USFWS Fish Passage Field Survey Manual

USFWS National Fish Passage Program and the Great Plains Fish Habitat Partnership

Resources Used In Creation of This Manual

Surface Water Screening Assessment and Prioritization Manual, North Atlantic [1]

Guideline to Prioritizing Fish Passage Barriers and Creating Fish Friendly Irrigation Structures, Lower Mekong Basin[2]

NAACC Aquatic Connectivity Manual and Fish Passage Barrier, Washington Department of Fish and Wildlife[3]

Culvert Inventory and Assessment for Fish Passage in the State of Alaska: A Guide to the Procedures and Techniques Used to Inventory and Assess Stream Crossings 2009- 2014[4]

Contents

Overview

The information in this manual was produced to assist field staff in completing data collection associated with fish passage assessment procedures for Region 6. The data collection and field approach are essential for robust prioritization of catchments and sites for future projects.

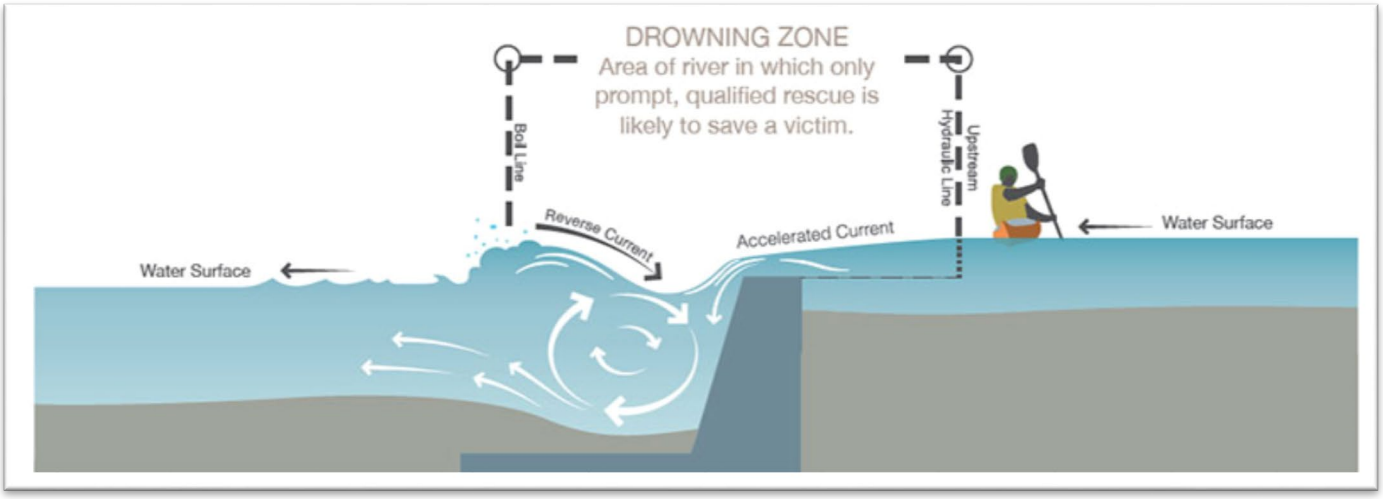
This manual breaks down the information required for each section of the data collection, provides clarifying examples and helps ensure accurate reporting by staff.

Survey Planning

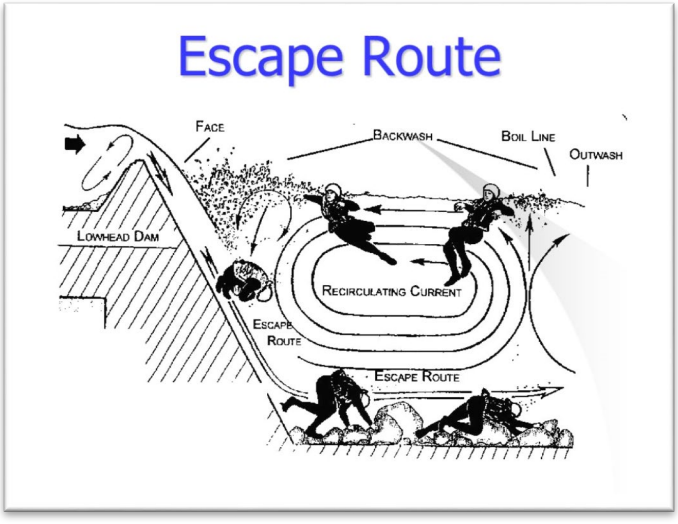
Safety

Many hazards are present while doing surveys in riparian systems and along roadways. It is our job to insure safety is our highest priority. This section will provide a brief summary of safety hazards associated with fish passage field surveys and how to mitigate risk.

Low Head Dams



Low head dams are common on waterways in the United States and are a risk to public safety. In the United States 548 fatalities associated with submerged hydraulic jumps have been recorded, as of circa January 2018. Hydraulic rollers, located immediately downstream of a dam, trap objects near the structure due to recirculation current. If caught in a hydraulic roller, one must swim to the stream bottom to catch the outgoing current.



When surveying via watercraft, it is recommended to survey upstream of the start location. When a low head dam is observed, portage the watercraft downstream of the boil zone. Launch the watercraft far enough upstream of low head dam to ensure proper steerage and power to move away from the dam. If upstream conditions are too dangerous to safely launch, return to start location and survey a different area deemed safer.

Informative Video: https://vimeo.com/39705763

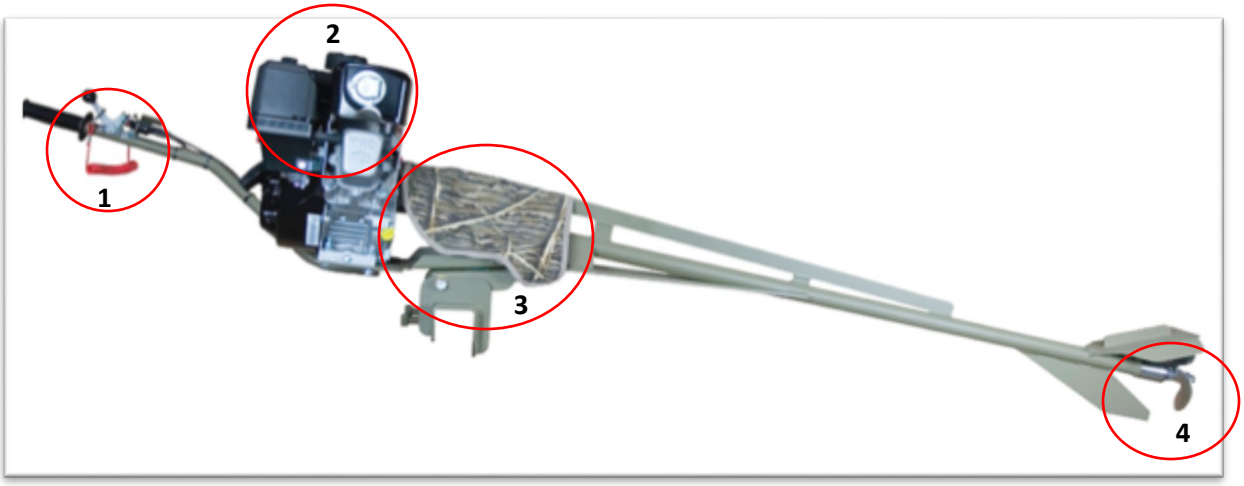
Swift Current

Current associated with streams and rivers can pose as a safety risk. When working around culverts it is very important that you are not swept into a culvert. When measuring culverts, measure on the downstream side while wearing a life jacket. If the flows are too strong to safely get an exact measurement, estimate culvert size and if possible return at a later date.

If swept into a stream or river, position your body at a 45 degree angle to the shoreline you plan on swimming to. With your feet positioned downstream, backstroke to the intended shoreline. Stay calm and watch out for downstream culverts, branches, and other objects you might get caught in or under.

Informative Video: https://www.youtube.com/watch?v=_HM-yqCXTfI

Long Tail Mud Motors



Longtail motors like other marine motors have safety risks associated with operation. The photo of a beavertail motor above displays four areas, circled in red and numbered, that are safety hazards. Listed below are hazards associated with each number.

1- The safety motor kill clip **MUST** be attached to boat operator **PRIOR** to starting engine. The safety motor kill clip **MUST** be attached to boat operator at all times while the motor is running. Failure to do so could result in a "run-away" boat, potentially resulting in boat damage and injury or death.
2- Hot surfaces are present on motor and exhaust port during and after operation. Severe burns are likely from skin to motor contact.
3- A power-take-off (PTO) is located beneath the camouflage cloth. **DO NOT TOUCH** this area while the motor is running. PTO spinning drive shafts are known for entangling loose clothing and accessories. Once entangled, the drive shaft pulls the entangled object and person towards the drive shaft, resulting in injury or death.
4- Unlike other outboard motors, longtail mud motors **DO NOT** have neutral and reverse. Longtail mud motors must be started with the propeller out of the water; once the motor starts the propeller spins. To begin steerage lower the propeller into the water. Neutral can be obtained by lifting the

propeller out of the water by pushing down on the handle. Think about object avoidance well ahead of arriving at an obstacle. A laceration hazard is present when the motor is running; remember if the motor is running, the prop is spinning.

Vehicle and Road Survey Safety

Parking: When parking along a roadway, during survey, make sure to not obstruct the road. Park on the side of the road with hazards on; wear a florescent safety vest or a life jacket while surveying. Try not to block field approaches. If you must park on an approach, pull over to the side; if an individual is unable to get around your parked vehicle, promptly move the vehicle. Park within the legal road right-of-way, which is typically 33 feet from the center of the road; don't park in a field or pasture. Building and maintaining good relationships with landowners and the public is very important.

Vehicle Use: Make sure to act professional while driving a work vehicle. Texting and calling while operating a vehicle is prohibited. Passengers should serve as the navigator and verbally instruct the driver on how to get to their next destination.

Equipment Checklist

Items needed to complete field surveys and insure safety:

- ☐ Fish Passage Field Survey Manual

Boat Gear

- ☐ Life Jackets and Type IV throwable
- ☐ Gas Can and Long Tail Motor Tank Filled (Full with Unleaded Ethanol Free Gasoline)
- ☐ Anchor w/ Rope
- ☐ Paddles
- ☐ Spare Plug
- ☐ Spare Prop, Prop Wrench, and Washers
- ☐ Hand Bilge Pump

Measuring Implements

- ☐ Reel Tape
- ☐ Laser Measure w/ spare batteries
- ☐ Range Finder
- ☐ Tape Measure
- ☐ Stadia Rod

- ☐ Pelican Case
  - ☐ iPad
  - ☐ Portable Charger (Charged) w/power cable
- ☐ Dry Bag
  - ☐ Screen Wipes and Quick Dry Towel
  - ☐ Rain Gear
  - ☐ Flashlight
  - ☐ Sun Protection
  - ☐ Insect Repellent
  - ☐ First Aid Kit

Vehicle Gear

- ☐ Tow Strap
- ☐ Fix-a-flat
- ☐ Jumper Cables
- ☐ Tire Iron
- ☐ Fire Extinguisher
- ☐ Jack

ATV Gear

- ☐ Helmets
- ☐ Gloves
- ☐ Fuel

☐ Cell Phone with 12 volt Charger

☐ Safety Vests

☐ Waders & Repair Kit

Prioritization and Logistics

Working with Landowners

Access permission is required before visiting a site and conducting work on any private property. There are no exceptions to this policy. If access cannot be obtained, make note of it and move to the next site.

Asking Permission: Prior to asking for permission it is best to use a one and done approach, meaning you only contact the landowner once for permission during that year. Make sure you've identified all potential survey locations and simple location references so they're easily and clearly described. Use OnXhunt application or contact the counties' recorder of deeds office to determine the landowner. A good resource to look up landowner phone numbers is anywho.com. Here is a mock conversation template:

> Hello, I'm ____ with the USFWS. Is ___ there? I'm contacting you today because I'm working on a project that identifies barriers for fish movement within the _____River Watershed. With your permission, we would like to survey your property during one day in (June/July OR July/August) for fish barriers. Would it be okay for us to survey your property?
>
> **YES RESPONSE**
>
> 1- Would you like us to call you a couple days before we survey?
>
> If **YES**,
>
> If you don't answer, will a voicemail suffice?
>
> 2- Would you like to be there when we survey?
>
> 3- Would it be okay to drive an ATV on your property? (Only if applicable, ask for permission to use ATVs in pastures or on designated trails only. We will not drive through cropland.)
>
> **IF THEY NEED US TO CONTACT THEIR RENTER**
>
> Renter's Info Needed
>
> 1- First and Last Name
>
> 2- Phone number
>
> Once we are done with our survey, we will mail you a summary of our survey results.
>
> **If the landowner asks, 'how will this information be used?'**
>
> **Reply**
>
> The results from the survey will be compared with others in the watershed to see where we can work with landowners to improve fish movement.
>
> Thank you for your time. I hope you have a great day!

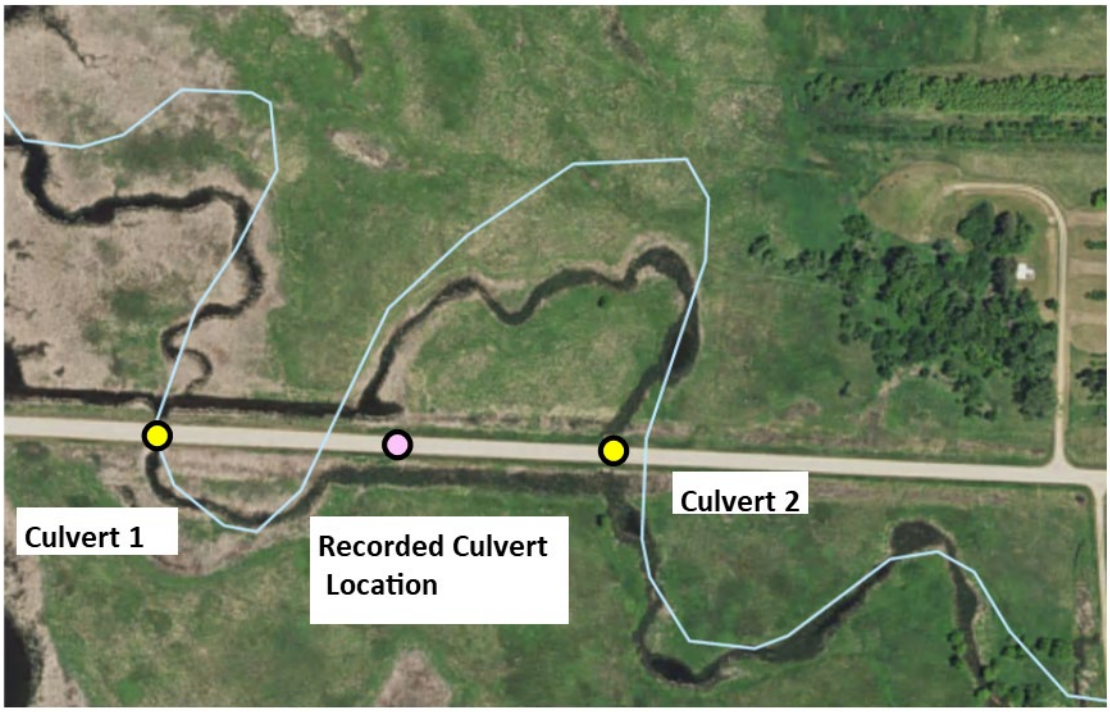
When talking with landowners, ALWAYS be respectful. They may have different views than you and dislike the USFWS. Don't argue with them. Listen to what they have to say. This conversation could be the first time they've talked to a USFWS employee.

Survey Points- Located In Potential Barrier Feature Class

Prior to starting survey, points on the landscape will be identified using GIS spatial analyses. Points identified have a ranking priority score ranging from 1 (low) to 5 (high). The initial couple weeks of surveying will be used to gauge surveying efficiency to estimate a plausible logistical target. It is important to survey all points until instructed by the crew leader to change methodology, which COULD include skipping certain types of points according to their score.

Please take note, some road and stream crossing locations are NOT exact within this feature class. Use both satellite imagery and surrounding landscape features, as indicators of stream or drainage area by looking for the lowest depression on the landscape. In some cases, points could be off greater than 100 yards due to alteration of channel (e.g. channelized stream) or a wide valley without a well-defined stream channel. **Just because a point exists on the map, it doesn't mean we have permission. Ensure you can LEGALLY access the point prior to surveying**. **A spatial layer will be provided containing information on areas we've been granted permission to survey.**

When surveying a location think about the total contributing area of the drainage intersecting the road. In some cases culverts can be over 100 yards apart but work together to allow water passage at a road intersection. Because culverts that are far apart are working together to move water downstream of the road intersection they should all be entered as one point on the map; place the point in the center of all water relief structures (See image below). Notice the channel along the ditch on the bottom side of the image. Specific measurements for each culvert should be added as related records to the one recorded culvert location.



In a few cases a combination of structures, such as bridges and culverts, are located at a stream and road intersection. See photo on next page.

If multiple structures are present, one (culvert and bridge feature class) point should be placed in the center of all water relief structures. Related records need to be added to the feature class point for each structure.

Boat Surveys

Boat surveys should be done using public water access right on navigable streams and rivers. Depending on the state and location, legality can vary greatly. Make sure to consult the crew leader prior to doing a boat survey to avoid inadvertently trespassing. In certain situations, access from private landowners will be needed to survey a certain portion or entire extent of a stream or river. It is important to note that in many places the stream bottom is owned by the adjacent landowner, so wading a stream without permission could be trespassing. If surveying via boat in areas where the stream bottom is privately owned, one must secure permission to step foot outside of boat, this can cause difficulty with taking measurements. If cell service is available and good, attempt to secure permission. If unable to get ahold of landowner or permission was not grated, anchor downstream of the boil zone and record as much information as possible, enter in comments the reason for missing information.

Road Side Surveys

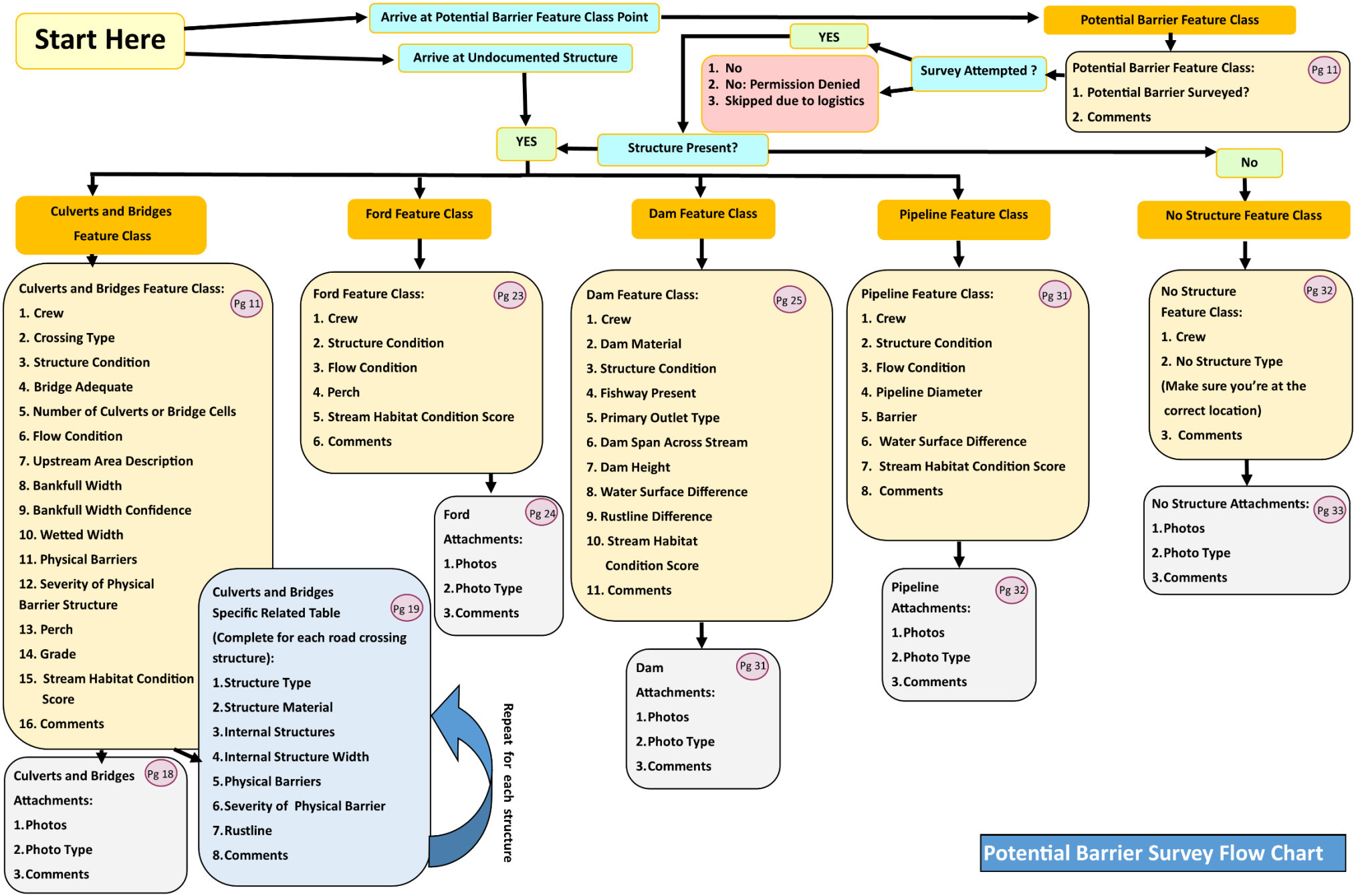
While surveying a roadway structure you must survey within the legal road easement boundary. Only walk outside of this zone if you have received permission from the landowner to do so. Private roads (e.g. driveways) do not have a public easement boundary so you must get permission before surveying. Please note public right of way laws can vary from state to state. Prior to and while doing surveys understand and obey right of way laws.

Railroad Surveys

Permission for doing surveys on railroad structures is required prior to doing so. The railroad authority may set special restrictions, such as a railroad personnel might need to be with while during surveys. Consult crew leader prior to doing railroad surveys.

Pipeline Surveys

Depending on the location of the pipeline, permission may be needed to do the survey. For example if the pipeline is within road right of way, permission is not needed. However, if the pipeline is located outside of a public boundary, permission is required. We have not called for permission to survey pipelines, because they are typically buried under the stream bed. Pipelines you will survey will be on a happenstance basis. If an exposed pipeline is identified in a stream while doing a boat survey, record as much info as possible. Make sure not to float over the pipeline because the propeller and boat could damage the pipeline. Notify the crew leader immediately, so they can contact the pipeline authority to notify them of the risk.


Start Here
Arrive at Potential Barrier Feature Class Point
Arrive at Undocumented Structure
Potential Barrier Feature Class
YES
Survey Attempted ?
1. No
2. No: Permission Denied
3. Skipped due to logistics
Potential Barrier Feature Class: Pg 11
1. Potential Barrier Surveyed?
2. Comments
YES
Structure Present?
No
Culverts and Bridges Feature Class
Ford Feature Class
Dam Feature Class
Pipeline Feature Class
No Structure Feature Class
Culverts and Bridges Feature Class: Pg 11
1. Crew
2. Crossing Type
3. Structure Condition
4. Bridge Adequate
5. Number of Culverts or Bridge Cells
6. Flow Condition
7. Upstream Area Description
8. Bankfull Width
9. Bankfull Width Confidence
10. Wetted Width
11. Physical Barriers
12. Severity of Physical Barrier Structure
13. Perch
14. Grade
15. Stream Habitat Condition Score
16. Comments
Culverts and Bridges Attachments: Pg 18
1. Photos
2. Photo Type
3. Comments
Culverts and Bridges Specific Related Table Pg 19
(Complete for each road crossing structure):
1. Structure Type
2. Structure Material
3. Internal Structures
4. Internal Structure Width
5. Physical Barriers
6. Severity of Physical Barrier
7. Rustline
8. Comments
Repeat for each structure
Ford Feature Class: Pg 23
1. Crew
2. Structure Condition
3. Flow Condition
4. Perch
5. Stream Habitat Condition Score
6. Comments
Ford Attachments: Pg 24
1. Photos
2. Photo Type
3. Comments
Dam Feature Class: Pg 25
1. Crew
2. Dam Material
3. Structure Condition
4. Fishway Present
5. Primary Outlet Type
6. Dam Span Across Stream
7. Dam Height
8. Water Surface Difference
9. Rustline Difference
10. Stream Habitat Condition Score
11. Comments
Dam Attachments: Pg 31
1. Photos
2. Photo Type
3. Comments
Pipeline Feature Class: Pg 31
1. Crew
2. Structure Condition
3. Flow Condition
4. Pipeline Diameter
5. Barrier
6. Water Surface Difference
7. Stream Habitat Condition Score
8. Comments
Pipeline Attachments: Pg 32
1. Photos
2. Photo Type
3. Comments
No Structure Feature Class: Pg 32
1. Crew
2. No Structure Type
(Make sure you're at the correct location)
3. Comments
No Structure Attachments: Pg 33
1. Photos
2. Photo Type
3. Comments
Potential Barrier Survey Flow Chart

Potential Barrier Feature Class

Please take note, some road and stream crossing locations are NOT exact within this feature class. Use both satellite imagery and surrounding landscape features to determine where the stream intersects potential barrier location. In some cases points could be off up to 100 yards or so. **Make sure you can LEGALLY access point prior to surveying.**

1. Surveyed Potential Barrier: **Yes, No, No-Permission Denied, Skipped Due To Logistical Constraints**

   Yes: Fill out **YES** if you **surveyed** or **attempted** to survey a barrier.

   No: This is the default value and is incorporated to help visually keep track of progress.

   No-Permission Denied: Fill this out if permission was denied to survey that potential barrier.

   Skipped Due to Logistical Constraints:
   A) Unable to survey due to the potential barrier not being feasible to survey.
   B) If deemed, though collaboration with crew and crew leader, that a certain ranking barrier class is not feasible to survey due to logistical constraints, select this option. The crew leader will make changes within Collector to remove the certain ranked barrier class to eliminate unneeded data entry.

2. Comments: **Optional, use to describe unique situations.**

Culverts and Bridges Feature Class

1. Crew: Crewmember taking measurements.
2. Crossing Type:

   Multilane: >2 lanes, including dived highways (assumed paved)

   Paved: public or private road

   Unpaved: public or private road

   Driveway: serving only one or two houses or businesses (paved or unpaved)

   Dirt Trail: for all-terrain vehicles only

   Walking Path: paved or unpaved

   Railroad: with tracks, whether or not currently used

   Other: describe in comments

3. Structure Condition: **Defective, Poor, Fair, Good, Excellent, Unknown**

   Defective: culvert or bridge is in dire need of prompt repair or replacement; flaws threaten to disrupt or are hindering traffic.

   Poor: culvert or bridge is in need of repair and shows potential for further deterioration.

   Fair: culvert or bridge is operational but may need maintenance to restore function to full potential; distinct rest line and/or abraded bottom present; adverse conditions could lead to major problems.

Good: culvert or bridge shows minor deficiencies; beginning of rust line formation may be visible; with continued maintenance culvert should be trouble free.

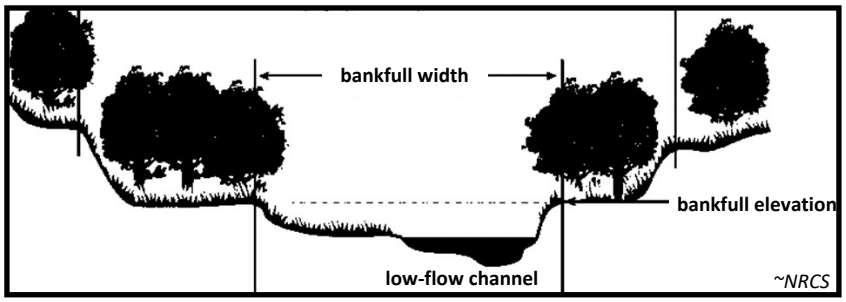
Excellent: culvert or bridge shows no signs of problems or rust; could allow flow at full capacity without disrupting fish passage.

Unknown: unable to access structure condition due to being submerged, blocked, etc.

4. Bridge Adequate: **Yes, No, N/A**

Yes is selected for bridges that are obviously adequate for fish passage. This determination is for bridges with abutments that are outside of bankfull width. **If YES is selected, no additional items need to be filled out for the feature class or related table**, however photos **must** be attached.

N/A is selected for locations that don't have a bridge.



5. Number of Culverts And/Or Bridge Cells: **#___**

6. Flow Condition: **No Flow**, **Typical-Low**, **Moderate**, **High** (Useful for reviewing data to understand flow condition during survey)

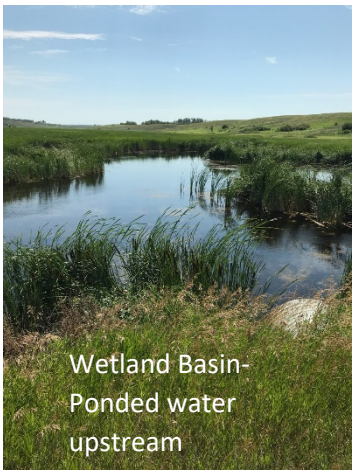
No Flow: No water is flowing in the natural stream channel; this option is typical of extreme droughts for perennial streams, or frequent conditions for intermittent or ephemeral streams.

Typical-Low: This is the most commonly used and expected value for surveys conducted during summer low flows, particularly on perennial streams. Water level in the stream will typically be below the level of non-aquatic vegetation, exposing portions of stream banks and bottom.

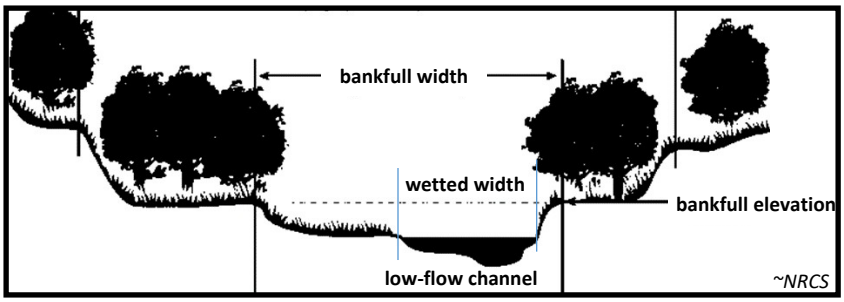
Moderate: This value is selected when recent rains have raised water levels at or above the level of herbaceous (non-woody) stream bank vegetation.

High: This value is selected only rarely, when flows are very high relative to stream banks, making crossing surveys very difficult or impossible, normally due to very recent, or ongoing major rain events. Avoid surveying crossings under high flows as data will not reflect more frequent flow conditions.

7. Upstream Area Description: **Riparian, Wetland Basin, Other (Describe in comments)**



8. Bankfull Width: ___ **Yards**



Bankfull Width: The width of a river or stream channel between the highest banks on either side of a stream. The flood plain is located above bankfull width. Take the measurement on the upstream side.

9. Bankfull Width Confidence: **High**, **Low/ Estimated**, **N/A**
High: Select this option only when you are highly confident that your assessment of bankfull Width meets the following criteria:
- Clear indicators are present to define the limits of bankfull width.
- All measurements of bankfull width were taken in undisturbed locations upstream or downstream of the crossing.
- No tributaries enter between the crossing and your area(s) of measurements.
- No measures taken at stream bends, pools, or braided channels.

Low/Estimated: Select this when **any** of the above criteria cannot be met.
N/A: Unable to determine bankfull width due to not being defined at all, an example could be an upstream wetland basin that lacks a definitive stream bed.

10. Wetted Width: ___ **Yards**
Wetted Width: The width of a river or stream channel that is wet. Take the measurement on the upstream side for **ONLY** upstream areas that are classified as riparian.

11. Physical Barriers: **None, Debris/Sediment/Rock, Deformation, Fencing, Dry, Other (Describe in comments).** If multiple structures are present, record data for **ONLY** the lowest structure or the structure most aligned with the downstream channel for multiple structures located at the same level. If multiple barriers exist, select the physical barrier type of the highest severity of physical barrier on structure.

Debris/Sediment/Rock: Woody debris or synthetic material, rock, or sediment blocks the flow of water into or through the structure. This can consist of wood or other vegetation, trash, sand, gravel, or rock. **Do not** check this option if you observe only very small amounts of debris that are likely to be washed away during the next rain event. Also, do not confuse sediment inside a structure that constitutes an appropriate stream bed with an accumulation that limits flow or passage of organisms.





Deformation: The structure is deformed in such a way that it significantly limits flow or inhibits the passage of aquatic organisms. This does not include minor dents and slightly misshapen structures.



12. Severity of Physical Barrier on Structure: **None**, **Minor**, **Moderate**, **Severe** (use table on next page to determine)

If multiple structures are present, record data for **ONLY** the lowest structure or the structure most aligned with the downstream channel for multiple structures located at the same level. Use table below to determine physical barrier severity on structure. If multiple barriers exist, use the highest severity classification to describe the severity of physical barrier on structure. E.g., a structure with moderate obstruction with branches and minor deformation would be classified as moderate severity of physical barrier on structure.

Physical Barrier	Severity	Severity Definition
None	None	No physical barriers exist - **apart** from Outlet Grade
Debris/Sediment/Rock Logs, branches, leaves, silt, sand, gravel, rock	None	None beyond few leaves or twigs as may occur in stream
	Minor	< 10% of the open area of the structure is blocked
	Moderate	10% - 50% of open area blocked
	Severe	> 50% of open area of structure blocked
Deformation Significant dents, crushed metal, collapsing structures	None	Small dents and cracks – insignificant effect on flow
	Minor	Flow is limited < 10%
	Moderate	Flow is limited between 10% - 50%
	Severe	Flow is limited > 50%
Fencing Wire, metal grating, wood	None	No fencing exists in any part of the structure
	Minor	Widely spaced wires or grating with > 0.5 foot (6 inch) gaps
	Moderate	Wires or grating with 0.2 - 0.5 foot (~ 2-6 inches)spacing
	Severe	Wires or grating with < 0.2 foot (~ 2 inch) spacing
Dry Other	Minor	May be passable at somewhat higher flows
	Moderate	Not likely passable at higher flows
	Severe	Impassable at higher flows
Dry	Minor	Use best judgment based on above standards
	Moderate	Use best judgment based on above standards
	Severe	Use best judgment based on above standards

13. Perch: **Vertical distance of drop from culvert outlet water surface to waterline below.**

Perch Categories
No perch
0- 0.5 ft
0.5- 1 ft
1- 2 ft
2- 3 ft
3- 7.5 ft
7.5- 10 ft
10+ ft

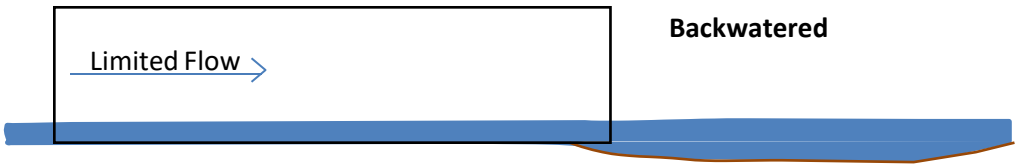
14. Grade: **Unknown, Backwatered, At Stream Grade**, **Free Fall**, **Cascade**, **Clogged/ Collapsed/ Submerged**

Grade: Outlet grade is an observation of the relative elevation of the structure to the streambed and how water flows as it exits the structure. This is not an assessment of stream slope (gradient).

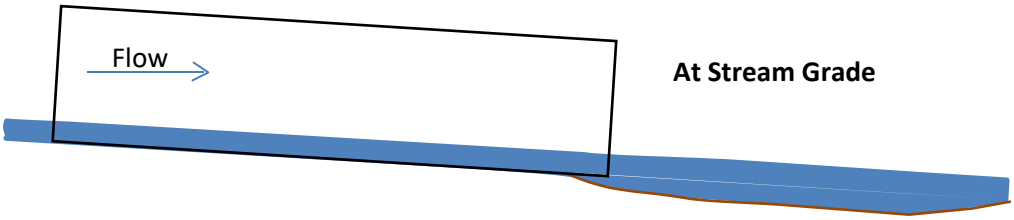
Choose only one option.

Unknown: Unable to determine grade.

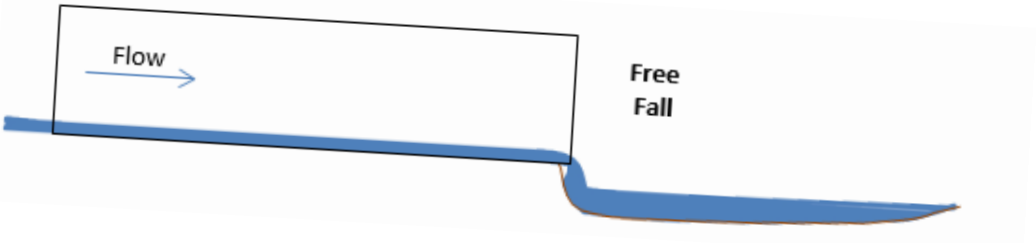
Backwatered: Backwatered condition occurs at zero grade or when something downstream acts as dam, causing a backwatered culvert. Wetland basins tend to be associated with backwatered conditions. Another indicator includes the lack of defined upstream and downstream stream channel.



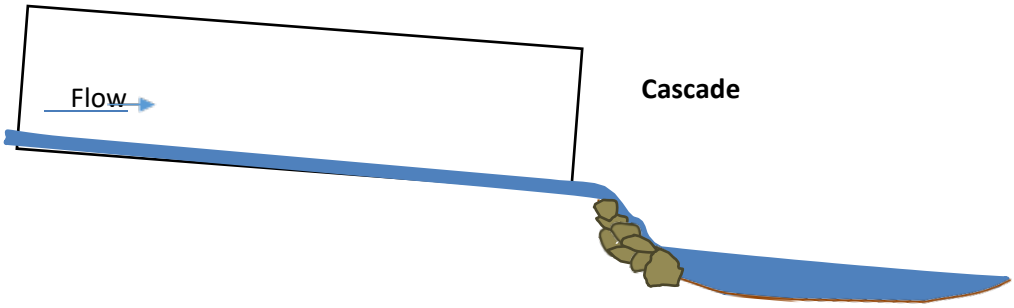
At Stream Grade: The bottom of the outlet of the structure is at approximately the same elevation as the stream bottom (there may be a small drop from the inside surface of the structure down to the stream bottom), such that **<u>water does not drop downward at all</u>** when flowing out of the structure.



Free Fall: The outlet of the structure is above the stream bottom such that **<u>water drops vertically</u>** when flowing out of the structure.



Cascade: The outlet of the structure is raised above the stream bottom at the outlet such that **<u>water flows very steeply downward across rock or other hard material</u>** when flowing from the structure. Think of this as series of small waterfalls at the outlet.






Clogged/Collapsed/Submerged (not pictured): The structure inlet is either full of debris, collapsed, or completely underwater (not usually all three), making inlet measurements impossible. This may be found in places where beavers or debris have plugged a structure inlet so completely that water has backed up and covered the inlet, or where a crossing has collapsed to the point that it cannot be measured at its inlet.

15. Stream Habitat Condition Score: 1 to 6

1- No filter strip, can be channelized or not channelized
2- Channelized, filter strip up to 10 yards wide
3- Not channelized, filter strip up to 10 yards wide (not pictured)
4- Channelized, filter strip greater than 10 yards wide (not pictured)
5- Not channelized, with filter strip 10 to 20 yards wide
6- Not channelized, with filter strip greater than 20 yards wide

Filter strips are grassland areas expanding outside of bankfull width. Filter strips include grazed grassland. It is important to note that cropland isn't considered a filter strip even if the crop vegetation is lush. The measurement of filter strips shall be the distance of grassland from the bankfull edge to nearest cropland edge. If filter strips are different lengths on both sides of the stream, use the shortest filter strip length to determine score. Observe upstream and downstream condition, record the lowest score. Channelized refers to a straightened a stream channel due to human modification.

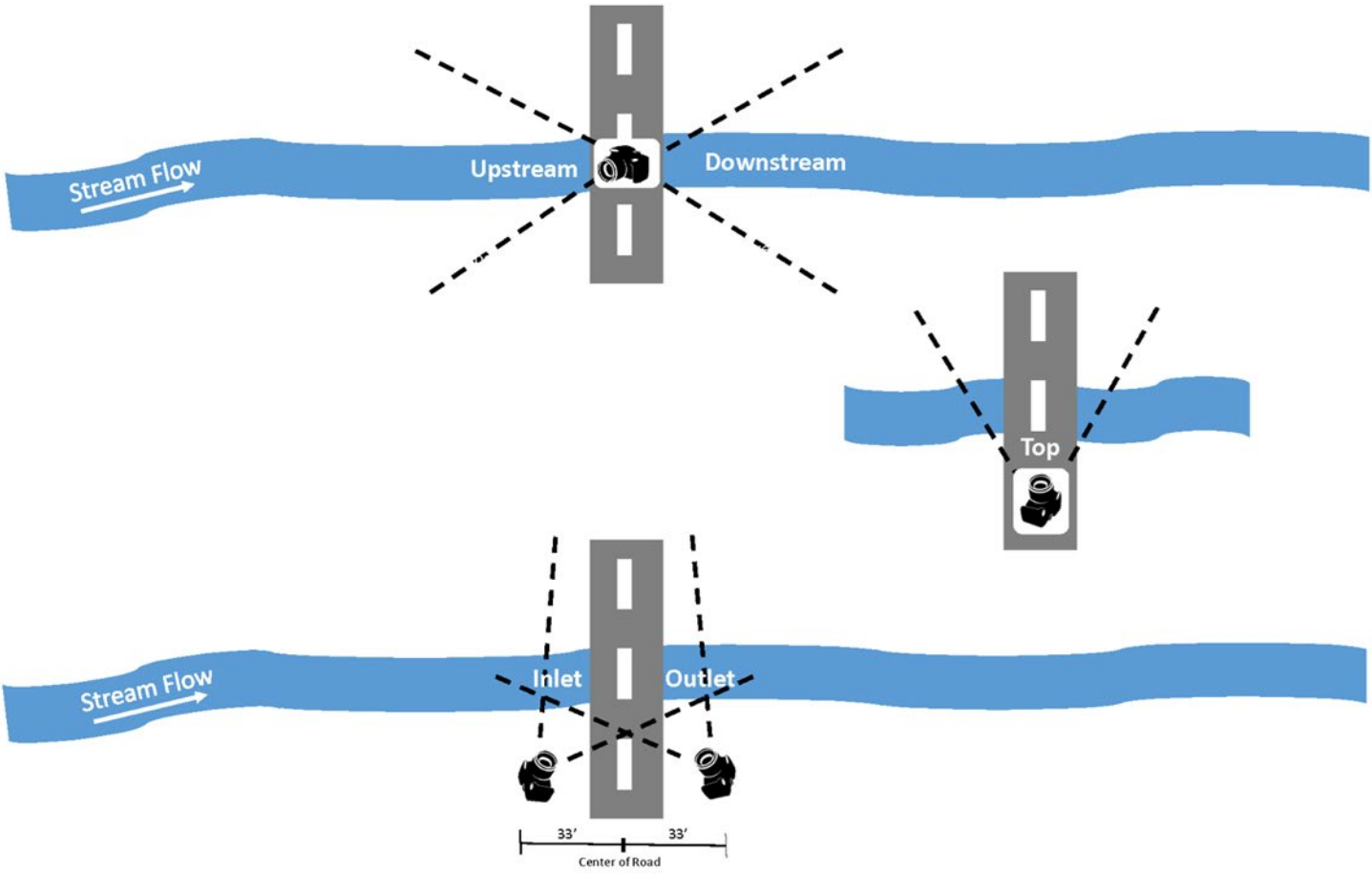
16. Comments: **Optional, use to describe unique situations.**

Culverts and Bridges Attachments

1. Photos: **Upstream, Downstream, Inlet, Outlet, Top,** Other (Describe in comments).

   Photos are **required** for **upstream**, **downstream**, **inlet**, **outlet**, and **top**. Photos taken should capture the structure and bankfull width if possible. If possible, try to not take pictures towards the sun. Make sure to work within the road right of way. We need permission prior to surveying on private roads (e.g. driveways) and private lands.

2. Photo Type: Once a photo is taken, **rename** the photo to its photo type. When renaming a photo use the shortened abbreviations as follows: **up** (Upstream), **down** (Downstream), **in** (inlet), **out** (outlet), **top, other**.

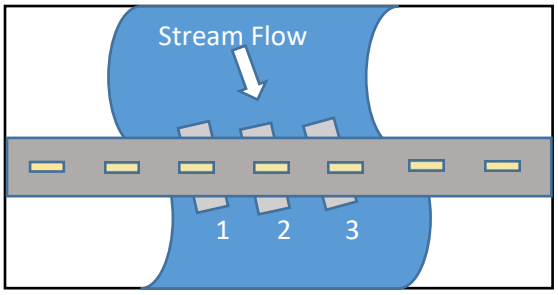


3. Comments: **Optional, use to describe unique situations.**

Culverts and Bridges Specific Related Tables

(One form per structure, e.g. a road crossing with 5 culverts would have 5 specific data forms)

When there are multiple culverts and/or bridge cells, record them in order from left to right while **looking upstream**. The left-most structure is structure 1, and structure numbers increase to the right. See examples below.



1. Structure Type: **Box Culvert**, **Round Culvert, Arch, Bridge with Side Slopes, Bridge with Abutments, Bridge with Side Slopes and Abutments, Other**

Box Culvert: These structures are usually made of concrete or stone, but sometimes of corrugated metal with a slightly arched top. Typically, they have a top, two sides, and a bottom.




Round Culvert: This is a circular pipe. It may or may not have substrate inside, even though the diagram on the field form shows a layer of substrate. It may be compressed slightly in one dimension, and should be considered round unless it is truly squashed so that it reflects a type 2 shape below.




Arch: This structure will often look like a round culvert on the top half.




Bridge with Side Slopes: This is a bridge with angled banks up to the bottom of the road deck. This type will have no obvious abutments, though they may be buried in the road fill.




Bridge with Abutments (Straight Wall): This is a bridge with sloping banks and vertical abutments (typically short) that support the bridge deck. (Arrows below show the abutments.)




Bridge with Side Slopes and Abutments: This is a bridge with sloping banks and vertical abutments (typically short) that support the bridge deck. (Arrows below show the abutments.)

Other- Add description in comments

2. Structure Material: **Metal**, **Concrete**, **Plastic**, **Wood, Rock**, **Fiberglass**, **Combination**, **Dirt Fill, Gravel/ Cobble**

3. Internal Structures: **None, Baffles/ Weirs, Supports, Unknown, Other (describe in comments)**
None: There are no apparent structures inside the crossing structure.

Baffles/Weirs: Baffles (partial width) or weirs (full width, notched or not) are incorporated into the structure, either inside or at its outlet, to help aquatic organisms move through the structure.

Supports: Some type of structural supports, such as bridge piers, vertical or horizontal beams, or rods apparently meant to support the structure, are observed inside the crossing structure.

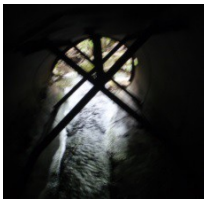
Other: Structure(s) other than the categories above are present inside the crossing structure. Provide a very brief description of those structures in comments.

Unknown: Unable to determine if internal structures are present, this could be due to a submerged culvert.

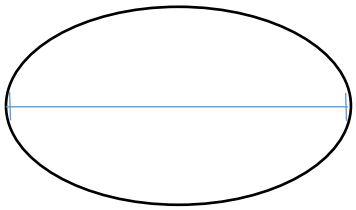
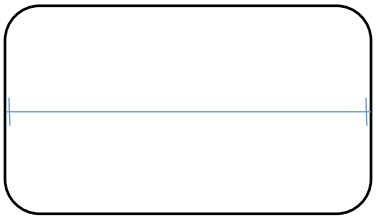
Comments: **Do not** include in comments items such as bedrock, material blockages, structural deformation, or inlet fencing to exclude beavers, which will be recorded below as **Physical Barriers**.







4. Internal Structure Width: **___ In**

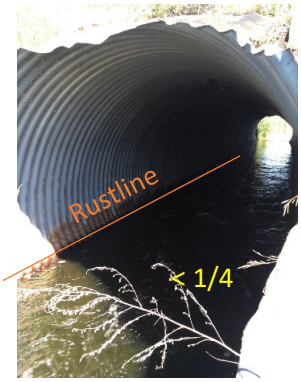
5. Physical Barriers: **None, Debris/Sediment/Rock, Deformation, Fencing, Dry, Other (Describe in comments)**

6. Severity of Physical Barrier on Structure: **None, Minor, Moderate, Severe**

Physical Barrier	Severity	Severity Definition
None	None	No physical barriers exist
Debris/Sediment/Rock Logs, branches, leaves, silt, sand, gravel, rock	None	None beyond few leaves or twigs as may occur in stream
	Minor	< 10% of the open area of the structure is blocked
	Moderate	10% - 50% of open area blocked
	Severe	> 50% of open area of structure blocked
Deformation Significant dents, crushed metal, collapsing structures	None	Small dents and cracks – insignificant effect on flow
	Minor	Flow is limited < 10%
	Moderate	Flow is limited between 10% - 50%
	Severe	Flow is limited > 50%
Fencing Wire, metal grating, wood	None	No fencing exists in any part of the structure
	Minor	Widely spaced wires or grating with > 0.5 foot (6 inch) gaps
	Moderate	Wires or grating with 0.2 - 0.5 foot (~ 2-6 inches)spacing
	Severe	Wires or grating with < 0.2 foot (~ 2 inch) spacing
Dry **Other**	Minor	May be passable at somewhat higher flows
	Moderate	Not likely passable at higher flows
	Severe	Impassable at higher flows

Dry	Minor	Use best judgment based on above standards
	Moderate	Use best judgment based on above standards
	Severe	Use best judgment based on above standards

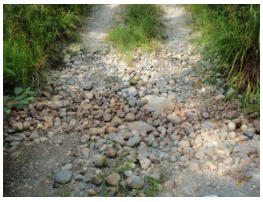
7. Rustline (Culverts only): **N/A, Unable to determine, < 1/4, 1/4- 1/2, > 1/2 of the vertical diameter of culvert**



8. Comments: **Optional, use to describe unique situations.**

Ford Feature Class

Ford: A ford is a shallow, open stream crossing that may have a minimal structure to stabilize where vehicles drive across the stream bottom.



1. Crew: Crewmember taking measurements.
2. Structure Condition: **Defective, Poor, Fair, Good, Excellent, Unknown**

   Defective: ford is in dire need of prompt repair; flaws threaten to disrupt or are hindering traffic.

   Poor: ford is in need of repair and shows potential for further deterioration.

   Fair: ford is operational but may need maintenance to restore function to full potential; adverse conditions could lead to major problems.

   Good: ford shows minor deficiencies.

   Excellent: ford shows no signs of problems.

   Unknown: unable to access structure condition due to being submerged, blocked, etc.

3. Flow Condition: **No Flow**, **Typical-Low**, **Moderate**, **High** (Useful for reviewing data to understand flow condition during survey)
   No Flow: No water is flowing in the natural stream channel; this option is typical of extreme droughts for perennial streams, or frequent conditions for intermittent or ephemeral streams.

   Typical-Low: This is the most commonly used and expected value for surveys conducted during summer low flows, particularly on perennial streams. Water level in the stream will typically be below the level of non-aquatic vegetation, exposing portions of stream banks and bottom.

   Moderate: This value is selected when recent rains have raised water levels at or above the level of herbaceous (non-woody) stream bank vegetation.

   High: This value is selected only rarely, when flows are very high relative to stream banks, making crossing surveys very difficult or impossible, normally due to very recent, or ongoing major rain events. Avoid surveying crossings under high flows as data will not reflect more frequent flow conditions.
   Unknown: unable to access structure condition due to being submerged, blocked, etc.
4. Perch: **Vertical distance of drop from ford downstream edge to waterline below.**

Perch Categories
No perch
0- 0.5 ft
0.5- 1 ft
1- 2 ft
2- 3 ft
3- 7.5 ft
7.5- 10 ft
10+ ft

5. Stream Habitat Condition Score: 1 to 6

   1- No filter strip, can be channelized or not channelized
   2- Channelized, filter strip up to 10 yards wide
   3- Not channelized, filter strip up to 10 yards wide (not pictured)
   4- Channelized, filter strip greater than 10 yards wide (not pictured)
   5- Not channelized, with filter strip 10 to 20 yards wide
   6- Not channelized, with filter strip greater than 20 yards wide

6. Comments: **Optional, use to describe unique situations.**

Ford Attachments

1. Photo Type: **Upstream, Downstream, Inlet, Outlet, Top,** Other (Describe in comments).

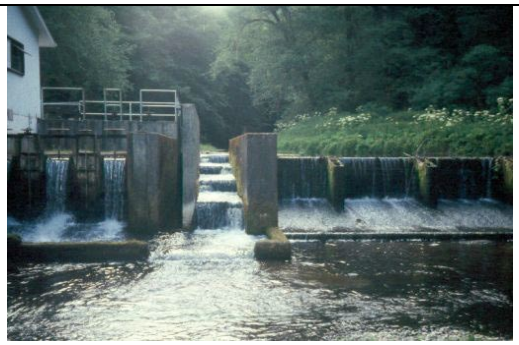
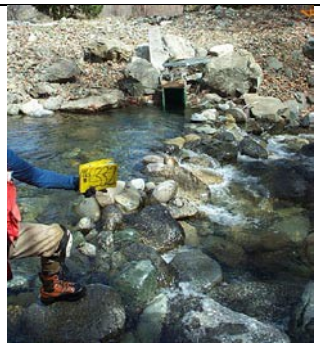
   Photos are **required** for **upstream**, **downstream**, and **top**. Photos taken should capture the structure and bankfull width. If possible, avoid taking pictures towards the sun. Make sure to work within the road right of way. We need permission prior to surveying on private roads (e.g. driveways) and private lands.

2. Photo Type: Once a photo is taken, **rename** the photo to its photo type. When renaming photos use the shortened abbreviations as follows: **up** (Upstream), **down** (Downstream), **in** (inlet), **out** (outlet), **top, other.**

3. Comments: **Optional, use to describe unique situations.**

Dam Feature Class

1. Crew: Crewmember taking measurements.
2. Dam Material: **Concrete, Masonry, Rock Fill, Earthen Fill, Timber, Metal, Beaver Dam, Waterfall, Other** (describe in comments)

 Full span concrete dam with removable wooden boards	 A concrete dam with a weir-pool fishway
 Masonry dam	 Rock fill dam and diversion
 Earthen fill dam	 Timber dam

 Metal dam constructed of sheet pile	 Beaver Dam
 Waterfall	

3. Structure Condition: **Washed Out, Poor, OK, New, Unknown**
Washed Out: The dam is no longer functioning due structure failure.

Poor: This value is intended for structures where the material appears to be failing, such as metal with rot (not just surface rust), or concrete, stone or wooden structures that are already collapsing, or in danger of immediate failure.

OK: This is the value given to the vast majority of dams. Many dams have deficiencies such as surface rust, dents, or dings which do not indicate risk of failure.

New: This value is assigned only to a crossing that has been installed very recently. Look for unblemished structures with new riprap and/or vegetative bank stabilization.

Unknown: unable to access structure condition due to being submerged, blocked, etc.

4. Fishway Present: **None, Weir Pool, Vertical Slot, Steep Pass, Rocky Ramp, Denil, Other- describe in comments and attach photo**

Weir Pool
Sheet pile weir-pool fishway downstream of a culvert

Weir Pool
A weir pool fishway within a culvert.

Weir Pool
Six-step, concrete, weir-pool fishway with wooden stop-logs attached to a dam.

Weir Pool
Concrete weir-pool fishway around a dam.

Vertical Slot Fishway
Vertical slot fishway attached to diversion dam.

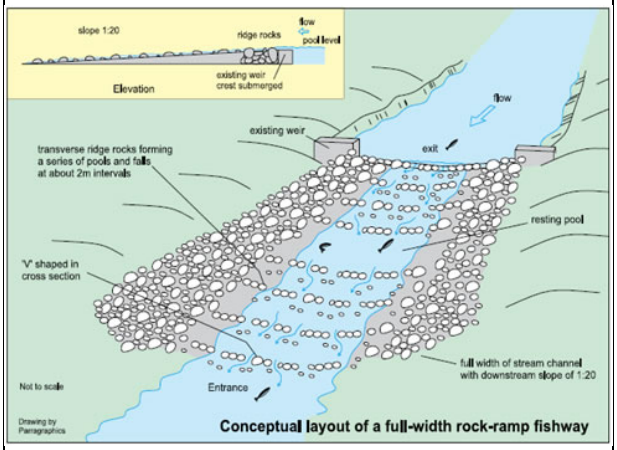
Vertical Slot Fishway
A six step concrete vertical slot fishway attached to a low head dam.

Vertical Slot Fishway
Attached to natural barrier waterfall; constructed in 1956.

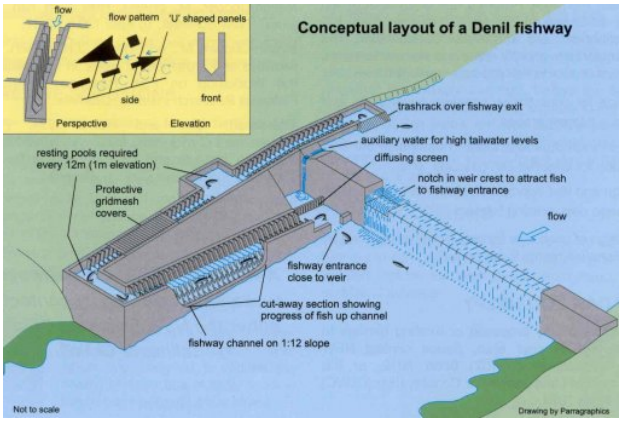
Vertical Slot Fishway
A formal vertical slot fishway, 137 m long with 44 vertical slots, attached to natural barrier waterfall.

Steep Pass Fishway
Alaska Steep Pass Fishway attached to culvert.

Steep Pass Fishway
A 4.5 m long Alaska steep pass ladder over an irrigation diversion dam.

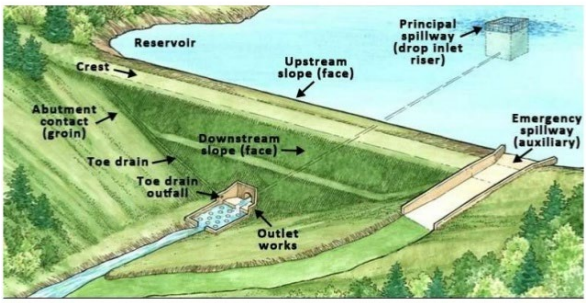


Rocky Ramp Fishway



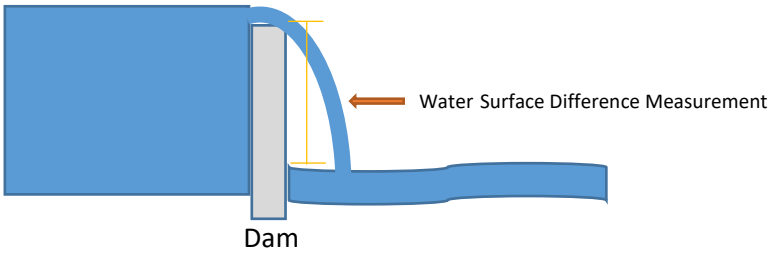
Denil Fishway

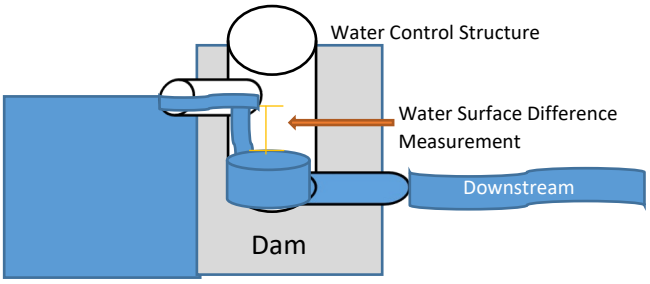
5. Primary Outlet Type: **Spillway, Standpipe (not adjustable), Flashboard Riser, Standpipe W/ Flashboard, Culvert,** Other (Describe in comments)

<table>
<tr>
<td> 
Spillway</td>
<td> 

In this example Standpipe w/Flashboard is the primary outlet type even though a spillway is a part of the structure</td>
</tr>
<tr>
<td> 
Flashboard Riser</td>
<td> 
Vertical standpipe with wooden flashboard riser</td>
</tr>
<tr>
<td> 
Culvert</td>
<td></td>
</tr>
</table>

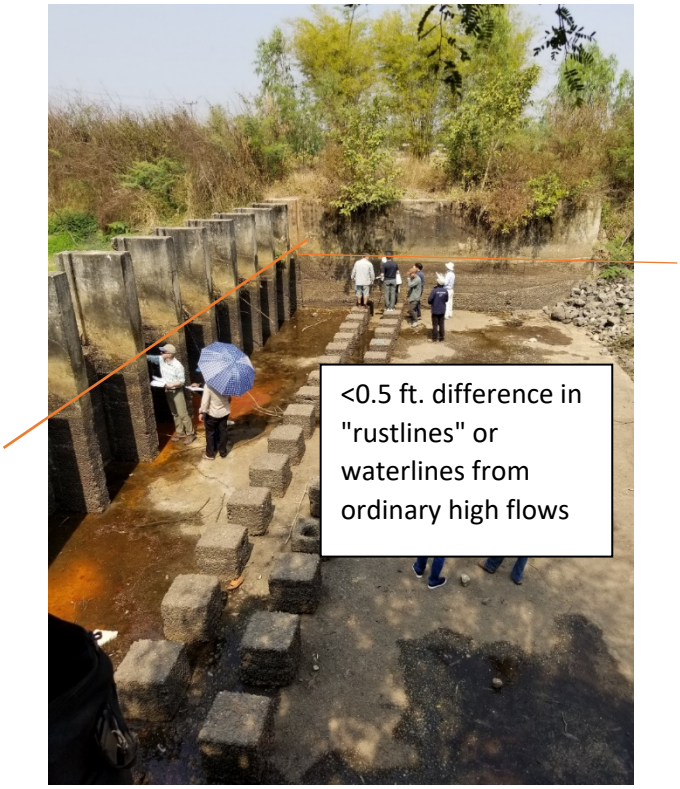
6. Dam Span Across Stream: **Full/ Partial**
7. Dam Height (Downstream Water Surface to Crest of Dam; if downstream area is dry, measure from stream bed to crest of dam)= **<3 feet, 3-6 feet, 6-9 feet, 9-12 feet, >12 feet**
8. Water Surface Difference (**IF SAFE**, measure from downstream water level at the base of dam to the top of dam where water is flowing over or measure from water level flowing out of water control structure to waterline below)= **__ In**





9. Rustline Difference: A discoloration or rustline may be present and can indicate the propensity of annual high flows at a given site. The difference in rustlines between headwater and tailwater of a lowhead dam can give an indication of how much a barrier a location is during annual high flows and migratory periods. Rustlines are variable and hard to determine in the field and should be regarded as an estimate only. For Great Plains species, any variation over 2 inches may be a barrier to some degree.

Rustline Difference Categories
No Difference
0- 0.5 ft
0.5- 1 ft
1- 2 ft
2- 3 ft
3- 7.5 ft
7.5- 10 ft
10+ ft
Unable to Determine



10. Stream Habitat Condition Score: **1 to 6**

- **1-** No filter strip, can be channelized or not channelized
- **2-** Channelized, filter strip up to 10 yards wide
- **3-** Not channelized, filter strip up to 10 yards wide
- **4-** Channelized, filter strip greater than 10 yards wide
- **5-** Not channelized, with filter strip 10 to 20 yards wide
- **6-** Not channelized, with filter strip greater than 20 yards wide

11. Comments: **Optional, use to describe unique situations.**

Dam Attachments

1. Photo Type: **Upstream, Downstream, Inlet, Outlet, Top,** Other (Describe in comments). Photos are **required** for **upstream**, **downstream**, **inlet**, **outlet**, and **top**. Photos taken should capture the structure and bankfull width if possible. If possible, try to not take pictures towards the sun. Make sure to work within the road right of way. We need permission prior to surveying on private roads (e.g. driveways) and private lands.

2. Photo Type: Once a photo is taken, **rename** the photo to its photo type. When renaming photos use the shortened abbreviations as follows: **up** (Upstream), **down** (Downstream), **in** (inlet), **out** (outlet), **top, other.**

3. Comments: **Optional, use to describe unique situations.**

Pipeline Feature Class

1. Crew: Crewmember taking measurements.
2. Structure Condition: **Poor, OK, New, Unknown**
   - **(1) Poor**: This value is intended for structures where the material appears to be failing, with rot (not just surface rust), or concrete, stone or wooden structures that are already collapsing, or in danger of immediate failure.
   - **(2) OK**: Might have some deficiencies such as surface rust, dents, or dings which do not indicate risk of failure.
   - **(3) New**: This value is assigned only to a pipeline that has been installed very recently. Look for unblemished structures with new riprap and/or vegetative bank stabilization.
   - **(4) Unknown**: This value applies to all sites where the condition of the pipeline cannot be assessed, such as when submerged.
3. Flow Condition: **No Flow**, **Typical-Low**, **Moderate**, **High**

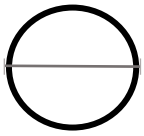
   No Flow: No water is flowing in the natural stream channel; this option is typical of extreme droughts for perennial streams, or frequent conditions for intermittent or ephemeral streams.

   Typical-Low: This is the most commonly used and expected value for surveys conducted during summer low flows, particularly on perennial streams. Water level in the stream will typically be below the level of non-aquatic vegetation, exposing portions of stream banks and bottom.

   Moderate: This value is selected when recent rains have raised water levels at or above the level of herbaceous (non-woody) stream bank vegetation.

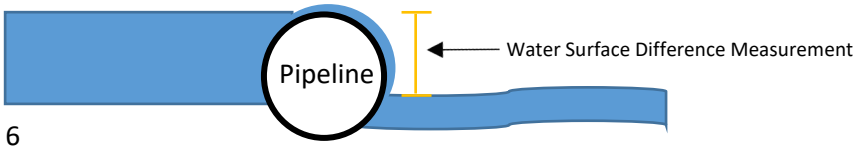
   High: This value is selected only rarely, when flows are very high relative to stream banks, making crossing surveys very difficult or impossible, normally due to very recent, or ongoing major rain events. Avoid surveying crossings under high flows as data will not reflect more frequent flow conditions.

4. Pipeline Diameter: **___ In**
   Pipeline Diameter: The external width of the pipe. Don't take measurement if you can't measure width; don't move soil to take measurement.



5. Barrier: **Yes, No, Unknown**
   Yes: Pipeline is exposed and acting as a dam. Water surface difference is greater than 1 inch.
   No: Pipeline is not acting as a dam or water surface difference is less than 1 inch.
   Unknown: Unable to determine if pipeline is a barrier.

6. Water Surface Difference: **___ In**
   Water surface difference is only measured when pipeline is acting as a dam. The measurement is taken from the top of the pipeline to the downstream waterline.



7. Stream Habitat Condition Score: 1 to 6

   1- No filter strip, can be channelized or not channelized
   2- Channelized, filter strip up to 10 yards wide
   3- Not channelized, filter strip up to 10 yards wide
   4- Channelized, filter strip greater than 10 yards wide
   5- Not channelized, with filter strip 10 to 20 yards wide
   6- Not channelized, with filter strip greater than 20 yards wide

8. Comments: **Optional, use to describe unique situations.**

Pipeline Attachments

1. Photos: **Upstream, Downstream, Inlet, Outlet, Top,** Other (Describe in comments).

   Photos are **required** for **upstream**, **downstream**, **inlet**, **outlet**, and **top**. Photos taken should capture the structure and bankfull width if possible. If possible, try to not take pictures towards the sun. Make sure to work within the road right of way. We need permission prior to surveying on private roads (e.g. driveways) and private lands.

2. Photo Type: Once a photo is taken, **rename** the photo to its photo type. When renaming a photo use the shortened abbreviations as follows: **up** (Upstream), **down** (Downstream), **in** (inlet), **out** (outlet), **top, other.**

3. Comments: **Optional, use to describe unique situations.**

No Structure Feature Class

1. Crew: Crewmember recording data.

2. No Structure Type:

   No Structure: There is no crossing where anticipated, usually because of incorrect road or stream location on maps. No further data is required. (Be sure you are in the correct location.)

   Removed Structure: A structure apparently existed previously at the site but has been removed, so the stream now flows through the site with no provision for vehicles to cross over it. Continue to complete the survey form to the extent possible. Include information in structure comments to explain your observations. For instance, indicate if an old culvert pipe is seen at the site, or if removal of the previous crossing structure left the stream with problems for aquatic organism

passage.

If bridge or dam abutments were not removed, take measurement of distance between abutments. Type in distance (yards) in comments.

Buried Stream: The planned crossing site does not include an inlet and/or outlet, likely because a stream previously in this location has been rerouted, probably underground. In this case, survey is not possible, and no further data is required.

Inaccessible*:* Survey is not possible because roads or trails to the crossing are not accessible. This may be due to private property posting, gates, poor condition, or other factors. Record in Crossing Comments why the site is inaccessible. No further data is required.

Other: Describe in comments.

3. Comments: **Optional, use to describe unique situations.**

No Structure Attachments

1. Photos: **Upstream, Downstream,** Other (Describe in comments).

   Removed Structure Photos: **Upstream, Downstream, Inlet, Outlet, Top,** Other (Describe in comments)

   Photos taken should capture the structure and bankfull width if possible. If possible, try to not take pictures towards the sun. Make sure to work within the road right of way. We need permission prior to surveying on private roads (e.g. driveways) and private lands.

2. Photo Type: Once a photo is taken, **rename** the photo to its photo type. When renaming a photo use the shortened abbreviations as follows: **up** (Upstream), **down** (Downstream), **in** (inlet), **out** (outlet), **top, other.**

3. Comments: **Optional, use to describe unique situations.**

References

1- Eisenman, M., and G. O' Doherty. 2014. Culvert Inventory and Assessment Manual for Fish Passage in the State of Alaska: A Guide to the Procedures and Techniques Used to Inventory and Assess Stream Crossings 2009- 2014. Alaska Departement of Fish and Game, Special Publication No. 14-08, Anchorage.

2- Marsden, T., C. Peterken, L. Baumgartner, and G. Thorncraft. 2015. Guideline to Prioritizing Fish Passage Barriers and Creating Fish Friendly Irrigation Structures Lower Mekong Basin. Mekong River Commission.

3- North Atlantic Aquatic Connectivity Collaborative. 2016. NAACC Stream Crossing Survey Data Form Instruction Guide, Version 1.2.

4- Washington Department of Fish and Wildlife. 2009. Fish Passage and Surface Water Diversion Screening Assessment and Prioritization Manual. Washington Department of Fish and Wildlife. Olympia, Washington.