee
<b>California Red-legged frog</b> ( <i>Rana draytonii</i> )	USFWS Threatened	X	X		
<b>Lahontan cutthroat trout</b> ( <i>Oncorhynchus clarki henshawi</i> )	USFWS Threatened		X	X	X
<b>Northwestern pond turtle</b> ( <i>Clemmys marmorata marmorata</i> )	USFS R5 Sensitive	X	X		
<b>Foothill yellow-legged frog</b> ( <i>Rana boylei</i> )	USFS R5 Sensitive	X	X		
<b>Sierra Nevada yellow-legged frog</b> ( <i>Rana sierrae</i> )	USFS Sensitive	X	X	X	X
<b>Great Basin rams-horn snail</b> ( <i>Helisoma newberryi newberryi</i> )	USFS R5 Sensitive			X	X
<b>Lahontan Lake tui chub</b> ( <i>Gila bicolor pectinifer</i> )	USFS R5 Sensitive			X	X
<b>Hardhead</b> ( <i>Mylopharodon conocephalus</i> )	USFS R5 Sensitive	X	X		
<b>California floater</b> ( <i>Anodonta californiensis</i> )	USFS R5 Sensitive				X
<b>Potential reintroduction species</b>					
<b>Central Valley spring-run Chinook salmon</b> ( <i>Oncorhynchus tshawytscha</i> )	USFWS Threatened	X	X		

## Field Crews and Inventory Collaboration

The Tahoe National Forest hired two seasonal biological technicians to carry out the majority of the AOP surveys for the West Zone of the Forest. TEAMS Enterprise Unit fisheries biologist, Brooke DeVault, stationed on the Tahoe NF was contracted to oversee the crew, assist in field work, and write the final report. Additional surveys were conducted by biological technicians employed by the East Zone fisheries biologist and the Yuba River Ranger District wildlife crew. Tina Mark, Forest Aquatic Program Manager, provided project oversight, coordination, and supervision. CMLG funds provided for a leased vehicle from GSA, biological technicians field work, TEAMS enterprise unit employee's time, Forest Biologist staff time, and the purchase of two sets of field equipment (laser level, stadia rods, measuring tapes, etc.) specifically for the AOP surveys.

## Survey Protocol

The San Dimas protocol (USDA Forest Service 2005) specifies the collection of a number of metrics for each crossing: longitudinal profile above, below and through each crossing, cross-sectional profile at the tailwater control, bankfull widths, and culvert measurements. These metrics were added into an Excel spreadsheet which calculated measurements such as culvert slope, outlet drop, and inlet and channel gradient which were then used in the evaluation criteria. Other information such as site photos, culvert description, and a site sketch were also collected for each culvert.

## Evaluation Criteria

The criteria for evaluation of whether or not a culvert is passable were the *California Salmonid Stream Habitat Restoration Manual, Fish Passage Evaluation at Stream Crossings* (CDFG 2003) and the Region 1 of the Forest Service culvert assessment (Burton 1998) (Appendix). Currently, specific criteria for aquatic species found on the Tahoe NF (i.e., rainbow trout, Sierra Nevada yellow-legged frog, Lahontan cutthroat trout, etc.) have not been developed. Therefore the CDFG and Region 1 criteria were used. These screening processes were used to classify existing crossings as meeting, needing further hydraulic analysis, or failing to meet fish passage criteria for selected fish species. These flowcharts attempt to define whether passage is provided through existing structures at the time of survey.

## Inventory Results

The Aquatic Organism Passage (AOP) at Road-Stream Crossings Project for FY 2010 on the Tahoe National Forest (TNF) completed full culvert inventory assessments on 61 road-stream crossings and documented 11 crossings/culverts that could not be surveyed using the San Dimas protocol (low water crossings, intermittent streams etc.). Thirty-seven culverts were inventoried in basins that may contain habitat for future Chinook salmon reintroductions (Table 2). Thirteen crossings were surveyed along streams that contain LCT. The remaining culverts were within watersheds that contain resident trout (rainbow, brown, and brook) and/or amphibians.

**Table 2. Summary of Tahoe NF crossings inventoried by aquatic species**

Species	# of Crossings Surveyed
<b>Chinook salmon</b>	37
<b>Lahontan cutthroat trout</b>	13
<b>Other (rainbow trout, amphibians etc.)</b>	11
<b>Total</b>	<b>61</b>

The CDFG criteria assessed 77% of the surveyed culverts as not meeting the criteria to pass fish (RED) (Table 3). The Region 1 criteria assessed 90% of the culvert crossings as not meeting the criteria to pass fish (Table 4).

AOP Inventory Summary FY 2010- Tahoe National Forest

**Table 3. Summary of passage determinations, CDFG criteria, for surveyed culverts**

Life Stage	Red	Gray	Green	Total
Adult/juvenile	47	13	1	61

**Table 4. Summary of passage determinations for adult and juvenile salmonids, Region 1 protocol, for surveyed culverts**

Life Stage	Red	Gray	Green	Total
Adult	55	4	2	61
Juvenile	58	2	1	61

Most of the "RED" crossings were associated with circular culverts (Table 5). Examples of the inlets and outlets of the circular culverts rated RED are displayed in Figures 1 and 2. Many of the RED culverts are barriers because of culvert slope and outlet drops but may be barriers for additional reasons as well. Only one (two for the Region 1 criteria) of the evaluated culverts met the passage criteria (GREEN) and therefore is not a barrier to salmonid fish passage. This crossing, Indian Creek\_1, and the one rated GREEN for adults by the Region 1 criteria, is an open-arch with a natural bottom (Figure 3 and 4). The remaining 27% (7% as assessed by Region 1 criteria) of the evaluated culverts were found to be indeterminate (GRAY) and candidates for further evaluation (e.g.; Fish Xing software). These crossings included open-bottom arches, circular culverts, and squashed pipe-arch culverts.

**Table 5. Summary of culvert passage evaluation (CDFG criteria) by culvert type.**

Culvert Type	Red	Gray	Green
Circular	41	3	0
Pipe-Arch	2	6	0
Box	1	3	0
Open-Arch (natural bottom)	1	1	1
Open-Arch (concrete bottom)	1	0	0
Other	1	0	0

AOP Inventory Summary FY 2010- Tahoe National Forest



Figure 1. Culvert outlet of Blue Ravine \_1



Figure 2. Culvert inlet of Indian Creek\_Trib\_2



Figure 3. Culvert outlet of Indian Creek\_1



Figure 4. Culvert inlet of Indian Creek\_1

## Additional Considerations

The modification or replacement of most of the “RED” or “GRAY” culverts may be desirable, however there may be specific locations where a non-passable culvert may be warranted or desired. There are streams within the East Zone of the Tahoe NF that contain Lahontan cutthroat trout. These populations persist because of isolation from non-native species that would prey upon, compete with or breed with LCT populations. There may be other culverts on the Forest where impassability is retained to protect amphibian populations (i.e. Sierra Nevada yellow legged frog) from predatory fish populations. The determinations of which culverts should remain impassable have not been made.

## Other Surveys

In addition to the culverts surveyed, crews also documented other road-stream crossings that were encountered along Forest Service system roads. Other road crossings documented included culverts on intermittent streams, low-water crossings, streams where water has been diverted (likely for mining purposes) and other special-case crossings. These crossings were documented with photos, notes and a site sketch.

## Habitat above Crossings Results

In addition to surveying culverts for ease of salmonid passage, a GIS analysis was conducted to determine the amount of available/potential aquatic habitat that occurs above each culvert.

## Method for Determining Miles of Potential Habitat

The fish distribution layer for the Tahoe NF was created in the mid-1990s and does not currently contain enough information to determine the upstream extent of fish distribution or what species some streams contain. In the absence of an updated fish distribution layer, stream gradient was used to determine the amount of potential habitat above and below each surveyed culvert. Determining the amount of available habitat will help with prioritization of culverts for replacement as well prioritization of culverts to be surveyed in the future. The amount of potential habitat above each culvert was determined using the following method:

- Each surveyed culvert was identified in a GIS table.
- The gradient of the stream above and below the culvert was determined using 50 meters segments and the distance to the next road crossing was identified.
- Stream gradient was broken into four categories: 0 to 4%, 4 to 15%, 15 to 20%, and 20% and greater. These categories were determined using gradient preferences for rainbow trout and Chinook salmon. The peer-reviewed literature and technical literature on this subject is sparse.
- Using the available literature (Larson and Moore 1985, Lunetta et al. 1997, Meixler et al. 2009) and consulting fisheries biologists (Mease pers. comm. 2010, Teater pers. comm. 2010) the categories were determined: 0 to 4% was deemed more preferable for Chinook salmon use (spawning, rearing etc.), 4 to 15% likely used by rainbow trout and Chinook salmon, 15 to 20% likely the least desirable for rainbow trout but still may be used, and 20% and above is unlikely to be used by either species, and is likely a barrier to movement.

Table 6 identifies the amount of potential habitat available above and below the ten culverts with most potential upstream habitat. This does not take into consideration man-made barriers and other unknown impediments or the quality of the habitat.



**Table 6. Estimates of available habitat upstream (US) and downstream (DS) of the ten surveyed culverts with the most upstream habitat available.**

Crossing ID	Watershed	Amount of habitat US (Less than 20%)	Amount of habitat DS (Less than 20%)	CDFG/Region 1 (adult)/Region 1 (juvenile) assessment
Howard_Creek_1	North Fork Yuba River	3.72	0.18	Gray/Red/Red
Cherokee_Creek_1	North Fork Yuba R.	2.51	0.86	Gray/Red/Red
SAGCRET10_X1	Sagehen Creek	2.49	5.35	Red/Red/Red
Little_Canyon_Creek_1	North Fork Yuba R.	2.09	0.59	Red/Red/Red
SF_Poorman_Creek_1	South Fork Yuba R.	1.82	0.48	Gray/Red/Red
Haskell_Creek_1	North Fork Yuba R.	1.75	1.21	Gray/Red/Red
Fulda_Creek_1	North Fork North Fork American R.	1.63	2.91	Gray/Red/Red
Willow_Creek_1	North Fork Yuba R.	1.56	0.11	Red/Red/Red
Independence_Creek_1	Little Truckee R.	1.53	2.64	Gray/Red/Red
Independence_Creek_2	Little Truckee R.	1.53	1.32	Red/Red/Red

\*Habitat estimates are conservative, since suitable habitat may extend beyond the next road crossing.

## Recommendations for Future Surveys and Culvert Modifications

For FY 2011, the Twin Culverts (Little Canyon Creek\_1 and Mill Creek\_1) (Figure 5) were submitted by the Tahoe NF as its highest priority for replacement. Both culverts were surveyed and rated as RED by the CDFG and Region 1 criteria; both creeks are also known to contain resident trout populations. Little Canyon Creek has one of the highest mileages of available above the culvert (see Table 6).

A total of 61 out of the estimated 719 perennial stream crossings were surveyed in 2010 (8.5%). Due to the large number of crossings still to be surveyed a list of priority culverts to be modified on the Tahoe NF has not been developed. Additional years of surveys are needed to complete the inventory. In addition, the fish distribution for the Tahoe NF is 15 years old and incomplete. Snorkel surveys coupled with the culvert surveys could be used to update this layer. Fish distribution could be used in the prioritization of culverts to modify.



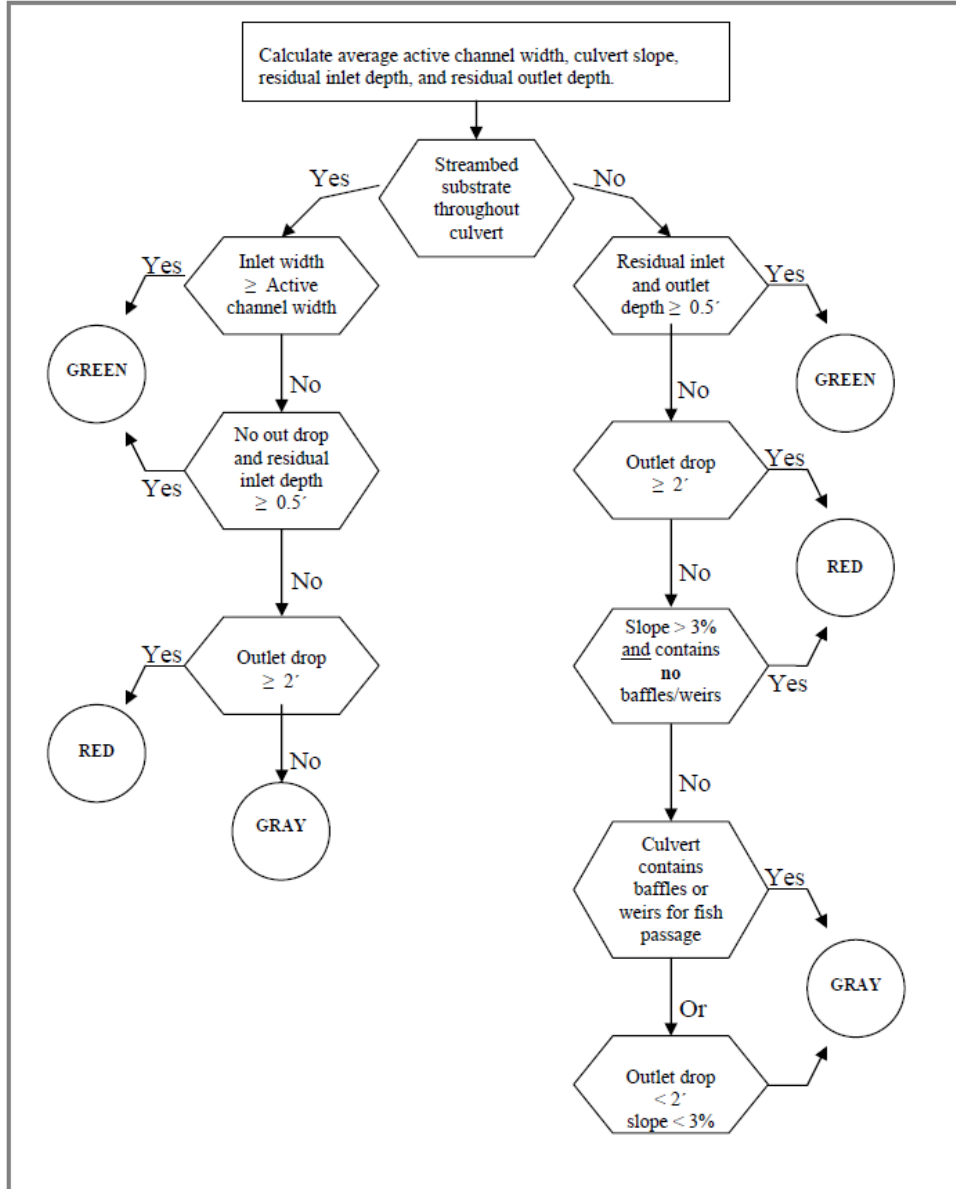
**Figure 5. Twin culverts (Little Canyon Creek\_1 and Mill Creek\_1) crossings proposed for replacement**

## Literature Cited

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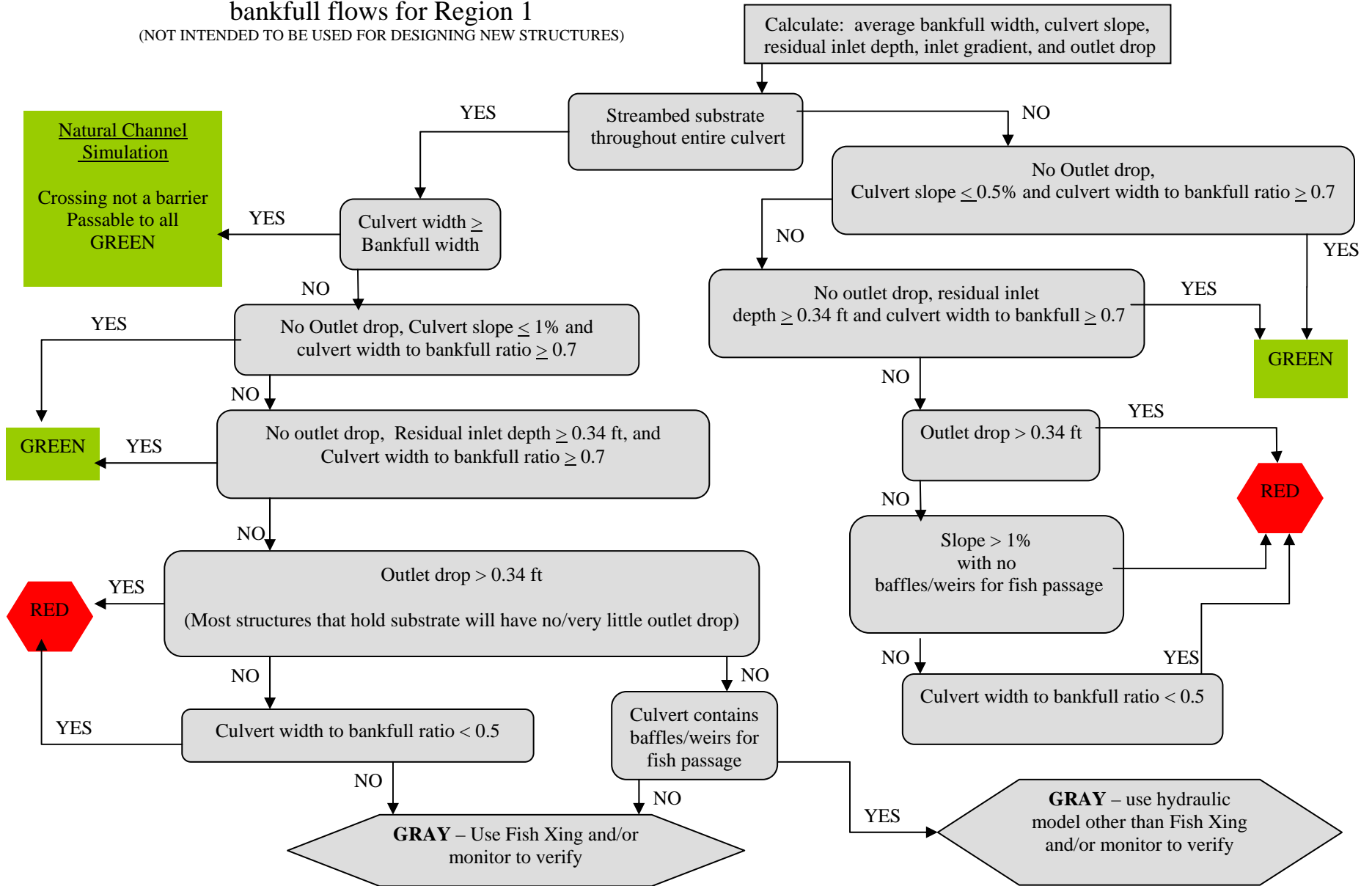
# Appendix: Evaluation Criteria

## CDFG Fish Passage Assessment Criteria



# Juvenile salmonid fish passage evaluation criteria at flows less than bankfull flows for Region 1

(NOT INTENDED TO BE USED FOR DESIGNING NEW STRUCTURES)



### Adult salmonid fish passage evaluation criteria for Region 1

(NOT INTENDED TO BE USED IN DESIGNING NEW STRUCTURES)

