"Field Assessment for Fish Passage Determination of Closed Bottomed Structures"

Ministry of Environment
Ministry of Forests

May, 2008

Agenda: Day 2

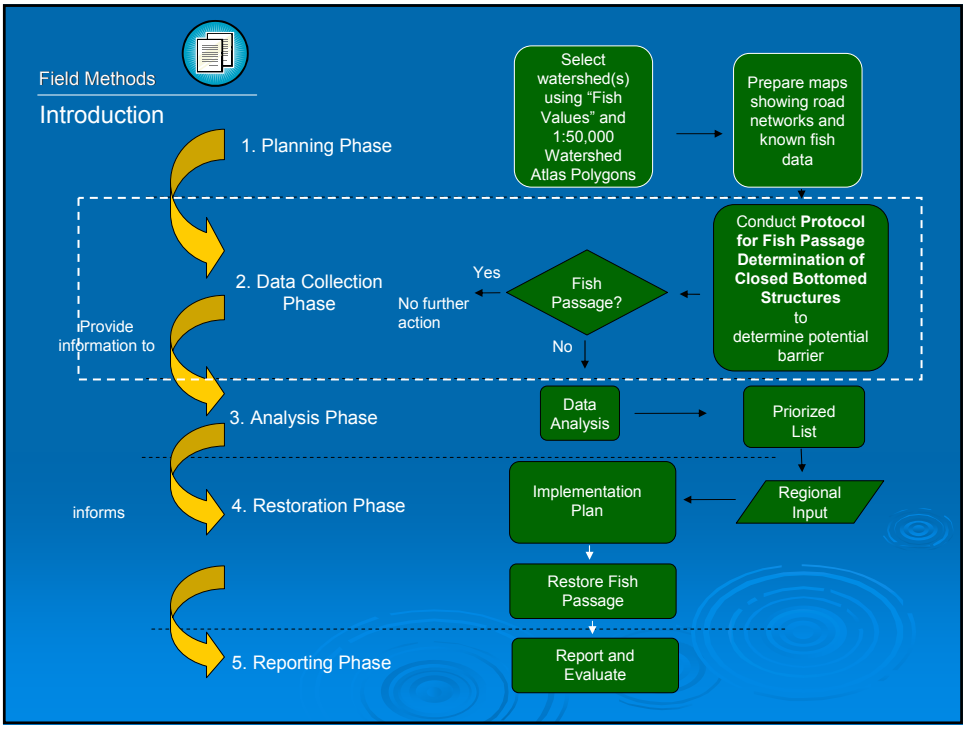
"Field Assessment for Fish Passage Determination of Closed Bottomed Structures"

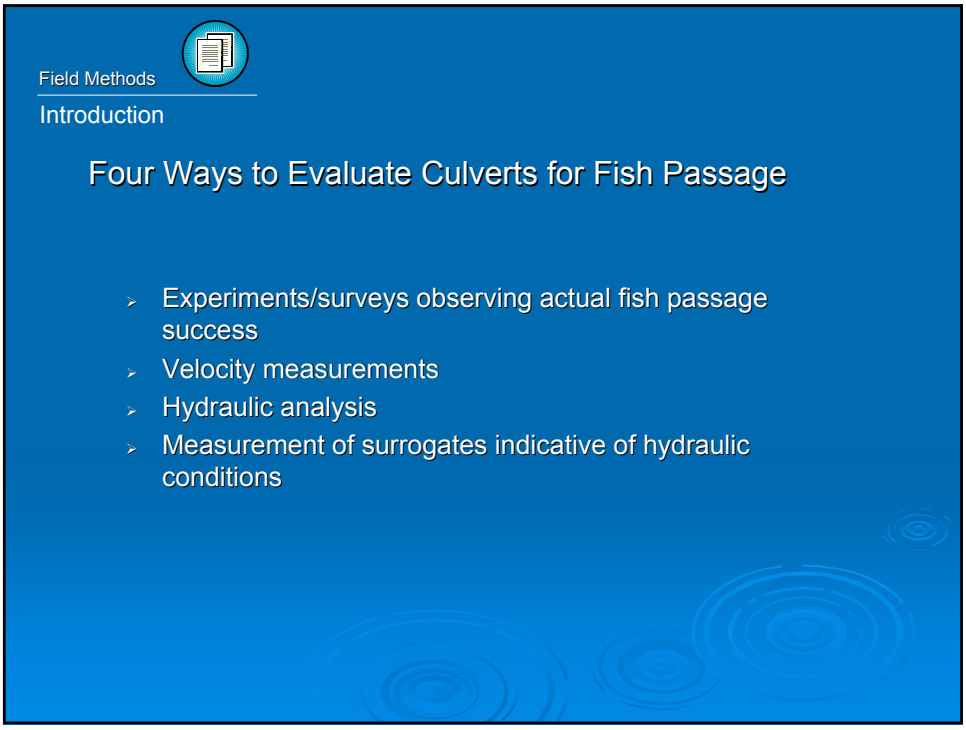
Morning (till 10:30)

1. Introduction
2. Important Considerations for Field Methodology

Field Trip

logistics


Field Methods
Introduction
1. Planning Phase
Select watershed(s) using "Fish Values" and 1:50,000 Watershed Atlas Polygons
Prepare maps showing road networks and known fish data
2. Data Collection Phase
Provide information to
Conduct **Protocol for Fish Passage Determination of Closed Bottomed Structures** to determine potential barrier
Fish Passage?
Yes
No further action
No
3. Analysis Phase
Data Analysis
Priorized List
4. Restoration Phase
informs
Implementation Plan
Regional Input
Restore Fish Passage
5. Reporting Phase
Report and Evaluate


Field Methods
Introduction
Four Ways to Evaluate Culverts for Fish Passage
Experiments/surveys observing actual fish passage success
Velocity measurements
Hydraulic analysis
Measurement of surrogates indicative of hydraulic conditions

Field Methods

Introduction

Observing actual fish passage success

Pros

- Site specific
- Certainty of results
- Specify type of barrier

Cons

- Extrapolation to other crossings
- Limited to species /age classes /flow conditions tested
- Permits
- Expensive (few sites done)
- Time
- Expertise

Field Methods

Introduction

Velocity Measurements
(Detailed measures/mapping of water velocity to find passable zones)

Pros

- Site specific information
- Specify type of barrier
- Data at different flow conditions

Cons

- Time
- Expensive
- Expertise (Touchy equipment)
- Difficult, hazardous at high flows
- Limited to conditions tested (Velocity flow related)
- Extrapolation to other crossings

Field Methods

Introduction

Hydraulic Analysis
(Mathematical modeling of flow in culverts)

Pros

- Site specific information
- Data at different flow conditions
- Necessary for backwater, baffle/weir, peak flow design
- All pipe sizes

Cons

- Time
- Expense can be high
- Expertise
- Equations not developed for some fish passage scenarios
- Some variables based on specific flow conditions

Field Methods

Introduction

Measurement of surrogates

Pros

- Some site specific information
- Less expense per site greater sample size
- Less expertise needed
- Extrapolation to other culverts
- Data can be useable for hydraulic analysis
- All pipe sizes

Cons

- Limited ability to ID type of barrier
- Relies on strength of assumptions about
  - General conditions allowing fish passage
  - How conditions change under different flows

Introduction

The protocols presented will be examples of surrogate methods

- Surrogate key advantages:
  - Surrogate measures can be done with people with little training
  - Surrogate protocols can cover more culverts in same amount of time boosting sample size
  - Information can be used in hydraulic analysis if right measures taken

Field Methods: Important Considerations

Field Methods

Important Considerations

Two main components

Field Protocol

Barrier Determination

} 10 -20 minutes

- **Designed for team of two people**
- **One with fisheries background and one with a road engineering background**

Field Methods

Important Considerations

Field Information

Information collected can be placed into three categories

- **Location and survey data (i.e. date, UTM, crossing type, etc.)**
- **Fish passage criteria (i.e. outlet drop, slope, channel width, etc.)**
- **Site information to assist in identifying potential remedy and assist in priorization (i.e. depth of fill, valley fill, habitat value etc.)**

Location and survey data

Fish passage criteria

Additional Site information

Closed Bottom Structure (CBS) Field Measurement Form					
1.	Date		13.	Downstream Width (nearest 0.1m)	____ ____ ____
2.	Crossing ID No.		14.	Outlet resid. Pool depth (cm)	
3.	Crew Name		15.	D/S Slope (%)	____
4.	UTM/GPS (include grid number) eg. 10u	Grid	16.	Habitat Value	Low Mod. High.
5.	Stream Name?		17.	Depth of Fill (m)	
6.	Road Name and km		18.	Valley Fill	
7.	MoF District?		19	Beaver Activity	
8.	Crossing Type	RC PA EC EA other ____	20.	Inlet drop (cm)	
9.	Embedded? (circle)	Yes No (30 cm or 20%) 0 25 50 75 100 Yes No (resem. channel)	21.	Backwatered?	0 25 50 75 100
10.	Culvert Dimensions (nearest 100mm)x(m)	____ ____ ____ (prim.) ____ ____ ____ ____ (sec)	22.	Fish Sighted?	
11.	Culvert Slope (%) (less than 4% use level) (nearest 0.1%) (otherwise clino)		23.	Culvert Fix	RM OBS SS EM BW
12.	Outlet Drop (cm)		24.	Photo (Circle) Documentation	Outlet Barrel D/S #'s -

Field Methods

Important Considerations

Location and survey data

1.	Date	
2.	Crossing ID No.	
3.	Crew Name	
4.	UTM/GPS (include grid number) eg. 10u	Grid
5.	Stream Name?	
6.	Road Name and km	
7.	MoF District?	
8.	Crossing Type	RC PA EC EA other ____

Field Methods

Important Considerations

Fish passage criteria

9.	*Embedded? (circle)*	*Yes No (30 cm or 20%)* *0 25 50 75 100* *Yes No (resem. channel)*
10.	*Culvert Dimensions (nearest 100mm)x(m)*	_____ _____ _____ *(prim.)* _____ _____ _____ *(sec)*
11.	*Culvert Slope (%) (less than 4% use level) (nearest 0.1%) (otherwise clino)*	
12.	*Downstream Width (nearest 0.1m)*	_____ _____ _____
13.	*Outlet Drop (cm)*	

Field Methods

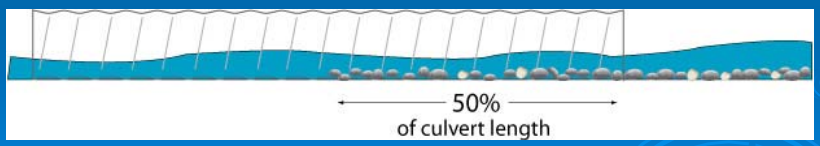
Important Considerations

Embedded

9.	*Embedded? (circle)*	*Yes No (30 cm or 20%)* *0 25 50 75 100* *Yes No (resem. channel)*

Key points

- **Looking for depth of embeddment and whether or not continuous through pipe**



Field Methods

Important Considerations

Culvert Dimensions

10.	*Culvert Dimensions (nearest 100mm)x(m)*	____ ____ ____ *(prim.)* ____ ____ ____ *(sec)*

Key points

- **Twin culverts : record invert elevation dif.**
- **use only primary culvert in barrier determination (outlet drop, channel width etc.)**
- **Take pics. of twin culverts**

Field Methods

Important Considerations

Slope

11.	*Culvert Slope (%) (less than 4% use level) (nearest 0.1%) (otherwise clino)*	

Key points

- **Use level for slopes less than 4% (nearest 0.1%)**

Field Methods

Important Considerations

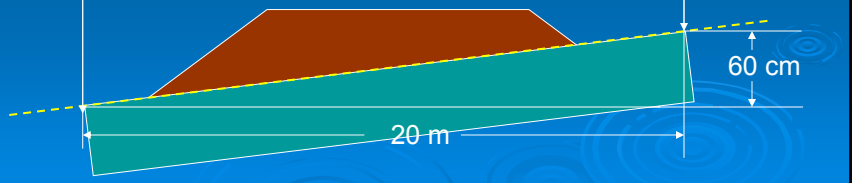
Slope

$$\text{Slope} = \frac{\text{Rise}}{\text{Run}}$$

$$= \frac{60}{2000}$$

$$= .03$$

$$= 3\%$$



Field Methods

Important Considerations

Downstream Width

12.	*Downstream Width (nearest 0.1m)*	____ ____ ____

Key points

- **Edge of rooted vegetation**
- **Definite change in vegetation and sediment texture**
- **Channel forming flow**
- **Use u/s channel width where culvert empties into a wetland or lake**

Field Methods

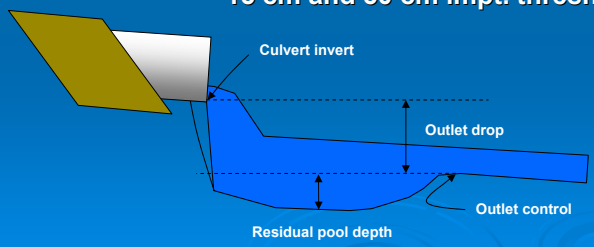
Important Considerations

Outlet Drop

13.	*Outlet Drop (cm)*	

Key points

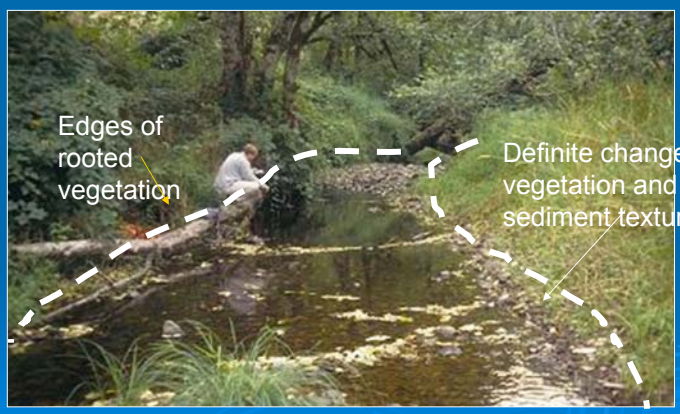
- **Invert of culvert to top of outlet control.**
- **Use meter stick or level rod**
- **15 cm and 30 cm impt. thresholds**



Field Methods

Important Considerations

Stream Channel Width



Field Methods

Important Considerations

Stream Channel Width

Field Methods

Important Considerations

Site information to assist in identifying potential remedy and assist in priorization

15.	*D/S Slope (%)*	_____
16.	*Habitat Value*	*Low Mod. High.*
17.	*Depth of Fill (m)*	
18.	*Valley Fill*	
19	*Beaver Activity*	
20.	*Inlet drop (cm)*	
21.	*Backwatered?*	*0 25 50 75 100*
22.	*Fish Sighted?*	
23.	*Culvert Fix*	
24.	*Photo (Circle) Documentation*	*Outlet Barrel D/S #'s -*

25. Comments

Field Methods

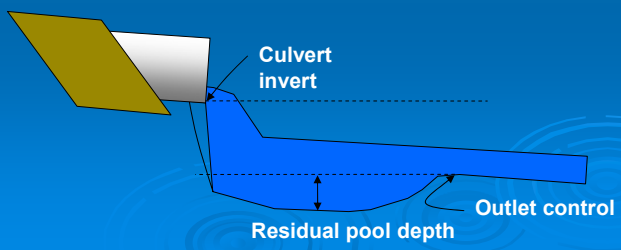
Important Considerations

Outlet pool

14.	*Outlet resid. Pool depth (cm)*	

Key points

- **Outlet control to pool bottom**



Field Methods

Important Considerations

Habitat Value

16.	*Habitat Value*	*Low*	*Mod.*	*High.*

Key points

- **make quick judgement about HV**
- **Arrive at concensus among team members**

Habitat u/s of Crossing Site	Fish Habitat Criteria
High	• The presence of high-value spawning or rearing habitat (e.g. locations with abundance of suitably sized gravels deep pools, undercut banks, or stable debris, which are critical to the fish population downstream of the subject crossing
Moderate	• Important migration corridor • Presence of suitable spawning habitat • Habitat with moderate rearing potential for the fish species present
Low	• The absence of suitable spawning habitat, and habitat with low rearing potential (eg. locations with distinct absence of deep pools, undercut banks, or stable debris, and with little or no suitably sized spawning gravels for the fish species present

Field Methods

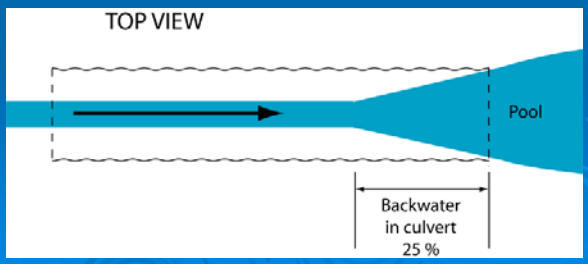
Important Considerations

Backwatered

21.	Backwatered?	0 25 50 75 100

Key points

- Outlet pool backs into barrel of culvert



Field Methods

Important Considerations

Culvert Fix

23.	Culvert Fix	RM OBS SS EM BW

Key points

1. (RM) Removal of the structure and deactivation of the road if access is not required. **May not be able to conclusively decide this at time of assessment**
2. (OBS) Replacing the culvert with a bridge or other open bottom structure. **Note proposed span and any other aspects of OBS deemed relevant.**
3. (SS) Replacing the structure with a streambed simulation design culvert. **Note proposed length of culvert**.

Field Methods

Important Considerations

Culvert Fix

23.	*Culvert Fix*	RM OBS SS EM BW

Key points

4. (EM) Adding substrate material to the culvert and possibly a downstream weir to reduce overall velocity and turbulence and provide low velocity areas. ***Note: This option should be considered only on sites where there is no Outlet Drop (OD), slope < 1.0 %, Stream Width Ratio (SWR) less than 1.0. Design and installation should not impact flood event design.***
5. (BW) Backwatering the structure to reduce velocity and turbulence. ***Note: This option should be considered only on sites where OD < 30 cm., slope < 2.0 %, Stream Width Ratio (SWR) less than 1.2 and stream profiling indicates it would be effective. Design of downstream weirs should be given careful consideration and based on a detailed stream profile. Backwatering requires additional information for proper design.***
6. Combination of 4. and 5.

Field Methods

Important Considerations

Photos

24.	*Photo (Circle) Documentation*	*Outlet D/S #'s -*	*Barrel*

Photo documentation

- The mandatory digital photos that are taken of each site (minimum 5) need to be renamed with the unique Crossing ID # as a prefix. For example, if the crossing ID is *McGregor 247-36*, then the first photo of that site will have a filename of '***McGregor_247-36_Outlet***',
- The other photos will be named simliarily with their location included as a suffix to the crossing #.
- A separate folder (named with the Unique Crossing ID) with all of the relevant photos should be created for each crossing.

Field Methods

Important Considerations

Location and Overview Information			
Date of Inspection	Crossing ID No.	Crew Name	UTM/GPS Co-ordinates Grid Easting Northing

Data Forms

Populate one spreadsheet per FIA culvert assessment project

You may create multiple worksheets within a spreadsheet if the project is large and you want to organize your data by road or by watershed

The final project submission to the Culvert Data Submission FTP site should include: the overarching project summary report; this spreadsheet and all of the photo folders.

Field Methods

Important Considerations

Channel Width

Culvert Diameter

Risk	Embedded*	value	Outlet drop	value	Slope	value	SWR	value	Length	value
low	> 30 cm. or 20% of Diameter and continuous	0[1]	< 15	0	< 1	0	< 1.0	0	< 15	0
mod	< 30 cm. or 20% of Diameter but continuous	5[2]	15 - 30	5	1 - 3	5	1.0 - 1.3	3	15 – 30	3
high	No embeddment or discontinuous	10	> 30	10	> 3	10	> 1.3	6	> 30	6

[1] Properly embedded culverts are considered passable as per natural stream channel. No further consideration of other surrogates is required.

[2] A culvert that is embedded less than 30 cm or 20% of the culvert diameter is at greater risk of being a barrier to fish passage.

Field Methods

Important Considerations

Barrier Determination

Cumulative Score	Result
0 - 14	passable
15 - 19	potential barrier
> 20	barrier

Field Methods

Important Considerations

Field Trip Logistics

- Split into 4 groups (5 ea.)
- Visit three sites

1. Shady Mile Farm Market: Jingle Pot Road – McIntyre Creek
2. and 3.: Two sites on Island Timberlands

Meet at Shady Mile Farm Market

Meet in Parking Lot at Island Timberlands, NW Bay Rd.

Field Trip Logistics

1. Shady Mile Farm Market - McIntyre Creek 3452 Jingle Pot Rd.

GPS coordinates: N49 10’ 30.9”
W 124 01’ 41.3”

Demonstration and discussion of various techniques

2. Island Timberlands N49 16’ 58.5”
W124 14’ 56.5”

Group exercise of methodology, use of level