Fisheries Habitat Enhancement and Sustainability Program Habitat Data Collection Manual

Alberta Fisheries Habitat Enhancement and Sustainability (FISHES) Program

Table of Contents

Contents

For copies of this manual, or for additional information on the Fisheries Habitat Enhancement and Sustainability (FISHES) Program including the Planning Framework, individual project rankings or project summary reports, please visit the FISHES home page (www.alberta.ca/southern-alberta-fishes-program-overview.aspx) on the Alberta Environment and Parks website.

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1.0 Overview

The purpose of this manual is to aid in the field collection of fisheries habitat information for use in the 'detailed assessment' phase of a FISHES project, and for later input into the Evaluation Scoring and Ranking Model (ESRM) of the FISHES Program. For ease of use, the manual follows the set up of the Habitat Unit Survey Data Sheet – the standardized data entry form used by the FISHES Program which is included at the end of this manual. Following the manual while completing the field sheet will help to ensure consistency and accuracy of the data collected.

TIPS FOR COLLECTING QUALITY FIELD DATA

- Field forms should be printed onto waterproof paper for working in inclement weather.
- Clearly and legibly record all data with a sharp pencil.
- Make corrections neatly.
- Record each feature individually. If the feature occurs across multiple habitat units it is recorded once for each habitat unit it occurs in, and feature area is recorded as the area of the feature that affects the individual habitat unit, not the entire feature area.
- Ensure all relative information is recorded for features (severity, size, cause).
- Once they are completed, data sheets should be checked by a field partner for legibility, accuracy and completeness.
- Check all page header information such as stream names, stream and site codes, locations, etc. to ensure they are correct on all forms.
- Any estimated measurements should be indicated by a lower case 'e' in the top right hand corner of the box the measurement is recorded in.
- Only use codes that are specified in the guide or on the data forms. If you use a code that is not in the guide indicate what it is in the comments.
- Additional information should be noted in the comments box.
- ALL measurements should be taken in meters (m) unless otherwise indicated.
- DO NOT leave a blank field on a data sheet. Always record a value or mark a dash to indicate the field was not collected and indicate why
- DO NOT MAKE ASSUMPTIONS. If in doubt, check the manual and discuss issues with your crew members.
- Record photo number and direction of photo e.g. left downstream bank (LDB); right downstream bank (RDB); upstream (US); downstream (DS).
- At each Feature site, photos should be taken at a minimum of the four aforementioned directions. (US,DS,LDB,RDB)
- If there are no features present, general site photos (US, DS, LDB, RDB) should be taken for future reference.

2.0 Site Locator and Identifier

2.1 Watershed

- Definition: The project name/watershed as determined by FISHES Project Priority Selection and Ranking Tool.

- Method: Assigned in the office.

2.2 Stream Name

- Definition: The gazetted name of the stream. If there is a local name or alias put it in parenthesis.
- Method: Determine from topographic maps. Local names can be obtained from summary reports, local knowledge, etc. If no name, record as "unnamed", e.g., unnamed tributary.

2.3 Reach Length

- Definition: Reach length is calculated by the ESRM. Maximum reach length is determined in office.
- Method: Record in meters.

2.4 Stream ID

- Definition: Stream identification number assigned by the ESRM.
- Method: Determined from ESRM output.

2.5 Reach ID

- Definition: Reach number as assigned by the ESRM.
- Method: Determine from ESRM output.

2.6 Date

- Definition: Date of field survey.
- Method and Recording Procedure: Record as Month, Day, Year (e.g., Jul 30 2014).

2.7 Time

- Definition: Start time of Habitat assessment.
- Method and Recording Procedure: Record local time using 24-hour clock (i.e., 1:30pm = 13:30h).

2.8 Crew

- Definition: Names of FISHES crew members completing the assessment.
- Method and Recording Procedure: Record first initial and last name of FISHES crew members (M. Sanderman, A. Lavigne). List the name of the crew lead first as the Recorder of information, followed by the names of crew members taking measurements.

2.9 Global Positioning System (GPS) Unit

- Definition: Handheld GPS unit used in detailed field assessment. If multiple crews are in the field, it is important to record which unit is used for the survey to ensure the correct data is accessed.
- Recording Procedure: Record GPS unit number used on the field sheet and transfer corresponding GPS information to the excel file.

2.10 Camera Unit

- Definition: Camera unit used in detailed field assessments. If multiple crews are in the field, it is important to record which unit is used for the survey to ensure the correct photos are accessed.
- Recording Procedure: Record camera unit number used on the field sheet.

3.0 Water Quality

The information collected in this section is typically generalized for the entire site, or collected only within the given reach.

3.1 Temp - Water Temperature

- Definition: Ambient stream water temperature.
- Method: Measure in flowing water at a location representative of the stream site. Record water temperature after measurement has stabilized. (ie. Consecutive readings for approximately 30 seconds).
- Recording Procedure: Record to nearest 0.1°C.

3.2 %Sat - Percent Saturation

- Definition: The amount of oxygen in water relative to the maximum amount of oxygen that can be dissolved theoretically in water at a given altitude and temperature.
- Method: Measure in flowing water at a location representative of the stream site and follow instructions as outlined in the equipment Operator's Manual.
- Recording Procedure: Record to nearest 0.1%.

3.3 DO - Dissolved Oxygen

- Definition: The concentration of oxygen dissolved in water; expressed as mg/L.
- Method: Measure in flowing water at a location representative of the stream site and follow instructions as outlined in the equipment Operator's Manual.
- Recording Procedure: Record to nearest 0.1 mg/L.

3.4 pH

- Definition: A measure of hydrogen ion concentration on a scale of 0 (highly acidic) to 14 (highly basic) with a pH of 7 as neutral.
- Method: Measure in flowing water at a location representative of the stream site and follow instructions as outlined in the equipment Operator's Manual.
- Recording Procedure: Record to nearest 0.1.

3.5 Conductivity (Cond)

- Definition: The ability of a solution to carry an electrical current.
- Method: Measure in flowing water at a location representative of the stream site and follow instructions as outlined in the equipment Operator's Manual.
- Recording Procedure: Record to nearest 0.1µS/cm.

3.6 Total Dissolved Solids (TDS)

- Definition: A measure of inorganic and organic materials dissolved in water that can pass through a 0.45 µm filter, expressed as mg/L.
- Method: Measure in flowing water at a location representative of the stream site and follow instructions as outlined in the equipment Operator's Manual.
- Recording Procedure: Record to nearest whole value ppm.

3.7 Comments Field

This section provides an opportunity to give general comments on site access, fish habitat, fish presence, potential projects etc. Be sure to fill this section out in detail.

4.0 Detailed Habitat Assessment

4.1 Transect Information

4.1.1 ID - Habitat Unit Identification

- Definition: Each habitat unit requires a unique identification number for the ESRM within each Reach Identification.
- Method and Recording Procedure: Use a numerical system to number each habitat unit. Start the assessment at either the most downstream end or upstream end of the reach. The Habitat unit identification numbers are referenced in the Features section to determine the location of important features and are an essential component for the ESRM to run.

4.1.2 D/S Wpt – Downstream Waypoint

- Definition: Geo-spatial referenced location of the furthest point downstream in a habitat unit.
- Method and Recording Procedure: Determine location using handheld GPS, record the waypoint in the handheld GPS unit and record on the field sheet the waypoint number to the corresponding habitat unit ID.

4.2 Habitat Unit Type - Refer to Habitat Unit (Table 1)

- Definition: Habitat units are relatively homogenous areas of channel that differ in depth, velocity, and substrate. They are typically as long as the average wetted width and should comprise at least 50% of the wetted width. Refer to Habitat Unit Table for Habitat Unit codes and definitions.
- Method: Record the 2-3 digit code for the Habitat Unit type, starting the assessment at the downstream end of the reach. If more than one wetted channel exists, use the channel with

greater flow to determine habitat unit assessment. Make note in the comments section in which habitat unit the channel splits and which downstream channel the assessment was done.

Table 1 Habitat Unit Types

Habitat Unit Type	Class	Unit ID	Description
Backwater		BW	Pool formed by an eddy along a channel margin downstream from obstructions such as bars, rootwads, boulders, or as a result of back-flooding upstream from an obstructional blockage. Also, a body of water, the stage of which is controlled by some feature of the channel downstream from the backwater, or in coves or covering low-lying areas and having access to the main body of water. Substrate in backwater is typically smaller then surrounding substrates.
Cascade		CA	Highly turbulent series of short falls and small scour basins with gradients exceeding 8%. Irregular plunges creating white-water generally composed of larger substrates (large gravel, cobble, and boulder). Usually passable to fish.
Chute		CH	A narrow, confined channel through which water flows rapidly. A rapid or quick descent in a stream, usually with bedrock substrate. Associated habitat types are RA, R1, R2.
Flat		FL	Area characterized by low velocity and near-uniform flow. Differentiated from pool habitat by high channel uniformity. More depositional than run habitat
Glide		GL	Glides are shallow (< 0.3 m deep), slow flowing, non-turbulent, and lack a defined thalweg, with a U-shaped, smooth, wide bottom. Glides are extended transitional areas between fast and slow water habitats. Substrate is usually silt/sand but may sometimes consist of gravel to small cobble.
Impoundment		IP 1-3	Includes pools and impoundments formed behind complete or nearly complete channel blockages. Impoundments tend to accumulate more sediment/organic debris than scour pools. Identify as class 1, 2 or 3 using pool criteria.
	1	IP1	Depth >1.0 m. Deep Impoundment
	2	IP2	Depth 0.5 – 1.0 m. Moderate depth Impoundment
	3	IP3	Depth < 0.5 m. Shallow Impoundment
Ledges		LG	Areas of Bedrock intrusion into the channel. Often creates Chutes and Pool/impoundment habitat.

Pool			Reduced current velocity, often with water deeper than the surrounding areas. Usually formed by the scouring or plunging action of water. Sub-surface velocities are slow and substrate usually composed of fines or small gravel.
	1	P1	Max depth >1.0 m. Deepest pool type
	2	P2	Depth 0.5 - 1.0m. Moderate depth.
	3	P3	Depth <0.5m. Shallow and/or small - Includes small pocket eddy type habitat.
Riffle		RF	Moderate to high velocity/gradient relative to run habitat. Surface agitated due to submerged or exposed coarse bed material causing moderate turbulence and ripples. Shallow relative to other channel units (generally ≤0.5m deep), coarse substrate, little to no white water or standing waves (some white water at points of constriction).
Run			Runs are typically deep, slow to fast flowing sections with variable substrates, with laminar flow, moderate slope, and with little surface turbulence. Little surface agitation. Substrate size is dependent on hydraulics. Run units are differentiated into three classes, based on depth.
	1	R1	Max depth >1.0 m. Deepest run habitat, generally deep/slow type.
	2	R2	Depth 0.5 - 1.0 m. Generally deep/fast or moderately deep/slow type.
	3	R3	Depth <0.5 m. Generally shallow/slow or shallow/fast type.
Rapid		RA	High velocity; deeper than riffle, with some exposed boulders at lower flows, substrate extremely coarse (large cobble/boulder), instream cover in pocket eddies and associated with substrate. Considerable turbulence, some white water, fast velocity (> 0.5 m/s), 4-7% slope.
Sheet		ST	Shallow water that flows uniformly over smooth bedrock. Non-turbulent.
Step Pool		SP	Series of pools separated by short riffles or cascades. Generally found in high gradient, confined mountain streams dominated by boulder substrate. The length of the turbulent water cannot exceed the mean wetted width, otherwise, classify the pools and turbulent water separately.

Syne		SN	Discrete section of non-flowing water connected to a flowing channel only at its downstream end, generally formed in a side channel or behind a peninsula.
Dam (barrier)	Beaver	BD	Structures causing complete or nearly complete channel blockage. Four types of dams are beaver, debris, landslide, or weir (man-made). Dams tend to accumulate more sediment/organic debris than scour pools. Barriers are classified as Full or Permanent (high severity), Partial (moderate severity), or Temporary (low severity) in ESRM
	Debris	DD	
	Landslide	LD	
	Man-made	MD	
Falls (barrier)		FA	A free fall or steep descent of water caused by a vertical drop. Falls formed from a full spanning flow obstruction, often bedrock. Note – Not a habitat unit that is entered into the ESRM. This habitat unit is entered into the model as a barrier feature.

Note – Not a habitat unit that is entered into the ESRM. This habitat unit is entered into the model as a barrier feature.

4.3 Unit Length (m)

- Definition: The length of a habitat unit along the thalweg, measured in meters.
- Method: Use a meter stick, tape measure, hip chain, or range finder to determine length of the habitat unit.

4.4 Wetted Width (m)

- Definition: The width of the water surface at the time of survey, measured at right angles to the direction of flow.
- Method: Use a meter stick, tape measure, hip chain, or range finder to determine the wetted width of the habitat unit.
    - Measure the distance of the wetted surface from side to side of the channel.
    - Include water under undercut banks, protruding rocks, logs, and stumps.
    - Exclude vegetated islands and use the sum of each wetted width in a transect as the total measured wetted width.
- Recording Procedure: Record to nearest 0.1 m. If channel is dry, record 0.

4.5 Bankfull Width (m)

- Definition: The distance between the ordinary high-water mark (OHW) of both right and left banks.
- Method: Use a meter stick, tape measure, hip chain, or range finder to determine the Bankfull width of the habitat unit.
    - Measure the distance across the channel perpendicular to the direction of flow from the left and right OHW.

    - Exclude vegetated islands and use the sum of each bankfull width in a transect as the total measured bankfull width.
- Recording Procedure: Record to nearest 0.1 m. If channel is undefined, record wetted width as the bankfull width. If area is impounded look for native channel and/or assess channel width upstream and downstream of impoundment for indications of bankfull width.

4.6 Bankfull Depth (m)

- Definition: The depth of water measured from the surface of the channel bottom in the thalweg to the top of the ordinary high-water mark.
- Method: Measure the depth in the thalweg to the OHW using a meter stick or tape measure.
- Recording Procedure: Record to the nearest 0.1 m.

4.7 Water Depth (m)

- Definition: The depth of the water measured from the water surface to top of substrate in the thalweg at the time of the survey.
- Method: Measure the water depth in the thalweg to the top of the water surface.
- Recording Procedure: Record to the nearest 0.1 m.

4.8 Feasibility

- Definition: An estimate of the feasibility of any project, including crew opinion on the potential of the section to be improved and the ability to access the area.
- Method and Recording Procedure: Assess each habitat unit for the feasibility of a range of projects and select the appropriate code from Table 2.

Table 2. Feasibility Unit Codes

Code	Definition	Description
N	None	No potential for restoration or mitigation projects. Habitat unit(s) with very limited access, exceptionally poor or exceptionally good fish habitat and/or units with no features present.
L	Low	Limited potential for restoration or mitigation projects. Habitat units may have no features to restore or have poor access. Projects that require heavy equipment or are expensive.
M	Moderate	Good potential for restoration or mitigation projects. Habitat units have features with moderately good access for work to occur.
H	High	Excellent potential for restoration or mitigation projects. Habitat units would benefit significantly from restoration/mitigation work. Access for work is good, costs are low and fish habitat is restored to previous levels or better.

4.9 Substrate Composition (O/F/S/SG/LG/CB/BL/RK)

- Definition: Refers to the size of the surficial bed material.

- Method: Divide the habitat unit into three transects (upstream, middle, and downstream). Then divide the transects into 10 equidistant points. As you walk across the transect place a hand, meter stick, net handle, wading rod, or any solid object into the stream at each of the 10 equidistant points. Remove the substrate particle the solid object is touching and classify it using the categories in the table below. If water depths are too great to remove substrate particles then visually classify the particle that is touched. The method described here is a modification of the Wolman Pebble Count (Wolman, 1954) and the Ontario Stream Assessment Protocol (Stanfield, 2013), a random step-toe procedure used to classify particle size distribution of surficial bed material.
    - Tally each particle classification in the respective column on the field sheet. (e.g. Fines- 2, Small Gravel- 5, Large Gravel – 1, Cobble- 2).
    - Add up the number of points for each class of bed material and multiply by 10 to determine percent. (i.e. Fines- 2x10=20%, Small Gravel- 5x10=50%, Large Gravel – 1x10%=10%, Cobble- 2x10=20%).
    - Add up the percentage for each class of bed material for the three transects and divide by three to get an estimate of bed material over the entire habitat unit.
    - If fines comprise part of the surficial bed material notes should be made about them, especially if they exceed 25 % of the total surficial substrate at the site. Notes should include whether the fine material is predominantly sand, silt, or hard packed clay, what habitat type is most affected, and anything else that is relevant. For example, increased deposition of fine sediment in pools can have implications on the quality of overwintering habitat at a site. A deep pool with sand substrate may have higher habitat values for salmonids than a deep pool with silt substrates.
- Recording: Record amount of bed material in appropriate column. Note, bed material in each transect should total 100%. If a substrate type is not present, record 0 (Table 3).

Table 3. Substrate Composition Unit Codes

Class	Code	Size	Description
Organics	O	N/A	Leaf litter, sticks, decaying plant material
Fines	F	<0.06 mm	Slick or greasy feel when rubbed between two fingers
Sand	S	0.6-2 mm	Gritty when rubbed between two fingers
Small Gravel	SG	2-16 mm	Ladybug to quarter size
Large Gravel	LG	17-64 mm	Quarter to tennis ball
Cobble	CB	65-256 mm	Tennis ball to soccer ball
Boulder	BL	>256	Larger than soccer ball
Bedrock	BD	N/A	No distinct edges, larger than car
Artificial	AR	N/A	Rock basket, gabions, bricks, trash, concrete

4.10 Embeddedness

- Definition: Refers to the extent to which rocks (gravel, cobble, and boulders) are covered by, or sunken in, the silt, sand, or mud of the stream bottom.
- Method: Visually assess in each habitat unit within the thalweg. If organic+fines+sand substrates comprise more than 50% of the habitat unit, record embeddedness as N/A. Use the code from the table below to record embeddedness (Table 4).

Table 4. Embeddedness Unit Codes

Code	Definition	Description
N	Unembedded	<5% surrounded by fine sediment
L	Low Embeddedness	5-25% surrounded by fine sediment
M	Moderate Embeddedness	25-50% surrounded by fine sediment
H	High Embeddedness	50-75% surrounded by fine sediment
V	Very High Embeddedness	>75% surrounded by fine sediment

5.0 Banks and Riparian in Reach

Banks, riparian vegetation, and riparian widths are assessed at every habitat unit for the left (LBH) and right (RBH) banks (when facing downstream). The top of the stream bank is the point where a break in slope of the land occurs such that the grade beyond the break is flatter than 3:1 (~70°) at any point for a minimum of 15 metres measured perpendicularly from the break. Where banks are not well defined (e.g. wetlands, gently sloping inside bends, or beaver ponds), the top of the bank is equivalent to the ordinary high watermark (OHW).

5.1 LBH/RBH - Top of Bank Height (m)

- Definition: The points closest to the boundary of the active floodplain where a break in slope of the land occurs such that the grade beyond the break is flatter than 3:1 (~70 degrees) at any point for a minimum of 15 metres measured perpendicularly from the break. Where banks are not well defined (e.g. in the case of wetlands or beaver ponds), the top of the bank is equivalent to the OHW or active floodplain, whichever is greater.
- Method: Measure from deepest point in the channel thalweg to the top of each bank along a transect.
- Recording Procedure: Record to nearest 0.1 m. If channel banks are undefined, record n/a.

5.2 L/R Bank Texture – Dominant and Subdominant Bank Texture

- Definition: The dominant and subdominant size class(es) of material that form the stream bank.
- Method and Recording Procedure: Visually assess bank material within each habitat unit and record the dominant and subdominant particle sizes. If only one particle size is present, record as dominant and record 'not applicable' for sub-dominant. See Bed Material for particle size and description.

5.3 Bank Stability

- Definition: Measures whether the stream banks are eroded. Signs of erosion include slumping, unvegetated banks, exposed tree roots, and exposed soil.
- Method and Recording Procedure: Visually assess each bank throughout the entire habitat unit and write the corresponding code (Table 5).

Table 5. Bank Stability Unit Codes

Code	Definition	Description
S	Stable	Evidence of bank failure is absent or minimal. <5% of bank affected
MS	Moderately Unstable	10-60% of bank has areas of erosion. High erosion potential during floods.
US	Unstable	Many eroded areas, obvious bank sloughing, 60-100% of bank has erosional scars.

5.4 Cause – Bank Stability Cause

- Definition: Bank stability can be a result of natural (N), flood (F), anthropogenic activity (A), or both flood and anthropogenic activity (B).
- Method and Recording Procedure: Visually assess each bank and indicate the suspected cause of bank stability by circle the most appropriate code (Table 6).

Table 6. Bank Stability Cause Unit Codes

Code	Definition	Description
N	Natural	Bank erosion that is caused by typical fluvial erosion.
F	Flood	Bank erosion that is caused by large flood events, or has likely been exacerbated by large flood events.
A	Anthropogenic	Bank stability that is a result of human activity. Stable banks can be a result of rip-rap placement or bio-engineering projects. Unstable banks can be a result of any human activity that decreased the stability of the bank.
B	Flood & Anthropogenic	Banks that have been affected by large flood events and human activity.

5.5 Riparian Width (m)

- Definition: Functional riparian width. The terrestrial zone adjacent to a watercourse where vegetation and microclimate are hydrologically influenced by the presence of perennial or intermittent water from the stream or river. Riparian ecosystems are maintained by high water tables and periodic flooding. Typically extends from the normal high-water mark to the toe of the valley wall, but may vary depending on the amount of influence from the watercourse. The outer boundary of the riparian area exists where:
    - Vegetation changes from plants responding to or requiring abundant water to drier, upland types;
    - Topographic changes like terraces, cutbanks or steep banks signal clear line between the greener, lusher, or denser vegetation and the upland;
    - Flood water reaches seasonally, or on a regular basis, as high water breaks out of the stream channel.
- Method and Recording Procedure: Measure, to the nearest meter, the terrestrial riparian zone adjacent to the watercourse at each habitat unit, on both the left and right approach. This may be done using a range finder or visual estimate.

5.6 Riparian veg (D/S)

- Definition: Description of the dominant (D) and subdominant (S) vegetation types present in the riparian zone.
- Method and Recording Procedure: Visually assess the vegetation types present within the areas determined to be the Functional Riparian Width and indicate the dominant and sub-dominant vegetation type. Use Table 7 below to fill in the vegetation types by combining left and right functional riparian width.

Table 7. Riparian Vegetation Unit Codes

Code	Definition
N	None
G	Grasses and Forbes
S	Shrubs
C	Conifers
D	Deciduous
M	Mixed Conifers and Deciduous
W	Wetland

5.7 Cover

- Definition: Cover is any structure in the wetted channel or within 1 m above the water surface that provides hiding, resting, or feeding places for fish (see table below).

- Method: Locate cover types within the wetted channel or within 1 m above the water surface. Estimate the area for each discrete occurrence of each cover type present within a habitat unit. When filling out the electronic input file, convert the cover area into a percent.
    - Woody debris is calculated as:

$$\frac{m^2\ of\ cover\ area}{bankfull\ width * unit\ length}$$

    - Overhanging vegetation, depth, undercut, boulder, and instream vegetation, are calculated as:

$$\frac{m^2\ of\ cover\ area}{wetted\ width * unit\ length}$$

    - Keep a tally of total m2 for each individual cover type.
- Recording Procedure: Record to the nearest 0.5 m2. See Table 8.

Table 8. Cover Type Unit Codes

Cover Type	Description
Over Hanging Vegetation (OHV)	Vegetation that projects over the stream and is < 1m above the water surface.
Woody Debris (WD)	Woody material, including root wads providing in-channel cover for fish, must be within 1m of water surface.
Depth	Can be considered cover when it is 75-100% deeper than the average depth of surrounding habitat units. It is usually a portion of stream with reduced current velocity at low to moderate flow, deeper than the surrounding area and usable by fish for resting or cover.
Undercut Banks (Under Cut)	Defined as a location where the bank hangs over part of the stream, providing cover.
Boulder Cover (BL Cover)	Boulders that add topographic complexity to uniform or flat habitat unit bottoms. Boulders are stream substrates larger than 256mm in diameter. They provide cover when they create a turbulent flow and provide emergence points for invertebrates.
Instream Vegetation (In Veg)	Aquatic vegetation within the wetted channel that provides cover.
Residual Pool Depth (Res Pool)	Corresponding to a minimum stream flow that just barely flows through pools that is calculated by subtracting water depth at a riffle crest from water depth in the upstream pool.

6.0 Disturbances

6.1 Features

- Definitions: Anything worth noting within the reach. Anthropogenic disturbances that have potential impacts on a watercourse are important features that are entered into the model. The following features are used in the model: fords, culverts, bridges, bank armour, other crossing, instream disturbance, riparian disturbance, and flood disturbance (see table below). All features have a severity rating (see table below).
- Method: Measure the area of the disturbance in m2. When filling out the electronic input file edit the data as such:

$$\frac{Feature\ area}{Unit\ length * (Bankfull\ width + Riparian\ widths)} * 100$$

- Recording Procedure:
  - Record habitat unit ID and appropriate feature recording code (Table 9).
  - Record waypoint ID.
  - Indicate severity level using the table below (Table 10).
  - Record the total area of disturbance (m2). Include any area that has been disturbed within the active channel and riparian area. For example, a pipeline ROW crosses a watercourse that has a riparian width of 35 m (20 m left; 15 m right) and the length of the ROW disturbance along the watercourse is 25 m, the total disturbed area is 25 m x 35 m = 875 m.
  - Record photos and comments.
- Features that extend into new habitat units need to be recorded as a new feature and given an area of the disturbance (m2) within the new habitat unit.

Table 9. Disturbance Features Unit Codes

Feature Code Model Input	Description
Bridge BD bridge	Bridge crossing means a watercourse crossing that is constructed using a single span bridge, single span pipeline bridge, multi-span bridge with abutments or piers, or other similar structure.
Culvert CV culvert	Culvert crossing means a watercourse crossing that is constructed using a round, arch or box culvert or other similar structure, on or within the bed of a water body. Crossings where more than one culvert is present should be recorded as one feature. Do NOT record additional culverts at the same location as new features. Use the severity rating and comment section to indicate the level of disturbance created by the culvert(s).

Ford FD ford	Ford crossing is a low-level crossing that results in the disturbance of the active channel and adjacent riparian area by an OHV. A ford has only one access and egress point that can extend 50 m from the active channel, and crosses the water body in a perpendicular manner.
Other Crossing OC Other	This included watercourse crossings that do not fall into the above categories such as recreational built foot bridges, logfill, and wildlife crossings.
Bank Armour BA armor	Any hard engineering bank stabilization techniques that do not utilize bio-engineering principles and whose primary stabilizing material is riprap. Riprap located or associated around watercourse crossings is not recorded as a separate feature and should be considered part of the crossing. Riprap that extends 50 m beyond the edge of the ROW can be considered a new feature.
Instream Disturbance ID Instream	Is a disturbance to an area within the bankfull width (active channel). This includes but is not limited to OHV trails that parallel a watercourse within the active channel, livestock activity, waste materials (garbage, tires, blown out watercourse crossings etc.) within the active channel, etc. Features such as fords (OHV crossings) do not get recorded as instream disturbances. The instream effect of fords is taken into consideration when weighting this feature type in the model.
Riparian Disturbance RD riparian	Is a disturbance to an area within the functional riparian width. This includes but is not limited to campsites, OHV, hiking and equestrian trails, agriculture activity (livestock, crops, etc.), and industrial activity (vehicle/pipeline ROWs, well sites, logging, etc.) Do NOT record riparian disturbances when they are associated with watercourse crossings (bridges, culverts, and fords). However, decommissioned vehicle ROWs (old logging roads) and active pipeline ROWs that have OHV fords should be recorded separately, one feature for the ford and one feature for the ROW riparian disturbance.
Flood Disturbance FD flood	Is a disturbance to the channel geometry resulting from high flow events. This includes but is not limited to braided channels, excessive gravel deposits, and eroded banks. Livestock activity that causes bank erosion should be recorded as an instream and/or riparian disturbance.

*Hanging culverts should be recorded as a culvert crossing feature and recorded as a barrier.

Table 10. Severity of Disturbances Unit Codes

Severity (Model Input)	Description
Low (L)	Indicates habitat that still functions for resident fish but may be changed from what it was naturally.
Moderate (M)	Indicates habitat where function may be impaired or reduced from natural habitats (e.g. Bank armour).
High (H)	Indicates habitat that is not usable by fish or a feature that blocks passage (e.g. Perched culvert, paved channel)

6.2 Barriers

- Definitions: Are any physical, physiographic, chemical, or biological obstacle to fish movement. Specific details on barriers are not used in the model however, such information can be useful for overall reach knowledge and/or project design.
- Recording Procedure: Describe the barrier. Record barrier severity (Table 11) and type (Table 12).

Table 11. Barrier Severity Unit Codes

Code	Severity	Description
L	Temporary	Maybe a seasonal barrier or can be removed by natural flow events.
M	Partial	Maybe a barrier to certain fish species or life stages.
H	Full	Barrier to all fish throughout the year.

Table 12. Barrier Type Unit Codes

Code	Type	Description
A	Anthropogenic	Man-made barriers including weirs, dams, culverts, etc.
N	Natural	Barriers that are a result of natural features such as water falls, chutes, gradient, or velocity barriers.
B	Both	Barriers that are a combination of both anthropogenic and natural aspects such as washed out and partially buried bridges (e.g. Allison Creek).

*Hanging culverts should be recorded as a culvert crossing feature and recorded as a barrier.

7.0 References

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Fitch L, Adams BW, Hale G. 2009. Riparian Health Assessment for Streams and Small Rivers - Field Workbook. Second Edition. Lethbridge, Alberta: Cows and Fish Program. 94 pages.

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Wolman MG. 1954. A method of sampling coarse river-bed material. American Geophysical Union Transactions 35: 951-6.

8.0 Habitat Unit Survey Data Sheet

FISHES Detailed Reach Level Assessment							
Watershed		Stream ID		Reach ID		Page	
Stream Name		Date		Crew			
Reach Length (m)		Time (24hr)					
Water Quality							
Time (24hr)	Temperature (°C)	Percent Saturation	D.O. (mg/L)	pH	Conductivity (µS)	TDS (ppm)	
Field Notes							

Detailed Habitat Assessment

Watershed		Stream ID		Reach ID		Date		Page	

Detailed Habitat Assessment										Substrate Composition (%)								
Unit ID	Downstream Waypoint (Lat Long)		Habitat Type	Unit Length (m)	Wetted Width (m)	Bankful Width (m)	Bankful Depth (m)	Max Depth (m)	Feas.	O	F	S	SG	LG	CB	BL	RK	Embeded

Detailed Habitat Assessment														Cover (m²)						
Unit ID	Bank Height (m)		Left Bank Texture		Right Bank Texture		Bank Stability		Cause	Riparian Width (m)		Riparian Vegetation		OHV	WD	Depth	Under cut	BL	Ins Veg	Residual Pool (m)
	Left	Right	Dom	Sub	Dom	Subdom	Left	Right		Left	Right	Dom	Subdom							

Features and Barriers

Watershed		Stream ID		Reach ID		Date		Page	

Unit ID	Feature Type	Waypoint (Lat Long)	Feature Area (m^2)	Severity	Barrier Type	Photos		Comments
						Number	View	