

# APPENDIX



# G

## Surface Water Quality Technical Report

PART 2 OF 2

Appendices A to B

NORTH STAR TO NSW/QUEENSLAND BORDER ENVIRONMENTAL IMPACT STATEMENT

ARTC

The Australian Government is delivering  
Inland Rail through the Australian  
Rail Track Corporation (ARTC), in  
partnership with the private sector.

APPENDIX

INLAND  
RAIL 

G

# Surface Water Quality Technical Report

## **Appendix A** Surface Water Quality Site Investigation Results

NORTH STAR TO NSW/QUEENSLAND BORDER ENVIRONMENTAL IMPACT STATEMENT

ARTC

The Australian Government is delivering  
Inland Rail through the Australian  
Rail Track Corporation (ARTC), in  
partnership with the private sector.

- #1:ADWG x10 (March 2015)
- #2:5mg/L may be tolerated if food additive
- #3:Arsenic (AsV) value adopted
- #4:Conserv value for sheep adopted
- #5:Anion calculated
- #6:Ion conversion calculation



## CHAIN OF CUSTODY RECORD

ARU 50 005 055 521

☐ Sydney LaboratoryUnit F3 Bld F 16 Mars Rd Lane Cove West NSW 2066  
02 9500 8400 EnviroSampleNSW@eurofins.com☐ Brisbane LaboratoryUnit 1, 21 Smallwood Pl, Mivern QLD 4172  
07 3902 4500 EnviroSampleQLD@eurofins.com☐ Perth LaboratoryUnit 2 91 Leach Highway Kewdale WA 6105  
08 9251 9600 EnviroSampleWA@eurofins.com☐ Melbourne LaboratoryUnit 1, 1500 New Chace Ashburton VIC 3145  
03 9254 1000 EnviroSampleVIC@eurofins.com

Company		AECOM		Project No		PFJV		Project Manager		LEESA Leithbridge		Sampler(s)		D. Iervasi	
Address				Project Name		NS2B		EDD Format (ESdat, EQUIS, Custom)		Jonathan Billington		Handed over by		" "	
Contact Name		Dion Iervasi		Analyses		Nutrients anions Metals Dissolved B pH Suspended Solids Specialised Nitrogen Electrical Conductivity Total Phosphorus Reactive Phosphorus Chlorophyll a PAF Dissolved Oxygen % Dissolved Oxygen (mg/L) Turbidity									
Phone No		0458 389 374		Special Directions											
Purchase Order				Quote ID No											
Note: Where results are requested please specify 'Total' or 'Filter' / 'SITE' code must be used to attract SITE pricing.															
Containers		Turnaround Time (TAT) Requirements (Default will be 5 days if not stated) <input checked="" type="checkbox"/> Overnight (9am)* <input type="checkbox"/> 1 Day* <input type="checkbox"/> 2 Day* <input type="checkbox"/> 3 Day* <input checked="" type="checkbox"/> 5 Day* <input type="checkbox"/> Other ( ) * Surcharges apply													
Sample Comments / Dangerous Goods Hazard Warning															
No	Client Sample ID	Sampled Date/Time (dd/mm/yy hh:mm)	Matrix (Solid (S) Water (W))												
1	NS2B- SITE 12	23/8	W	X	X	X	X	X	X	X	X	X	X	X	X
2	" " 5	"	W	X	X	X	X	X	X	X	X	X	X	X	X
3	" " 16	"	W	X	X	X	X	X	X	X	X	X	X	X	X
4	" " 11	"	W	X	X	X	X	X	X	X	X	X	X	X	X
5	Duplicate	"	W	X	X	X	X	X	X	X	X	X	X	X	X
6															
7															
8															
9															
10															
Total Counts															
Method of Shipment		<input checked="" type="checkbox"/> Courier (# TOLL ) <input type="checkbox"/> Hand Delivered <input type="checkbox"/> Postal		Name		Dion Iervasi		Signature		D. Iervasi		Date		23/8/18	
Eurofins   mgt Laboratory Use Only		Received By		G. Bignard		SYD   BNE   MEL   PER   ADL   NTL   DRW		Signature		CB		Date		24/8/18	
		Received By				SYD   BNE   MEL   PER   ADL   NTL   DRW		Signature				Date		---	

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | mgt Standard Terms and Conditions unless agreed otherwise. A copy of Eurofins | mgt Standard Terms and Conditions is available on request.

Eurofins Environment Testing Australia Pty Ltd trading as Eurofins | mgt

HARR 24/8 #614408

# Certificate of Analysis

AECOM Aust Pty Ltd Melbourne  
 Collins Square, Tower 2, Level 11, 727 Collins Street  
 Docklands  
 VIC 3008



NATA Accredited  
 Accreditation Number 1261  
 Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing  
 The results of the tests, calibrations and/or  
 measurements included in this document are traceable  
 to Australian/national standards.

Attention: Jonathan Billington

Report 614408-W  
 Project name FFJV  
 Project ID NS2B  
 Received Date Aug 24, 2018

Client Sample ID			NS2B-SITE 12	NS2B-SITE 5	NS2B-SITE 16	NS2B-SITE 11
Sample Matrix			Water	Water	Water	Water
Eurofins   mgt Sample No.			M18-Au34578	M18-Au34579	M18-Au34580	M18-Au34581
Date Sampled			Aug 23, 2018	Aug 23, 2018	Aug 23, 2018	Aug 23, 2018
Test/Reference	LOR	Unit				
<b>Polycyclic Aromatic Hydrocarbons</b>						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene <sup>N07</sup>	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g,h,i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a,h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1,2,3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	69	80	59	55
p-Terphenyl-d14 (surr.)	1	%	86	106	87	82
Ammonia (as N)	0.01	mg/L	0.03	0.11	0.05	0.03
Chloride	1	mg/L	50	14	29	36
Chlorophyll a	5	ug/L	< 5	7.5	41	< 5
Conductivity (at 25°C)	1	uS/cm	490	320	630	520
Dissolved Oxygen	0.01	mg/L	9.3	8.5	9.2	9.2
Dissolved Oxygen (% Saturation)		%	100	92	100	100
Nitrate & Nitrite (as N)	0.05	mg/L	< 0.05	0.11	< 0.05	< 0.05
Nitrate (as N)	0.02	mg/L	0.03	0.11	< 0.02	< 0.02
Nitrite (as N)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Organic Nitrogen (as N)	0.2	mg/L	0.37	0.49	0.95	0.47
pH (at 25°C)	0.1	pH Units	8.2	7.7	8.6	8.3
Phosphate total (as P)	0.05	mg/L	0.06	0.15	0.10	0.08
Phosphorus reactive (as P)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Sulphate (as S)	5	mg/L	< 5	< 5	17	< 5
Suspended Solids	1	mg/L	9.1	65	56	14

Client Sample ID			NS2B-SITE 12	NS2B-SITE 5	NS2B-SITE 16	NS2B-SITE 11
Sample Matrix			Water	Water	Water	Water
Eurofins   mgt Sample No.			M18-Au34578	M18-Au34579	M18-Au34580	M18-Au34581
Date Sampled			Aug 23, 2018	Aug 23, 2018	Aug 23, 2018	Aug 23, 2018
Test/Reference	LOR	Unit				
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	0.4	0.6	1.0	0.5
Total Nitrogen (as N)	0.2	mg/L	0.4	0.7	1.0	0.5
Turbidity	1	NTU	4.1	71	40	6.8
<b>Alkalinity (speciated)</b>						
Bicarbonate Alkalinity (as CaCO <sub>3</sub> )	20	mg/L	200	130	260	200
Carbonate Alkalinity (as CaCO <sub>3</sub> )	10	mg/L	< 10	< 10	18	< 10
<b>Heavy Metals</b>						
Arsenic (filtered)	0.001	mg/L	0.008	< 0.001	0.001	0.001
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Chromium (filtered)	0.001	mg/L	0.002	< 0.001	< 0.001	< 0.001
Copper (filtered)	0.001	mg/L	0.002	< 0.001	0.003	< 0.001
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	0.012	0.004	0.007	0.003
Zinc (filtered)	0.005	mg/L	0.005	< 0.005	< 0.005	< 0.005

Client Sample ID			DUPLICATE
Sample Matrix			Water
Eurofins   mgt Sample No.			M18-Au34582
Date Sampled			Aug 23, 2018
Test/Reference	LOR	Unit	
<b>Polycyclic Aromatic Hydrocarbons</b>			
Acenaphthene	0.001	mg/L	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001
Anthracene	0.001	mg/L	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001
Benzo(b&j)fluoranthene <sup>N07</sup>	0.001	mg/L	< 0.001
Benzo(g,h,i)perylene	0.001	mg/L	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001
Chrysene	0.001	mg/L	< 0.001
Dibenz(a,h)anthracene	0.001	mg/L	< 0.001
Fluoranthene	0.001	mg/L	< 0.001
Fluorene	0.001	mg/L	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001
Naphthalene	0.001	mg/L	< 0.001
Phenanthrene	0.001	mg/L	< 0.001
Pyrene	0.001	mg/L	< 0.001
Total PAH*	0.001	mg/L	< 0.001
2-Fluorobiphenyl (surr.)	1	%	89
p-Terphenyl-d14 (surr.)	1	%	105
Ammonia (as N)	0.01	mg/L	0.04
Chloride	1	mg/L	37
Chlorophyll a	5	ug/L	< 5
Conductivity (at 25°C)	1	uS/cm	510
Dissolved Oxygen	0.01	mg/L	9.2
Dissolved Oxygen (% Saturation)		%	100

<b>Client Sample ID</b>			<b>DUPLICATE</b>
<b>Sample Matrix</b>			<b>Water</b>
<b>Eurofins   mgt Sample No.</b>			<b>M18-Au34582</b>
<b>Date Sampled</b>			<b>Aug 23, 2018</b>
Test/Reference	LOR	Unit	
Nitrate & Nitrite (as N)	0.05	mg/L	< 0.05
Nitrate (as N)	0.02	mg/L	< 0.02
Nitrite (as N)	0.02	mg/L	< 0.02
Organic Nitrogen (as N)	0.2	mg/L	0.46
pH (at 25°C)	0.1	pH Units	8.3
Phosphate total (as P)	0.05	mg/L	0.07
Phosphorus reactive (as P)	0.05	mg/L	< 0.05
Sulphate (as S)	5	mg/L	< 5
Suspended Solids	1	mg/L	16
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	0.5
Total Nitrogen (as N)	0.2	mg/L	0.5
Turbidity	1	NTU	7.8
<b>Alkalinity (speciated)</b>			
Bicarbonate Alkalinity (as CaCO <sub>3</sub> )	20	mg/L	200
Carbonate Alkalinity (as CaCO <sub>3</sub> )	10	mg/L	< 10
<b>Heavy Metals</b>			
Arsenic (filtered)	0.001	mg/L	0.001
Cadmium (filtered)	0.0002	mg/L	< 0.0002
Chromium (filtered)	0.001	mg/L	< 0.001
Copper (filtered)	0.001	mg/L	< 0.001
Lead (filtered)	0.001	mg/L	< 0.001
Mercury (filtered)	0.0001	mg/L	< 0.0001
Nickel (filtered)	0.001	mg/L	0.003
Zinc (filtered)	0.005	mg/L	< 0.005

## Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.  
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Polycyclic Aromatic Hydrocarbons	Melbourne	Aug 30, 2018	7 Day
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Chlorophyll a	Melbourne	Aug 29, 2018	2 Day
- Method: LTM-INO-4340 Chlorophyll a in Waters			
Conductivity (at 25°C)	Melbourne	Aug 29, 2018	28 Day
- Method: LTM-INO-4030 Conductivity			
Dissolved Oxygen	Melbourne	Aug 29, 2018	1 Day
- Method: LTM-INO-4130 Determination of Dissolved Oxygen using a DO meter			
Dissolved Oxygen (% Saturation)	Melbourne	Aug 29, 2018	1 Day
- Method: LTM-INO-4130 Determination of Dissolved Oxygen using a DO meter			
pH (at 25°C)	Melbourne	Aug 29, 2018	0 Hours
- Method: LTM-GEN-7090 pH in water by ISE			
Phosphate total (as P)	Melbourne	Aug 29, 2018	28 Day
- Method: APHA 4500-P E. Phosphorous			
Phosphorus reactive (as P)	Melbourne	Aug 29, 2018	2 Day
- Method: APHA4500-PO4			
Suspended Solids	Melbourne	Aug 29, 2018	7 Days
- Method: LTM-INO-4070 Analysis of Suspended Solids in Water by Gravimetry			
Turbidity	Melbourne	Aug 29, 2018	2 Day
- Method: Turbidity by classical using APHA 2130B (LTM-INO-4140)			
Metals M8 filtered	Melbourne	Aug 29, 2018	28 Day
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Nitrogens (speciated)			
Ammonia (as N)	Melbourne	Aug 29, 2018	28 Day
- Method: APHA 4500-NH3 Ammonia Nitrogen by FIA			
Nitrate & Nitrite (as N)	Melbourne	Aug 29, 2018	28 Day
- Method: APHA 4500-NO3/NO2 Nitrate-Nitrite Nitrogen by FIA			
Nitrate (as N)	Melbourne	Aug 29, 2018	28 Day
- Method: APHA 4500-NO3 Nitrate Nitrogen by FIA			
Nitrite (as N)	Melbourne	Aug 29, 2018	2 Day
- Method: APHA 4500-NO2 Nitrite Nitrogen by FIA			
Organic Nitrogen (as N)	Melbourne	Aug 28, 2018	7 Day
- Method: APHA 4500 Organic Nitrogen (N)			
Total Kjeldahl Nitrogen (as N)	Melbourne	Aug 29, 2018	7 Day
- Method: LTM-INO-4310 TKN in Waters & Soils by FIA			
Major Anions			
Chloride	Melbourne	Aug 29, 2018	28 Day
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
Sulphate (as S)	Melbourne	Aug 29, 2018	28 Day
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
Alkalinity (speciated)	Melbourne	Aug 29, 2018	14 Day
- Method: APHA 2320 Alkalinity by Titration			

**Company Name:** AECOM Aust Pty Ltd Melbourne  
**Address:** Collins Square, Tower 2, Level 11, 727 Collins Street  
Docklands  
VIC 3008  
**Project Name:** FFJV  
**Project ID:** NS2B

**Order No.:**  
**Report #:** 614408  
**Phone:** 03 9653 1234  
**Fax:** 03 9654 7117

**Received:** Aug 24, 2018 9:00 AM  
**Due:** Aug 31, 2018  
**Priority:** 5 Day  
**Contact Name:** - ALL INVOICES

**Eurofins | mgt Analytical Services Manager : Natalie Krasselt**

Sample Detail						Chlorophyll a	Conductivity (at 25°C)	Dissolved Oxygen	Dissolved Oxygen (% Saturation)	pH (at 25°C)	Phosphate total (as P)	Phosphorus reactive (as P)	Suspended Solids	Turbidity	Polycyclic Aromatic Hydrocarbons	Metals M8 filtered	Major Anions	Nitrogens (speciated)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217																		
Brisbane Laboratory - NATA Site # 20794																		
Perth Laboratory - NATA Site # 23736																		
External Laboratory																		
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID													
1	NS2B-SITE 12	Aug 23, 2018		Water	M18-Au34578	X	X	X	X	X	X	X	X	X	X	X	X	X
2	NS2B-SITE 5	Aug 23, 2018		Water	M18-Au34579	X	X	X	X	X	X	X	X	X	X	X	X	X
3	NS2B-SITE 16	Aug 23, 2018		Water	M18-Au34580	X	X	X	X	X	X	X	X	X	X	X	X	X
4	NS2B-SITE 11	Aug 23, 2018		Water	M18-Au34581	X	X	X	X	X	X	X	X	X	X	X	X	X
5	DUPLICATE	Aug 23, 2018		Water	M18-Au34582	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						5	5	5	5	5	5	5	5	5	5	5	5	5

## Internal Quality Control Review and Glossary

### General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

### Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

**\*\*NOTE:** pH duplicates are reported as a range NOT as RPD

### Units

**mg/kg:** milligrams per kilogram

**mg/L:** milligrams per litre

**ug/L:** micrograms per litre

**ppm:** Parts per million

**ppb:** Parts per billion

**%:** Percentage

**org/100mL:** Organisms per 100 millilitres

**NTU:** Nephelometric Turbidity Units

**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

### Terms

<b>Dry</b>	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
<b>LOR</b>	Limit of Reporting.
<b>SPIKE</b>	Addition of the analyte to the sample and reported as percentage recovery.
<b>RPD</b>	Relative Percent Difference between two Duplicate pieces of analysis.
<b>LCS</b>	Laboratory Control Sample - reported as percent recovery.
<b>CRM</b>	Certified Reference Material - reported as percent recovery.
<b>Method Blank</b>	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
<b>Surr - Surrogate</b>	The addition of a like compound to the analyte target and reported as percentage recovery.
<b>Duplicate</b>	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
<b>USEPA</b>	United States Environmental Protection Agency
<b>APHA</b>	American Public Health Association
<b>TCLP</b>	Toxicity Characteristic Leaching Procedure
<b>COC</b>	Chain of Custody
<b>SRA</b>	Sample Receipt Advice
<b>QSM</b>	Quality Systems Manual ver 5.1 US Department of Defense
<b>CP</b>	Client Parent - QC was performed on samples pertaining to this report
<b>NCP</b>	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
<b>TEQ</b>	Toxic Equivalency Quotient

### QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

### QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

## Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Method Blank</b>							
<b>Polycyclic Aromatic Hydrocarbons</b>							
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g,h,i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
Dibenz(a,h)anthracene	mg/L	< 0.001			0.001	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
Indeno(1,2,3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
<b>Method Blank</b>							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Chloride	mg/L	< 1			1	Pass	
Nitrate & Nitrite (as N)	mg/L	< 0.05			0.05	Pass	
Nitrate (as N)	mg/L	< 0.02			0.02	Pass	
Nitrite (as N)	mg/L	< 0.02			0.02	Pass	
Phosphate total (as P)	mg/L	< 0.05			0.05	Pass	
Phosphorus reactive (as P)	mg/L	< 0.05			0.05	Pass	
Sulphate (as S)	mg/L	< 5			5	Pass	
Suspended Solids	mg/L	< 1			1	Pass	
Total Kjeldahl Nitrogen (as N)	mg/L	< 0.2			0.2	Pass	
Turbidity	NTU	< 1			1	Pass	
<b>Method Blank</b>							
<b>Alkalinity (speciated)</b>							
Bicarbonate Alkalinity (as CaCO <sub>3</sub> )	mg/L	< 20			20	Pass	
Carbonate Alkalinity (as CaCO <sub>3</sub> )	mg/L	< 10			10	Pass	
<b>Method Blank</b>							
<b>Heavy Metals</b>							
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0002			0.0002	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Mercury (filtered)	mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
<b>LCS - % Recovery</b>							
<b>Polycyclic Aromatic Hydrocarbons</b>							
Acenaphthene	%	120			70-130	Pass	
Acenaphthylene	%	124			70-130	Pass	
Anthracene	%	129			70-130	Pass	
Benz(a)anthracene	%	86			70-130	Pass	
Benzo(a)pyrene	%	124			70-130	Pass	
Benzo(b&j)fluoranthene	%	117			70-130	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benzo(g,h,i)perylene			%	116			70-130	Pass	
Benzo(k)fluoranthene			%	123			70-130	Pass	
Chrysene			%	96			70-130	Pass	
Dibenz(a,h)anthracene			%	102			70-130	Pass	
Fluoranthene			%	121			70-130	Pass	
Fluorene			%	124			70-130	Pass	
Indeno(1,2,3-cd)pyrene			%	99			70-130	Pass	
Naphthalene			%	109			70-130	Pass	
Phenanthrene			%	130			70-130	Pass	
Pyrene			%	122			70-130	Pass	
<b>LCS - % Recovery</b>									
Ammonia (as N)			%	99			70-130	Pass	
Chloride			%	100			70-130	Pass	
Nitrate & Nitrite (as N)			%	109			70-130	Pass	
Nitrate (as N)			%	100			70-130	Pass	
Nitrite (as N)			%	105			70-130	Pass	
Phosphate total (as P)			%	102			70-130	Pass	
Phosphorus reactive (as P)			%	128			70-130	Pass	
Sulphate (as S)			%	100			70-130	Pass	
Suspended Solids			%	101			70-130	Pass	
Total Kjeldahl Nitrogen (as N)			%	100			70-130	Pass	
<b>LCS - % Recovery</b>									
<b>Alkalinity (speciated)</b>									
Carbonate Alkalinity (as CaCO <sub>3</sub> )			%	97			70-130	Pass	
<b>LCS - % Recovery</b>									
<b>Heavy Metals</b>									
Arsenic (filtered)			%	98			80-120	Pass	
Cadmium (filtered)			%	105			80-120	Pass	
Chromium (filtered)			%	102			80-120	Pass	
Copper (filtered)			%	98			80-120	Pass	
Lead (filtered)			%	104			80-120	Pass	
Mercury (filtered)			%	104			70-130	Pass	
Nickel (filtered)			%	98			80-120	Pass	
Zinc (filtered)			%	99			80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Spike - % Recovery</b>									
<b>Polycyclic Aromatic Hydrocarbons</b>				Result 1					
Acenaphthene	B18-Au28943	NCP	%	103			70-130	Pass	
Acenaphthylene	B18-Au28943	NCP	%	109			70-130	Pass	
Anthracene	B18-Au28943	NCP	%	113			70-130	Pass	
Benz(a)anthracene	B18-Au28943	NCP	%	120			70-130	Pass	
Benzo(a)pyrene	B18-Au28943	NCP	%	121			70-130	Pass	
Benzo(b&j)fluoranthene	B18-Au28943	NCP	%	113			70-130	Pass	
Benzo(g,h,i)perylene	B18-Au28943	NCP	%	124			70-130	Pass	
Benzo(k)fluoranthene	B18-Au28943	NCP	%	129			70-130	Pass	
Chrysene	B18-Au28943	NCP	%	123			70-130	Pass	
Dibenz(a,h)anthracene	B18-Au28943	NCP	%	97			70-130	Pass	
Fluoranthene	B18-Au28943	NCP	%	127			70-130	Pass	
Fluorene	B18-Au28943	NCP	%	111			70-130	Pass	
Indeno(1,2,3-cd)pyrene	B18-Au28943	NCP	%	111			70-130	Pass	
Naphthalene	B18-Au28943	NCP	%	100			70-130	Pass	
Phenanthrene	B18-Au28943	NCP	%	115			70-130	Pass	
Pyrene	B18-Au28943	NCP	%	120			70-130	Pass	
<b>Spike - % Recovery</b>									

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
				Result 1					
Chloride	M18-Au36593	NCP	%	76			70-130	Pass	
Phosphate total (as P)	M18-Au36599	NCP	%	114			70-130	Pass	
Sulphate (as S)	M18-Au36593	NCP	%	87			70-130	Pass	
<b>Spike - % Recovery</b>									
<b>Alkalinity (speciated)</b>				Result 1					
Bicarbonate Alkalinity (as CaCO <sub>3</sub> )	M18-Au32486	NCP	%	95			70-130	Pass	
<b>Spike - % Recovery</b>									
<b>Heavy Metals</b>				Result 1					
Arsenic (filtered)	M18-Au34716	NCP	%	100			70-130	Pass	
Cadmium (filtered)	M18-Au34716	NCP	%	98			70-130	Pass	
Chromium (filtered)	M18-Au34716	NCP	%	99			70-130	Pass	
Copper (filtered)	M18-Au34716	NCP	%	93			70-130	Pass	
Lead (filtered)	M18-Au34716	NCP	%	93			70-130	Pass	
Mercury (filtered)	M18-Au34716	NCP	%	93			70-130	Pass	
Nickel (filtered)	M18-Au34716	NCP	%	94			70-130	Pass	
Zinc (filtered)	M18-Au34716	NCP	%	95			70-130	Pass	
<b>Spike - % Recovery</b>									
				Result 1					
Ammonia (as N)	M18-Au34582	CP	%	95			70-130	Pass	
Nitrate & Nitrite (as N)	M18-Au34582	CP	%	98			70-130	Pass	
Nitrate (as N)	M18-Au34582	CP	%	98			70-130	Pass	
Nitrite (as N)	M18-Au34582	CP	%	102			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Duplicate</b>									
<b>Polycyclic Aromatic Hydrocarbons</b>				Result 1	Result 2	RPD			
Acenaphthene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Acenaphthylene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Anthracene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benz(a)anthracene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(a)pyrene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(b&j)fluoranthene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(g,h,i)perylene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(k)fluoranthene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Chrysene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Dibenz(a,h)anthracene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluoranthene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluorene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Indeno(1,2,3-cd)pyrene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Naphthalene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Phenanthrene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Pyrene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
<b>Duplicate</b>									
				Result 1	Result 2	RPD			
Chloride	M18-Au36414	NCP	mg/L	17000	17000	3.0	30%	Pass	
Dissolved Oxygen	S18-Au33928	NCP	mg/L	9.3	9.2	1.0	30%	Pass	
Phosphate total (as P)	M18-Au32667	NCP	mg/L	0.26	0.30	14	30%	Pass	
Phosphorus reactive (as P)	M18-Au34578	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Sulphate (as S)	M18-Au36414	NCP	mg/L	710	670	6.0	30%	Pass	
Turbidity	S18-Au33929	NCP	NTU	< 1	< 1	<1	30%	Pass	

Duplicate								
Heavy Metals				Result 1	Result 2	RPD		
Arsenic (filtered)	M18-Au34716	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Cadmium (filtered)	M18-Au34716	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Chromium (filtered)	M18-Au34716	NCP	mg/L	0.002	0.001	9.0	30%	Pass
Copper (filtered)	M18-Au34716	NCP	mg/L	0.002	0.002	5.0	30%	Pass
Lead (filtered)	M18-Au34716	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Mercury (filtered)	M18-Au34716	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Nickel (filtered)	M18-Au34716	NCP	mg/L	0.002	0.001	9.0	30%	Pass
Zinc (filtered)	M18-Au34716	NCP	mg/L	0.020	0.020	3.0	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Dissolved Oxygen (% Saturation)	M18-Au34579	CP	%	92	93	1.0	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Conductivity (at 25°C)	M18-Au34581	CP	uS/cm	520	520	<1	30%	Pass
pH (at 25°C)	M18-Au34581	CP	pH Units	8.3	8.3	pass	30%	Pass
Duplicate								
Alkalinity (speciated)				Result 1	Result 2	RPD		
Bicarbonate Alkalinity (as CaCO <sub>3</sub> )	M18-Au34581	CP	mg/L	200	210	6.0	30%	Pass
Carbonate Alkalinity (as CaCO <sub>3</sub> )	M18-Au34581	CP	mg/L	< 10	< 10	<1	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Ammonia (as N)	M18-Au34582	CP	mg/L	0.04	0.03	16	30%	Pass
Chlorophyll a	M18-Au34582	CP	ug/L	< 5	< 5	<1	30%	Pass
Nitrate & Nitrite (as N)	M18-Au34582	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass
Nitrate (as N)	M18-Au34582	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass
Nitrite (as N)	M18-Au34582	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass
Suspended Solids	M18-Au34582	CP	mg/L	16	15	9.0	30%	Pass

## Comments

### Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

### Qualifier Codes/Comments

Code	Description
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

## Authorised By

Natalie Krasselt	Analytical Services Manager
Alex Petridis	Senior Analyst-Metal (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Michael Brancati	Senior Analyst-Inorganic (VIC)



**Glenn Jackson**

### National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

\* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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APPENDIX

INLAND  
RAIL 

G

# Surface Water Quality Technical Report

## Appendix B Field Data Sheets

NORTH STAR TO NSW/QUEENSLAND BORDER ENVIRONMENTAL IMPACT STATEMENT

ARTC

The Australian Government is delivering  
Inland Rail through the Australian  
Rail Track Corporation (ARTC), in  
partnership with the private sector.

Date 21-8-18 Site No. #1 Time 1135 Recorder's Name SARAH CLAUERTRiver Name MOBBINDRY CREEK Location LOT 9 DP 756010Weather CLAR+ SUNNY Rain in last week? Y ☐ N ☒ Photograph numbers and details \_\_\_\_\_Latitude: 

deg	min	sec
28	86	98

 73 Longitude: 

deg	min	sec
150	40	18

 01

GPS Name and Datum \_\_\_\_\_

ON COLLECTOR  
(001) U/S - 1+2, CENTRE 3+4, D/S - 5+6  
(001 D/S) U/S - 1+2, CENTRE 3+4, D/S - 5+6  
(001 - MUSSEL)

## PLANFORM SKETCH OF SITE

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.  
Left bank is facing downstream.

## LENGTH OF SAMPLING SITE

Bankfull width \_\_\_\_\_ (m)

x 10

Length of sampling site \_\_\_\_\_ (m)

## Notes

SITE D/S OF ROAD CROSSING  
EXISTING RAIL LINE  
NUMEROUS FRESHWATER MUSSELS  
OBSERVED IN DRY RIVER BED  
(ALATHYRIA PROBUGA)BEFORE LEAVING THE  
SITE, CHECK DATA  
SHEETS TO ENSURE  
THAT ALL VARIABLES  
HAVE BEEN RECORDED

## BASIC WATER CHEMISTRY

Temperature 20.5 °C  
 Conductivity \_\_\_\_\_  
 Dissolved Oxygen \_\_\_\_\_ mg l<sup>-1</sup>  
 Dissolved Oxygen Sat. \_\_\_\_\_ %  
 pH \_\_\_\_\_  
 Turbidity \_\_\_\_\_  
 Total phosphorus ☐ \_\_\_\_\_  
 Total nitrogen ☐ \_\_\_\_\_  
 ALKALINITY  
 Amount of water \_\_\_\_\_ ml  
 Amount of H<sub>2</sub>SO<sub>4</sub> \_\_\_\_\_ ml  
 Alkalinity \_\_\_\_\_ mg l<sup>-1</sup>

Water sample taken?

## Valley shape

Choose one category only

	<input type="checkbox"/> Steep valley
	<input type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input checked="" type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

## Local impacts on streams

Choose one or more categories and describe the detail of each

- |                                                            |                                                  |
|------------------------------------------------------------|--------------------------------------------------|
| <input type="checkbox"/> Sand or gravel mining             | <input type="checkbox"/> Sewage effluent         |
| <input type="checkbox"/> Other mining                      | <input type="checkbox"/> Channel straightening   |
| <input type="checkbox"/> Road                              | <input type="checkbox"/> River improvement works |
| <input type="checkbox"/> Bridge / culvert / wharf          | <input type="checkbox"/> Water extraction        |
| <input type="checkbox"/> Ford / ramp                       | <input type="checkbox"/> Dredging                |
| <input type="checkbox"/> Discharge pipe                    | <input checked="" type="checkbox"/> Grazing      |
| <input type="checkbox"/> Forestry activities               | <input type="checkbox"/> Litter                  |
| <input type="checkbox"/> Sugar mill                        | <input type="checkbox"/> Recreation              |
| <input type="checkbox"/> Irrigation run-off or pipe outlet | <input type="checkbox"/> Other                   |

Description \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Floodplain width

\_\_\_\_\_ Average 5 (m)  
FLOOD PLAIN CANNOT BE DETERMINED

## Floodplain features

Choose one or more features when present

- |                                                                                                                                           |                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> Sampling site has no distinct floodplain                                                                         | <input type="checkbox"/> Scroll systems<br>Short, crescentic strips or patches formed along the inner bank of a stream meander                               |
| <input type="checkbox"/> Oxbows / billabongs<br>Body of water occupying a former river meander, isolated by a shift in the stream channel | <input type="checkbox"/> Splays<br>Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain       |
| <input type="checkbox"/> Remnant channels<br>Formed during a previous hydrological regime. May be infilled with sediment                  | <input type="checkbox"/> Floodplain scours<br>Scour holes formed by the concentrated clearing and digging action of flowing water                            |
| <input type="checkbox"/> Flood channels<br>A channel that distributes water onto the floodplain and off the floodplain during floods      | <input checked="" type="checkbox"/> No floodplain features present<br>Floodplain present at the sampling site but does not contain any of the above features |

## Local landuse

Choose one category for each bank

- | Left                                | Right                                                                      |
|-------------------------------------|----------------------------------------------------------------------------|
| <input type="checkbox"/>            | <input type="checkbox"/> Native forest                                     |
| <input type="checkbox"/>            | <input type="checkbox"/> Native grassland (not grazed)                     |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> Grazing (native or non-native pasture) |
| <input type="checkbox"/>            | <input type="checkbox"/> Exotic grassland (lawns etc., no grazing)         |
| <input type="checkbox"/>            | <input type="checkbox"/> Forestry Native [ ] [ ] Pine [ ] [ ]              |
| <input type="checkbox"/>            | <input type="checkbox"/> Cropped Rainfed [ ] [ ] Irrigated [ ] [ ]         |
| <input type="checkbox"/>            | <input type="checkbox"/> Urban residential                                 |
| <input type="checkbox"/>            | <input type="checkbox"/> Commercial                                        |
| <input type="checkbox"/>            | <input type="checkbox"/> Industrial or intensive agricultural              |
| <input type="checkbox"/>            | <input type="checkbox"/> Recreation                                        |
| <input type="checkbox"/>            | <input type="checkbox"/> Other _____                                       |

**Riparian zone composition**

Assess for whole sampling site

	% Cover		Vegetation Description
Trees (>10m in height)	<u>15</u>	} May total more than 100%	<u>EUC. TUT + BRIGALOW + EUC. POP</u>
Trees (<10m in height)	<u>10</u>		<u>AS ABOVE</u>
Shrubs	<u>1</u>		<u>ACACIA SP</u>
Grasses / ferns / sedges	<u>80</u>		<u>NATIVE GRASS</u>

**Shading of channel**
☐ < 5%    ☐ 6 – 25%    ☒ 26 – 50%    ☐ 51 – 75%    ☐ > 76%
**Extent of trailing bank vegetation**
☐ nil    ☒ moderate  
☐ slight    ☐ extensive
**Native and exotic riparian vegetation**
 % Native 80 } Total 100%  
 % Exotic 20
**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

		Left bank	Right bank
None		<input type="checkbox"/>	<input type="checkbox"/>
Isolated / scattered		<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Occasional clumps		<input type="checkbox"/>	<input type="checkbox"/>
Semi-continuous		<input type="checkbox"/>	<input type="checkbox"/>
Continuous		<input type="checkbox"/>	<input type="checkbox"/>

**Regeneration of native woody vegetation**

Is the sampling site in undisturbed forest?

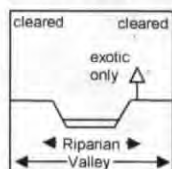
Y [ ] N [X]

If no, record regeneration category

☐ Abundant (>5% cover) and healthy  
☐ Present  
☒ Very limited (<1% cover)

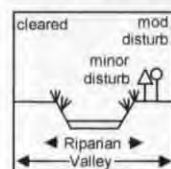
**Overall vegetation disturbance rating**

Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

**Extreme disturbance** ☐

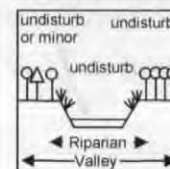
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie. dominated by exotic species with native species rare or completely absent)

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**High disturbance** ☐

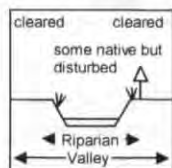
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain

**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

**Low disturbance** ☐

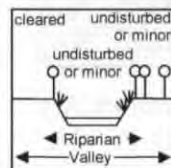
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor.

**Valley vegetation** – native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species

**Very high disturbance** ☒

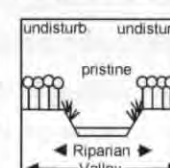
**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover.

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**Moderate disturbance** ☐

**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state






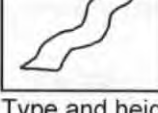
**Very low disturbance** ☐

**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

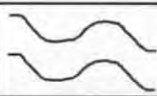



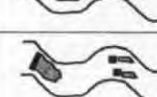


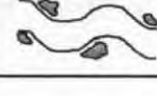
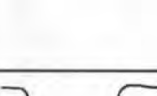
**Physical barriers to local fish passage**

Choose one category for each flow condition




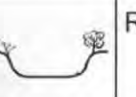




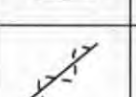
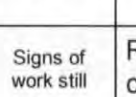
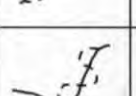
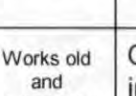
		Base flow	Low flow	High flow
	No passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Moderately restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Good passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Type and height of barrier(s) NIL**Type of bars**

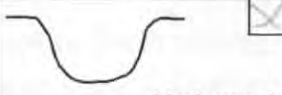

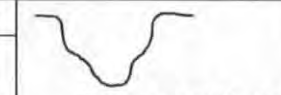



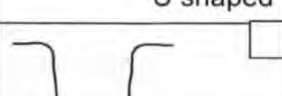
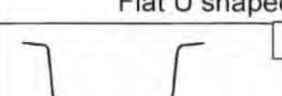
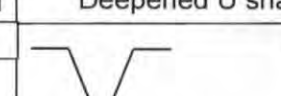
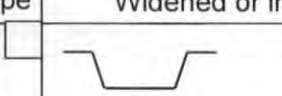

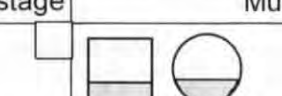
Choose one or more categories

	Bars absent	<input type="checkbox"/>
	Side/point bars VEGETATED	<input checked="" type="checkbox"/>
	Side/point bars UNVEGETATED	<input type="checkbox"/>
	Mid-channel bars VEGETATED	<input type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input type="checkbox"/>
	Bars around obstructions	<input type="checkbox"/>
	Braided channel	<input checked="" type="checkbox"/>
	Infilled channel	<input type="checkbox"/>
	High flow deposits	<input type="checkbox"/>

**Extent of bars**% of streambed forming a bar of any type 5 %**Dominant sediment particle size on bars**
 Boulder/cobble [ ] Pebble [ ] Gravel [ ]  
 Sand [ ] Silt/clay ☒ or \_\_\_\_\_ mm
**Channel modifications** Choose one or more categories

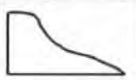


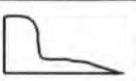

	No modifications	<input checked="" type="checkbox"/>		Reinforced	<input type="checkbox"/>
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>
	Dams and diversions	<input type="checkbox"/>		Infilled	<input type="checkbox"/>
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input type="checkbox"/>
	Straightened	<input type="checkbox"/>		Signs of work still	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>		Works old and revegetated	<input type="checkbox"/>
				Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
U shaped		Flat U shaped		Deepened U shape		Widened or infilled		Two stage		Multi stage	
	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
Box		Wide box		V shaped		Trapezoid		Concrete V		Pipe or culvert	

**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input type="checkbox"/>	<input type="checkbox"/>
	Convex	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Stepped	<input type="checkbox"/>	<input type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>

**Factors affecting bank stability**

Choose one or more categories

<input type="checkbox"/> None	<input type="checkbox"/> Cleared vegetation
<input type="checkbox"/> Mining	<input type="checkbox"/> Irrigation draw-down
<input type="checkbox"/> Runoff	<input type="checkbox"/> Reservoir releases
<input checked="" type="checkbox"/> Stock access	<input type="checkbox"/> Seepage
<input type="checkbox"/> Human access	<input type="checkbox"/> Flow and waves
<input checked="" type="checkbox"/> Ford, culvert or bridge	<input type="checkbox"/> Drainpipes
<input type="checkbox"/> Feral animals	
<input type="checkbox"/> Other	

Description \_\_\_\_\_

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**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input type="checkbox"/>	<input type="checkbox"/>
	Moderate 30 - 60°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Low 10 - 30°	<input type="checkbox"/>	<input type="checkbox"/>
	Flat <10°	<input type="checkbox"/>	<input type="checkbox"/>

**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops

% bedrock outcrops Left bank 0

Right Bank 0

**Artificial bank protection measures**

Choose one or more categories

<input checked="" type="checkbox"/> None	<input type="checkbox"/> Fenced stock watering points
<input type="checkbox"/> Fence structures	<input type="checkbox"/> Vegetation plantings
<input type="checkbox"/> Levee banks	<input type="checkbox"/> Logs strapped to bank
<input type="checkbox"/> Rock or wall layer	<input type="checkbox"/> Concrete channel lining
<input type="checkbox"/> Rip rap	
<input type="checkbox"/> Fenced human access	
<input type="checkbox"/> Other	

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**Sediment oils**

☒ absent ☐ light ☐ moderate ☐ profuse

**Water oils**

☒ none ☐ flecks ☐ globs ☐ sheen ☐ slick

**Sediment odours**

☒ normal/none ☐ sewage ☐ petroleum ☐ chemical

☐ anaerobic ☐ other \_\_\_\_\_

**Water odours**

☒ normal/none ☐ sewage ☐ petroleum ☐ chemical

☐ other DRY

**Turbidity (visual assessment)**

☐ Clear ☐ Slight ☐ Turbid ☐ Opaque

Is water clarity reduced by:

☐ Suspended material (e.g mud, clay, organics) ☐ Dissolved material (e.g plant leachates)

**Water level at the time of sampling**

☒ Dry ☐ No flow ☐ Low ☐ Baseflow or near baseflow

☐ High ☐ Flood (don't sample)

**Artificial features at the sampling site**

Choose one or more categories

☐ Major ☐ Minor ☒ Ford ☐ Bridge ☐ Culvert ☐ Other weir

Description

LATE BRIDGE 4/5

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**Large woody debris**

Overall % cover of logs and branches greater than 10cm in diameter

1 % Notes on visibility \_\_\_\_\_









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**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<b>Waterfall</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Step Height <1m Gradient 5-60° Strong currents		<b>Cascade</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Gradient 3-5° Strong currents Rocks break surface		<b>Rapid</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		<b>Riffle</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small currents Surface unbroken and smooth		<b>Glide</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small but distinct & uniform current Surface unbroken		<b>Run</b>	90 % of site 200 Est. Av. Length (m) 0.3 Est. Av. Depth (m) 6 Est. Av. Width (m)
Area where stream widens or deepens and current declines		<b>Pool</b>	10 % of site 55 Est. Av. Length (m) 0.7 Est. Av. Depth (m) 6 Est. Av. Width (m)
A reasonable sized (>20% of channel width) cut-off section away from		<b>Backwater</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)

Note: An additional response variable planform channel pattern is measured in the office

**Macrophyte cover** Assess % cover of the sampling site by each category.

Overall % cover of macrophytes 5 }  
 % cover of emergent macrophytes 5  
 % cover of floating macrophytes 0  
 % cover of submerged macrophytes 0 } Total should equal overall % cover of macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory.

N denotes a native taxa and I denotes an introduced taxa.

**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	_____
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	_____
<i>Cyperus</i> (Sedge) I/N	<input type="checkbox"/>	_____
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	_____
<i>Juncus</i> (Rush) I/N	<input type="checkbox"/>	_____
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	_____
<i>Phragmites</i> (Common Reed) N	<input type="checkbox"/>	_____
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	_____
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	_____
Other <u>Carex</u>	<input type="checkbox"/>	5
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	_____
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	_____
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	_____
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____






**Floating macrophytes**

	Present	%
<i>Azolla</i> (Azolla) N	<input type="checkbox"/>	_____
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

Overall % cover of native macrophyte taxa 100 }  
 Overall % cover of native macrophyte taxa 0 } Total should equal overall % cover of macrophytes from above


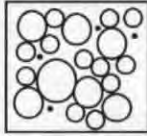
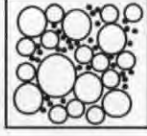
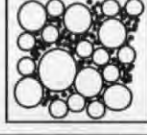
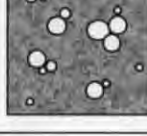
**Bed compaction**

Choose one category only

	Tightly packed, armoured Array of sediment sizes, overlapping, tightly packed and very hard to dislodge	<input type="checkbox"/>
	Packed, unarmoured Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate	<input type="checkbox"/>
	Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate	<input type="checkbox"/>
	Low compaction (1) Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily	<input type="checkbox"/>
	Low compaction (2) Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily	<input checked="" type="checkbox"/>

**Sediment matrix**







Choose one category only

	Bedrock	<input type="checkbox"/>
	Open framework 0-5% fine sediment, high availability of interstitial spaces	<input type="checkbox"/>
	Matrix filled contact framework 5-32% fine sediment, moderate availability of interstitial spaces	<input type="checkbox"/>
	Framework diluted 32-60% fine sediment, low availability of interstitial spaces	<input type="checkbox"/>
	Matrix dominated >60% fine sediment, interstitial spaces virtually absent	<input checked="" type="checkbox"/>

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	Very angular	<input type="checkbox"/>
	Angular	<input type="checkbox"/>
	Sub-angular	<input checked="" type="checkbox"/>
	Rounded	<input type="checkbox"/>
	Well rounded	<input type="checkbox"/>
	Cobble, pebble and gravel fractions not present	<input type="checkbox"/>

In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding

Stable

Unstable - depositing

<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material.	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked, but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.
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USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>1. Epifaunal substrate / available cover</b>	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					40-70% mix of stable habitat; well-suited for full colonisation potential, adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>2. Embeddedness</b>	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>3. Velocity / depth regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep).					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>4. Sediment deposition</b>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>5. Channel flow status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>6. Channel alteration</b>	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Frequency of riffles (or bends)</b>	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7.1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	0			

TOTAL HIGH GRADIENT HABITAT SCORE

Site No. 001Date 21-8-18USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

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Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
1. Epifaunal substrate / available cover	Greater than 50% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					30-50% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Pool substrate characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.					Mixture of soft sand, mud or clay; mud may be dominant; some root mats and submerged vegetation present.					All mud or clay or sand bottom; little or no root mat; no submerged vegetation.					Hard-pan clay or bedrock; no root mat or vegetation.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.					Majority of pools large-deep; very few shallow.					Shallow pools much more prevalent than deep pools.					Majority of pools small-shallow or pools absent.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Channel sinuosity</b> The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas)																					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b> Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.						Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars					
<b>SCORE</b>	Left bank					10	9	8	7	6	5	4	3	2	1	0					
<b>SCORE</b>	Right bank					10	9	8	7	6	5	4	3	2	1	0					
<b>9. Vegetative protection (score each bank)</b> More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.						70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
<b>SCORE</b>	Left bank					10	9	8	7	6	5	4	3	2	1	0					
<b>SCORE</b>	Right bank					10	9	8	7	6	5	4	3	2	1	0					
<b>10. Riparian zone score (score each bank)</b> Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.						Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
<b>SCORE</b>	Left bank					10	9	8	7	6	5	4	3	2	1	0					
<b>SCORE</b>	Right bank					10	9	8	7	6	5	4	3	2	1	0					

TOTAL LOW GRADIENT HABITAT SCORE

☒ <10%    ☐ 10-35%    ☐ 35-65%    ☐ 65-90%    ☐ >90%

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)**  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)**  **A**

**Stream width at the water surface (m)**

**Bank height (m)**

**Bank width (m)**  **B**

**Vertical distance between the water surface and the water mark (m)**

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)**

**Bank width (m)**  **c**

**Vertical distance between the water surface and the water mark (m)**

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

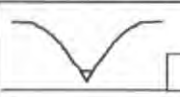

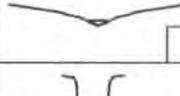
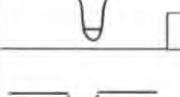

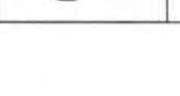
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2002-1625+1626, 2002-1627+1628, 2002-1629+1630, 2002-1631+1632, 2002-1633+1634, 2002-1635+1636, 2002-1637+1638, 2002-1639+1640, 2002-1641+1642, 2002-1643+1644, 2002-164

## BASIC WATER CHEMISTRY

	Units
Temperature <u>12.1</u>	°C
Conductivity	
Dissolved Oxygen	mg l <sup>-1</sup>
Dissolved Oxygen Sat.	%
pH	
Turbidity	
Total phosphorus <input type="checkbox"/>	
Total nitrogen <input type="checkbox"/>	
Water sample taken?	
ALKALINITY	
Amount of water	ml
Amount of H <sub>2</sub> SO <sub>4</sub>	ml
Alkalinity	mg l <sup>-1</sup>

## Valley shape

Choose one category only

	<input type="checkbox"/> Steep valley
	<input type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input checked="" type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

## Local impacts on streams

Choose one or more categories and describe the detail of each

<input type="checkbox"/> Sand or gravel mining	<input type="checkbox"/> Sewage effluent
<input type="checkbox"/> Other mining	<input type="checkbox"/> Channel straightening
<input type="checkbox"/> Road	<input type="checkbox"/> River improvement works
<input type="checkbox"/> Bridge / culvert / wharf	<input type="checkbox"/> Water extraction
<input type="checkbox"/> Ford / ramp	<input type="checkbox"/> Dredging
<input type="checkbox"/> Discharge pipe	<input checked="" type="checkbox"/> Grazing
<input type="checkbox"/> Forestry activities	<input type="checkbox"/> Litter
<input type="checkbox"/> Sugar mill	<input type="checkbox"/> Recreation
<input type="checkbox"/> Irrigation run-off or pipe outlet	<input type="checkbox"/> Other

Description \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Floodplain width

\_\_\_\_\_ Average \_\_\_\_\_ (m)

Flood 10m 10m 10m 10m

## Floodplain features

Choose one or more features when present

<input type="checkbox"/> Sampling site has no distinct floodplain	<input type="checkbox"/> Scroll systems Short, crescentic strips or patches formed along the inner bank of a stream meander
<input type="checkbox"/> Oxbows / billabongs Body of water occupying a former river meander, isolated by a shift in the stream channel	<input type="checkbox"/> Splays Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain
<input type="checkbox"/> Remnant channels Formed during a previous hydrological regime. May be infilled with sediment	<input type="checkbox"/> Floodplain scours Scour holes formed by the concentrated clearing and digging action of flowing water
<input type="checkbox"/> Flood channels A channel that distributes water onto the floodplain and off the floodplain during floods	<input checked="" type="checkbox"/> No floodplain features present Floodplain present at the sampling site but does not contain any of the above features

## Local landuse

Choose one category for each bank

Left	Right
<input type="checkbox"/>	<input type="checkbox"/> Native forest
<input type="checkbox"/>	<input type="checkbox"/> Native grassland (not grazed)
<input checked="" type="checkbox"/>	<input type="checkbox"/> Grazing (native or non-native pasture)
<input type="checkbox"/>	<input type="checkbox"/> Exotic grassland (lawns etc., no grazing)
<input type="checkbox"/>	<input type="checkbox"/> Forestry Native [ ] [ ] Pine [ ] [ ]
<input type="checkbox"/>	<input type="checkbox"/> Cropped Rainfed [ ] [ ] Irrigated [ ] [ ]
<input type="checkbox"/>	<input type="checkbox"/> Urban residential
<input type="checkbox"/>	<input type="checkbox"/> Commercial
<input type="checkbox"/>	<input type="checkbox"/> Industrial or intensive agricultural
<input type="checkbox"/>	<input type="checkbox"/> Recreation
<input type="checkbox"/>	<input type="checkbox"/> Other _____

**Riparian zone composition**

Assess for whole sampling site

	% Cover	Vegetation Description
Trees (>10m in height)	80	} May total more than 100% LUC, TUR + ACACIA sp. WILGA + WOBBOR BUSH MYRTLE + EXOTIC GRASSES
Trees (<10m in height)	10	
Shrubs	5	
Grasses / ferns / sedges	50	

**Shading of channel**
☐ < 5%    ☐ 6 – 25%    ☐ 26 – 50%    ☒ 51 – 75%    ☐ > 76%
**Extent of trailing bank vegetation**
☐ nil    ☒ moderate  
☐ slight    ☐ extensive
**Native and exotic riparian vegetation**
 % Native 30 } Total 100%  
 % Exotic 70
**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

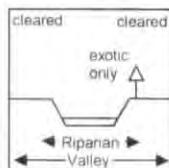
		Left bank	Right bank
None		<input type="checkbox"/>	<input type="checkbox"/>
Isolated / scattered		<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps		<input type="checkbox"/>	<input type="checkbox"/>
Semi-continuous		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Continuous		<input type="checkbox"/>	<input type="checkbox"/>

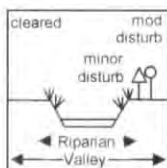
**Regeneration of native woody vegetation**

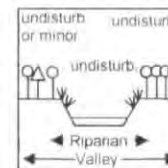
Is the sampling site in undisturbed forest?

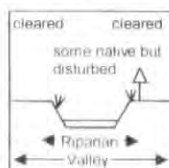
Y[ ] N[☒]
 If no, record regeneration category  
☐ Abundant (>5% cover) and healthy  
☐ Present  
☐ Very limited (<1% cover)
**Overall vegetation disturbance rating**

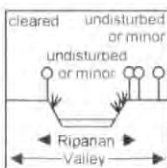
Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

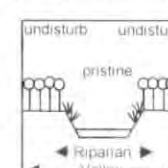
**Extreme disturbance** ☐
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie dominated by exotic species with native species rare or completely absent)

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc)
**High disturbance** ☒
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain

**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present
**Low disturbance** ☐
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor

**Valley vegetation** – native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species
**Very high disturbance** ☒
**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover






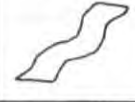
**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc)
**Moderate disturbance** ☐
**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state
**Very low disturbance** ☐
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Physical barriers to local fish passage**








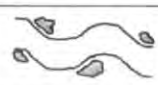
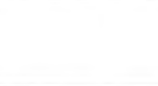
Choose one category for each flow condition

		Base flow	Low flow	High flow
	No passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Moderately restricted passage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Good passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Type and height of barrier(s)

**Type of bars**



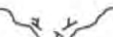


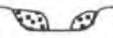



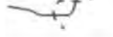
Choose one or more categories

	Bars absent	<input type="checkbox"/>
	Side/point bars VEGETATED	<input type="checkbox"/>
	Side/point bars UNVEGETATED	<input type="checkbox"/>
	Mid-channel bars VEGETATED	<input type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input checked="" type="checkbox"/>
	Bars around obstructions	<input type="checkbox"/>
	Braided channel	<input type="checkbox"/>
	Infilled channel	<input type="checkbox"/>
	High flow deposits	<input type="checkbox"/>












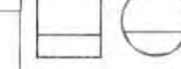
**Extent of bars**

% of streambed forming a bar of any type 1 %

**Dominant sediment particle size on bars**
 Boulder/cobble [ ] Pebble [ ] Gravel [ ]  
 Sand [ ] Silt/clay [x] or \_\_\_\_\_ mm
**Channel modifications** Choose one or more categories






	No modifications	<input checked="" type="checkbox"/>		Reinforced	<input type="checkbox"/>
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>
	Dams and diversions	<input type="checkbox"/>		Infilled	<input type="checkbox"/>
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input type="checkbox"/>
	Straightened	<input type="checkbox"/>	Signs of work still	Recently channelised	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>	Works old and revegetated	Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	U shaped	<input type="checkbox"/>		Flat U shaped	<input type="checkbox"/>		Deepened U shape	<input type="checkbox"/>		Widened or infilled	<input type="checkbox"/>		Two stage	<input type="checkbox"/>		Multi stage	<input type="checkbox"/>
	Box	<input type="checkbox"/>		Wide box	<input type="checkbox"/>		V shaped	<input type="checkbox"/>		Trapezoid	<input type="checkbox"/>		Concrete V	<input type="checkbox"/>		Pipe or culvert	<input type="checkbox"/>


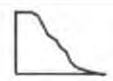

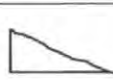
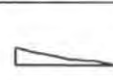
**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Convex	<input type="checkbox"/>	<input type="checkbox"/>
	Stepped	<input type="checkbox"/>	<input type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>

**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input type="checkbox"/>	<input type="checkbox"/>
	Moderate 30 - 60°	<input type="checkbox"/>	<input type="checkbox"/>
	Low 10 - 30°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Flat <10°	<input type="checkbox"/>	<input type="checkbox"/>

**Sediment oils**
☒ absent ☐ light ☐ moderate ☐ profuse
**Water oils**
☒ none ☐ flecks ☐ globs ☐ sheen ☐ slick
**Sediment odours**
☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ anaerobic ☐ other \_\_\_\_\_
**Water odours**
☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ other \_\_\_\_\_
**Turbidity (visual assessment)**
☐ Clear ☐ Slight ☐ Turbid ☐ Opaque

Is water clarity reduced by:

☐ Suspended material (e.g. mud, clay, organics) ☐ Dissolved material (e.g. plant leachates)
**Water level at the time of sampling**
☒ Dry ☐ No flow ☐ Low ☐ Baseflow or near baseflow  
☐ High ☐ Flood (don't sample)
**Artificial features at the sampling site**

Choose one or more categories

☐ Major ☐ Minor ☐ Ford ☐ Bridge ☐ Culvert ☐ Other weir

 Description \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
**Large woody debris**

Overall % cover of logs and branches greater than 10cm in diameter

 \_\_\_\_\_ % Notes on visibility \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
**Factors affecting bank stability**

Choose one or more categories

☐ None ☐ Cleared vegetation  
☐ Mining ☐ Irrigation draw-down  
☐ Runoff ☐ Reservoir releases  
☒ Stock access ☐ Seepage  
☐ Human access ☐ Flow and waves  
☐ Ford, culvert or bridge ☐ Drainpipes  
☐ Feral animals ☐ Other  
☐ Other

 Description \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops

 % bedrock outcrops Left bank \_\_\_\_\_  
 Right Bank \_\_\_\_\_
**Artificial bank protection measures**



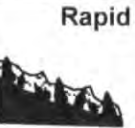





Choose one or more categories

☒ None ☐ Fenced stock watering points  
☐ Fence structures ☐ Vegetation plantings  
☐ Levee banks ☐ Logs strapped to bank  
☐ Rock or wall layer ☐ Concrete channel lining  
☐ Rip rap  
☐ Fenced human access  
☐ Other \_\_\_\_\_

 \_\_\_\_\_  
 \_\_\_\_\_

**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<u>0</u> % of site ____ Est. Av. Length (m) ____ Est. Av. Height (m) ____ Est. Av. Gradient (°)
Step Height <1m Gradient 5-60° Strong currents		<u>0</u> % of site ____ Est. Av. Length (m) ____ Est. Av. Height (m) ____ Est. Av. Gradient (°)
Gradient 3-5° Strong currents Rocks break surface		<u>0</u> % of site ____ Est. Av. Length (m) ____ Est. Av. Depth (m) ____ Est. Av. Width (m)
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		<u>0</u> % of site ____ Est. Av. Length (m) ____ Est. Av. Depth (m) ____ Est. Av. Width (m)
Gradient 1-3° Small currents Surface unbroken and smooth		<u>0</u> % of site ____ Est. Av. Length (m) ____ Est. Av. Depth (m) ____ Est. Av. Width (m)
Gradient 1-3° Small but distinct & uniform current Surface unbroken		<u>100</u> % of site <u>2.0</u> Est. Av. Length (m) <u>1.0</u> Est. Av. Depth (m) <u>2</u> Est. Av. Width (m)
Area where stream widens or deepens and current declines		____ % of site ____ Est. Av. Length (m) ____ Est. Av. Depth (m) ____ Est. Av. Width (m)
A reasonable sized (>20% of channel width) cut-off section away from		____ % of site ____ Est. Av. Length (m) ____ Est. Av. Depth (m) ____ Est. Av. Width (m)

Note: An additional response variable planform channel pattern is measured in the office**Macrophyte cover** Assess % cover of the sampling site by each category.

Overall % cover of macrophytes 5 % cover of emergent macrophytes 5  
 % cover of floating macrophytes \_\_\_\_\_  
 % cover of submerged macrophytes \_\_\_\_\_

Total should equal overall % cover of macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory. N denotes a native taxa and I denotes an introduced taxa.

**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	_____
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	_____
<i>Cyperus</i> (Sedge) I/N	<input type="checkbox"/>	_____
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	_____
<i>Juncus</i> (Rush) I/N	<input type="checkbox"/>	_____
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	_____
<i>Phragmites</i> (Common Reed) N	<input type="checkbox"/>	_____
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	_____
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	_____
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	_____
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	_____
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____


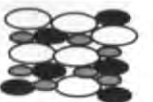



**Floating macrophytes**

	Present	%
<i>Azolla</i> (Azolla) N	<input type="checkbox"/>	_____
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

Overall % cover of native macrophyte taxa \_\_\_\_\_ } Total should equal overall % cover of macrophytes from above  
 Overall % cover of native macrophyte taxa \_\_\_\_\_ }


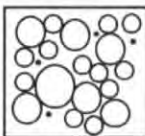
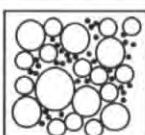
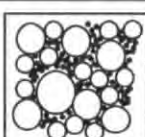
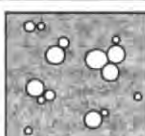
**Bed compaction**

Choose one category only

	<b>Tightly packed, armoured</b> Array of sediment sizes, overlapping, tightly packed and very hard to dislodge
	<b>Packed, unarmoured</b> Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate
	<b>Moderate compaction</b> Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate
	<b>Low compaction (1)</b> Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily
	<b>Low compaction (2)</b> Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily

**Sediment matrix**






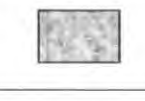
Choose one category only

	<b>Bedrock</b>
	<b>Open framework</b> 0-5% fine sediment, high availability of interstitial spaces
	<b>Matrix filled contact framework</b> 5-32% fine sediment, moderate availability of interstitial spaces
	<b>Framework dilated</b> 32-60% fine sediment, low availability of interstitial spaces
	<b>Matrix dominated</b> >60% fine sediment, interstitial spaces virtually absent

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	<b>Very angular</b>
	<b>Angular</b>
	<b>Sub-angular</b>
	<b>Rounded</b>
	<b>Well rounded</b>
	<b>Cobble, pebble and gravel fractions not present</b>

In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding ← ————— Stable ————— → Unstable - depositing				
<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material.	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked, but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>1. Epifaunal substrate / available cover</b>	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient)					40-70% mix of stable habitat; well-suited for full colonisation potential, adequate habitat for maintenance of populations, presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale)					20-40% mix of stable habitat; habitat availability less than desirable, substrate frequently disturbed or removed					Less than 20% stable habitat; lack of habitat is obvious, substrate unstable or lacking					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>2. Embeddedness</b>	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>3. Velocity / depth regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep).					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>4. Sediment deposition</b>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material; increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>5. Channel flow status</b>	Water reaches base of both lower banks; and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel, or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>6. Channel alteration</b>	Channelization or dredging absent or minimal, stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement, over 80% of the stream reach channelized and disrupted; instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Frequency of riffles (or bends)</b>	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7.1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			

TOTAL HIGH GRADIENT HABITAT SCORE

Site No. 002Date 21-8-12

## USEPA Habitat Assessment

## LOW GRADIENT STREAMS

Page 1 of 2

Circle a score for each parameter

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>1. Epifaunal substrate / available cover</b> Greater than 50% of substrate favourable for epifaunal colonisation and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient)																					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>2. Pool substrate characterization</b> Mixture of substrate materials, with gravel and firm sand prevalent, root mats and submerged vegetation common.																					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>3. Pool variability</b> Even mix of large-shallow, large-deep, small-shallow, small-deep pools present																					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>4. Sediment deposition</b> Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition																					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>5. Channel flow status</b> Water reaches base of both lower banks, and minimal amount of channel substrate is exposed																					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>6. Channel alteration</b> Channelization or dredging absent or minimal, stream with normal pattern																					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

Site No. 002Date 21-8-18USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Channel sinuosity</b> The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).																					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b> Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.						Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
<b>SCORE</b>	Left bank					10	9	8	7	6	5	4	3	2	1	0					
<b>SCORE</b>	Right bank					10	9	8	7	6	5	4	3	2	1	0					
<b>9. Vegetative protection (score each bank)</b> More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.						70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
<b>SCORE</b>	Left bank					10	9	8	7	6	5	4	3	2	1	0					
<b>SCORE</b>	Right bank					10	9	8	7	6	5	4	3	2	1	0					
<b>10. Riparian zone score (score each bank)</b> Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.						Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
<b>SCORE</b>	Left bank					10	9	8	7	6	5	4	3	2	1	0					
<b>SCORE</b>	Right bank					10	9	8	7	6	5	4	3	2	1	0					

TOTAL LOW GRADIENT HABITAT SCORE

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

**Cross-section number** 1 **of** 2

**Type of bedform at the cross-section**  
☐ Riffle ☒ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** 33  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** 11 **A**

**Stream width at the water surface (m)** 0

**Bank height (m)** 1.5

**Bank width (m)** 10 **B**

**Vertical distance between the water surface and the water mark (m)** 2.0

**Bank height (m)** 1.5

**Bank width (m)** 12 **C**

**Vertical distance between the water surface and the water mark (m)** 2.0

**Horizontal distances (m)**

1	2	3	4	5	6	7	8	9	10	11									

**Vertical water depths (cm)**

**Notes on cross-section measurement****Riparian zone width**

Left bank 6 (m) Right bank 6 (m)

**Bank material**

Assess % composition for each bank

Left bank Right bank

Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	<u>100</u>	<u>100</u>
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	<u>100</u>

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number** 2 **of** 2

**Type of bedform at the cross-section**  
☐ Riffle ☒ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** 30  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** 11 A

**Stream width at the water surface (m)** 0

**Bank height (m)**  
1.6

**Bank width (m)** 5 B

**Vertical distance between the water surface and the water mark (m)**  
2.0

**Horizontal distances (m)**

1	2	3	4	5	6	7	8	9	10	11				

**Vertical water depths (cm)**

**Bank height (m)**  
1.6

**Bank width (m)** 16 C

**Vertical distance between the water surface and the water mark (m)**  
2.0

Left bank 5 (m) Right bank 9 (m)

Left bank    Right bank

Fines (silt and clay, <0.06mm)

APPENDIX

Total 100% each

Fines (silt and clay <0.06mm)

Total 100%

☒ <10%    ☐ 10-35%    ☐ 35-65%    ☐ 65-90%    ☐ >90%

**Channel cross-sections and variables to be measured in the area around a cross section**

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Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)**  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)**

**Bank height (m)**

**Bank width (m)** B

**Vertical distance between the water surface and the water mark (m)**

**Horizontal distances (m)**

**Vertical water depths (cm)**

**Bank height (m)**

**Bank width (m)** C

**Vertical distance between the water surface and the water mark (m)**

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

0024/5 1.2 W/S, NO CCM, 3.1.2

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features. Left bank is facing downstream.

x 10

Length of sampling site 2.1 (m)

## Notes

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BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES HAVE BEEN RECORDED

Y

## BASIC WATER CHEMISTRY

Temperature                      °C

Conductivity                     

Dissolved Oxygen                      mg l<sup>-1</sup>

Dissolved Oxygen Sat.                      %

pH                     

Turbidity                     

Total phosphorus ☐                     

Total nitrogen ☐                     

ALKALINITY

Amount of water                      ml





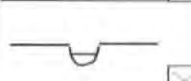

Amount of H<sub>2</sub>SO<sub>4</sub>                      ml

Alkalinity                      mg l<sup>-1</sup>

Water sample taken?

## Valley shape

Choose one category only

	<input type="checkbox"/> Steep valley
	<input type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input checked="" type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

## Local impacts on streams

Choose one or more categories and describe the detail of each

- |                                                            |                                                  |
|------------------------------------------------------------|--------------------------------------------------|
| <input type="checkbox"/> Sand or gravel mining             | <input type="checkbox"/> Sewage effluent         |
| <input type="checkbox"/> Other mining                      | <input type="checkbox"/> Channel straightening   |
| <input type="checkbox"/> Road                              | <input type="checkbox"/> River improvement works |
| <input type="checkbox"/> Bridge / culvert / wharf          | <input type="checkbox"/> Water extraction        |
| <input type="checkbox"/> Ford / ramp                       | <input type="checkbox"/> Dredging                |
| <input type="checkbox"/> Discharge pipe                    | <input checked="" type="checkbox"/> Grazing      |
| <input type="checkbox"/> Forestry activities               | <input type="checkbox"/> Litter                  |
| <input type="checkbox"/> Sugar mill                        | <input type="checkbox"/> Recreation              |
| <input type="checkbox"/> Irrigation run-off or pipe outlet | <input type="checkbox"/> Other                   |

Description                     

## Local landuse

Choose one category for each bank

- | Left                     | Right                                                              |
|--------------------------|--------------------------------------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> Native forest                             |
| <input type="checkbox"/> | <input type="checkbox"/> Native grassland (not grazed)             |
| <input type="checkbox"/> | <input type="checkbox"/> Grazing (native or non-native pasture)    |
| <input type="checkbox"/> | <input type="checkbox"/> Exotic grassland (lawns etc., no grazing) |
| <input type="checkbox"/> | <input type="checkbox"/> Forestry Native [ ] [ ] Pine [ ] [ ]      |
| <input type="checkbox"/> | <input type="checkbox"/> Cropped Rainfed [ ] [ ] Irrigated [ ] [ ] |
| <input type="checkbox"/> | <input type="checkbox"/> Urban residential                         |
| <input type="checkbox"/> | <input type="checkbox"/> Commercial                                |
| <input type="checkbox"/> | <input type="checkbox"/> Industrial or intensive agricultural      |
| <input type="checkbox"/> | <input type="checkbox"/> Recreation                                |
| <input type="checkbox"/> | <input type="checkbox"/> Other <u>                    </u>         |

## Floodplain width

                     Average                      (m)

## Floodplain features

Choose one or more features when present

- |                                                                                                                                           |                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> Sampling site has no distinct floodplain                                                                         | <input type="checkbox"/> Scroll systems<br>Short, crescentic strips or patches formed along the inner bank of a stream meander                         |
| <input type="checkbox"/> Oxbows / billabongs<br>Body of water occupying a former river meander, isolated by a shift in the stream channel | <input type="checkbox"/> Splays<br>Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain |
| <input type="checkbox"/> Remnant channels<br>Formed during a previous hydrological regime. May be infilled with sediment                  | <input type="checkbox"/> Floodplain scours<br>Scour holes formed by the concentrated clearing and digging action of flowing water                      |
| <input type="checkbox"/> Flood channels<br>A channel that distributes water onto the floodplain and off the floodplain during floods      | <input type="checkbox"/> No floodplain features present<br>Floodplain present at the sampling site but does not contain any of the above features      |

**Riparian zone composition**

Assess for whole sampling site

	% Cover		Vegetation Description
Trees (>10m in height)	<u>15</u>	} May total more than 100%	<u>MATURE EUC. TERT</u>
Trees (<10m in height)	<u>1</u>		<u>SMALL NATIVE TREE + PALM</u>
Shrubs	<u>1</u>		<u>ACACIA + SAMBUCUM</u>
Grasses / ferns / sedges	<u>85</u>		<u>SPRUE + NATIVE GRASS</u>

**Shading of channel**
☐ < 5%    ☐ 6 – 25%    ☒ 26 – 50%    ☐ 51 – 75%    ☐ > 76%
**Extent of trailing bank vegetation**
☐ nil    ☐ moderate  
☐ slight    ☒ extensive
**Native and exotic riparian vegetation**
 % Native 80  
 % Exotic 20 } Total 100%
**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

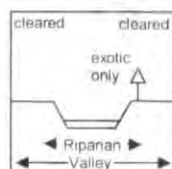
		Left bank	Right bank
None		<input type="checkbox"/>	<input type="checkbox"/>
Isolated / scattered		<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input type="checkbox"/>	<input checked="" type="checkbox"/>
Occasional clumps		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Semi-continuous		<input type="checkbox"/>	<input type="checkbox"/>
Continuous		<input type="checkbox"/>	<input type="checkbox"/>

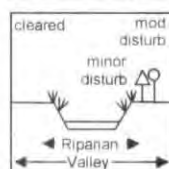
**Regeneration of native woody vegetation**

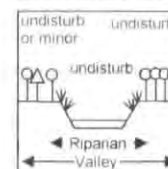
Is the sampling site in undisturbed forest?

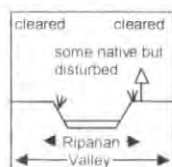
Y [ ] N [ ☒ ]
 If no, record regeneration category  
☐ Abundant (>5% cover) and healthy  
☐ Present  
☒ Very limited (<1% cover)
**Overall vegetation disturbance rating**

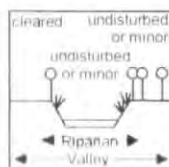
Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

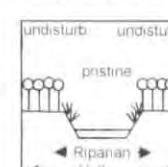
**Extreme disturbance** ☐
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie dominated by exotic species with native species rare or completely absent)

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)
**High disturbance** ☐
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain

**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present
**Low disturbance** ☐
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor.

**Valley vegetation** – native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species
**Very high disturbance** ☐
**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover.

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)
**Moderate disturbance** ☐
**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state
**Very low disturbance** ☐
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Physical barriers to local fish passage**

Choose one category for each flow condition

		Base flow	Low flow	High flow
	No passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Moderately restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Good passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Type and height of barrier(s) \_\_\_\_\_

**Type of bars**

Choose one or more categories

	Bars absent	<input checked="" type="checkbox"/>
	Side/point bars VEGETATED	<input type="checkbox"/>
	Side/point bars UNVEGETATED	<input checked="" type="checkbox"/>
	Mid-channel bars VEGETATED	<input type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input type="checkbox"/>
	Bars around obstructions	<input type="checkbox"/>
	Braided channel	<input type="checkbox"/>
	Infilled channel	<input type="checkbox"/>
	High flow deposits	<input type="checkbox"/>

**Extent of bars**

% of streambed forming a bar of any type \_\_\_\_\_ %

**Dominant sediment particle size on bars**
 Boulder/cobble [ ] Pebble [ ] Gravel [ ]  
 Sand [ ] Silt/clay [x] or \_\_\_\_\_ mm
**Channel modifications** Choose one or more categories





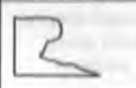
	No modifications	<input checked="" type="checkbox"/>		Reinforced	<input type="checkbox"/>
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>
	Dams and diversions	<input type="checkbox"/>		Infilled	<input type="checkbox"/>
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input type="checkbox"/>
	Straightened	<input type="checkbox"/>	Signs of work still	Recently channelised	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>	Works old and revegetated	Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	U shaped	<input type="checkbox"/>		Flat U shaped	<input type="checkbox"/>		Deepened U shape	<input type="checkbox"/>		Widened or infilled	<input type="checkbox"/>		Two stage	<input checked="" type="checkbox"/>		Multi stage	<input type="checkbox"/>
	Box	<input type="checkbox"/>		Wide box	<input type="checkbox"/>		V shaped	<input type="checkbox"/>		Trapezoid	<input type="checkbox"/>		Concrete V	<input type="checkbox"/>		Pipe or culvert	<input type="checkbox"/>

**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input type="checkbox"/>	<input type="checkbox"/>
	Convex	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Stepped	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>

**Factors affecting bank stability**

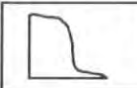
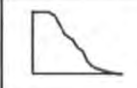

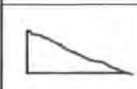
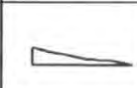
Choose one or more categories

- |                                                  |                                               |
|--------------------------------------------------|-----------------------------------------------|
| <input type="checkbox"/> None                    | <input type="checkbox"/> Cleared vegetation   |
| <input type="checkbox"/> Mining                  | <input type="checkbox"/> Irrigation draw-down |
| <input type="checkbox"/> Runoff                  | <input type="checkbox"/> Reservoir releases   |
| <input type="checkbox"/> Stock access            | <input type="checkbox"/> Seepage              |
| <input type="checkbox"/> Human access            | <input type="checkbox"/> Flow and waves       |
| <input type="checkbox"/> Ford, culvert or bridge | <input type="checkbox"/> Drainpipes           |
| <input type="checkbox"/> Feral animals           |                                               |
| <input type="checkbox"/> Other                   |                                               |

Description \_\_\_\_\_

**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input type="checkbox"/>	<input type="checkbox"/>
	Moderate 30 - 60°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Low 10 - 30°	<input type="checkbox"/>	<input type="checkbox"/>
	Flat <10°	<input type="checkbox"/>	<input type="checkbox"/>

**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops

% bedrock outcrops Left bank \_\_\_\_\_

Right Bank \_\_\_\_\_

**Artificial bank protection measures**

Choose one or more categories

- |                                              |                                                       |
|----------------------------------------------|-------------------------------------------------------|
| <input type="checkbox"/> None                | <input type="checkbox"/> Fenced stock watering points |
| <input type="checkbox"/> Fence structures    | <input type="checkbox"/> Vegetation plantings         |
| <input type="checkbox"/> Levee banks         | <input type="checkbox"/> Logs strapped to bank        |
| <input type="checkbox"/> Rock or wall layer  | <input type="checkbox"/> Concrete channel lining      |
| <input type="checkbox"/> Rip rap             |                                                       |
| <input type="checkbox"/> Fenced human access |                                                       |
| <input type="checkbox"/> Other               |                                                       |

**Sediment oils**

- ☒
- absent
- ☐
- light
- ☐
- moderate
- ☐
- profuse

**Water oils**

- ☒
- none
- ☐
- flecks
- ☐
- globs
- ☐
- sheen
- ☐
- slick

**Sediment odours**

- ☒
- normal/none
- ☐
- sewage
- ☐
- petroleum
- ☐
- chemical
- 
- ☐
- anaerobic
- ☐
- other \_\_\_\_\_

**Water odours**

- ☒
- normal/none
- ☐
- sewage
- ☐
- petroleum
- ☐
- chemical
- 
- ☐
- other \_\_\_\_\_

**Turbidity (visual assessment)**

- ☐
- Clear
- ☐
- Slight
- ☐
- Turbid
- ☐
- Opaque

Is water clarity reduced by:

- ☐
- Suspended material (e.g. mud, clay, organics)
- ☐
- Dissolved material (e.g. plant leachates)

**Water level at the time of sampling**

- ☒
- Dry
- ☐
- No flow
- ☐
- Low
- ☐
- Baseflow or near baseflow
- 
- ☐
- High
- ☐
- Flood (don't sample)

**Artificial features at the sampling site**

Choose one or more categories

- ☐
- Major
- ☐
- Minor
- ☐
- Ford
- ☐
- Bridge
- ☐
- Culvert
- ☐
- Other weir

Description \_\_\_\_\_









**Large woody debris**

Overall % cover of logs and branches greater than 10cm in diameter

\_\_\_\_\_ % Notes on visibility \_\_\_\_\_

**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<input type="radio"/> % of site _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°) _____
Step Height <1m Gradient 5-60° Strong currents		<input type="radio"/> % of site _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°) _____
Gradient 3-5° Strong currents Rocks break surface		<input type="radio"/> % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m) _____
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		<input type="radio"/> % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m) _____
Gradient 1-3° Small currents Surface unbroken and smooth		<input type="radio"/> % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m) _____
Gradient 1-3° Small but distinct & uniform current Surface unbroken		<input checked="" type="radio"/> % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m) _____
Area where stream widens or deepens and current declines		<input type="radio"/> % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m) _____
A reasonable sized (>20% of channel width) cut off section away from		<input type="radio"/> % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m) _____

Note: An additional response variable planform channel pattern is measured in the office

**Macrophyte cover** Assess % cover of the sampling site by each category.

Overall % cover of macrophytes 0.5 % cover of emergent macrophytes \_\_\_\_\_  
 % cover of floating macrophytes \_\_\_\_\_  
 % cover of submerged macrophytes \_\_\_\_\_

Total should equal overall % cover of macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory. N denotes a native taxa and I denotes an introduced taxa.

**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	_____
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	_____
<i>Cyperus</i> (Sedge) I/N	<input type="checkbox"/>	_____
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	_____
<i>Juncus</i> (Rush) I/N	<input type="checkbox"/>	_____
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	_____
<i>Phragmites</i> (Common Reed) N	<input type="checkbox"/>	_____
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	_____
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	_____
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	_____
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	_____
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

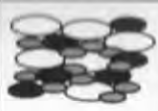




**Floating macrophytes**

	Present	%
<i>Azolla</i> (Azolla) N	<input type="checkbox"/>	_____
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

Overall % cover of native macrophyte taxa \_\_\_\_\_  
 Overall % cover of native macrophyte taxa \_\_\_\_\_ } Total should equal overall % cover of macrophytes from above






**Bed compaction**

Choose one category only

	<b>Tightly packed, armoured</b> Array of sediment sizes, overlapping, tightly packed and very hard to dislodge	<input type="checkbox"/>
	<b>Packed, unarmoured</b> Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate	<input type="checkbox"/>
	<b>Moderate compaction</b> Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate	<input type="checkbox"/>
	<b>Low compaction (1)</b> Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily	<input type="checkbox"/>
	<b>Low compaction (2)</b> Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily	<input checked="" type="checkbox"/>

**Sediment matrix**







Choose one category only

	<b>Bedrock</b>	<input type="checkbox"/>
	<b>Open framework</b> 0-5% fine sediment, high availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix filled contact framework</b> 5-32% fine sediment, moderate availability of interstitial spaces	<input type="checkbox"/>
	<b>Framework dilated</b> 32-60% fine sediment, low availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix dominated</b> >60% fine sediment, interstitial spaces virtually absent	<input checked="" type="checkbox"/>

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	<b>Very angular</b>	<input type="checkbox"/>
	<b>Angular</b>	<input type="checkbox"/>
	<b>Sub-angular</b>	<input type="checkbox"/>
	<b>Rounded</b>	<input type="checkbox"/>
	<b>Well rounded</b>	<input type="checkbox"/>
	<b>Cobble, pebble and gravel fractions not present</b>	<input type="checkbox"/>

In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding

Stable

Unstable - depositing

<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material.	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>1. Epifaunal substrate / available cover</b>	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient)					40-70% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale)					20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>2. Embeddedness</b>	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>3. Velocity / depth regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m.					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low)					Dominated by 1 velocity/depth regime (usually slow-deep)					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>4. Sediment deposition</b>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition					Some new increase in bar formation, mostly from gravel, sand or fine sediment. 5-30% of the bottom affected, slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars. 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent					Heavy deposits of fine material, increased bar development, more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>5. Channel flow status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel, or <25% of channel substrate is exposed					Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed					Very little water in channel and mostly present as standing pools					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>6. Channel alteration</b>	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present					Channelization may be extensive; embankments or shoring structures present on both banks, and 40 to 80% of stream reach channelized and disrupted					Banks shored with gabion or cement, over 80% of the stream reach channelized and disrupted; instream habitat greatly altered or removed entirely					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

Site No. \_\_\_\_\_ Date \_\_\_\_\_

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Frequency of riffles (or bends)</b>	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
SCORE	Left bank		10	9	8	7	6	5		4	3	2		1	0						
SCORE	Right bank		10	9	8	7	6	5		4	3	2		1	0						
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
SCORE	Left bank		10	9	8	7	6	5		4	3	2		1	0						
SCORE	Right bank		10	9	8	7	6	5		4	3	2		1	0						
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
SCORE	Left bank		10	9	8	7	6	5		4	3	2		1	0						
SCORE	Right bank		10	9	8	7	6	5		4	3	2		1	0						

TOTAL HIGH GRADIENT HABITAT SCORE

## USEPA Habitat Assessment

Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>1. Epifaunal substrate / available cover</b>	Greater than 50% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient)					30-50% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale)					10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed					Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>2. Pool substrate characterization</b>	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common					Mixture of soft sand, mud or clay; mud may be dominant; some root mats and submerged vegetation present					All mud or clay or sand bottom; little or no root mat; no submerged vegetation					Hard-pan clay or bedrock; no root mat or vegetation					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>3. Pool variability</b>	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present					Majority of pools large-deep; very few shallow					Shallow pools much more prevalent than deep pools					Majority of pools small-shallow or pools absent					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>4. Sediment deposition</b>	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition					Some new increase in bar formation; mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent					Heavy deposits of fine material; increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>5. Channel flow status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed					Water fills >75% of the available channel; or <25% of channel substrate is exposed					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed					Very little water in channel and mostly present as standing pools					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>6. Channel alteration</b>	Channelization or dredging absent or minimal; stream with normal pattern					Some channelization present; usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present					Channelization may be extensive; embankments or shoring structures present on both banks, and 40 to 80% of stream reach channelized and disrupted					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted; instream habitat greatly altered or removed entirely					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Channel sinuosity</b> The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)																					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b> Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.						Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas, 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
SCORE	Left bank																				
SCORE	Right bank																				
<b>9. Vegetative protection (score each bank)</b> More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.						70-90% of the streambank surfaces covered by native vegetation; but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
SCORE	Left bank																				
SCORE	Right bank																				
<b>10. Riparian zone score (score each bank)</b> Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.						Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <5 metres; little or no riparian vegetation is present because of human activities.					
SCORE	Left bank																				
SCORE	Right bank																				

TOTAL LOW GRADIENT HABITAT SCORE

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number** 03 **of** 12

**Type of bedform at the cross-section**  
☐ Riffle ☒ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** (=total of boxes A+B+C) 1.5

**Stream width at the water mark (m)** 1.1 **A**

**Stream width at the water surface (m)** 1.1

**Bank height (m)** 2.1

**Bank width (m)** 1.99 **B**

**Vertical distance between the water surface and the water mark (m)** 0.5

**Bank height (m)** 1.5

**Bank width (m)** 1.1 **c**

**Vertical distance between the water surface and the water mark (m)** 0.5

**Horizontal distances (m)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----

**Vertical water depths (cm)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material**

Assess % composition for each bank

Left bank Right bank

Bedrock \_\_\_\_\_

Boulder (>256mm) \_\_\_\_\_

Cobble (64-256mm) \_\_\_\_\_

Pebble (16-64mm) \_\_\_\_\_

Gravel (2-16mm) \_\_\_\_\_

Sand (0.06-2mm) \_\_\_\_\_

Fines (silt and clay, <0.06mm) \_\_\_\_\_

Total 100% each

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock \_\_\_\_\_

Boulder (>256mm) \_\_\_\_\_

Cobble (64-256mm) \_\_\_\_\_

Pebble (16-64mm) \_\_\_\_\_

Gravel (2-16mm) \_\_\_\_\_

Sand (0.06-2mm) \_\_\_\_\_

Fines (silt and clay <0.06mm) \_\_\_\_\_

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Channel cross-sections and variables to be measured in the area around a cross section**

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Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number 8.2 of 1**

**Type of bedform at the cross-section**  
☐ Riffle ☒ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)**  
 (=total of boxes A+B+C)  

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)**

**Bank height (m)** 1.8

**Bank width (m)** 8

**Vertical distance between the water surface and the water mark (m)** 1.7

**Bank height (m)**  

**Bank width (m)** c

**Vertical distance between the water surface and the water mark (m)** 1.0

Horizontal distances (m)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----

Vertical water depths (cm)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----

**Riparian zone width**

Left bank 8 (m) Right bank 7 (m)

**Notes on cross-section measurement****Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	} Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	} Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

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**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)**  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)**

**Bank height (m)**

**Bank width (m)** B

**Vertical distance between the water surface and the water mark (m)**

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)**

**Bank width (m)** C

**Vertical distance between the water surface and the water mark (m)**

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

Date 21.8.18 Site No. 004 Time 1430 Recorder's Name SARAH BLAUKERiver Name BACK CREEK Location LOT 18 DP756011Weather CLEAR + SUNNY Rain in last week? Y ☐ N ☒ Photograph numbers and details \_\_\_\_\_Latitude: 

deg	min	sec
28	8	48

 71297 Longitude: 

deg	min	sec
15	0	40

 650120

GPS Name and Datum \_\_\_\_\_

004 5-6 VE, 7-8 VE, 10-12 VE, 14-16 VE, 18-20 VE  
004 45 1-2 VE, 3-4 VE, 5-6 VE, 7-8 VE, 9-10 VE, 11-12 VE, 13-14 VE, 15-16 VE, 17-18 VE, 19-20 VE  
004 - 100m

## PLANFORM SKETCH OF SITE

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.  
Left bank is facing downstream.

## LENGTH OF SAMPLING SITE

Bankfull width \_\_\_\_\_ (m)

x 10

Length of sampling site \_\_\_\_\_ (m)

## Notes

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

BEFORE LEAVING THE  
SITE, CHECK DATA  
SHEETS TO ENSURE  
THAT ALL VARIABLES  
HAVE BEEN RECORDED☐



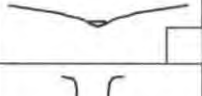
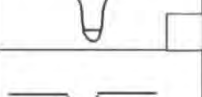
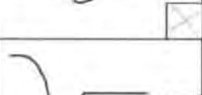
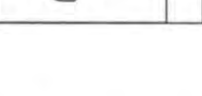
Y

## BASIC WATER CHEMISTRY

		Units
Temperature	_____	°C
Conductivity	_____	
Dissolved Oxygen	_____	mg l <sup>-1</sup>
Dissolved Oxygen Sat.	_____	%
pH	_____	
Turbidity	_____	
Total phosphorus <input type="checkbox"/>	_____	
Total nitrogen <input type="checkbox"/>	_____	
Water sample taken?		
ALKALINITY		
Amount of water	_____	ml
Amount of H <sub>2</sub> SO <sub>4</sub>	_____	ml
Alkalinity	_____	mg l <sup>-1</sup>

## Valley shape

Choose one category only

	<input type="checkbox"/> Steep valley
	<input type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input checked="" type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

## Local impacts on streams

Choose one or more categories and describe the detail of each

- |                                                            |                                                  |
|------------------------------------------------------------|--------------------------------------------------|
| <input type="checkbox"/> Sand or gravel mining             | <input type="checkbox"/> Sewage effluent         |
| <input type="checkbox"/> Other mining                      | <input type="checkbox"/> Channel straightening   |
| <input type="checkbox"/> Road                              | <input type="checkbox"/> River improvement works |
| <input type="checkbox"/> Bridge / culvert / wharf          | <input type="checkbox"/> Water extraction        |
| <input type="checkbox"/> Ford / ramp                       | <input type="checkbox"/> Dredging                |
| <input type="checkbox"/> Discharge pipe                    | <input checked="" type="checkbox"/> Grazing      |
| <input type="checkbox"/> Forestry activities               | <input type="checkbox"/> Litter                  |
| <input type="checkbox"/> Sugar mill                        | <input type="checkbox"/> Recreation              |
| <input type="checkbox"/> Irrigation run-off or pipe outlet | <input type="checkbox"/> Other                   |

 Description \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Floodplain width

\_\_\_\_\_ Average \_\_\_\_\_ (m)

## Floodplain features

Choose one or more features when present

- |                                                                                                                                           |                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> Sampling site has no distinct floodplain                                                                         | <input type="checkbox"/> Scroll systems<br>Short, crescentic strips or patches formed along the inner bank of a stream meander                         |
| <input type="checkbox"/> Oxbows / billabongs<br>Body of water occupying a former river meander, isolated by a shift in the stream channel | <input type="checkbox"/> Splays<br>Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain |
| <input type="checkbox"/> Remnant channels<br>Formed during a previous hydrological regime. May be infilled with sediment                  | <input type="checkbox"/> Floodplain scours<br>Scour holes formed by the concentrated clearing and digging action of flowing water                      |
| <input type="checkbox"/> Flood channels<br>A channel that distributes water onto the floodplain and off the floodplain during floods      | <input type="checkbox"/> No floodplain features present<br>Floodplain present at the sampling site but does not contain any of the above features      |

## Local landuse

Choose one category for each bank

- | Left                                | Right                                                                      |
|-------------------------------------|----------------------------------------------------------------------------|
| <input type="checkbox"/>            | <input type="checkbox"/> Native forest                                     |
| <input type="checkbox"/>            | <input type="checkbox"/> Native grassland (not grazed)                     |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> Grazing (native or non-native pasture) |
| <input type="checkbox"/>            | <input type="checkbox"/> Exotic grassland (lawns etc., no grazing)         |
| <input type="checkbox"/>            | <input type="checkbox"/> Forestry Native [ ] [ ] Pine [ ] [ ]              |
| <input type="checkbox"/>            | <input type="checkbox"/> Cropped Rainfed [ ] [ ] Irrigated [ ] [ ]         |
| <input type="checkbox"/>            | <input type="checkbox"/> Urban residential                                 |
| <input type="checkbox"/>            | <input type="checkbox"/> Commercial                                        |
| <input type="checkbox"/>            | <input type="checkbox"/> Industrial or intensive agricultural              |
| <input type="checkbox"/>            | <input type="checkbox"/> Recreation                                        |
| <input type="checkbox"/>            | <input type="checkbox"/> Other _____                                       |

**Riparian zone composition**

Assess for whole sampling site

	% Cover		Vegetation Description
Trees (>10m in height)	95	} May total more than 100%	EUC. TER. + BRIDGEM.
Trees (<10m in height)	20		+
Shrubs	10		smaller trees + shrubs + ferns
Grasses / ferns / sedges	65		native grasses + ferns

**Shading of channel**
☐ < 5%    ☐ 6 – 25%    ☐ 26 – 50%    ☒ 51 – 75%    ☐ > 76%
**Extent of trailing bank vegetation**
☒ nil    ☐ moderate  
☒ slight    ☐ extensive
**Native and exotic riparian vegetation**
 % Native 80  
 % Exotic 20    } Total 100%
**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

		Left bank	Right bank
None		<input type="checkbox"/>	<input type="checkbox"/>
Isolated / scattered		<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps		<input type="checkbox"/>	<input type="checkbox"/>
Semi-continuous		<input type="checkbox"/>	<input type="checkbox"/>
Continuous		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

**Regeneration of native woody vegetation**

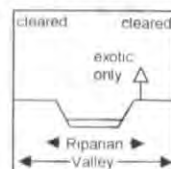
Is the sampling site in undisturbed forest?

Y [ ] N [ ]

If no, record regeneration category

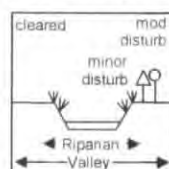
☒ Abundant (>5% cover) and healthy  
☐ Present  
☐ Very limited (<1% cover)
**Overall vegetation disturbance rating**

Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

**Extreme disturbance** ☐

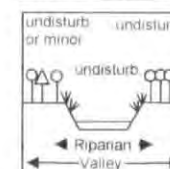
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie dominated by exotic species with native species rare or completely absent)

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**High disturbance** ☐

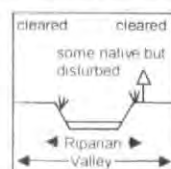
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain

**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

**Low disturbance** ☐

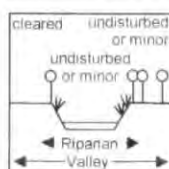
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor

**Valley vegetation** – native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species

**Very high disturbance** ☒

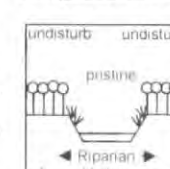
**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**Moderate disturbance** ☐

**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state







**Very low disturbance** ☐

**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Physical barriers to local fish passage**








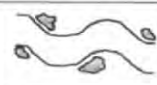

Choose one category for each flow condition

		Base flow	Low flow	High flow
	No passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Moderately restricted passage	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Good passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>






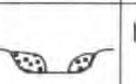


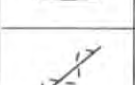
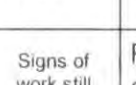
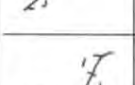
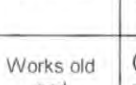
Type and height of barrier(s) \_\_\_\_\_

**Type of bars**




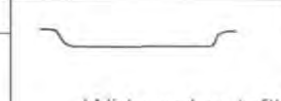


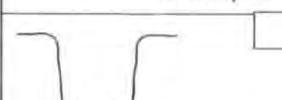
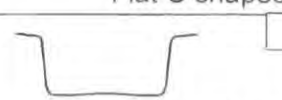
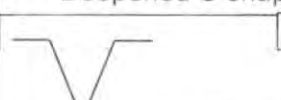
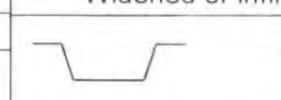


Choose one or more categories

	Bars absent	<input type="checkbox"/>
	Side/point bars VEGETATED	<input checked="" type="checkbox"/>
	Side/point bars UNVEGETATED	<input type="checkbox"/>
	Mid-channel bars VEGETATED	<input type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input type="checkbox"/>
	Bars around obstructions	<input type="checkbox"/>
	Braided channel	<input type="checkbox"/>
	Infilled channel	<input type="checkbox"/>
	High flow deposits	<input type="checkbox"/>

**Extent of bars**% of streambed forming a bar of any type 5 %**Dominant sediment particle size on bars**
 Boulder/cobble [ ] Pebble [ ] Gravel [ ]  
 Sand [ ] Silt/clay ☒ or \_\_\_\_\_ mm
**Channel modifications** Choose one or more categories

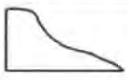
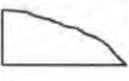



	No modifications	<input checked="" type="checkbox"/>		Reinforced	<input type="checkbox"/>
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>
	Dams and diversions	<input type="checkbox"/>		Infilled	<input type="checkbox"/>
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input type="checkbox"/>
	Straightened	<input type="checkbox"/>		Signs of work still	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>		Works old and revegetated	<input type="checkbox"/>
				Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	U shaped	<input type="checkbox"/>		Flat U shaped	<input type="checkbox"/>		Deepened U shape	<input type="checkbox"/>		Widened or infilled	<input type="checkbox"/>		Two stage	<input type="checkbox"/>		Multi stage	<input type="checkbox"/>
	Box	<input type="checkbox"/>		Wide box	<input type="checkbox"/>		V shaped	<input type="checkbox"/>		Trapezoid	<input type="checkbox"/>		Concrete V	<input type="checkbox"/>		Pipe or culvert	<input type="checkbox"/>

**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input type="checkbox"/>	<input type="checkbox"/>
	Convex	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Stepped	<input type="checkbox"/>	<input type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>

**Factors affecting bank stability**

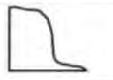


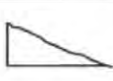

Choose one or more categories

- |                                                  |                                               |
|--------------------------------------------------|-----------------------------------------------|
| <input type="checkbox"/> None                    | <input type="checkbox"/> Cleared vegetation   |
| <input type="checkbox"/> Mining                  | <input type="checkbox"/> Irrigation draw-down |
| <input checked="" type="checkbox"/> Runoff       | <input type="checkbox"/> Reservoir releases   |
| <input checked="" type="checkbox"/> Stock access | <input type="checkbox"/> Seepage              |
| <input type="checkbox"/> Human access            | <input type="checkbox"/> Flow and waves       |
| <input type="checkbox"/> Ford, culvert or bridge | <input type="checkbox"/> Drainpipes           |
| <input type="checkbox"/> Feral animals           |                                               |
| <input type="checkbox"/> Other                   |                                               |

Description \_\_\_\_\_

 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input type="checkbox"/>	<input type="checkbox"/>
	Moderate 30 - 60°	<input type="checkbox"/>	<input type="checkbox"/>
	Low 10 - 30°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Flat <10°	<input type="checkbox"/>	<input type="checkbox"/>

**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops

% bedrock outcrops Left bank \_\_\_\_\_

Right Bank \_\_\_\_\_

**Artificial bank protection measures**

Choose one or more categories

- |                                              |                                                       |
|----------------------------------------------|-------------------------------------------------------|
| <input checked="" type="checkbox"/> None     | <input type="checkbox"/> Fenced stock watering points |
| <input type="checkbox"/> Fence structures    | <input type="checkbox"/> Vegetation plantings         |
| <input type="checkbox"/> Levee banks         | <input type="checkbox"/> Logs strapped to bank        |
| <input type="checkbox"/> Rock or wall layer  | <input type="checkbox"/> Concrete channel lining      |
| <input type="checkbox"/> Rip rap             |                                                       |
| <input type="checkbox"/> Fenced human access |                                                       |
| <input type="checkbox"/> Other               |                                                       |

 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
**Sediment oils**

- ☒
- absent
- ☐
- light
- ☐
- moderate
- ☐
- profuse

**Water oils**

- ☒
- none
- ☐
- flecks
- ☐
- globs
- ☐
- sheen
- ☐
- slick

**Sediment odours**

- ☒
- normal/none
- ☐
- sewage
- ☐
- petroleum
- ☐
- chemical
- 
- ☐
- anaerobic
- ☐
- other \_\_\_\_\_

**Water odours**

- ☒
- normal/none
- ☐
- sewage
- ☐
- petroleum
- ☐
- chemical
- 
- ☐
- other \_\_\_\_\_

**Turbidity (visual assessment)**

- ☐
- Clear
- ☐
- Slight
- ☐
- Turbid
- ☐
- Opaque

Is water clarity reduced by:

- ☐
- Suspended material (e.g mud, clay, organics)
- ☐
- Dissolved material (e.g plant leachates)

**Water level at the time of sampling**

- ☒
- Dry
- ☐
- No flow
- ☐
- Low
- ☐
- Baseflow or near baseflow
- 
- ☐
- High
- ☐
- Flood (don't sample)

**Artificial features at the sampling site**

Choose one or more categories

- ☐
- Major
- ☐
- Minor
- ☒
- Ford
- ☐
- Bridge
- ☐
- Culvert
- ☐
- Other weir









 Description \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
**Large woody debris**

Overall % cover of logs and branches greater than 10cm in diameter

 \_\_\_\_\_ % Notes on visibility \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<b>Waterfall</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Step Height <1m Gradient 5-60° Strong currents		<b>Cascade</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Gradient 3-5° Strong currents Rocks break surface		<b>Rapid</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		<b>Riffle</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small currents Surface unbroken and smooth		<b>Glide</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small but distinct & uniform current Surface unbroken		<b>Run</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Area where stream widens or deepens and current declines		<b>Pool</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
A reasonable sized (>20% of channel width) cut-off section away from		<b>Backwater</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)

Note: An additional response variable planform channel pattern is measured in the office**Macrophyte cover** Assess % cover of the sampling site by each category.

Overall % cover of macrophytes 0 % cover of emergent macrophytes 0  
 % cover of floating macrophytes 0  
 % cover of submerged macrophytes 0

Total should equal overall % cover of macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory.

N denotes a native taxa and I denotes an introduced taxa.

**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	_____
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	_____
<i>Cyperus</i> (Sedge) I/N	<input type="checkbox"/>	_____
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	_____
<i>Juncus</i> (Rush) I/N	<input type="checkbox"/>	_____
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	_____
<i>Phragmites</i> (Common Reed) N	<input type="checkbox"/>	_____
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	_____
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	_____
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	_____
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	_____
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____






**Floating macrophytes**

	Present	%
<i>Azolla</i> (Azolla) N	<input type="checkbox"/>	_____
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

Overall % cover of native macrophyte taxa \_\_\_\_\_ } Total should equal overall % cover of macrophytes from above  
 Overall % cover of native macrophyte taxa \_\_\_\_\_ }


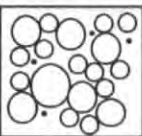
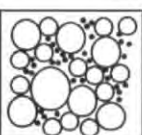
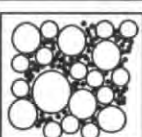
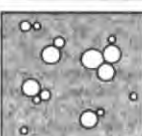
**Bed compaction**

Choose one category only

	<b>Tightly packed, armoured</b> Array of sediment sizes, overlapping, tightly packed and very hard to dislodge	<input type="checkbox"/>
	<b>Packed, unarmoured</b> Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate	<input type="checkbox"/>
	<b>Moderate compaction</b> Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate	<input type="checkbox"/>
	<b>Low compaction (1)</b> Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily	<input type="checkbox"/>
	<b>Low compaction (2)</b> Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily	<input checked="" type="checkbox"/>

**Sediment matrix**







Choose one category only

	<b>Bedrock</b>	<input type="checkbox"/>
	<b>Open framework</b> 0-5% fine sediment, high availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix filled contact framework</b> 5-32% fine sediment, moderate availability of interstitial spaces	<input type="checkbox"/>
	<b>Framework dilated</b> 32-60% fine sediment, low availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix dominated</b> >60% fine sediment, interstitial spaces virtually absent	<input type="checkbox"/>

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	<b>Very angular</b>	<input type="checkbox"/>
	<b>Angular</b>	<input checked="" type="checkbox"/>
	<b>Sub-angular</b>	<input checked="" type="checkbox"/>
	<b>Rounded</b>	<input type="checkbox"/>
	<b>Well rounded</b>	<input type="checkbox"/>
	<b>Cobble, pebble and gravel fractions not present</b>	<input type="checkbox"/>

In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding ← ————— Stable —————→ Unstable - depositing				
<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material.	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked, but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>1. Epifaunal substrate / available cover</b>	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient)					40-70% mix of stable habitat, well-suited for full colonisation potential; adequate habitat for maintenance of populations, presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale)					20-40% mix of stable habitat; habitat availability less than desirable, substrate frequently disturbed or removed					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>2. Embeddedness</b>	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>3. Velocity / depth regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m.					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep).					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>4. Sediment deposition</b>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel/sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars, 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development, more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>5. Channel flow status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel, or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>6. Channel alteration</b>	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization (i.e. dredging) greater than 20 yr may be present but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement, over 80% of the stream reach channelized and disrupted; instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Frequency of riffles (or bends)</b>	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing; minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation; but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			

TOTAL HIGH GRADIENT HABITAT SCORE

Site No. 654 Date 21.8.10USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
1. Epifaunal substrate / available cover	Greater than 50% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					30-50% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Pool substrate characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.					Mixture of soft sand, mud or clay; mud may be dominant; some root mats and submerged vegetation present.					All mud or clay or sand bottom; little or no root mat; no submerged vegetation.					Hard-pan clay or bedrock; no root mat or vegetation.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.					Majority of pools large-deep; very few shallow.					Shallow pools much more prevalent than deep pools.					Majority of pools small-shallow or pools absent.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected, slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Channel sinuosity</b> The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).																					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b> Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.																					
<b>SCORE</b>	Left bank					10	9	8	7	6	5	4	3	2	1	0					
<b>SCORE</b>	Right bank					10	9	8	7	6	5	4	3	2	1	0					
<b>9. Vegetative protection (score each bank)</b> More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.																					
<b>SCORE</b>	Left bank					10	9	8	7	6	5	4	3	2	1	0					
<b>SCORE</b>	Right bank					10	9	8	7	6	5	4	3	2	1	0					
<b>10. Riparian zone score (score each bank)</b> Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.																					
<b>SCORE</b>	Left bank					10	9	8	7	6	5	4	3	2	1	0					
<b>SCORE</b>	Right bank					10	9	8	7	6	5	4	3	2	1	0					

TOTAL LOW GRADIENT HABITAT SCORE

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number** 1 **of** 2

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☒ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** (=total of boxes A+B+C) 26

**Stream width at the water mark (m)** 8 **A**

**Stream width at the water surface (m)** 0

**Bank height (m)** 0.3

**Bank width (m)** 4 **B**

**Vertical distance between the water surface and the water mark (m)** 1.2

**Horizontal distances (m)**

1	2	3	4	5	6	7	8								

**Vertical water depths (cm)**

**Bank height (m)** 0.3

**Bank width (m)** 14 **C**

**Vertical distance between the water surface and the water mark (m)** 1.3

**Notes on cross-section measurement****Riparian zone width**

Left bank 7 (m) Right bank 4 (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	<u>100</u>	<u>100</u>
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	<u>100</u>

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☒ 65-90% ☐ >90%

**Channel cross-sections and variables to be measured in the area around a cross section**

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Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number** \_\_\_\_\_ **of** \_\_\_\_\_

**Type of bedform at the cross-section**

☐ Riffle ☒ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
(=total of boxes A+B+C)

**Stream width at the water mark (m)** \_\_\_\_\_ **A**

**Stream width at the water surface (m)** \_\_\_\_\_

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** \_\_\_\_\_ **B**

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** \_\_\_\_\_ **C**

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

**Horizontal distances (m)**

1	2	3	4	5															
---	---	---	---	---	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**Vertical water depths (cm)**

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**Horizontal distances (m)**

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**Vertical water depths (cm)**

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)**

**Bank height (m)**

**Bank width (m)** B

**Vertical distance between the water surface and the water mark (m)**

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)**

**Bank width (m)** C

**Vertical distance between the water surface and the water mark (m)**

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

Date

22.8.18

Site No.

005

Time

0700

Recorder's Name

SARAH GILBERT

River Name

BACIL CREEK

Location

Crown Land T52

Weather

CLEAR - Sunny

Rain in last week? Y [ ] N [X]

Photograph numbers and details

005 - 1 x 2

Latitude:

deg min sec  
28 50 44

Longitude:

deg min sec  
150 23 58

GPS Name and Datum

-28.84575343

150.40023410

## PLANFORM SKETCH OF SITE

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features. Left bank is facing downstream.



## LENGTH OF SAMPLING SITE

Bankfull width \_\_\_\_\_ (m)

x 10

Length of sampling site \_\_\_\_\_ (m)

## Notes

1. 10.1.18 - 1 x 2

2. 10.1.18 - 1 x 2

3. 10.1.18 - 1 x 2

4. 10.1.18 - 1 x 2

5. 10.1.18 - 1 x 2

6. 10.1.18 - 1 x 2

7. 10.1.18 - 1 x 2

8. 10.1.18 - 1 x 2

9. 10.1.18 - 1 x 2

10. 10.1.18 - 1 x 2

BEFORE LEAVING THE  
SITE, CHECK DATA  
SHEETS TO ENSURE  
THAT ALL VARIABLES  
HAVE BEEN RECORDED



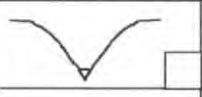

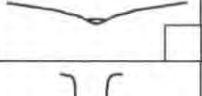
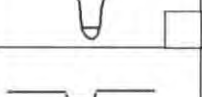
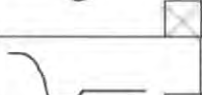
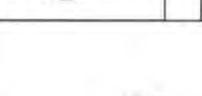
Y

## BASIC WATER CHEMISTRY

		Units
Temperature	<u>8.3</u>	°C
Conductivity	<u>177.5 <math>\mu S/cm</math></u> <u>261.1 <math>\mu S/cm</math></u> <u>SPC</u>	
Dissolved Oxygen	<u>3.9</u>	mg l <sup>-1</sup>
Dissolved Oxygen Sat.	<u>34.2</u>	%
pH	<u>7.21</u>	
Turbidity	<u>119</u>	
Total phosphorus	<input checked="" type="checkbox"/> <u>Water sample taken?</u>	
Total nitrogen	<input checked="" type="checkbox"/>	
ALKALINITY		
Amount of water	<u>23</u>	ml
Amount of H <sub>2</sub> SO <sub>4</sub>	<u>7 drops</u>	ml
Alkalinity	<u>85</u>	mg l <sup>-1</sup>

## Valley shape

Choose one category only

	<input type="checkbox"/> Steep valley
	<input type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input checked="" type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

## Local impacts on streams

Choose one or more categories and describe the detail of each

- |                                                            |                                                  |
|------------------------------------------------------------|--------------------------------------------------|
| <input type="checkbox"/> Sand or gravel mining             | <input type="checkbox"/> Sewage effluent         |
| <input type="checkbox"/> Other mining                      | <input type="checkbox"/> Channel straightening   |
| <input type="checkbox"/> Road                              | <input type="checkbox"/> River improvement works |
| <input type="checkbox"/> Bridge / culvert / wharf          | <input type="checkbox"/> Water extraction        |
| <input type="checkbox"/> Ford / ramp                       | <input type="checkbox"/> Dredging                |
| <input type="checkbox"/> Discharge pipe                    | <input checked="" type="checkbox"/> Grazing      |
| <input type="checkbox"/> Forestry activities               | <input checked="" type="checkbox"/> Litter       |
| <input type="checkbox"/> Sugar mill                        | <input type="checkbox"/> Recreation              |
| <input type="checkbox"/> Irrigation run-off or pipe outlet | <input type="checkbox"/> Other                   |

 Description \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Local landuse

Choose one category for each bank

- | Left                                | Right                                                              |
|-------------------------------------|--------------------------------------------------------------------|
| <input type="checkbox"/>            | <input type="checkbox"/> Native forest                             |
| <input type="checkbox"/>            | <input checked="" type="checkbox"/> Native grassland (not grazed)  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Grazing (native or non-native pasture)    |
| <input type="checkbox"/>            | <input type="checkbox"/> Exotic grassland (lawns etc., no grazing) |
| <input type="checkbox"/>            | <input type="checkbox"/> Forestry Native [ ] [ ] Pine [ ] [ ]      |
| <input type="checkbox"/>            | <input type="checkbox"/> Cropped Rainfed [ ] [ ] Irrigated [ ] [ ] |
| <input type="checkbox"/>            | <input type="checkbox"/> Urban residential                         |
| <input type="checkbox"/>            | <input type="checkbox"/> Commercial                                |
| <input type="checkbox"/>            | <input type="checkbox"/> Industrial or intensive agricultural      |
| <input type="checkbox"/>            | <input type="checkbox"/> Recreation                                |
| <input type="checkbox"/>            | <input type="checkbox"/> Other _____                               |

## Floodplain width

 \_\_\_\_\_ Average 15 (m)

## Floodplain features

Choose one or more features when present

- |                                                                                                                                           |                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> Sampling site has no distinct floodplain                                                                         | <input type="checkbox"/> Scroll systems<br>Short, crescentic strips or patches formed along the inner bank of a stream meander                         |
| <input type="checkbox"/> Oxbows / billabongs<br>Body of water occupying a former river meander, isolated by a shift in the stream channel | <input type="checkbox"/> Splays<br>Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain |
| <input type="checkbox"/> Remnant channels<br>Formed during a previous hydrological regime. May be infilled with sediment                  | <input type="checkbox"/> Floodplain scours<br>Scour holes formed by the concentrated clearing and digging action of flowing water                      |
| <input type="checkbox"/> Flood channels<br>A channel that distributes water onto the floodplain and off the floodplain during floods      | <input type="checkbox"/> No floodplain features present<br>Floodplain present at the sampling site but does not contain any of the above features      |

**Riparian zone composition**

Assess for whole sampling site

	% Cover		Vegetation Description
Trees (>10m in height)	40	} May total more than 100%	E. kerrii, Bragdon
Trees (<10m in height)	20		
Shrubs	15		Willow
Grasses / ferns / sedges	140		right bank less disturbed than left bank

**Shading of channel**
☐ < 5%    ☐ 6 – 25%    ☐ 26 – 50%    ☒ 51 – 75%    ☐ > 76%
**Extent of trailing bank vegetation**
☐ nil    ☒ moderate  
☐ slight    ☐ extensive
**Native and exotic riparian vegetation**

% Native 90 } Total 100%  
 % Exotic 10

**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

		Left bank	Right bank
None		<input type="checkbox"/>	<input type="checkbox"/>
Isolated / scattered		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Semi-continuous		<input type="checkbox"/>	<input checked="" type="checkbox"/>
Continuous		<input type="checkbox"/>	<input type="checkbox"/>

**Regeneration of native woody vegetation**

Is the sampling site in undisturbed forest?

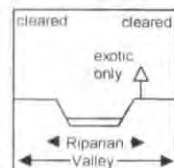
Y [ ] N [x]

If no, record regeneration category

☐ Abundant (>5% cover) and healthy  
☒ Present  
☐ Very limited (<1% cover)

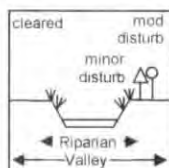
**Overall vegetation disturbance rating**

Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

**Extreme disturbance** ☐

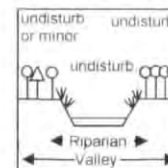
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie dominated by exotic species with native species rare or completely absent)

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**High disturbance** ☐

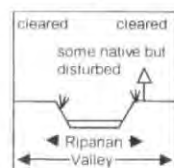
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain

**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

**Low disturbance** ☐

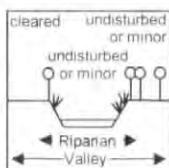
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor

**Valley vegetation** – native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species

**Very high disturbance** ☒

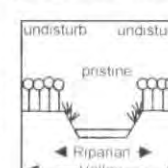
**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**Moderate disturbance** ☐

**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state

**Very low disturbance** ☐

**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Physical barriers to local fish passage**

Choose one category for each flow condition

		Base flow	Low flow	High flow
	No passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Moderately restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Good passage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Type and height of barrier(s) \_\_\_\_\_

**Type of bars**

Choose one or more categories

	Bars absent	<input type="checkbox"/>
	Side/point bars VEGETATED	<input type="checkbox"/>
	Side/point bars UNVEGETATED	<input checked="" type="checkbox"/>
	Mid-channel bars VEGETATED	<input type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input type="checkbox"/>
	Bars around obstructions	<input checked="" type="checkbox"/>
	Braided channel	<input type="checkbox"/>
	Infilled channel	<input type="checkbox"/>
	High flow deposits	<input type="checkbox"/>

**Extent of bars**% of streambed forming a bar of any type 5 %**Dominant sediment particle size on bars**
 Boulder/cobble [ ☐ ] Pebble [ ☐ ] Gravel [ ☐ ]  
 Sand [ ☐ ] Silt/clay [ ☒ ] or \_\_\_\_\_ mm
**Channel modifications** Choose one or more categories

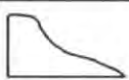
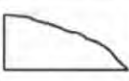

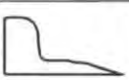

	No modifications	<input checked="" type="checkbox"/>		Reinforced	<input type="checkbox"/>
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>
	Dams and diversions	<input type="checkbox"/>		Infilled	<input type="checkbox"/>
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input type="checkbox"/>
	Straightened	<input type="checkbox"/>		Signs of work still	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>		Works old and revegetated	<input type="checkbox"/>
				Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	U shaped	<input checked="" type="checkbox"/>		Flat U shaped	<input type="checkbox"/>		Deepened U shape	<input type="checkbox"/>		Widened or infilled	<input type="checkbox"/>		Two stage	<input type="checkbox"/>		Multi stage	<input type="checkbox"/>
	Box	<input type="checkbox"/>		Wide box	<input type="checkbox"/>		V shaped	<input type="checkbox"/>		Trapezoid	<input type="checkbox"/>		Concrete V	<input type="checkbox"/>		Pipe or culvert	<input type="checkbox"/>


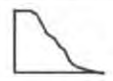

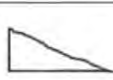
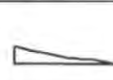
**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Convex	<input type="checkbox"/>	<input type="checkbox"/>
	Stepped	<input type="checkbox"/>	<input type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>

**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Moderate 30 - 60°	<input type="checkbox"/>	<input type="checkbox"/>
	Low 10 - 30°	<input type="checkbox"/>	<input type="checkbox"/>
	Flat <10°	<input type="checkbox"/>	<input type="checkbox"/>

**Sediment oils**☒ absent ☐ light ☐ moderate ☐ profuse**Water oils**☐ none ☐ flecks ☐ globs ☒ sheen ☐ slick**Sediment odours**☐ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☒ anaerobic ☐ other \_\_\_\_\_**Water odours**☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ other \_\_\_\_\_**Turbidity (visual assessment)**☐ Clear ☐ Slight ☒ Turbid ☐ Opaque

Is water clarity reduced by:

☒ Suspended material (e.g. mud, clay, organics) ☐ Dissolved material (e.g. plant leachates)**Factors affecting bank stability**

Choose one or more categories

- |                                                  |                                               |
|--------------------------------------------------|-----------------------------------------------|
| <input type="checkbox"/> None                    | <input type="checkbox"/> Cleared vegetation   |
| <input type="checkbox"/> Mining                  | <input type="checkbox"/> Irrigation draw-down |
| <input type="checkbox"/> Runoff                  | <input type="checkbox"/> Reservoir releases   |
| <input checked="" type="checkbox"/> Stock access | <input type="checkbox"/> Seepage              |
| <input type="checkbox"/> Human access            | <input type="checkbox"/> Flow and waves       |
| <input type="checkbox"/> Ford, culvert or bridge | <input type="checkbox"/> Drainpipes           |
| <input type="checkbox"/> Feral animals           |                                               |
| <input type="checkbox"/> Other                   |                                               |

Description \_\_\_\_\_

**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops

% bedrock outcrops Left bank \_\_\_\_\_

Right Bank \_\_\_\_\_

**Artificial bank protection measures**

Choose one or more categories

- |                                              |                                                       |
|----------------------------------------------|-------------------------------------------------------|
| <input checked="" type="checkbox"/> None     | <input type="checkbox"/> Fenced stock watering points |
| <input type="checkbox"/> Fence structures    | <input type="checkbox"/> Vegetation plantings         |
| <input type="checkbox"/> Levee banks         | <input type="checkbox"/> Logs strapped to bank        |
| <input type="checkbox"/> Rock or wall layer  | <input type="checkbox"/> Concrete channel lining      |
| <input type="checkbox"/> Rip rap             |                                                       |
| <input type="checkbox"/> Fenced human access |                                                       |
| <input type="checkbox"/> Other               |                                                       |

**Water level at the time of sampling**☐ Dry ☐ No flow ☐ Low ☐ Baseflow or near baseflow  
☐ High ☐ Flood (don't sample)**Artificial features at the sampling site**

Choose one or more categories

☐ Major ☐ Minor ☐ Ford ☐ Bridge ☐ Culvert ☐ Other weir

Description \_\_\_\_\_



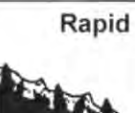

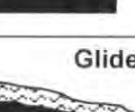
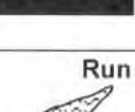


**Large woody debris**

Overall % cover of logs and branches greater than 10cm in diameter

\_\_\_\_\_ % Notes on visibility \_\_\_\_\_

**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<b>Waterfall</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Step Height <1m Gradient 5-60° Strong currents		<b>Cascade</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Gradient 3-5° Strong currents Rocks break surface		<b>Rapid</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		<b>Riffle</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small currents Surface unbroken and smooth		<b>Glide</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small but distinct & uniform current Surface unbroken		<b>Run</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Area where stream widens or deepens and current declines		<b>Pool</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
A reasonable sized (>20% of channel width) cut-off section away from		<b>Backwater</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)

Note: An additional response variable planform channel pattern is measured in the office

**Macrophyte cover** Assess % cover of the sampling site by each category.

Overall % cover of macrophytes 15 % cover of emergent macrophytes \_\_\_\_\_  
 % cover of floating macrophytes \_\_\_\_\_  
 % cover of submerged macrophytes \_\_\_\_\_

Total should equal overall % cover of macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory.

N denotes a native taxa and I denotes an introduced taxa.

**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	_____
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	_____
<i>Cyperus</i> (Sedge) I/N	<input type="checkbox"/>	_____
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	_____
<i>Juncus</i> (Rush) I/N	<input checked="" type="checkbox"/>	_____
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	_____
<i>Phragmites</i> (Common Reed) N	<input type="checkbox"/>	_____
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	_____
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	_____
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	_____
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	_____
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

**Floating macrophytes**






	Present	%
<i>Azolla</i> (Azolla) N	<input type="checkbox"/>	_____
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

Overall % cover of native macrophyte taxa \_\_\_\_\_  
 Overall % cover of native macrophyte taxa \_\_\_\_\_

Total should equal overall % cover of macrophytes from above


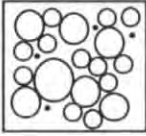
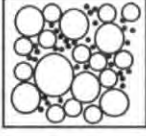
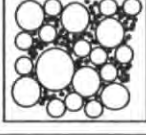
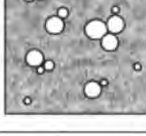
**Bed compaction**

Choose one category only

	<b>Tightly packed, armoured</b> Array of sediment sizes, overlapping, tightly packed and very hard to dislodge	<input type="checkbox"/>
	<b>Packed, unarmoured</b> Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate	<input type="checkbox"/>
	<b>Moderate compaction</b> Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate	<input type="checkbox"/>
	<b>Low compaction (1)</b> Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily	<input type="checkbox"/>
	<b>Low compaction (2)</b> Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily	<input type="checkbox"/>

**Sediment matrix**







Choose one category only

	<b>Bedrock</b>	<input type="checkbox"/>
	<b>Open framework</b> 0-5% fine sediment, high availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix filled contact framework</b> 5-32% fine sediment, moderate availability of interstitial spaces	<input type="checkbox"/>
	<b>Framework dilated</b> 32-60% fine sediment, low availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix dominated</b> >60% fine sediment, interstitial spaces virtually absent	<input type="checkbox"/>

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	<b>Very angular</b>	<input type="checkbox"/>
	<b>Angular</b>	<input type="checkbox"/>
	<b>Sub-angular</b>	<input type="checkbox"/>
	<b>Rounded</b>	<input type="checkbox"/>
	<b>Well rounded</b>	<input type="checkbox"/>
	<b>Cobble, pebble and gravel fractions not present</b>	<input type="checkbox"/>

In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding

Stable

Unstable - depositing

<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material.	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>1. Epifaunal substrate / available cover</b>	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					40-70% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>2. Embeddedness</b>	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>3. Velocity / depth regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep).					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>4. Sediment deposition</b>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material; increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>5. Channel flow status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>6. Channel alteration</b>	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted; instream habitat greatly altered or removed entirely.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Frequency of riffles (or bends)</b>	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas, 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			

TOTAL HIGH GRADIENT HABITAT SCORE

Site No. 002

Date 22.8.18

USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
1. Epifaunal substrate / available cover	Greater than 50% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient)					30-50% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale)					10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed					Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Pool substrate characterization	Mixture of substrate materials, with gravel and firm sand prevalent, root mats and submerged vegetation common					Mixture of soft sand, mud or clay; mud may be dominant; some root mats and submerged vegetation present					All mud or clay or sand bottom; little or no root mat; no submerged vegetation					Hard-pan clay or bedrock; no root mat or vegetation					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present					Majority of pools large-deep, very few shallow					Shallow pools much more prevalent than deep pools					Majority of pools small-shallow or pools absent					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent					Heavy deposits of fine material; increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed					Water fills >75% of the available channel, or <25% of channel substrate is exposed					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed					Very little water in channel and mostly present as standing pools					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present					Channelization may be extensive; embankments or shoring structures present on both banks, and 40 to 80% of stream reach channelized and disrupted					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted; instream habitat greatly altered or removed entirely					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

## USEPA Habitat Assessment

## LOW GRADIENT STREAMS

Page 2 of 2

Circle a score for each parameter

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Channel sinuosity</b> The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).																					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b> Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.																					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>9. Vegetative protection (score each bank)</b> More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.																					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>10. Riparian zone score (score each bank)</b> Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.																					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			

TOTAL LOW GRADIENT HABITAT SCORE

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section

**Cross-section number** \_\_\_\_\_ **of** \_\_\_\_\_

**Type of bedform at the cross-section**

☐ Riffle ☐ Run ☒ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
(=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)** 2

**Bank height (m)** .6

**Bank width (m)** 4 B

**Vertical distance between the water surface and the water mark (m)** .5

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** c

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

**Horizontal distances (m)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----

**Vertical water depths (cm)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----

**Horizontal distances (m)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----

**Vertical water depths (cm)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----

**Notes on cross-section measurement****Riparian zone width**

Left bank 9 (m) Right bank 6 (m)

**Bank material**

Assess % composition for each bank

Left bank Right bank

Bedrock \_\_\_\_\_

Boulder (>256mm) \_\_\_\_\_

Cobble (64-256mm) \_\_\_\_\_

Pebble (16-64mm) \_\_\_\_\_

Gravel (2-16mm) \_\_\_\_\_

Sand (0.06-2mm) \_\_\_\_\_

Fines (silt and clay <0.06mm) \_\_\_\_\_

Total 100% each

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock \_\_\_\_\_

Boulder (>256mm) \_\_\_\_\_

Cobble (64-256mm) \_\_\_\_\_

Pebble (16-64mm) \_\_\_\_\_

Gravel (2-16mm) \_\_\_\_\_

Sand (0.06-2mm) \_\_\_\_\_

Fines (silt and clay <0.06mm) \_\_\_\_\_

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Channel cross-sections and variables to be measured in the area around a cross section**

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**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number** \_\_\_\_\_ **of** \_\_\_\_\_

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☒ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** \_\_\_\_\_ **A**

**Stream width at the water surface (m)** \_\_\_\_\_

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** \_\_\_\_\_ **B**

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

**Horizontal distances (m)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----

**Vertical water depths (cm)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** \_\_\_\_\_ **C**

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
Total 100%	

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Channel cross-sections and variables to be measured in the area around a cross section**

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**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)** \_\_\_\_\_

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** B

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** C

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

Date 21-8-18 Site No. 006- Time 1530 Recorder's Name SARAH CLARKE

River Name BACK CREEK Location LOT 7 DP 756010

Weather CLEAR & SUNNY Rain in last week? Y [ ] N [X] Photograph numbers and details

Latitude: 

deg	min	sec
28	85	49

 04S Longitude: 

deg	min	sec
150	40	74

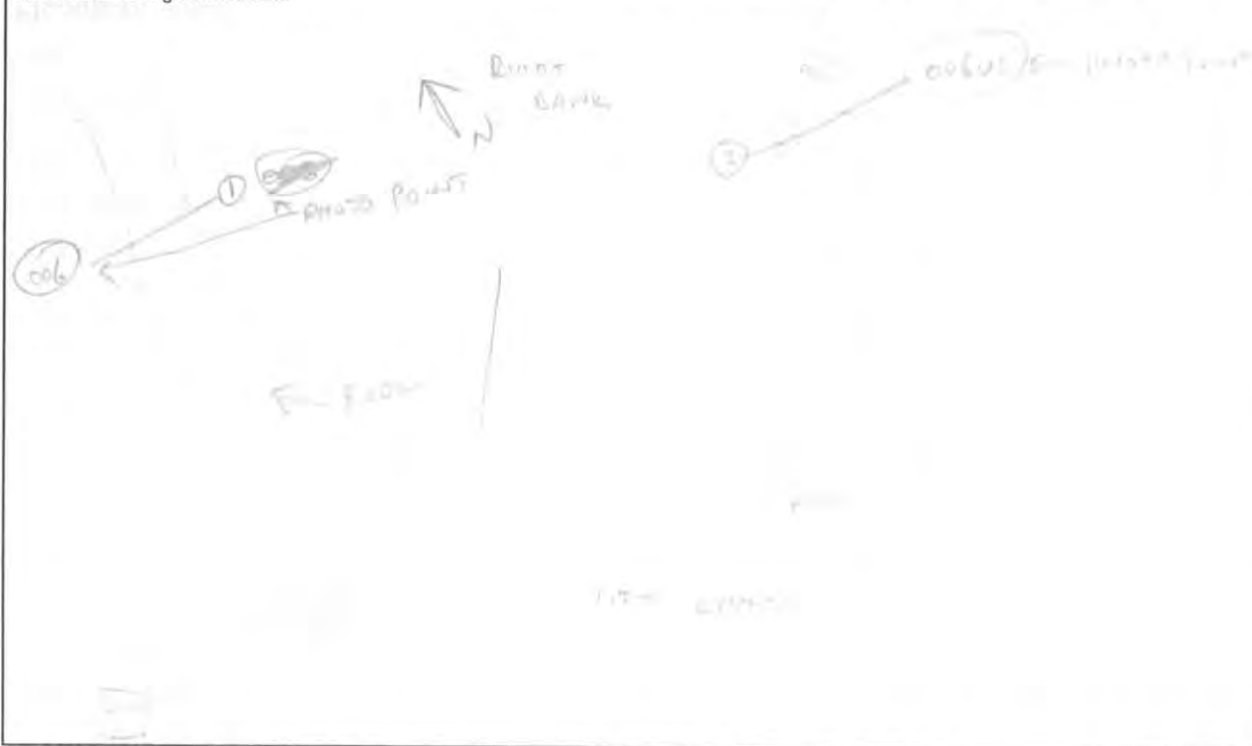
 8067

GPS Name and Datum

00603 1+2 u/s, 3+4 u/s, 5+6 D/S pool u/s 7+8  
pool D/S 9+10  
006 1+2 u/s, 3+4 u/s, 5+6 D/S

## PLANFORM SKETCH OF SITE

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.  
Left bank is facing downstream.



## LENGTH OF SAMPLING SITE

Bankfull width \_\_\_\_\_ (m)

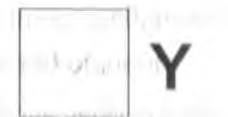
x 10

Length of sampling site \_\_\_\_\_ (m)

## Notes

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

BEFORE LEAVING THE  
SITE, CHECK DATA  
SHEETS TO ENSURE  
THAT ALL VARIABLES  
HAVE BEEN RECORDED





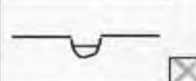



BASIC WATER CHEMISTRY		Units
Temperature	_____	°C
Conductivity	_____	
Dissolved Oxygen	_____	mg l <sup>-1</sup>
Dissolved Oxygen Sat.	_____	%
pH	_____	
Turbidity	_____	
Total phosphorus <input type="checkbox"/>	_____	
Total nitrogen <input type="checkbox"/>	_____	
ALKALINITY		
Amount of water	_____	ml
Amount of H <sub>2</sub> SO <sub>4</sub>	_____	ml
Alkalinity	_____	mg l <sup>-1</sup>

Water sample taken?

**Valley shape**

Choose one category only

	<input type="checkbox"/> Steep valley
	<input type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input checked="" type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

**Local impacts on streams**

Choose one or more categories and describe the detail of each

<input type="checkbox"/> Sand or gravel mining	<input type="checkbox"/> Sewage effluent
<input type="checkbox"/> Other mining	<input type="checkbox"/> Channel straightening
<input type="checkbox"/> Road	<input type="checkbox"/> River improvement works
<input type="checkbox"/> Bridge / culvert / wharf	<input type="checkbox"/> Water extraction
<input type="checkbox"/> Ford / ramp	<input type="checkbox"/> Dredging
<input type="checkbox"/> Discharge pipe	<input checked="" type="checkbox"/> Grazing
<input type="checkbox"/> Forestry activities	<input type="checkbox"/> Litter
<input type="checkbox"/> Sugar mill	<input type="checkbox"/> Recreation
<input type="checkbox"/> Irrigation run-off or pipe outlet	<input type="checkbox"/> Other

Description \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Floodplain width**

\_\_\_\_\_ Average \_\_\_\_\_ (m)

**Floodplain features**

Choose one or more features when present

<input type="checkbox"/> Sampling site has no distinct floodplain	<input type="checkbox"/> Scroll systems Short, crescentic strips or patches formed along the inner bank of a stream meander
<input type="checkbox"/> Oxbows / billabongs Body of water occupying a former river meander, isolated by a shift in the stream channel	<input type="checkbox"/> Splays Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain
<input type="checkbox"/> Remnant channels Formed during a previous hydrological regime. May be infilled with sediment	<input type="checkbox"/> Floodplain scours Scour holes formed by the concentrated clearing and digging action of flowing water
<input type="checkbox"/> Flood channels A channel that distributes water onto the floodplain and off the floodplain during floods	<input checked="" type="checkbox"/> No floodplain features present Floodplain present at the sampling site but does not contain any of the above features

**Local landuse**

Choose one category for each bank.

Left	Right
<input type="checkbox"/>	<input type="checkbox"/> Native forest
<input type="checkbox"/>	<input type="checkbox"/> Native grassland (not grazed)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Grazing (native or non-native pasture)
<input type="checkbox"/>	<input type="checkbox"/> Exotic grassland (lawns etc., no grazing)
<input type="checkbox"/>	<input type="checkbox"/> Forestry Native [ ] [ ] Pine [ ] [ ]
<input type="checkbox"/>	<input type="checkbox"/> Cropped Rainfed [ ] [ ] Irrigated [ ] [ ]
<input type="checkbox"/>	<input type="checkbox"/> Urban residential
<input type="checkbox"/>	<input type="checkbox"/> Commercial
<input type="checkbox"/>	<input type="checkbox"/> Industrial or intensive agricultural
<input type="checkbox"/>	<input type="checkbox"/> Recreation
<input type="checkbox"/>	<input type="checkbox"/> Other _____

**Riparian zone composition**

Assess for whole sampling site

	% Cover		Vegetation Description
Trees (>10m in height)	80	} May total more than 100%	QUEEN
Trees (<10m in height)	20		" "
Shrubs	5		WARRIOR BUSH
Grasses / ferns / sedges	75		NATIVE + EXOTIC JER

**Shading of channel**
☐ < 5%    ☐ 6 – 25%    ☐ 26 – 50%    ☐ 51 – 75%    ☒ > 76%
**Extent of trailing bank vegetation**
☐ nil    ☐ moderate  
☒ slight    ☐ extensive
**Native and exotic riparian vegetation**

% Native	80	} Total 100%
% Exotic	20	

**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

		Left bank	Right bank
None		<input type="checkbox"/>	<input type="checkbox"/>
Isolated / scattered		<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps		<input type="checkbox"/>	<input type="checkbox"/>
Semi-continuous		<input type="checkbox"/>	<input type="checkbox"/>
Continuous		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

**Regeneration of native woody vegetation**

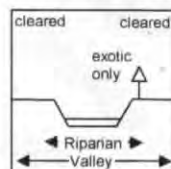
Is the sampling site in undisturbed forest?

Y [ ] N [X]

If no, record regeneration category

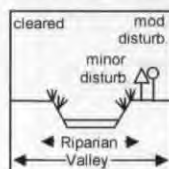
☒ Abundant (>5% cover) and healthy  
☐ Present  
☐ Very limited (<1% cover)
**Overall vegetation disturbance rating**

Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

**Extreme disturbance** ☐

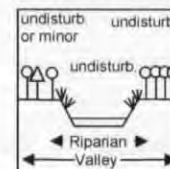
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie. dominated by exotic species with native species rare or completely absent)

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**High disturbance** ☐

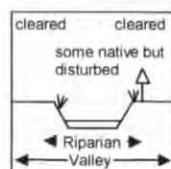
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain

**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

**Low disturbance** ☐

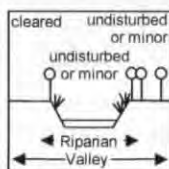
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor.

**Valley vegetation** – native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species

**Very high disturbance** ☒

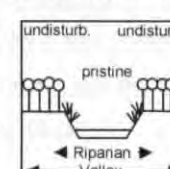
**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover.

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**Moderate disturbance** ☐

**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state






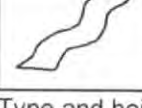
**Very low disturbance** ☐

**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Physical barriers to local fish passage**



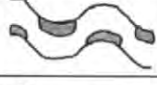






Choose one category for each flow condition

		Base flow	Low flow	High flow
	No passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Moderately restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Good passage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>







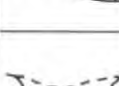
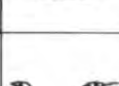
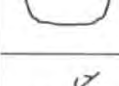
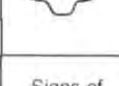
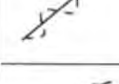
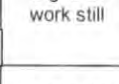
Type and height of barrier(s) \_\_\_\_\_

**Type of bars**










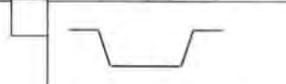

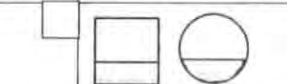
Choose one or more categories

	Bars absent	<input checked="" type="checkbox"/>
	Side/point bars VEGETATED	<input type="checkbox"/>
	Side/point bars UNVEGETATED	<input type="checkbox"/>
	Mid-channel bars VEGETATED	<input type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input type="checkbox"/>
	Bars around obstructions	<input type="checkbox"/>
	Braided channel	<input type="checkbox"/>
	Infilled channel	<input type="checkbox"/>
	High flow deposits	<input type="checkbox"/>

**Extent of bars**% of streambed forming a bar of any type 0 %**Dominant sediment particle size on bars**
 Boulder/cobble [ ] Pebble [ ] Gravel [ ]  
 Sand [ ] Silt/clay [ ] or \_\_\_\_\_ mm
**Channel modifications** Choose one or more categories


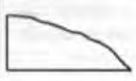

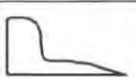

	No modifications	<input checked="" type="checkbox"/>		Reinforced	<input type="checkbox"/>	
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>	
	Dams and diversions	<input type="checkbox"/>		Infilled	<input type="checkbox"/>	
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input type="checkbox"/>	
	Straightened	<input type="checkbox"/>		Signs of work still	Recently channelised	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>		Works old and revegetated	Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	<input type="checkbox"/>		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
U shaped		Flat U shaped		Deepened U shape		Widened or infilled		Two stage		Multi stage	
	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
Box		Wide box		V shaped		Trapezoid		Concrete V		Pipe or culvert	

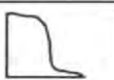


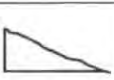
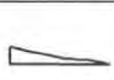
**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Convex	<input type="checkbox"/>	<input type="checkbox"/>
	Stepped	<input type="checkbox"/>	<input type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>

**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input type="checkbox"/>	<input type="checkbox"/>
	Moderate 30 - 60°	<input type="checkbox"/>	<input type="checkbox"/>
	Low 10 - 30°	<input type="checkbox"/>	<input type="checkbox"/>
	Flat <10°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

**Sediment oils**☒ absent ☐ light ☐ moderate ☐ profuse**Water oils**☒ none ☐ flecks ☐ globs ☐ sheen ☐ slick**Sediment odours**☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ anaerobic ☐ other \_\_\_\_\_**Water odours**☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ other \_\_\_\_\_**Turbidity (visual assessment)**☐ Clear ☐ Slight ☐ Turbid ☐ Opaque

Is water clarity reduced by:

☐ Suspended material (e.g. mud, clay, organics) ☐ Dissolved material (e.g. plant leachates)**Water level at the time of sampling**☒ Dry ☐ No flow ☐ Low ☐ Baseflow or near baseflow  
☐ High ☐ Flood (don't sample)**Artificial features at the sampling site**

Choose one or more categories

☐ Major ☐ Minor ☐ Ford ☐ Bridge ☐ Culvert ☐ Other weir

Description \_\_\_\_\_

**Large woody debris**

Overall % cover of logs and branches greater than 10cm in diameter

\_\_\_\_\_ % Notes on visibility \_\_\_\_\_

**Factors affecting bank stability**

Choose one or more categories

<input type="checkbox"/> None	<input type="checkbox"/> Cleared vegetation
<input type="checkbox"/> Mining	<input type="checkbox"/> Irrigation draw-down
<input type="checkbox"/> Runoff	<input type="checkbox"/> Reservoir releases
<input checked="" type="checkbox"/> Stock access	<input type="checkbox"/> Seepage
<input type="checkbox"/> Human access	<input type="checkbox"/> Flow and waves
<input type="checkbox"/> Ford, culvert or bridge	<input type="checkbox"/> Drainpipes
<input type="checkbox"/> Feral animals	
<input type="checkbox"/> Other	

Description \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops

% bedrock outcrops Left bank \_\_\_\_\_  
Right Bank \_\_\_\_\_**Artificial bank protection measures**



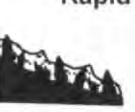

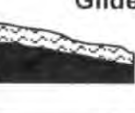



Choose one or more categories

<input checked="" type="checkbox"/> None	<input type="checkbox"/> Fenced stock watering points
<input type="checkbox"/> Fence structures	<input type="checkbox"/> Vegetation plantings
<input type="checkbox"/> Levee banks	<input type="checkbox"/> Logs strapped to bank
<input type="checkbox"/> Rock or wall layer	<input type="checkbox"/> Concrete channel lining
<input type="checkbox"/> Rip rap	
<input type="checkbox"/> Fenced human access	
<input type="checkbox"/> Other	

\_\_\_\_\_  
\_\_\_\_\_

**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<b>Waterfall</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Step Height <1m Gradient 5-60° Strong currents		<b>Cascade</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Gradient 3-5° Strong currents Rocks break surface		<b>Rapid</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		<b>Riffle</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small currents Surface unbroken and smooth		<b>Glide</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small but distinct & uniform current Surface unbroken		<b>Run</b>	85 _____ % of site 200 _____ Est. Av. Length (m) 0.5 _____ Est. Av. Depth (m) 7 _____ Est. Av. Width (m)
Area where stream widens or deepens and current declines		<b>Pool</b>	15 _____ % of site 50 _____ Est. Av. Length (m) 1.0 _____ Est. Av. Depth (m) 18 _____ Est. Av. Width (m)
A reasonable sized (>20% of channel width) cut-off section away from		<b>Backwater</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)

Note: An additional response variable planform channel pattern is measured in the office

**Macrophyte cover** Assess % cover of the sampling site by each category.

Overall % cover of macrophytes 25 % cover of emergent macrophytes 5  
 % cover of floating macrophytes 20  
 % cover of submerged macrophytes 10

Total should equal overall % cover of macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory. N denotes a native taxa and I denotes an introduced taxa.

**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	_____
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	_____
<i>Cyperus</i> (Sedge) I/N	<input type="checkbox"/>	_____
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	_____
<i>Juncus</i> (Rush) I/N	<input type="checkbox"/>	_____
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	_____
<i>Phragmites</i> (Common Reed) N	<input type="checkbox"/>	_____
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	_____
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	_____
Other <u>402-18-79</u>	<input checked="" type="checkbox"/>	5
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	_____
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	_____
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	_____
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____






**Floating macrophytes**

	Present	%
<i>Azolla</i> (Azolla) N	<input type="checkbox"/>	_____
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

Overall % cover of native macrophyte taxa \_\_\_\_\_ } Total should equal overall % cover  
 Overall % cover of native macrophyte taxa \_\_\_\_\_ } of macrophytes from above


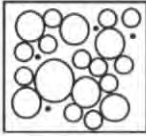
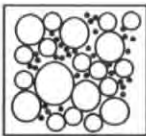
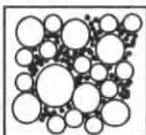
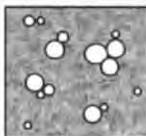
**Bed compaction**

Choose one category only

	<b>Tightly packed, armoured</b> Array of sediment sizes, overlapping, tightly packed and very hard to dislodge	<input type="checkbox"/>
	<b>Packed, unarmoured</b> Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate	<input type="checkbox"/>
	<b>Moderate compaction</b> Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate	<input type="checkbox"/>
	<b>Low compaction (1)</b> Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily	<input type="checkbox"/>
	<b>Low compaction (2)</b> Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily	<input type="checkbox"/>

**Sediment matrix**







Choose one category only

	<b>Bedrock</b>	<input type="checkbox"/>
	<b>Open framework</b> 0-5% fine sediment, high availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix filled contact framework</b> 5-32% fine sediment, moderate availability of interstitial spaces	<input type="checkbox"/>
	<b>Framework dilated</b> 32-60% fine sediment, low availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix dominated</b> >60% fine sediment, interstitial spaces virtually absent	<input checked="" type="checkbox"/>

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	<b>Very angular</b>	<input type="checkbox"/>
	<b>Angular</b>	<input type="checkbox"/>
	<b>Sub-angular</b>	<input type="checkbox"/>
	<b>Rounded</b>	<input type="checkbox"/>
	<b>Well rounded</b>	<input type="checkbox"/>
	<b>Cobble, pebble and gravel fractions not present</b>	<input checked="" type="checkbox"/>

In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding

Stable

Unstable - depositing

<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material.	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked, but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

USEPA Habitat Assessment  
 Circle a score for each parameter

HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
1. Epifaunal substrate / available cover	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					40-70% mix of stable habitat, well-suited for full colonisation potential; adequate habitat for maintenance of populations, presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					20-40% mix of stable habitat; habitat availability less than desirable, substrate frequently disturbed or removed.					Less than 20% stable habitat, lack of habitat is obvious, substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Embeddedness	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Velocity / depth regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep).					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment, 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars, 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development, more than 50% of the bottom changing frequently, pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel, or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal, stream with normal pattern.					Some channelization present, usually in areas of bridge abutments, evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive, embankments or shoring structures present on both banks, and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement, over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Frequency of riffles (or bends)</b>	Occurrence of riffles relatively frequent, ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent, distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend, bottom contours provide some habitat, distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles, poor habitat, distance between riffles divided by the width of the stream is a ratio of >25.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal, little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion, high erosion potential during floods.					Unstable, many eroded areas, 'raw' areas frequent along straight sections and bends, obvious bank sloughing, 60-100% of bank has erosional scars.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident, almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented, disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious, patches of bare soil or closely cropped vegetation common, less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high, vegetation has been removed to 5 centimetres or less in average stubble height.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres, human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres, human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres, human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres, little or no riparian vegetation is present because of human activities.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			

TOTAL HIGH GRADIENT HABITAT SCORE

## USEPA Habitat Assessment

Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
1. Epifaunal substrate / available cover	Greater than 50% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient)					30-50% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale)					10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed					Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Pool substrate characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common					Mixture of soft sand, mud or clay; mud may be dominant; some root mats and submerged vegetation present					All mud or clay or sand bottom; little or no root mat; no submerged vegetation					Hard-pan clay or bedrock; no root mat or vegetation					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present					Majority of pools large-deep, very few shallow					Shallow pools much more prevalent than deep pools					Majority of pools small-shallow or pools absent					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent					Heavy deposits of fine material; increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed					Water fills >75% of the available channel; or <25% of channel substrate is exposed					Water fills 25-75% of the available channel; and/or riffle substrates are mostly exposed					Very little water in channel and mostly present as standing pools					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted; instream habitat greatly altered or removed entirely					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
7. Channel sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).					The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.					The bends in the stream increase the stream 1 to 2 times longer than if it was in a straight line.					Channel straight, waterway has been channelized for a long distance.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
8. Bank stability (score each bank)	Banks stable, evidence of erosion or bank failure absent or minimal, little potential for future problems. <5% of bank affected.					Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.					Unstable, many eroded areas, 'raw' areas frequent along straight sections and bends, obvious bank sloughing, 60-100% of bank has erosional scars.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
9. Vegetative protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes, vegetative disruption through grazing or mowing minimal or not evident, almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented, disruption evident but not affecting full plant growth potential to any great extent, more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation, disruption obvious, patches of bare soil or closely cropped vegetation common, less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation, disruption of streambank vegetation is very high, vegetation has been removed to 5 centimetres or less in average stubble height remaining.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
10. Riparian zone score (score each bank)	Width of riparian zone >18 metres, human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres, human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres, human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres, little or no riparian vegetation is present because of human activities.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			

TOTAL LOW GRADIENT HABITAT SCORE

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number** 1 of 2

**Type of bedform at the cross-section**  
☐ Riffle ☒ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** (=total of boxes A+B+C) 19

**Stream width at the water mark (m)** 10 A

**Stream width at the water surface (m)** 0

**Bank height (m)** 0.3

**Bank width (m)** 3 B

**Vertical distance between the water surface and the water mark (m)** 1.5

**Horizontal distances (m)**

1	2	3	4	5	6	7	8	9	10								
---	---	---	---	---	---	---	---	---	----	--	--	--	--	--	--	--	--

**Vertical water depths (cm)**

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**Bank height (m)** 0.3

**Bank width (m)** 7 C

**Vertical distance between the water surface and the water mark (m)** 1.5

**Notes on cross-section measurement****Riparian zone width**

Left bank 5 (m) Right bank 10 (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%



**Channel cross-sections and variables to be measured in the area around a cross section**

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Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)**  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)**  **A**

**Stream width at the water surface (m)**

**Bank height (m)**

**Bank width (m)**  **B**

**Vertical distance between the water surface and the water mark (m)**

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)**

**Bank width (m)**  **c**

**Vertical distance between the water surface and the water mark (m)**

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material**

Assess % composition for each bank

Left bank Right bank

Bedrock \_\_\_\_\_

Boulder (>256mm) \_\_\_\_\_

Cobble (64-256mm) \_\_\_\_\_

Pebble (16-64mm) \_\_\_\_\_

Gravel (2-16mm) \_\_\_\_\_

Sand (0.06-2mm) \_\_\_\_\_

Fines (silt and clay, <0.06mm) \_\_\_\_\_

Total 100% each

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock \_\_\_\_\_

Boulder (>256mm) \_\_\_\_\_

Cobble (64-256mm) \_\_\_\_\_

Pebble (16-64mm) \_\_\_\_\_

Gravel (2-16mm) \_\_\_\_\_

Sand (0.06-2mm) \_\_\_\_\_

Fines (silt and clay <0.06mm) \_\_\_\_\_

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

Date 22.8.18

Site No. 007

Time 1523

Recorder's Name DR. J. J. J. J.

River Name WHALLAN CREEK

Location

ROAD RESERVE

Weather CLEAR + SUNNY

Rain in last week? Y [ ] N [X]

Photograph numbers and details

Latitude: deg min sec  
28 46 45Longitude: deg min sec  
150 24 53

GPS Name and Datum

007 142 W/S, B4-1000, 3-6 D/S

2-8

007 R/L - 142 L/D 3AM and R/L B/D

## PLANFORM SKETCH OF SITE

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.  
Left bank is facing downstream.

## LENGTH OF SAMPLING SITE

Bankfull width 7 (m)

x 10

Length of sampling site 710 (m)

## Notes

SITE ASSIGNED FROM NORTH SIDE (X)

Flood water in 1000-1000-1000

BEFORE LEAVING THE  
SITE, CHECK DATA  
SHEETS TO ENSURE  
THAT ALL VARIABLES  
HAVE BEEN RECORDED







Y

## BASIC WATER CHEMISTRY

		Units
Temperature	_____	°C
Conductivity	_____	
Dissolved Oxygen	_____	mg l <sup>-1</sup>
Dissolved Oxygen Sat.	_____	%
pH	_____	
Turbidity	_____	
Total phosphorus <input type="checkbox"/>	_____	
Total nitrogen <input type="checkbox"/>	_____	
Water sample taken?		
ALKALINITY		
Amount of water	_____	ml
Amount of H <sub>2</sub> SO <sub>4</sub>	_____	ml
Alkalinity	_____	mg l <sup>-1</sup>

## Valley shape

Choose one category only

	<input type="checkbox"/> Steep valley
	<input type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input checked="" type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

## Local impacts on streams

Choose one or more categories and describe the detail of each

- |                                                              |                                                  |
|--------------------------------------------------------------|--------------------------------------------------|
| <input type="checkbox"/> Sand or gravel mining               | <input type="checkbox"/> Sewage effluent         |
| <input type="checkbox"/> Other mining                        | <input type="checkbox"/> Channel straightening   |
| <input type="checkbox"/> Road                                | <input type="checkbox"/> River improvement works |
| <input checked="" type="checkbox"/> Bridge / culvert / wharf | <input type="checkbox"/> Water extraction        |
| <input checked="" type="checkbox"/> Ford / ramp              | <input type="checkbox"/> Dredging                |
| <input type="checkbox"/> Discharge pipe                      | <input checked="" type="checkbox"/> Grazing      |
| <input type="checkbox"/> Forestry activities                 | <input checked="" type="checkbox"/> Litter       |
| <input type="checkbox"/> Sugar mill                          | <input type="checkbox"/> Recreation              |
| <input type="checkbox"/> Irrigation run-off or pipe outlet   | <input type="checkbox"/> Other                   |

 Description \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

 Floodplain width \_\_\_\_\_ Average \_\_\_\_\_ (m)  
 uni. DIST. FORMED

## Floodplain features

Choose one or more features when present

- |                                                                                                                                           |                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> Sampling site has no distinct floodplain                                                                         | <input type="checkbox"/> Scroll systems<br>Short, crescentic strips or patches formed along the inner bank of a stream meander                               |
| <input type="checkbox"/> Oxbows / billabongs<br>Body of water occupying a former river meander, isolated by a shift in the stream channel | <input type="checkbox"/> Splays<br>Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain       |
| <input type="checkbox"/> Remnant channels<br>Formed during a previous hydrological regime. May be infilled with sediment                  | <input type="checkbox"/> Floodplain scours<br>Scour holes formed by the concentrated clearing and digging action of flowing water                            |
| <input type="checkbox"/> Flood channels<br>A channel that distributes water onto the floodplain and off the floodplain during floods      | <input checked="" type="checkbox"/> No floodplain features present<br>Floodplain present at the sampling site but does not contain any of the above features |

## Local landuse

Choose one category for each bank

- | Left                                | Right                                                                      |
|-------------------------------------|----------------------------------------------------------------------------|
| <input type="checkbox"/>            | <input type="checkbox"/> Native forest                                     |
| <input type="checkbox"/>            | <input type="checkbox"/> Native grassland (not grazed)                     |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> Grazing (native or non-native pasture) |
| <input type="checkbox"/>            | <input type="checkbox"/> Exotic grassland (lawns etc., no grazing)         |
| <input type="checkbox"/>            | <input type="checkbox"/> Forestry Native [ ] [ ] Pine [ ] [ ]              |
| <input type="checkbox"/>            | <input type="checkbox"/> Cropped Rainfed [ ] [ ] Irrigated [ ] [ ]         |
| <input type="checkbox"/>            | <input type="checkbox"/> Urban residential                                 |
| <input type="checkbox"/>            | <input type="checkbox"/> Commercial                                        |
| <input type="checkbox"/>            | <input type="checkbox"/> Industrial or intensive agricultural              |
| <input type="checkbox"/>            | <input type="checkbox"/> Recreation                                        |
| <input type="checkbox"/>            | <input type="checkbox"/> Other _____                                       |

**Riparian zone composition**

Assess for whole sampling site

	% Cover		Vegetation Description
Trees (>10m in height)	40	} May total more than 100%	Euc. Tm. + Acacia
Trees (<10m in height)	5		"
Shrubs	3		
Grasses / ferns / sedges	20		NATIVE + EXOTIC GRASSES

**Shading of channel**
☒ < 5%    ☐ 6 – 25%    ☐ 26 – 50%    ☐ 51 – 75%    ☐ > 76%
**Extent of trailing bank vegetation**
☒ nil    ☐ moderate  
☐ slight    ☐ extensive
**Native and exotic riparian vegetation**

% Native 60 } Total 100%  
 % Exotic 40 }  
 CRUISES BASED ON  
 VISUAL FRONT ROADSIDE

**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

		Left bank	Right bank
None		<input type="checkbox"/>	<input type="checkbox"/>
Isolated / scattered		<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps		<input type="checkbox"/>	<input type="checkbox"/>
Semi-continuous		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Continuous		<input type="checkbox"/>	<input type="checkbox"/>

**Regeneration of native woody vegetation**

Is the sampling site in undisturbed forest?

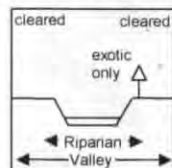
Y [ ] N [X]

If no, record regeneration category

☐ Abundant (>5% cover) and healthy Present  
☒ Very limited (<1% cover)

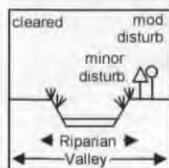
**Overall vegetation disturbance rating**

Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

**Extreme disturbance** ☐

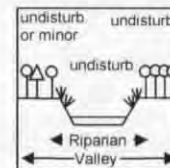
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie. dominated by exotic species with native species rare or completely absent)

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**High disturbance** ☐

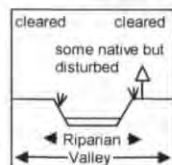
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain

**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

**Low disturbance** ☐

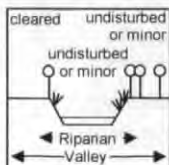
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor.

**Valley vegetation** – native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species

**Very high disturbance** ☒

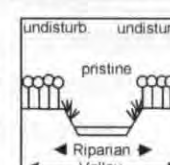
**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover.

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**Moderate disturbance** ☐

**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state






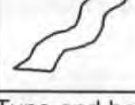
**Very low disturbance** ☐

**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition









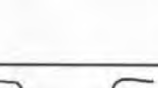
**Physical barriers to local fish passage**

Choose one category for each flow condition









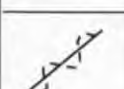
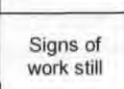
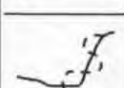
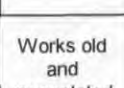
		Base flow	Low flow	High flow
	No passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Moderately restricted passage	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Good passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

 Type and height of barrier(s) ROAD 15  
A FORD. CROSSING NO CULVERTS
**Type of bars**








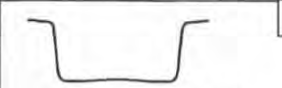

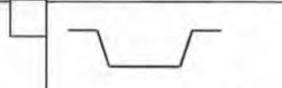


Choose one or more categories

	Bars absent	<input type="checkbox"/>
	Side/point bars VEGETATED	<input type="checkbox"/>
	Side/point bars UNVEGETATED	<input type="checkbox"/>
	Mid-channel bars VEGETATED	<input checked="" type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input type="checkbox"/>
	Bars around obstructions	<input type="checkbox"/>
	Braided channel	<input type="checkbox"/>
	Infilled channel	<input type="checkbox"/>
	High flow deposits	<input type="checkbox"/>

**Extent of bars**% of streambed forming a bar of any type 2 %**Dominant sediment particle size on bars**
 Boulder/cobble [ ] Pebble [ ] Gravel [ ]  
 Sand [ ] Silt/clay ☒ or \_\_\_\_\_ mm
**Channel modifications** Choose one or more categories


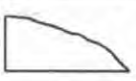



	No modifications	<input checked="" type="checkbox"/>		Reinforced	<input type="checkbox"/>
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>
	Dams and diversions	<input type="checkbox"/>		Infilled	<input type="checkbox"/>
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input type="checkbox"/>
	Straightened	<input type="checkbox"/>		Signs of work still	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>		Works old and revegetated	<input type="checkbox"/>
				Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
U shaped		Flat U shaped		Deepened U shape		Widened or infilled		Two stage		Multi stage	
	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
Box		Wide box		V shaped		Trapezoid		Concrete V		Pipe or culvert	




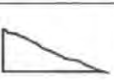
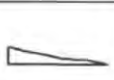
**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input type="checkbox"/>	<input type="checkbox"/>
	Convex	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Stepped	<input type="checkbox"/>	<input type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>

**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input type="checkbox"/>	<input type="checkbox"/>
	Moderate 30 - 60°	<input type="checkbox"/>	<input type="checkbox"/>
	Low 10 - 30°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Flat <10°	<input type="checkbox"/>	<input type="checkbox"/>

**Sediment oils**☒ absent ☐ light ☐ moderate ☐ profuse**Water oils**☒ none ☐ flecks ☐ globs ☐ sheen ☐ slick**Sediment odours**
☐ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ anaerobic ☒ other None
**Water odours**
☐ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☒ other None
**Turbidity (visual assessment)**☐ Clear ☐ Slight ☒ Turbid ☐ Opaque

Is water clarity reduced by:

☒ Suspended material  
(e.g mud, clay, organics) ☐ Dissolved material  
(e.g plant leachates)
**Water level at the time of sampling**
☐ Dry ☒ No flow ☐ Low ☐ Baseflow or near baseflow  
☐ High ☐ Flood (don't sample)
**Artificial features at the sampling site**

Choose one or more categories

☐ Major ☐ Minor ☐ Ford ☒ Bridge ☐ Culvert ☐ Other  
 weir

Description \_\_\_\_\_

**Large woody debris**

Overall % cover of logs and branches greater than 10cm in diameter

 \_\_\_\_\_ % Notes on visibility \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
**Factors affecting bank stability**

Choose one or more categories

☐ None ☐ Cleared vegetation  
☐ Mining ☐ Irrigation draw-down  
☒ Runoff ☐ Reservoir releases  
☒ Stock access ☐ Seepage  
☐ Human access ☐ Flow and waves  
☐ Ford, culvert or bridge ☐ Drainpipes  
☐ Feral animals ☐ Other

 Description \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops

 % bedrock outcrops Left bank \_\_\_\_\_  
 Right Bank \_\_\_\_\_
**Artificial bank protection measures**



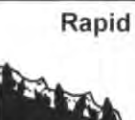

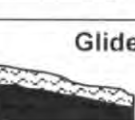



Choose one or more categories

☒ None ☐ Fenced stock watering points  
☐ Fence structures ☐ Vegetation plantings  
☐ Levee banks ☐ Logs strapped to bank  
☐ Rock or wall layer ☐ Concrete channel lining  
☐ Rip rap  
☐ Fenced human access  
☐ Other \_\_\_\_\_

 \_\_\_\_\_  
 \_\_\_\_\_

**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<b>Waterfall</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Step Height <1m Gradient 5-60° Strong currents		<b>Cascade</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Gradient 3-5° Strong currents Rocks break surface		<b>Rapid</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		<b>Riffle</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small currents Surface unbroken and smooth		<b>Glide</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small but distinct & uniform current Surface unbroken		<b>Run</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Area where stream widens or deepens and current declines		<b>Pool</b>	100 600 200 400 <b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
A reasonable sized (>20% of channel width) cut-off section away from		<b>Backwater</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)

Note: An additional response variable planform channel pattern is measured in the office

**Macrophyte cover** Assess % cover of the sampling site by each category.

Overall % cover of macrophytes 0 % cover of emergent macrophytes \_\_\_\_\_  
 % cover of floating macrophytes \_\_\_\_\_  
 % cover of submerged macrophytes \_\_\_\_\_

Total should equal overall % cover of macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory.

N denotes a native taxa and I denotes an introduced taxa.

**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	_____
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	_____
<i>Cyperus</i> (Sedge) I/N	<input type="checkbox"/>	_____
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	_____
<i>Juncus</i> (Rush) I/N	<input type="checkbox"/>	_____
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	_____
<i>Phragmites</i> (Common Reed) N	<input type="checkbox"/>	_____
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	_____
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	_____
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	_____
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	_____
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

**Floating macrophytes**






	Present	%
<i>Azolla</i> (Azolla) N	<input type="checkbox"/>	_____
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

Overall % cover of native macrophyte taxa \_\_\_\_\_  
 Overall % cover of native macrophyte taxa \_\_\_\_\_

Total should equal overall % cover of macrophytes from above




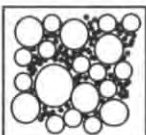
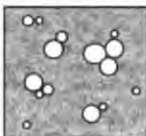
**Bed compaction**

Choose one category only

	<b>Tightly packed, armoured</b> Array of sediment sizes, overlapping, tightly packed and very hard to dislodge	<input type="checkbox"/>
	<b>Packed, unarmoured</b> Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate	<input type="checkbox"/>
	<b>Moderate compaction</b> Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate	<input type="checkbox"/>
	<b>Low compaction (1)</b> Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily	<input type="checkbox"/>
	<b>Low compaction (2)</b> Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily	<input checked="" type="checkbox"/>

**Sediment matrix**







Choose one category only

	<b>Bedrock</b>	<input type="checkbox"/>
	<b>Open framework</b> 0-5% fine sediment, high availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix filled contact framework</b> 5-32% fine sediment, moderate availability of interstitial spaces	<input type="checkbox"/>
	<b>Framework dilated</b> 32-60% fine sediment, low availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix dominated</b> >60% fine sediment, interstitial spaces virtually absent	<input checked="" type="checkbox"/>

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	<b>Very angular</b>	<input type="checkbox"/>
	<b>Angular</b>	<input type="checkbox"/>
	<b>Sub-angular</b>	<input type="checkbox"/>
	<b>Rounded</b>	<input type="checkbox"/>
	<b>Well rounded</b>	<input type="checkbox"/>
	<b>Cobble, pebble and gravel fractions not present</b>	<input checked="" type="checkbox"/>

In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding

Stable

Unstable - depositing

<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material.	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked, but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>1. Epifaunal substrate / available cover</b>	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					40-70% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>2. Embeddedness</b>	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>3. Velocity / depth regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep).					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>4. Sediment deposition</b>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>5. Channel flow status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>6. Channel alteration</b>	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Frequency of riffles (or bends)</b>	Occurrence of riffles relatively frequent, ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7). variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent, distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat, distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat, distance between riffles divided by the width of the stream is a ratio of >25.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas, 'raw' areas frequent along straight sections and bends; obvious bank sloughing. 60-100% of bank has erosional scars.					
SCORE	Left bank					10	9	8	7	6	5	4	3	2	1	0					
SCORE	Right bank					10	9	8	7	6	5	4	3	2	1	0					
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
SCORE	Left bank					10	9	8	7	6	5	4	3	2	1	0					
SCORE	Right bank					10	9	8	7	6	5	4	3	2	1	0					
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
SCORE	Left bank					10	9	8	7	6	5	4	3	2	1	0					
SCORE	Right bank					10	9	8	7	6	5	4	3	2	1	0					

TOTAL HIGH GRADIENT HABITAT SCORE

Site No. 507Date 22.8.15

## USEPA Habitat Assessment

Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
1. Epifaunal substrate / available cover	Greater than 50% of substrate favourable for epifaunal colonisation and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient)					30-50% mix of stable habitat, well-suited for full colonisation potential, adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale)					10-30% mix of stable habitat, habitat availability less than desirable, substrate frequently disturbed or removed					Less than 10% stable habitat, lack of habitat is obvious, substrate unstable or lacking					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Pool substrate characterization	Mixture of substrate materials, with gravel and firm sand prevalent, root mats and submerged vegetation common					Mixture of soft sand, mud or clay, mud may be dominant, some root mats and submerged vegetation present					All mud or clay or sand bottom, little or no root mat, no submerged vegetation					Hard-pan clay or bedrock, no root mat or vegetation					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present					Majority of pools large-deep, very few shallow					Shallow pools much more prevalent than deep pools					Majority of pools small-shallow or pools absent					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition					Some new increase in bar formation, mostly from gravel, sand or fine sediment, 20-50% of the bottom affected, slight deposition in pools					Moderate deposition of new gravel, sand or fine sediment on old and new bars, 50-80% of the bottom affected, sediment deposits at obstructions, constrictions and bends, moderate deposition in pools prevalent					Heavy deposits of fine material, increased bar development, more than 80% of the bottom changing frequently, pools almost absent due to substantial sediment deposition					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed					Water fills >75% of the available channel, or <25% of channel substrate is exposed					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed					Very little water in channel and mostly present as standing pools					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal, stream with normal pattern					Some channelization present, usually in areas of bridge abutments, evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present					Channelization may be extensive, embankments or shoring structures present on both banks, and 40 to 80% of stream reach channelized and disrupted					Banks shored with gabion or cement over 80% of the stream reach channelized and disrupted, instream habitat greatly altered or removed entirely					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Channel sinuosity</b> The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).																					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b> Banks stable: evidence of erosion or bank failure absent or minimal. Little potential for future problems. <5% of bank affected.						Moderately stable: infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable: 30-60% of bank in reach has areas of erosion, high erosion potential during floods.					Unstable: many eroded areas, 'raw' areas frequent along straight sections and bends, obvious bank sloughing, 60-100% of bank has erosional scars.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>9. Vegetative protection (score each bank)</b> More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.						70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height remaining.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>10. Riparian zone score (score each bank)</b> Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.						Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	0			

TOTAL LOW GRADIENT HABITAT SCORE

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)**  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)**  **A**

**Stream width at the water surface (m)**

**Bank height (m)**

**Bank width (m)**  **B**

**Vertical distance between the water surface and the water mark (m)**

**Horizontal distances (m)**

**Vertical water depths (cm)**

**Bank height (m)**

**Bank width (m)**  **c**

**Vertical distance between the water surface and the water mark (m)**

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	} Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	} Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)**  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)**  A

**Stream width at the water surface (m)**

**Bank height (m)**

**Bank width (m)**  B

**Vertical distance between the water surface and the water mark (m)**

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)**

**Bank width (m)**  C

**Vertical distance between the water surface and the water mark (m)**

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	} Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	} Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

Date 23.8.18 Site No. 009 Time 0630 Recorder's Name SARAH CLAUERTRiver Name WHALLAN CREEK Location CROWN LANDWeather CLEAR + SUNNY Rain in last week? Y [ ] N [☒]

Photograph numbers and details

Latitude: 

deg	min	sec
28	40	13

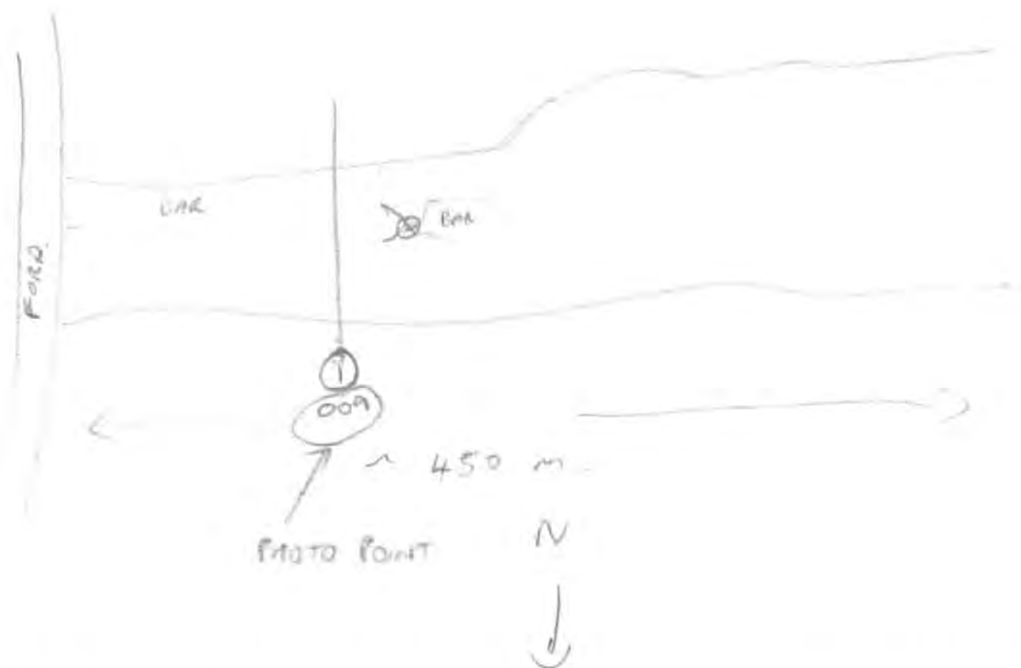
Longitude: 

deg	min	sec
150	27	26

GPS Name and Datum

009 1+2 W/S 3+4 O/S 5+6 O/S

## PLANFORM SKETCH OF SITE

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.  
Left bank is facing downstream.

## LENGTH OF SAMPLING SITE

Bankfull width 50 (m)

x 10

Length of sampling site 500 (m)

## Notes

SITE ASSESSED FROM ROAD SIDEACCESS BLOCKEDBEFORE LEAVING THE  
SITE, CHECK DATA  
SHEETS TO ENSURE  
THAT ALL VARIABLES  
HAVE BEEN RECORDED

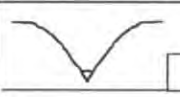

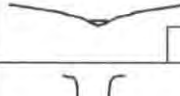
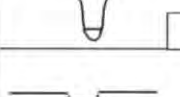

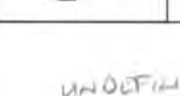
Y

## BASIC WATER CHEMISTRY

	Units
Temperature <u>21.5</u>	°C
Conductivity	
Dissolved Oxygen	mg l <sup>-1</sup>
Dissolved Oxygen Sat.	%
pH	
Turbidity	
Total phosphorus <input type="checkbox"/>	
Total nitrogen <input type="checkbox"/>	
Water sample taken?	
ALKALINITY	
Amount of water	ml
Amount of H <sub>2</sub> SO <sub>4</sub>	ml
Alkalinity	mg l <sup>-1</sup>

## Valley shape

Choose one category only

	<input type="checkbox"/> Steep valley
	<input type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input checked="" type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

UNDEFINED

Floodplain width \_\_\_\_\_ Average \_\_\_\_\_ (m)

## Floodplain features

Choose one or more features when present

<input type="checkbox"/> Sampling site has no distinct floodplain	<input type="checkbox"/> Scroll systems Short, crescentic strips or patches formed along the inner bank of a stream meander
<input type="checkbox"/> Oxbows / billabongs Body of water occupying a former river meander, isolated by a shift in the stream channel	<input type="checkbox"/> Splays Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain
<input type="checkbox"/> Remnant channels Formed during a previous hydrological regime. May be infilled with sediment	<input type="checkbox"/> Floodplain scours Scour holes formed by the concentrated clearing and digging action of flowing water
<input type="checkbox"/> Flood channels A channel that distributes water onto the floodplain and off the floodplain during floods	<input checked="" type="checkbox"/> No floodplain features present Floodplain present at the sampling site but does not contain any of the above features

## Local impacts on streams

Choose one or more categories and describe the detail of each

<input type="checkbox"/> Sand or gravel mining	<input type="checkbox"/> Sewage effluent
<input type="checkbox"/> Other mining	<input type="checkbox"/> Channel straightening
<input type="checkbox"/> Road	<input type="checkbox"/> River improvement works
<input type="checkbox"/> Bridge / culvert / wharf	<input type="checkbox"/> Water extraction
<input checked="" type="checkbox"/> Ford / ramp	<input type="checkbox"/> Dredging
<input type="checkbox"/> Discharge pipe	<input checked="" type="checkbox"/> Grazing
<input type="checkbox"/> Forestry activities	<input checked="" type="checkbox"/> Litter
<input type="checkbox"/> Sugar mill	<input type="checkbox"/> Recreation
<input type="checkbox"/> Irrigation run-off or pipe outlet	<input type="checkbox"/> Other

Description LOWLAND + CREEK HAS BEEN FENCED + GRAZED

## Local landuse

Choose one category for each bank

Left	Right
<input type="checkbox"/>	<input type="checkbox"/> Native forest
<input type="checkbox"/>	<input type="checkbox"/> Native grassland (not grazed)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Grazing (native or non-native pasture)
<input type="checkbox"/>	<input type="checkbox"/> Exotic grassland (lawns etc., no grazing)
<input type="checkbox"/>	<input type="checkbox"/> Forestry Native [ ] [ ] Pine [ ] [ ]
<input type="checkbox"/>	<input type="checkbox"/> Cropped Rainfed <input checked="" type="checkbox"/> Irrigated [ ] [ ]
<input type="checkbox"/>	<input type="checkbox"/> Urban residential
<input type="checkbox"/>	<input type="checkbox"/> Commercial
<input type="checkbox"/>	<input type="checkbox"/> Industrial or intensive agricultural
<input type="checkbox"/>	<input type="checkbox"/> Recreation
<input type="checkbox"/>	<input type="checkbox"/> Other _____

**Riparian zone composition**

Assess for whole sampling site

	% Cover		Vegetation Description
Trees (>10m in height)	<u>10</u>	} May total more than 100%	<u>EUC. TOL. + ACALIA SALICINA</u>
Trees (<10m in height)	<u>5</u>		<u>" " " "</u>
Shrubs	<u>30</u>		<u>WEDD ACALIA (MIMOSA)</u>
Grasses / ferns / sedges	<u>25</u>		<u>NATIVE</u>

**Shading of channel**
☒ < 5%    ☐ 6 – 25%    ☐ 26 – 50%    ☐ 51 – 75%    ☐ > 76%
**Extent of trailing bank vegetation**
☒ nil    ☐ moderate  
☐ slight    ☐ extensive
**Native and exotic riparian vegetation**

% Native	<u>50</u>	} Total 100%
% Exotic	<u>50</u>	

**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

		Left bank	Right bank
None		<input type="checkbox"/>	<input type="checkbox"/>
Isolated / scattered		<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Semi-continuous		<input type="checkbox"/>	<input checked="" type="checkbox"/>
Continuous		<input type="checkbox"/>	<input type="checkbox"/>

**Regeneration of native woody vegetation**

Is the sampling site in undisturbed forest?

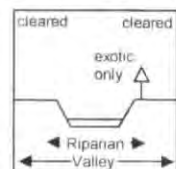
Y ☐ N ☒

If no, record regeneration category

<input type="checkbox"/>	Abundant (>5% cover) and healthy
<input type="checkbox"/>	Present
<input checked="" type="checkbox"/>	Very limited (<1% cover)

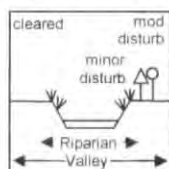
**Overall vegetation disturbance rating**

Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

**Extreme disturbance** ☐

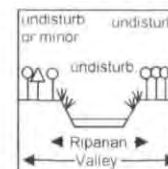
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie. dominated by exotic species with native species rare or completely absent)

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**High disturbance** ☐

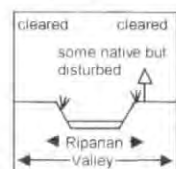
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain

**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

**Low disturbance** ☐

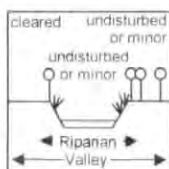
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor

**Valley vegetation** – native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species

**Very high disturbance** ☒

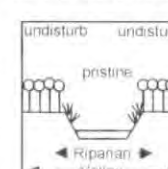
**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**Moderate disturbance** ☐

**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state






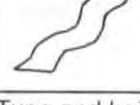
**Very low disturbance** ☐

**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

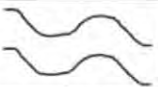








**Physical barriers to local fish passage**

Choose one category for each flow condition






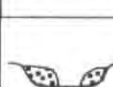
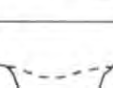

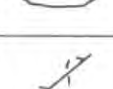
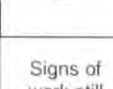
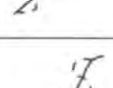
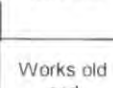
		Base flow	Low flow	High flow
	No passage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Moderately restricted passage	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Good passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Type and height of barrier(s) FOLD.**Type of bars**







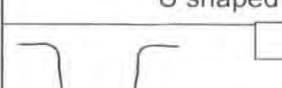
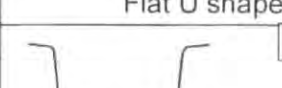
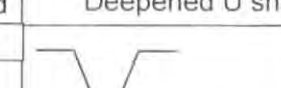



Choose one or more categories

	Bars absent	<input type="checkbox"/>
	Side/point bars VEGETATED	<input checked="" type="checkbox"/>
	Side/point bars UNVEGETATED	<input checked="" type="checkbox"/>
	Mid-channel bars VEGETATED	<input checked="" type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input type="checkbox"/>
	Bars around obstructions	<input type="checkbox"/>
	Braided channel	<input type="checkbox"/>
	Infilled channel	<input type="checkbox"/>
	High flow deposits	<input type="checkbox"/>

**Extent of bars**% of streambed forming a bar of any type 30 %**Dominant sediment particle size on bars**
 Boulder/cobble [ ☐ ] Pebble [ ☐ ] Gravel [ ☐ ]  
 Sand ☒ Silt/clay [ ☐ ] or \_\_\_\_\_ mm
**Channel modifications** Choose one or more categories

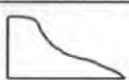
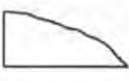

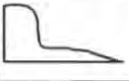

	No modifications	<input checked="" type="checkbox"/>		Reinforced	<input type="checkbox"/>
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>
	Dams and diversions	<input type="checkbox"/>		Infilled	<input type="checkbox"/>
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input type="checkbox"/>
	Straightened	<input type="checkbox"/>		Signs of work still	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>		Works old and revegetated	<input type="checkbox"/>
				Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	U shaped	<input type="checkbox"/>		Flat U shaped	<input type="checkbox"/>		Deepened U shape	<input type="checkbox"/>		Widened or infilled	<input type="checkbox"/>		Two stage	<input checked="" type="checkbox"/>		Multi stage	<input type="checkbox"/>
	Box	<input type="checkbox"/>		Wide box	<input type="checkbox"/>		V shaped	<input type="checkbox"/>		Trapezoid	<input type="checkbox"/>		Concrete V	<input type="checkbox"/>		Pipe or culvert	<input type="checkbox"/>


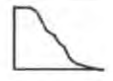
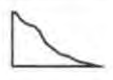
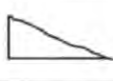

**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input type="checkbox"/>	<input type="checkbox"/>
	Convex	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Stepped	<input type="checkbox"/>	<input type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>

**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input type="checkbox"/>	<input type="checkbox"/>
	Moderate 30 - 60°	<input type="checkbox"/>	<input type="checkbox"/>
	Low 10 - 30°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Flat <10°	<input type="checkbox"/>	<input type="checkbox"/>

**Sediment oils**☒ absent ☐ light ☐ moderate ☐ profuse**Water oils**☒ none ☐ flecks ☐ globs ☐ sheen ☐ slick**Sediment odours**☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ anaerobic ☐ other \_\_\_\_\_**Water odours** *DRY*☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ other \_\_\_\_\_**Turbidity (visual assessment)**☐ Clear ☐ Slight ☐ Turbid ☐ Opaque*DRY*  
Is water clarity reduced by:☐ Suspended material  
(e.g mud, clay, organics) ☐ Dissolved material  
(e.g plant leachates)**Water level at the time of sampling**☒ Dry ☐ No flow ☐ Low ☐ Baseflow or near baseflow  
☐ High ☐ Flood (don't sample)**Artificial features at the sampling site**

Choose one or more categories

☐ Major ☐ Minor ☒ Ford ☐ Bridge ☐ Culvert ☐ Other  
weirDescription FORD AT UPSTREAM  
Road crossing**Large woody debris**

Overall % cover of logs and branches greater than 10cm in diameter

1 % Notes on visibility LIMITED VISIBILITY**Factors affecting bank stability**

Choose one or more categories

☐ None ☒ Cleared vegetation  
☐ Mining ☐ Irrigation draw-down  
☐ Runoff ☐ Reservoir releases  
☒ Stock access ☐ Seepage  
☐ Human access ☐ Flow and waves  
☐ Ford, culvert or bridge ☐ Drainpipes  
☐ Feral animals ☐ OtherDescription \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops



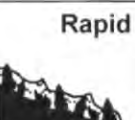

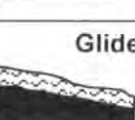



% bedrock outcrops Left bank 0  
Right Bank 0**Artificial bank protection measures**

Choose one or more categories

☒ None ☐ Fenced stock watering points  
☐ Fence structures ☐ Vegetation plantings  
☐ Levee banks ☐ Logs strapped to bank  
☐ Rock or wall layer ☐ Concrete channel lining  
☐ Rip rap  
☐ Fenced human access  
☐ Other \_\_\_\_\_\_\_\_\_\_  
\_\_\_\_\_

**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<b>Waterfall</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Step Height <1m Gradient 5-60° Strong currents		<b>Cascade</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Gradient 3-5° Strong currents Rocks break surface		<b>Rapid</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		<b>Riffle</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small currents Surface unbroken and smooth		<b>Glide</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small but distinct & uniform current Surface unbroken		<b>Run</b>	<b>% of site</b> 100 450 0-5 70 _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Area where stream widens or deepens and current declines		<b>Pool</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
A reasonable sized (>20% of channel width) cut-off section away from		<b>Backwater</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)

Note: An additional response variable planform channel pattern is measured in the office

**Macrophyte cover** Assess % cover of the sampling site by each category.

Overall % cover of macrophytes 0 % cover of emergent macrophytes 0  
 % cover of floating macrophytes 0  
 % cover of submerged macrophytes 0

Total should equal overall % cover of macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory. N denotes a native taxa and I denotes an introduced taxa.

**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	_____
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	_____
<i>Cyperus</i> (Sedge) I/N	<input type="checkbox"/>	_____
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	_____
<i>Juncus</i> (Rush) I/N	<input type="checkbox"/>	_____
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	_____
<i>Phragmites</i> (Common Reed) N	<input type="checkbox"/>	_____
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	_____
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	_____
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	_____
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	_____
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

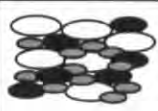




**Floating macrophytes**

	Present	%
<i>Azolla</i> (Azolla) N	<input type="checkbox"/>	_____
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

Overall % cover of native macrophyte taxa \_\_\_\_\_ } Total should equal overall % cover of macrophytes from above  
 Overall % cover of native macrophyte taxa \_\_\_\_\_ }


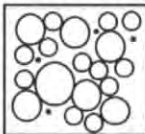

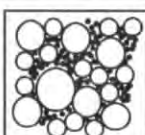
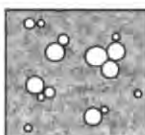
**Bed compaction**

Choose one category only

	<b>Tightly packed, armoured</b> Array of sediment sizes, overlapping, tightly packed and very hard to dislodge	<input type="checkbox"/>
	<b>Packed, unarmoured</b> Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate	<input type="checkbox"/>
	<b>Moderate compaction</b> Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate	<input checked="" type="checkbox"/>
	<b>Low compaction (1)</b> Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily	<input type="checkbox"/>
	<b>Low compaction (2)</b> Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily	<input type="checkbox"/>

**Sediment matrix**





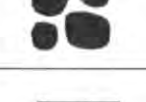

Choose one category only

	<b>Bedrock</b>	<input type="checkbox"/>
	<b>Open framework</b> 0-5% fine sediment, high availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix filled contact framework</b> 5-32% fine sediment, moderate availability of interstitial spaces	<input type="checkbox"/>
	<b>Framework dilated</b> 32-60% fine sediment, low availability of interstitial spaces	<input checked="" type="checkbox"/>
	<b>Matrix dominated</b> >60% fine sediment, interstitial spaces virtually absent	<input type="checkbox"/>

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	<b>Very angular</b>	<input type="checkbox"/>
	<b>Angular</b>	<input type="checkbox"/>
	<b>Sub-angular</b>	<input type="checkbox"/>
	<b>Rounded</b>	<input type="checkbox"/>
	<b>Well rounded</b>	<input type="checkbox"/>
	<b>Cobble, pebble and gravel fractions not present</b>	<input type="checkbox"/>

In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding

Stable

Unstable - depositing

<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material.	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked, but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
1. Epifaunal substrate / available cover	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient)					40-70% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale)					20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Embeddedness	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Velocity / depth regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m.					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep).					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment, 5-30% of the bottom affected, slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars, 30-50% of the bottom affected, sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development, more than 50% of the bottom changing frequently, pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel, or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted; instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Frequency of riffles (or bends)</b>	Occurrence of riffles relatively frequent, ratio of distance between riffles divided by width of the stream <7.1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent, distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat, distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles, poor habitat, distance between riffles divided by the width of the stream is a ratio of >25.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable, evidence of erosion or bank failure absent or minimal, little potential for future problems <5% of bank affected.					Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.					Unstable, many eroded areas, 'raw' areas frequent along straight sections and bends, obvious bank sloughing, 60-100% of bank has erosional scars.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non-woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident, almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented, disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation, disruption obvious, patches of bare soil or closely cropped vegetation common, less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation, disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres, human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres, human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres, little or no riparian vegetation is present because of human activities.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			

TOTAL HIGH GRADIENT HABITAT SCORE

## USEPA Habitat Assessment

## LOW GRADIENT STREAMS

Page 1 of 2

Circle a score for each parameter

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>1. Epifaunal substrate / available cover</b> Greater than 50% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient)																					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>2. Pool substrate characterization</b> Mixture of substrate materials, with gravel and firm sand prevalent, root mats and submerged vegetation common.																					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>3. Pool variability</b> Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.																					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>4. Sediment deposition</b> Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition																					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>5. Channel flow status</b> Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.																					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>6. Channel alteration</b> Channelization or dredging absent or minimal; stream with normal pattern.																					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
7. Channel sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).					The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.					The bends in the stream increase the stream 1 to 2 times longer than if it was in a straight line.					Channel straight, waterway has been channelized for a long distance.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
8. Bank stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
SCORE	Left bank		10	9																	
SCORE	Right bank		10																		
9. Vegetative protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height remaining.					
SCORE	Left bank		10	9																	
SCORE	Right bank		10																		
10. Riparian zone score (score each bank)	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
SCORE	Left bank		10	9																	
SCORE	Right bank		10																		

TOTAL LOW GRADIENT HABITAT SCORE

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number** 1 **of** 1

**Type of bedform at the cross-section**  
☐ Riffle ☒ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** 60  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** 30 **A**

**Stream width at the water surface (m)** 0

**Bank height (m)** 3.5

**Bank width (m)** 20 **B**

**Vertical distance between the water surface and the water mark (m)** 0.5

**Bank height (m)** 3.5

**Bank width (m)** 10 **C**

**Vertical distance between the water surface and the water mark (m)** 0.5

**Notes on cross-section measurement**

ONLY ONE DUE TO NO ACCESS

**Riparian zone width**

Left bank 30 (m) Right bank 25 (m)

**Bank material** Assess % composition for each bank

Left bank Right bank

Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	<u>10</u>	<u>0</u>
Fines (silt and clay <0.06mm)	<u>90</u>	<u>100</u>
	<u>100</u>	<u>100</u>

Total 100% each

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	<u>20</u>
Fines (silt and clay <0.06mm)	<u>80</u>

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

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**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)** \_\_\_\_\_

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** B

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** C

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

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The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)**

**Bank height (m)**

**Bank width (m)** B

**Vertical distance between the water surface and the water mark (m)**

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)**

**Bank width (m)** C

**Vertical distance between the water surface and the water mark (m)**

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

Dior IPRVABI

SARAH GUNART

### Photograph numbers and details

(o/i)  $1+2$  us,  $3+4$  centre,  $5+6$  D/B

---

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features. Left bank is facing downstream.



Bankfull width \_\_\_\_\_ (m)

x 10

Length of sampling site \_\_\_\_\_ (m)

DUNFARFORD RIVER + FLOW = 42

DATE: 11/15/2011

- SITE ACCESSIBLE FROM HIGHWAY

$$= F-H \text{ 二項式展開 2 行目 } \textcircled{1}$$

- DUPLICATE SAMPLE FROM SITE

BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES HAVE BEEN RECORDED

Y

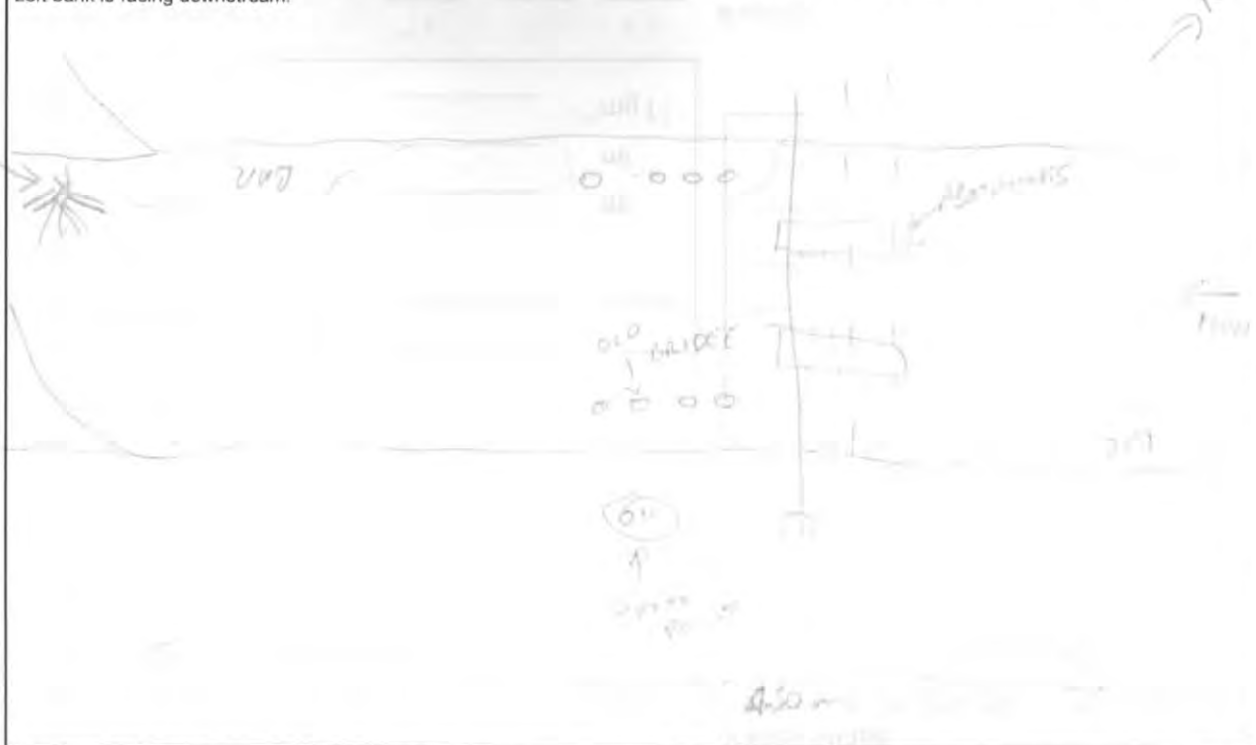
Date 23-8-18 Site No. 011 Time 0900 Recorder's Name SARAH GARDNERRiver Name MACHINERY RIVER Location PUBLIC ACCESSWeather CLEAR + SUNNY Rain in last week? Y ☐ N ☒ Photograph numbers and details (011) 1+2 WS, 3+4 CENTRE, 5+6 D/S

Latitude:	deg	min	sec	Longitude:	deg	min	sec
	28	40	60		150	30	31

GPS Name and Datum \_\_\_\_\_

## PLANFORM SKETCH OF SITE

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.  
Left bank is facing downstream.



## LENGTH OF SAMPLING SITE

Bankfull width \_\_\_\_\_ (m)

x 10

Length of sampling site \_\_\_\_\_ (m)

## Notes

SITE IS UPSTREAM OF CONFLUENCE  
DUMARRES RIVER + MACHINERY  
RIVER.

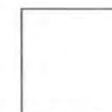
- BANK WIDTH MEASURED AT  
- SITE ACCESSED FROM ROAD BRIDGE

- 4+5m. But 20m. to the next site

- FOR CROSS-SECTION SCALE (1)

- DUPLICATE SAMPLE FROM SITE!

BEFORE LEAVING THE  
SITE, CHECK DATA  
SHEETS TO ENSURE  
THAT ALL VARIABLES  
HAVE BEEN RECORDED



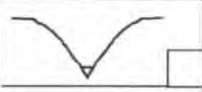
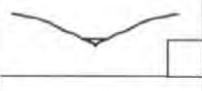
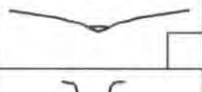
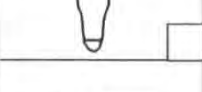
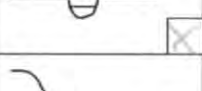
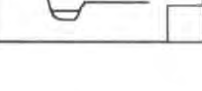
Y

## BASIC WATER CHEMISTRY

	Units
Temperature	11.7 °C
Conductivity	319.5 $\mu S/cm$ / 428.6 $\mu S/cm$
Dissolved Oxygen	9.44 mg l <sup>-1</sup>
Dissolved Oxygen Sat.	89.5 %
pH	7.92
Turbidity	13.1 ntu
Total phosphorus <input type="checkbox"/>	
Total nitrogen <input type="checkbox"/>	
Water sample taken?	
ALKALINITY	
Amount of water	23 ml
Amount of H <sub>2</sub> SO <sub>4</sub>	13 ml
Alkalinity	65 mg l <sup>-1</sup>
Salinity 0.21	

## Valley shape

Choose one category only

	<input type="checkbox"/> Steep valley
	<input type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input checked="" type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

## Local impacts on streams

Choose one or more categories and describe the detail of each

<input type="checkbox"/> Sand or gravel mining	<input type="checkbox"/> Sewage effluent
<input type="checkbox"/> Other mining	<input type="checkbox"/> Channel straightening
<input type="checkbox"/> Road	<input type="checkbox"/> River improvement works
<input checked="" type="checkbox"/> Bridge / culvert / wharf	<input type="checkbox"/> Water extraction
<input type="checkbox"/> Ford / ramp	<input type="checkbox"/> Dredging
<input type="checkbox"/> Discharge pipe	<input type="checkbox"/> Grazing
<input type="checkbox"/> Forestry activities	<input type="checkbox"/> Litter
<input type="checkbox"/> Sugar mill	<input checked="" type="checkbox"/> Recreation
<input type="checkbox"/> Irrigation run-off or pipe outlet	<input type="checkbox"/> Other

Description \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Local landuse

Choose one category for each bank

Left	Right
<input type="checkbox"/>	<input type="checkbox"/> Native forest
<input type="checkbox"/>	<input type="checkbox"/> Native grassland (not grazed)
<input type="checkbox"/>	<input type="checkbox"/> Grazing (native or non-native pasture)
<input type="checkbox"/>	<input type="checkbox"/> Exotic grassland (lawns etc., no grazing)
<input type="checkbox"/>	<input type="checkbox"/> Forestry Native [ ] [ ] Pine [ ] [ ]
<input type="checkbox"/>	<input checked="" type="checkbox"/> Cropped Rainfed [ ] [ ] Irrigated [ ] [ ]
<input type="checkbox"/>	<input type="checkbox"/> Urban residential
<input type="checkbox"/>	<input type="checkbox"/> Commercial
<input type="checkbox"/>	<input type="checkbox"/> Industrial or intensive agricultural
<input type="checkbox"/>	<input type="checkbox"/> Recreation
<input type="checkbox"/>	<input type="checkbox"/> Other _____

## Floodplain width

70 80 90 Average 85 (m)

## Floodplain features

Choose one or more features when present

<input type="checkbox"/> Sampling site has no distinct floodplain	<input type="checkbox"/> Scroll systems Short, crescentic strips or patches formed along the inner bank of a stream meander
<input type="checkbox"/> Oxbows / billabongs Body of water occupying a former river meander, isolated by a shift in the stream channel	<input type="checkbox"/> Splays Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain
<input checked="" type="checkbox"/> Remnant channels Formed during a previous hydrological regime. May be infilled with sediment	<input type="checkbox"/> Floodplain scours Scour holes formed by the concentrated clearing and digging action of flowing water
<input type="checkbox"/> Flood channels A channel that distributes water onto the floodplain and off the floodplain during floods	<input type="checkbox"/> No floodplain features present Floodplain present at the sampling site but does not contain any of the above features

**Riparian zone composition**

Assess for whole sampling site

	% Cover		Vegetation Description
Trees (>10m in height)	70	} May total more than 100%	E. telet, C. Cunningham MelB
Trees (<10m in height)	20		"
Shrubs	5		Mimosa
Grasses / ferns / sedges	70		Phragmites couch grass etc

**Shading of channel**
☐ < 5%    ☒ 6 – 25%    ☐ 26 – 50%    ☐ 51 – 75%    ☐ > 76%
**Extent of trailing bank vegetation**
☐ nil    ☐ moderate  
☒ slight    ☐ extensive
**Native and exotic riparian vegetation**

% Native 90 } Total 100%  
 % Exotic 10

**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

		Left bank	Right bank
None		<input type="checkbox"/>	<input type="checkbox"/>
Isolated / scattered		<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps		<input type="checkbox"/>	<input type="checkbox"/>
Semi-continuous		<input type="checkbox"/>	<input type="checkbox"/>
Continuous		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

**Regeneration of native woody vegetation**

Is the sampling site in undisturbed forest?

Y [ ] N [X]

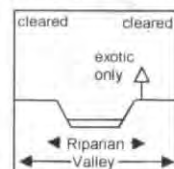
If no, record regeneration category

☐  
☒  
☐

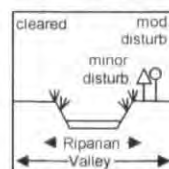
Abundant (>5% cover) and healthy  
 Present  
 Very limited (<1% cover)

**Overall vegetation disturbance rating**

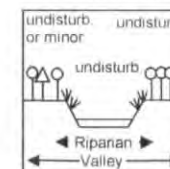
Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

**Extreme disturbance** ☐

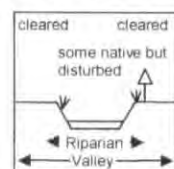
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie. dominated by exotic species with native species rare or completely absent)  
**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**High disturbance** ☐

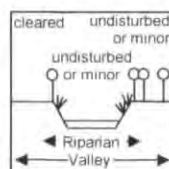
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain  
**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

**Low disturbance** ☐

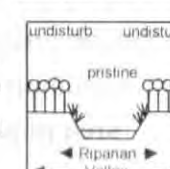
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor.  
**Valley vegetation** – native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species

**Very high disturbance** ☒

**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover  
**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**Moderate disturbance** ☐

**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate  
**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state

**Very low disturbance** ☐

**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition  
**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Physical barriers to local fish passage**

Choose one category for each flow condition

		Base flow	Low flow	High flow
	No passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Moderately restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Good passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Type and height of barrier(s) \_\_\_\_\_

**Type of bars**

Choose one or more categories

	Bars absent	<input type="checkbox"/>
	Side/point bars VEGETATED	<input type="checkbox"/>
	Side/point bars UNVEGETATED	<input checked="" type="checkbox"/>
	Mid-channel bars VEGETATED	<input type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input checked="" type="checkbox"/>
	Bars around obstructions	<input type="checkbox"/>
	Braided channel	<input type="checkbox"/>
	Infilled channel	<input type="checkbox"/>
	High flow deposits	<input type="checkbox"/>

**Extent of bars**% of streambed forming a bar of any type 10 %**Dominant sediment particle size on bars**
 Boulder/cobble [ ☐ ] Pebble [ ☐ ] Gravel [ ☒ ] *traced bines*  
 Sand [ ☒ ] Silt/clay [ ☐ ] or \_\_\_\_\_ mm *no more*
**Channel modifications** Choose one or more categories






	No modifications	<input checked="" type="checkbox"/>		Reinforced	<input type="checkbox"/>
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>
	Dams and diversions	<input type="checkbox"/>		Infilled	<input type="checkbox"/>
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input type="checkbox"/>
	Straightened	<input type="checkbox"/>		Signs of work still	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>		Works old and revegetated	<input type="checkbox"/>
				Recently channelised	<input type="checkbox"/>
				Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	U shaped	<input type="checkbox"/>		Flat U shaped	<input type="checkbox"/>		Deepened U shape	<input type="checkbox"/>		Widened or infilled	<input type="checkbox"/>		Two stage	<input checked="" type="checkbox"/>		Multi stage	<input type="checkbox"/>
	Box	<input type="checkbox"/>		Wide box	<input type="checkbox"/>		V shaped	<input type="checkbox"/>		Trapezoid	<input type="checkbox"/>		Concrete V	<input type="checkbox"/>		Pipe or culvert	<input type="checkbox"/>

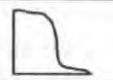
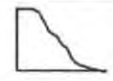

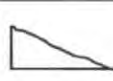
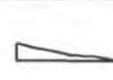
**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Convex	<input type="checkbox"/>	<input type="checkbox"/>
	Stepped	<input type="checkbox"/>	<input type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>

**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input type="checkbox"/>	<input type="checkbox"/>
	Moderate 30 - 60°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Low 10 - 30°	<input type="checkbox"/>	<input type="checkbox"/>
	Flat <10°	<input type="checkbox"/>	<input type="checkbox"/>

**Sediment oils**
☒ absent ☐ light ☐ moderate ☐ profuse
**Water oils**
☒ none ☐ flecks ☐ globs ☐ sheen ☐ slick
**Sediment odours**
☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ anaerobic ☐ other \_\_\_\_\_
**Water odours**
☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ other \_\_\_\_\_
**Turbidity (visual assessment)**
☐ Clear ☒ Slight ☐ Turbid ☐ Opaque

Is water clarity reduced by:

☐ Suspended material (e.g. mud, clay, organics) ☒ Dissolved material (e.g. plant leachates)
**Water level at the time of sampling**
☐ Dry ☐ No flow ☒ Low ☐ Baseflow or near baseflow  
☐ High ☐ Flood (don't sample)
**Artificial features at the sampling site**

Choose one or more categories

☐ Major ☐ Minor ☐ Ford ☒ Bridge ☐ Culvert ☐ Other weir

 Description Old Ford  
 \_\_\_\_\_  
 \_\_\_\_\_
**Large woody debris**

Overall % cover of logs and branches greater than 10cm in diameter

5 % Notes on visibility 11  
 \_\_\_\_\_  
 \_\_\_\_\_
**Factors affecting bank stability**

Choose one or more categories

☐ None ☒ Cleared vegetation  
☐ Mining ☐ Irrigation draw-down  
☐ Runoff ☐ Reservoir releases  
☐ Stock access ☐ Seepage  
☒ Human access ☐ Flow and waves  
☒ Ford, culvert or bridge ☐ Drainpipes  
☐ Feral animals ☐ Other  
 Description \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops



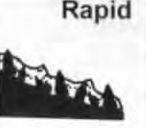





 % bedrock outcrops Left bank 0%  
 Right Bank 0%
**Artificial bank protection measures**

Choose one or more categories

☒ None ☐ Fenced stock watering points  
☐ Fence structures ☐ Vegetation plantings  
☐ Levee banks ☐ Logs strapped to bank  
☐ Rock or wall layer ☐ Concrete channel lining  
☐ Rip rap  
☐ Fenced human access  
☐ Other old sediment bank  
2m long old road end  
smaller 2m long

**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<b>Waterfall</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Step Height <1m Gradient 5-60° Strong currents		<b>Cascade</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Gradient 3-5° Strong currents Rocks break surface		<b>Rapid</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		<b>Riffle</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small currents Surface unbroken and smooth		<b>Glide</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small but distinct & uniform current Surface unbroken		<b>Run</b>	<u>100</u> % of site <u>5.50</u> Est. Av. Length (m) <u>1</u> Est. Av. Depth (m) <u>25</u> Est. Av. Width (m)
Area where stream widens or deepens and current declines		<b>Pool</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
A reasonable sized (>20% of channel width) cut-off section away from		<b>Backwater</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)

Note: An additional response variable planform channel pattern is measured in the office**Macrophyte cover** Assess % cover of the sampling site by each category.

Overall % cover of macrophytes 2 % cover of emergent macrophytes 2  
 % cover of floating macrophytes 0.01  
 % cover of submerged macrophytes \_\_\_\_\_

Total should equal overall % cover of macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory. N denotes a native taxa and I denotes an introduced taxa.

**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	_____
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	_____
<i>Cyperus</i> (Sedge) I/N	<input type="checkbox"/>	_____
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	_____
<i>Juncus</i> (Rush) I/N	<input type="checkbox"/>	_____
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	_____
<i>Phragmites</i> (Common Reed) N	<input checked="" type="checkbox"/>	<u>2</u>
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	_____
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	_____
Other <u><i>Potamogeton</i></u>	<input checked="" type="checkbox"/>	<u>0.01</u>
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	_____
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	_____
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	_____
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____






**Floating macrophytes**

	Present	%
<i>Azolla</i> (Azolla) N	<input checked="" type="checkbox"/>	<u>0.01</u>
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

Overall % cover of native macrophyte taxa \_\_\_\_\_ } Total should equal overall % cover  
 Overall % cover of native macrophyte taxa 1 } of macrophytes from above



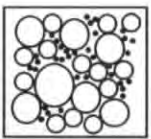
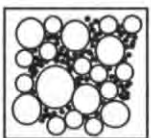
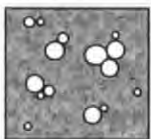
**Bed compaction**

Choose one category only

	Tightly packed, armoured Array of sediment sizes, overlapping, tightly packed and very hard to dislodge	<input type="checkbox"/>
	Packed, unarmoured Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate	<input type="checkbox"/>
	Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate	<input type="checkbox"/>
	Low compaction (1) Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily	<input checked="" type="checkbox"/>
	Low compaction (2) Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily	<input type="checkbox"/>

**Sediment matrix**






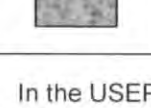
Choose one category only

	Bedrock	<input type="checkbox"/>
	Open framework 0-5% fine sediment, high availability of interstitial spaces	<input type="checkbox"/>
	Matrix filled contact framework 5-32% fine sediment, moderate availability of interstitial spaces	<input type="checkbox"/>
	Framework dilated 32-60% fine sediment, low availability of interstitial spaces	<input checked="" type="checkbox"/>
	Matrix dominated >60% fine sediment, interstitial spaces virtually absent	<input type="checkbox"/>

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	Very angular	<input type="checkbox"/>
	Angular	<input type="checkbox"/>
	Sub-angular	<input type="checkbox"/>
	Rounded	<input type="checkbox"/>
	Well rounded	<input checked="" type="checkbox"/>
	Cobble, pebble and gravel fractions not present	<input type="checkbox"/>

In the USEPA Habitat Assessment on the  
following pages, be sure to use the correct form  
for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding

Stable

Unstable - depositing

<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material.	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked, but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
1. Epifaunal substrate / available cover	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					40-70% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Embeddedness	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Velocity / depth regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep).					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected, slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material; increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel, or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Frequency of riffles (or bends)</b>	Occurrence of riffles relatively frequent, ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key in streams where riffles are continuous, placement of boulders or other large, natural obstruction is important					Occurrence of riffles infrequent, distance between riffles divided by the width of the stream is between 7 to 15					Occasional riffle or bend; bottom contours provide some habitat, distance between riffles divided by the width of the stream is between 15 to 25					Generally all flat water or shallow riffles, poor habitat, distance between riffles divided by the width of the stream is a ratio of >25					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods					Unstable; many eroded areas, 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars					
SCORE	Left bank					10	9	8	7	6	5	4	3	2	1	0					
SCORE	Right bank					10	9	8	7	6	5	4	3	2	1	0					
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height					
SCORE	Left bank					10	9	8	7	6	5	4	3	2	1	0					
SCORE	Right bank					10	9	8	7	6	5	4	3	2	1	0					
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities					
SCORE	Left bank					10	9	8	7	6	5	4	3	2	1	0					
SCORE	Right bank					10	9	8	7	6	5	4	3	2	1	0					

TOTAL HIGH GRADIENT HABITAT SCORE

USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
1. Epifaunal substrate / available cover	Greater than 50% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					30-50% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Pool substrate characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.					Mixture of soft sand, mud or clay; mud may be dominant; some root mats and submerged vegetation present.					All mud or clay or sand bottom; little or no root mat; no submerged vegetation.					Hard-pan clay or bedrock; no root mat or vegetation.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.					Majority of pools large-deep, very few shallow.					Shallow pools much more prevalent than deep pools.					Majority of pools small-shallow or pools absent.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material; increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel; and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Channel sinuosity</b> The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).																					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b> Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.						Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>9. Vegetative protection (score each bank)</b> More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.						70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>10. Riparian zone score (score each bank)</b> Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.						Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	0			

TOTAL LOW GRADIENT HABITAT SCORE

## Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number** 1 **of** 1

**Type of bedform at the cross-section**  
☐ Riffle ☒ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** (=total of boxes A+B+C) 74

**Stream width at the water mark (m)** 29 A

**Stream width at the water surface (m)** 35

**Bank height (m)** 6.0

**Bank width (m)** 14 B

**Vertical distance between the water surface and the water mark (m)** 1.8

**Horizontal distances (m)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
10	10	15	35	50	80	100	100	100	100	120	20	110	150	60	20									

**Vertical water depths (cm)**

**Bank height (m)** 6.0

**Bank width (m)** 17 C

**Vertical distance between the water surface and the water mark (m)** 1.5

## Notes on cross-section measurement

## Riparian zone width

Left bank 12 (m) Right bank 50 (m)

## Bank material Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

## Substrate composition

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	1
Pebble (16-64mm)	_____
Gravel (2-16mm)	20
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	20

Total 100%

## Filamentous algae cover

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

## Periphyton cover

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

## Moss cover

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

## Detritus cover

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

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**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)**

**Bank height (m)**

**Bank width (m)** B

**Vertical distance between the water surface and the water mark (m)**

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)**

**Bank width (m)** c

**Vertical distance between the water surface and the water mark (m)**

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	Total 100%

**Filamentous algae cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

Assess in the area 5m either side of the cross section

**Channel cross-sections and variables to be measured in the area around a cross section**

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**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)**  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)**  **A**

**Stream width at the water surface (m)**

**Bank height (m)**

**Bank width (m)**  **B**

**Vertical distance between the water surface and the water mark (m)**

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)**

**Bank width (m)**  **C**

**Vertical distance between the water surface and the water mark (m)**

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

Date 23-8-18 Site No. 012 Time 0700 Recorder's Name SARAH GUNTERS

River Name	MACINTYRE RIVER	Location	PUBLIC ACCESS @ BOGGABILLA
------------	-----------------	----------	----------------------------

Weather CLEAR + SUNNY Rain in last week? Y ☐ N ☒

Photograph numbers and details 9.10.82

Latitude: 

deg	min	sec
28	36	34

 Longitude: 

deg	min	sec
150	21	50

(12B) 1+2 W/S, 3+4 centre, 5+6 O/S, 7+8 locum - 100%

GPS Name and Datum

## PLANFORM SKETCH OF SITE

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features. Left bank is facing downstream.

## LENGTH OF SAMPLING SITE

Bankfull width 102 (m)

x 10

Length of sampling site 1200 (m)

## Notes

At water plunging site  
veg on left bank  
2 days earlier, rubbers  
around it

TOP - 700 m high  
- but traps x4, for 2h - no fish  
- fish coming over (1)

BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES HAVE BEEN RECORDED

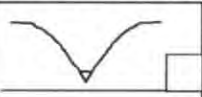

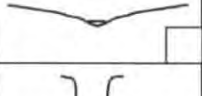
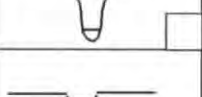
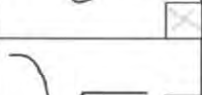
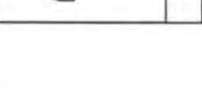


## BASIC WATER CHEMISTRY

		Units
Temperature	<u>12.0</u>	°C
Conductivity	<u>308.1 / 410.3</u>	<u>µS/cm</u>
Dissolved Oxygen	<u>8.79</u>	mg l <sup>-1</sup>
Dissolved Oxygen Sat.	<u>83.5</u>	%
pH	<u>7.74</u>	
Turbidity	<u>12.5</u>	<u>NTU</u>
Total phosphorus	<input checked="" type="checkbox"/>	
Total nitrogen	<input checked="" type="checkbox"/>	
Water sample taken?		
ALKALINITY		
Amount of water	<u>23</u>	ml
Amount of H <sub>2</sub> SO <sub>4</sub>	<u>11</u>	ml
Alkalinity	<u>55</u>	mg l <sup>-1</sup>
<u>Salinity 0.2 ppt</u>		

## Valley shape

Choose one category only

	<input type="checkbox"/> Steep valley
	<input type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input checked="" type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

## Local impacts on streams

Choose one or more categories and describe the detail of each

- |                                                            |                                                             |
|------------------------------------------------------------|-------------------------------------------------------------|
| <input type="checkbox"/> Sand or gravel mining             | <input type="checkbox"/> Sewage effluent                    |
| <input type="checkbox"/> Other mining                      | <input type="checkbox"/> Channel straightening              |
| <input type="checkbox"/> Road                              | <input type="checkbox"/> River improvement works            |
| <input type="checkbox"/> Bridge / culvert / wharf          | <input checked="" type="checkbox"/> Water extraction        |
| <input type="checkbox"/> Ford / ramp                       | <input type="checkbox"/> Dredging                           |
| <input type="checkbox"/> Discharge pipe                    | <input type="checkbox"/> Grazing                            |
| <input type="checkbox"/> Forestry activities               | <input checked="" type="checkbox"/> Litter                  |
| <input type="checkbox"/> Sugar mill                        | <input checked="" type="checkbox"/> Recreation              |
| <input type="checkbox"/> Irrigation run-off or pipe outlet | <input checked="" type="checkbox"/> Other <u>recreation</u> |

Description

Sandy, brown, low flow

## Local landuse

Choose one category for each bank

Left Right

- |                                     |                          |                                           |
|-------------------------------------|--------------------------|-------------------------------------------|
| <input type="checkbox"/>            | <input type="checkbox"/> | Native forest                             |
| <input type="checkbox"/>            | <input type="checkbox"/> | Native grassland (not grazed)             |
| <input type="checkbox"/>            | <input type="checkbox"/> | Grazing (native or non-native pasture)    |
| <input type="checkbox"/>            | <input type="checkbox"/> | Exotic grassland (lawns etc., no grazing) |
| <input type="checkbox"/>            | <input type="checkbox"/> | Forestry Native [ ] [ ] Pine [ ] [ ]      |
| <input type="checkbox"/>            | <input type="checkbox"/> | Cropped Rainfed [ ] [ ] Irrigated [ ] [ ] |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Urban residential                         |
| <input type="checkbox"/>            | <input type="checkbox"/> | Commercial                                |
| <input type="checkbox"/>            | <input type="checkbox"/> | Industrial or intensive agricultural      |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Recreation                                |
| <input type="checkbox"/>            | <input type="checkbox"/> | Other _____                               |

## Floodplain width

200 250 250 Average 233 (m)

## Floodplain features

Choose one or more features when present

- |                                                                                                                                                      |                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> Sampling site has no distinct floodplain                                                                                    | <input checked="" type="checkbox"/> Scroll systems<br>Short, crescentic strips or patches formed along the inner bank of a stream meander              |
| <input checked="" type="checkbox"/> Oxbows / billabongs<br>Body of water occupying a former river meander, isolated by a shift in the stream channel | <input type="checkbox"/> Splays<br>Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain |
| <input checked="" type="checkbox"/> Remnant channels<br>Formed during a previous hydrological regime. May be infilled with sediment                  | <input type="checkbox"/> Floodplain scours<br>Scour holes formed by the concentrated clearing and digging action of flowing water                      |
| <input type="checkbox"/> Flood channels<br>A channel that distributes water onto the floodplain and off the floodplain during floods                 | <input type="checkbox"/> No floodplain features present<br>Floodplain present at the sampling site but does not contain any of the above features      |

**Riparian zone composition**

Assess for whole sampling site

	% Cover	Vegetation Description
Trees (>10m in height)	40	Eucalypt + Melaleuca spp.
Trees (<10m in height)	5	
Shrubs	50	Acacia spp.
Grasses / ferns / sedges	80	Native + Exotic

May total more than 100%

**Shading of channel**
☒ < 5%    ☐ 6 – 25%    ☐ 26 – 50%    ☐ 51 – 75%    ☐ > 76%
**Extent of trailing bank vegetation**
☒ nil    ☐ moderate  
☐ slight    ☐ extensive
**Native and exotic riparian vegetation**
 % Native 75 } Total 100%  
 % Exotic 25
**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

		Left bank	Right bank
None		<input type="checkbox"/>	<input type="checkbox"/>
Isolated / scattered		<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps		<input type="checkbox"/>	<input type="checkbox"/>
Semi-continuous		<input type="checkbox"/>	<input type="checkbox"/>
Continuous		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

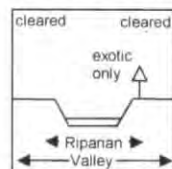
**Regeneration of native woody vegetation**

Is the sampling site in undisturbed forest?

Y [ ] N [ ]

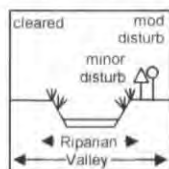
 If no, record regeneration category  
☐ Abundant (>5% cover) and healthy  
☐ Present  
☒ Very limited (<1% cover)
**Overall vegetation disturbance rating**

Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

**Extreme disturbance** ☐

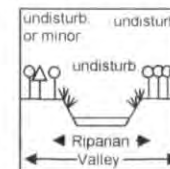
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie. dominated by exotic species with native species rare or completely absent)

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**High disturbance** ☐

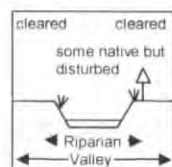
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain

**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

**Low disturbance** ☐

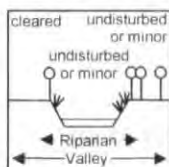
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor

**Valley vegetation** – native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species

**Very high disturbance** ☒

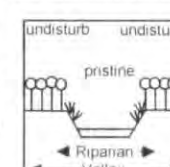
**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**Moderate disturbance** ☐

**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state





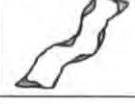
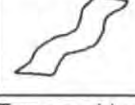
**Very low disturbance** ☐

**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Physical barriers to local fish passage**

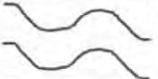








Choose one category for each flow condition

		Base flow	Low flow	High flow
	No passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Moderately restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Good passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Type and height of barrier(s) \_\_\_\_\_

**Type of bars**

Choose one or more categories







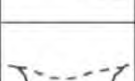
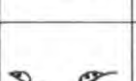
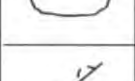
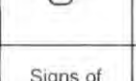
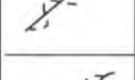
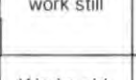
	Bars absent	<input type="checkbox"/>
	Side/point bars VEGETATED	<input type="checkbox"/>
	Side/point bars UNVEGETATED	<input checked="" type="checkbox"/>
	Mid-channel bars VEGETATED	<input type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input type="checkbox"/>
	Bars around obstructions	<input type="checkbox"/>
	Braided channel	<input type="checkbox"/>
	Infilled channel	<input type="checkbox"/>
	High flow deposits	<input type="checkbox"/>

**Extent of bars**% of streambed forming a bar of any type 5 %**Dominant sediment particle size on bars**







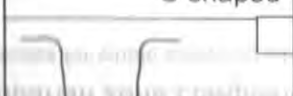
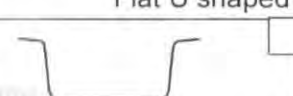
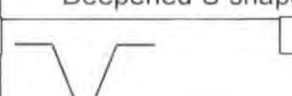
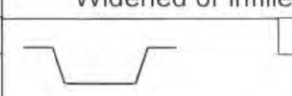
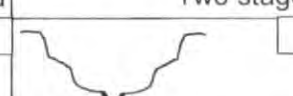
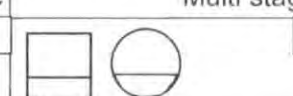
Boulder/cobble [ ] Pebble [ ] Gravel [ ]

Sand [x] Silt/clay [ ] or \_\_\_\_\_ mm

**Channel modifications** Choose one or more categories





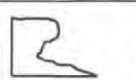
	No modifications	<input checked="" type="checkbox"/>		Reinforced	<input type="checkbox"/>
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>
	Dams and diversions	<input type="checkbox"/>		Infilled	<input type="checkbox"/>
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input type="checkbox"/>
	Straightened	<input type="checkbox"/>		Signs of work still	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>		Works old and revegetated	<input type="checkbox"/>
				Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	U shaped	<input checked="" type="checkbox"/>		Flat U shaped	<input type="checkbox"/>		Deepened U shape	<input type="checkbox"/>		Widened or infilled	<input type="checkbox"/>		Two stage	<input type="checkbox"/>		Multi stage	<input type="checkbox"/>
	Box	<input type="checkbox"/>		Wide box	<input type="checkbox"/>		V shaped	<input type="checkbox"/>		Trapezoid	<input type="checkbox"/>		Concrete V	<input type="checkbox"/>		Pipe or culvert	<input type="checkbox"/>


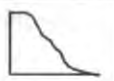

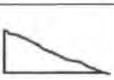
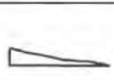
**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Convex	<input type="checkbox"/>	<input type="checkbox"/>
	Stepped	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>

**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Moderate 30 - 60°	<input type="checkbox"/>	<input type="checkbox"/>
	Low 10 - 30°	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Flat <10°	<input type="checkbox"/>	<input type="checkbox"/>

**Sediment oils**
☒ absent ☐ light ☐ moderate ☐ profuse
**Water oils**
☒ none ☐ flecks ☐ globs ☐ sheen ☐ slick
**Sediment odours**
☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ anaerobic ☐ other \_\_\_\_\_
**Water odours**
☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ other \_\_\_\_\_
**Turbidity (visual assessment)**
☒ Clear ☐ Slight ☐ Turbid ☐ Opaque

Is water clarity reduced by:

☐ Suspended material (e.g mud, clay, organics) ☐ Dissolved material (e.g plant leachates)
**Water level at the time of sampling**
☐ Dry ☐ No flow ☒ Low ☐ Baseflow or near baseflow  
☐ High ☐ Flood (don't sample)
**Artificial features at the sampling site**

Choose one or more categories

☐ Major ☐ Minor ☐ Ford ☐ Bridge ☐ Culvert ☐ Other weir

 Description \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
**Large woody debris**

Overall % cover of logs and branches greater than 10cm in diameter

 \_\_\_\_\_ % Notes on visibility \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
**Factors affecting bank stability**

Choose one or more categories

☐ None ☐ Cleared vegetation  
☐ Mining ☐ Irrigation draw-down  
☐ Runoff ☐ Reservoir releases  
☒ Stock access ☐ Seepage  
☒ Human access ☐ Flow and waves  
☐ Ford, culvert or bridge ☐ Drainpipes  
☐ Feral animals ☐ Other  
☐ Other

 Description \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops

 % bedrock outcrops Left bank 0  
 Right Bank 0
**Artificial bank protection measures**



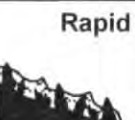

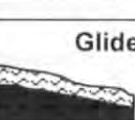



Choose one or more categories

☒ None ☐ Fenced stock watering points  
☐ Fence structures ☐ Vegetation plantings  
☐ Levee banks ☐ Logs strapped to bank  
☐ Rock or wall layer ☐ Concrete channel lining  
☐ Rip rap  
☐ Fenced human access  
☐ Other \_\_\_\_\_

 \_\_\_\_\_  
 \_\_\_\_\_

**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<b>Waterfall</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Step Height <1m Gradient 5-60° Strong currents		<b>Cascade</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Gradient 3-5° Strong currents Rocks break surface		<b>Rapid</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		<b>Riffle</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small currents Surface unbroken and smooth		<b>Glide</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small but distinct & uniform current Surface unbroken		<b>Run</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Area where stream widens or deepens and current declines		<b>Pool</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
A reasonable sized (>20% of channel width) cut-off section away from group features		<b>Backwater</b>	<b>% of site</b> _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)

Note: An additional response variable planform channel pattern is measured in the office

**Macrophyte cover** Assess % cover of the sampling site by each category.

Overall % cover of macrophytes 1 % cover of emergent macrophytes 1  
 % cover of floating macrophytes 0  
 % cover of submerged macrophytes 0

Total should equal overall % cover of macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory. N denotes a native taxa and I denotes an introduced taxa.

**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	
<i>Cyperus</i> (Sedge) I/N	<input type="checkbox"/>	
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	
<i>Juncus</i> (Rush) I/N	<input type="checkbox"/>	
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	
<i>Phragmites</i> (Common Reed) N	<input checked="" type="checkbox"/>	1
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	






**Floating macrophytes**

	Present	%
<i>Azolla</i> (Azolla) N	<input type="checkbox"/>	
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	

Overall % cover of native macrophyte taxa \_\_\_\_\_ } Total should equal overall % cover of macrophytes from above  
 Overall % cover of native macrophyte taxa \_\_\_\_\_ }


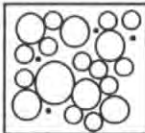
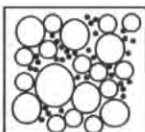
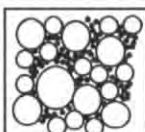
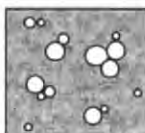
**Bed compaction**

Choose one category only

	<b>Tightly packed, armoured</b> Array of sediment sizes, overlapping, tightly packed and very hard to dislodge	<input type="checkbox"/>
	<b>Packed, unarmoured</b> Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate	<input type="checkbox"/>
	<b>Moderate compaction</b> Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate	<input checked="" type="checkbox"/>
	<b>Low compaction (1)</b> Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily	<input type="checkbox"/>
	<b>Low compaction (2)</b> Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily	<input type="checkbox"/>

**Sediment matrix**







Choose one category only

	<b>Bedrock</b>	<input type="checkbox"/>
	<b>Open framework</b> 0-5% fine sediment, high availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix filled contact framework</b> 5-32% fine sediment, moderate availability of interstitial spaces	<input type="checkbox"/>
	<b>Framework dilated</b> 32-60% fine sediment, low availability of interstitial spaces	<input checked="" type="checkbox"/>
	<b>Matrix dominated</b> >60% fine sediment, interstitial spaces virtually absent	<input type="checkbox"/>

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	<b>Very angular</b>	<input type="checkbox"/>
	<b>Angular</b>	<input type="checkbox"/>
	<b>Sub-angular</b>	<input type="checkbox"/>
	<b>Rounded</b>	<input type="checkbox"/>
	<b>Well rounded</b>	<input type="checkbox"/>
	<b>Cobble, pebble and gravel fractions not present</b>	<input type="checkbox"/>

In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding

Stable

Unstable - depositing

<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material.	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked, but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.
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USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
1. Epifaunal substrate / available cover	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					40-70% mix of stable habitat, well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					20-40% mix of stable habitat, habitat availability less than desirable, substrate frequently disturbed or removed.					Less than 20% stable habitat, lack of habitat is obvious, substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Embeddedness	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Velocity / depth regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep).					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment, 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars, 30-50% of the bottom affected; sediment deposits at obstructions, constructions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development, more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel, or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal, stream with normal pattern.					Some channelization present, usually in areas of bridge abutments, evidence of past channelization, i.e. dredging (greater than 20 yr) may be present but recent channelization is not present.					Channelization may be extensive, embankments or shoring structures present on both banks, and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement, over 80% of the stream reach channelized and disrupted, instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
7. Frequency of riffles (or bends)	Occurrence of riffles relatively frequent: ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent: distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
8. Bank stability (score each bank)	Banks stable: evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas, 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
SCORE	Left bank		10	9	8	7	6	5		4	3	2		1	0						
SCORE	Right bank		10	9	8	7	6	5		4	3	2		1	0						
9. Vegetative protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
SCORE	Left bank		10	9	8	7	6	5		4	3	2		1	0						
SCORE	Right bank		10	9	8	7	6	5		4	3	2		1	0						
10. Riparian zone score (score each bank)	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
SCORE	Left bank		10	9	8	7	6	5		4	3	2		1	0						
SCORE	Right bank		10	9	8	7	6	5		4	3	2		1	0						

TOTAL HIGH GRADIENT HABITAT SCORE

Site No. 012Date 26-0-19USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>1. Epifaunal substrate / available cover</b>	Greater than 50% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					30-50% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>2. Pool substrate characterization</b>	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.					Mixture of soft sand, mud or clay; mud may be dominant; some root mats and submerged vegetation present.					All mud or clay or sand bottom; little or no root mat; no submerged vegetation.					Hard-pan clay or bedrock; no root mat or vegetation.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>3. Pool variability</b>	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.					Majority of pools large-deep, very few shallow.					Shallow pools much more prevalent than deep pools.					Majority of pools small-shallow or pools absent.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>4. Sediment deposition</b>	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material; increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>5. Channel flow status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel, or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>6. Channel alteration</b>	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present; usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted; instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
7. Channel sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).					The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.					The bends in the stream increase the stream 1 to 2 times longer than if it was in a straight line.					Channel straight; waterway has been channelized for a long distance.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
8. Bank stability (score each bank)	Banks stable: evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
9. Vegetative protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height remaining.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			
10. Riparian zone score (score each bank)	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	0			

TOTAL LOW GRADIENT HABITAT SCORE

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number** \_\_\_\_\_ **of** \_\_\_\_\_

**Type of bedform at the cross-section**  
☐ Riffle ☒ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)** C

**Bank height (m)** 2.8

**Bank width (m)** 1.1

**Vertical distance between the water surface and the water mark (m)** 1.7

**Bank height (m)**

**Bank width (m)** c

**Vertical distance between the water surface and the water mark (m)**

Horizontal distances (m)

Vertical water depths (cm)

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material**

Assess % composition for each bank

Left bank Right bank

Bedrock \_\_\_\_\_

Boulder (>256mm) \_\_\_\_\_

Cobble (64-256mm) \_\_\_\_\_

Pebble (16-64mm) \_\_\_\_\_

Gravel (2-16mm) \_\_\_\_\_

Sand (0.06-2mm) \_\_\_\_\_

Fines (silt and clay <0.06mm) \_\_\_\_\_

Total 100% each

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock \_\_\_\_\_

Boulder (>256mm) \_\_\_\_\_

Cobble (64-256mm) \_\_\_\_\_

Pebble (16-64mm) \_\_\_\_\_

Gravel (2-16mm) \_\_\_\_\_

Sand (0.06-2mm) \_\_\_\_\_

Fines (silt and clay <0.06mm) \_\_\_\_\_

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

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**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number**        **of**       

**Type of bedform at the cross-section**  
☐ Riffle ☒ Run ☐ Pool ☐ Cascade ☐ Other       

**Bankfull channel width (m)**         
 (=total of boxes A+B+C)

**Stream width at the water mark (m)**        A

**Stream width at the water surface (m)**       

**Bank height (m)** 4.5

**Bank width (m)** 20 B

**Vertical distance between the water surface and the water mark (m)** 1.3

**Horizontal distances (m)**

1	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

**Vertical water depths (cm)**

5	8	10	12	15	18	20	22	25	28	30	32	35	38	40	42	45	48	50	52	55	58	60	62	65	68	70	72	75	78	80	82	85	88	90	92	95	98	100
---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

**Bank height (m)**       

**Bank width (m)**        c

**Vertical distance between the water surface and the water mark (m)**       

**Notes on cross-section measurement****Riparian zone width**

Left bank        (m) Right bank        (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
Total 100%	

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Channel cross-sections and variables to be measured in the area around a cross section**

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**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)** \_\_\_\_\_

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** B

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** C

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

Left bank Right bank

Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay <0.06mm)	_____	_____
Total 100% each		

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
Total 100%	

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

## AUSRIVAS Physical Assessment Protocol Field Data Sheets

Page 1

Site No. 014 Date 23.8.18

DION IERWASI

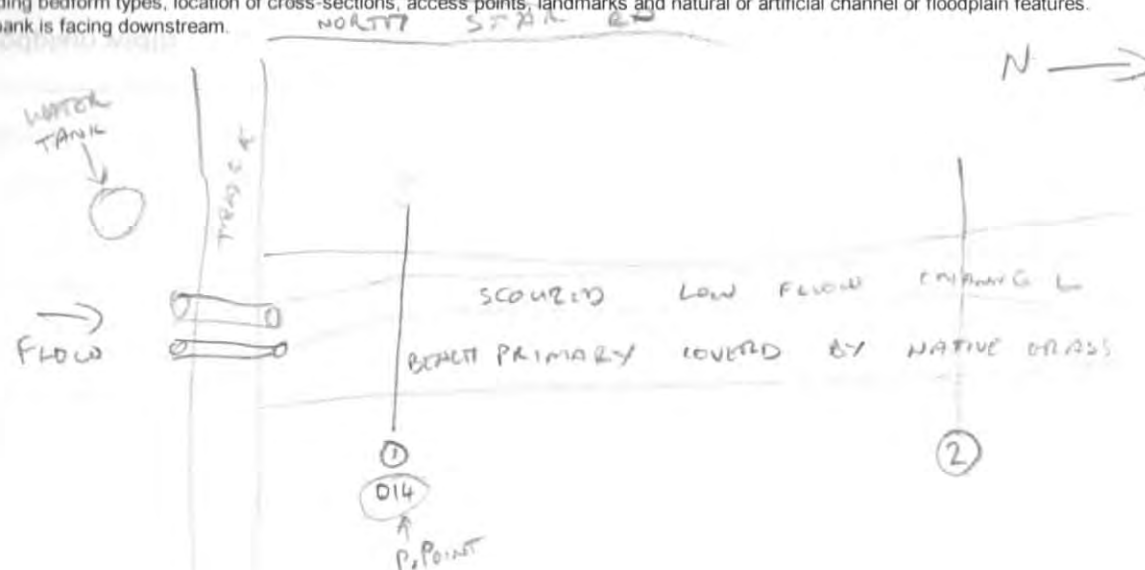
Date 23.8.18 Site No. 014 Time 1430 Recorder's Name SARAH GAWALRTRiver Name UN NAMED CREEK Location LOT 24 DP 756010Weather CLEAR + SUNNY Rain in last week? Y [ ] N ☒ Photograph numbers and details \_\_\_\_\_

deg	min	sec	deg	min	sec
Latitude: <u>28</u>	<u>53</u>	<u>37</u>	Longitude: <u>150</u>	<u>24</u>	<u>13</u>
GPS Name and Datum _____					

(014) 1+2 W/S 3+4 CENTRE, 5+6 D/S  
7+8 CULVERTS UNDER TRAIL

## PLANFORM SKETCH OF SITE

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.  
Left bank is facing downstream.



## LENGTH OF SAMPLING SITE

Bankfull width 30 (m)

x 10

Length of sampling site 300 (m)

## Notes

SITE HIGHLY MODIFIED  
CREEK IN AGRICULTURAL  
CROPPING LAND SCAPE

BEFORE LEAVING THE  
SITE, CHECK DATA  
SHEETS TO ENSURE  
THAT ALL VARIABLES  
HAVE BEEN RECORDED



## BASIC WATER CHEMISTRY

	Units
Temperature <u>DRY</u>	°C
Conductivity	
Dissolved Oxygen	mg l <sup>-1</sup>
Dissolved Oxygen Sat.	%
pH	
Turbidity	
Total phosphorus <input type="checkbox"/>	
Total nitrogen <input type="checkbox"/>	
Water sample taken?	
ALKALINITY	
Amount of water	ml
Amount of H <sub>2</sub> SO <sub>4</sub>	ml
Alkalinity	mg l <sup>-1</sup>

## Valley shape

Choose one category only

	<input type="checkbox"/> Steep valley
	<input type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input checked="" type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

## Local impacts on streams

Choose one or more categories and describe the detail of each

<input type="checkbox"/> Sand or gravel mining	<input type="checkbox"/> Sewage effluent
<input type="checkbox"/> Other mining	<input checked="" type="checkbox"/> Channel straightening
<input type="checkbox"/> Road	<input type="checkbox"/> River improvement works
<input type="checkbox"/> Bridge / culvert / wharf	<input type="checkbox"/> Water extraction
<input checked="" type="checkbox"/> Ford / ramp	<input type="checkbox"/> Dredging
<input type="checkbox"/> Discharge pipe	<input type="checkbox"/> Grazing
<input type="checkbox"/> Forestry activities	<input type="checkbox"/> Litter
<input type="checkbox"/> Sugar mill	<input type="checkbox"/> Recreation
<input type="checkbox"/> Irrigation run-off or pipe outlet	<input type="checkbox"/> Other

Description LEVEE - CONSTRUCTED ALONG BOTH BANKS

## Floodplain width

\_\_\_\_\_ Average \_\_\_\_\_ (m)

EXTENSIVE TO BROAD TO MODERATE

## Floodplain features

Choose one or more features when present

<input type="checkbox"/> Sampling site has no distinct floodplain	<input type="checkbox"/> Scroll systems Short, crescentic strips or patches formed along the inner bank of a stream meander
<input type="checkbox"/> Oxbows / billabongs Body of water occupying a former river meander, isolated by a shift in the stream channel	<input type="checkbox"/> Splays Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain
<input checked="" type="checkbox"/> Remnant channels Formed during a previous hydrological regime. May be infilled with sediment	<input type="checkbox"/> Floodplain scours Scour holes formed by the concentrated clearing and digging action of flowing water
<input checked="" type="checkbox"/> Flood channels A channel that distributes water onto the floodplain and off the floodplain during floods	<input checked="" type="checkbox"/> No floodplain features present Floodplain present at the sampling site but does not contain any of the above features

## Local landuse

Choose one category for each bank

Left	Right
<input type="checkbox"/>	<input type="checkbox"/> Native forest
<input type="checkbox"/>	<input type="checkbox"/> Native grassland (not grazed)
<input type="checkbox"/>	<input type="checkbox"/> Grazing (native or non-native pasture)
<input type="checkbox"/>	<input type="checkbox"/> Exotic grassland (lawns etc., no grazing)
<input type="checkbox"/>	<input type="checkbox"/> Forestry Native [ ] [ ] Pine [ ] [ ]
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Cropped Rainfed <input checked="" type="checkbox"/> Irrigated [ ] [ ]
<input type="checkbox"/>	<input type="checkbox"/> Urban residential
<input type="checkbox"/>	<input type="checkbox"/> Commercial
<input type="checkbox"/>	<input type="checkbox"/> Industrial or intensive agricultural
<input type="checkbox"/>	<input type="checkbox"/> Recreation
<input type="checkbox"/>	<input type="checkbox"/> Other _____

**Riparian zone composition**

Assess for whole sampling site

	% Cover		Vegetation Description
Trees (>10m in height)	0	} May total more than 100%	-
Trees (<10m in height)	0		-
Shrubs	5		ROLLY POPEY
Grasses / ferns / sedges	90		NATIVE GRASS

**Shading of channel**
☒ < 5%    ☐ 6 – 25%    ☐ 26 – 50%    ☐ 51 – 75%    ☐ > 76%
**Extent of trailing bank vegetation**
☒ nil    ☐ moderate  
☐ slight    ☐ extensive
**Native and exotic riparian vegetation**

% Native 80 } Total 100%  
 % Exotic 20

**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

		Left bank	Right bank
None		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Isolated / scattered		<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps		<input type="checkbox"/>	<input type="checkbox"/>
Semi-continuous		<input type="checkbox"/>	<input type="checkbox"/>
Continuous		<input type="checkbox"/>	<input type="checkbox"/>

**Regeneration of native woody vegetation**

Is the sampling site in undisturbed forest?

Y [ ] N ☒

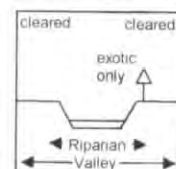
If no, record regeneration category

☐ Abundant (>5% cover) and healthy Present

☒ Very limited (<1% cover)

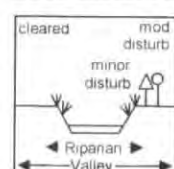
**Overall vegetation disturbance rating**

Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

**Extreme disturbance** ☒

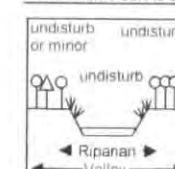
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie dominated by exotic species with native species rare or completely absent)

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**High disturbance** ☐

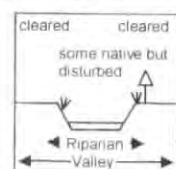
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain

**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

**Low disturbance** ☐

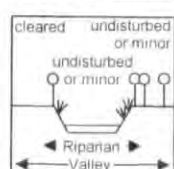
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor

**Valley vegetation** – native vegetation present on BOTH sides of the river with a virtually intact canopy and few exotic species

**Very high disturbance** ☐

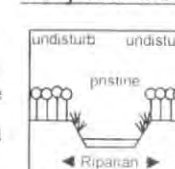
**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**Moderate disturbance** ☐

**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state

**Very low disturbance** ☐

**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Physical barriers to local fish passage**

Choose one category for each flow condition

		Base flow	Low flow	High flow
	No passage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Moderately restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Good passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Type and height of barrier(s) \_\_\_\_\_

**Type of bars**

Choose one or more categories

	Bars absent	<input type="checkbox"/>
	Side/point bars VEGETATED	<input type="checkbox"/>
	Side/point bars UNVEGETATED	<input type="checkbox"/>
	Mid-channel bars VEGETATED	<input type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input type="checkbox"/>
	Bars around obstructions	<input type="checkbox"/>
	Braided channel	<input type="checkbox"/>
	Infilled channel	<input checked="" type="checkbox"/>
	High flow deposits	<input type="checkbox"/>

**Extent of bars**% of streambed forming a bar of any type 80 %**Dominant sediment particle size on bars**Boulder/cobble [ ☐ ] Pebble [ ☐ ] Gravel [ ☐ ]Sand [ ☒ ] Silt/clay [ ☐ ] or \_\_\_\_\_ mm**Channel modifications** Choose one or more categories






	No modifications	<input type="checkbox"/>		Reinforced	<input type="checkbox"/>
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>
	Dams and diversions	<input type="checkbox"/>		Infilled	<input type="checkbox"/>
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input type="checkbox"/>
	Straightened	<input type="checkbox"/>	Signs of work still	Recently channelised	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>	Works old and revegetated	Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	U shaped	<input type="checkbox"/>		Flat U shaped	<input checked="" type="checkbox"/>		Deepened U shape	<input type="checkbox"/>		Widened or infilled	<input type="checkbox"/>		Two stage	<input type="checkbox"/>		Multi stage	<input type="checkbox"/>
	Box	<input type="checkbox"/>		Wide box	<input type="checkbox"/>		V shaped	<input type="checkbox"/>		Trapezoid	<input type="checkbox"/>		Concrete V	<input type="checkbox"/>		Pipe or culvert	<input type="checkbox"/>




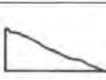
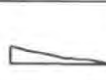
**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input type="checkbox"/>	<input type="checkbox"/>
	Convex	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Stepped	<input type="checkbox"/>	<input type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>

**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input type="checkbox"/>	<input type="checkbox"/>
	Moderate 30 - 60°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Low 10 - 30°	<input type="checkbox"/>	<input type="checkbox"/>
	Flat <10°	<input type="checkbox"/>	<input type="checkbox"/>

**Factors affecting bank stability**

Choose one or more categories

<input type="checkbox"/> None	<input checked="" type="checkbox"/> Cleared vegetation
<input type="checkbox"/> Mining	<input type="checkbox"/> Irrigation draw-down
<input checked="" type="checkbox"/> Runoff	<input type="checkbox"/> Reservoir releases
<input type="checkbox"/> Stock access	<input type="checkbox"/> Seepage
<input type="checkbox"/> Human access	<input type="checkbox"/> Flow and waves
<input type="checkbox"/> Ford, culvert or bridge	<input type="checkbox"/> Drainpipes
<input type="checkbox"/> Feral animals	
<input type="checkbox"/> Other	

Description \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops

% bedrock outcrops Left bank 0

Right Bank 0

**Artificial bank protection measures**

Choose one or more categories

<input checked="" type="checkbox"/> None	<input type="checkbox"/> Fenced stock watering points
<input type="checkbox"/> Fence structures	<input type="checkbox"/> Vegetation plantings
<input checked="" type="checkbox"/> Levee banks	<input type="checkbox"/> Logs strapped to bank
<input type="checkbox"/> Rock or wall layer	<input type="checkbox"/> Concrete channel lining
<input type="checkbox"/> Rip rap	
<input type="checkbox"/> Fenced human access	
<input type="checkbox"/> Other <u>LINE CLEARED BANK</u>	

BRANCHES OF CROOKED BUSH

ALUM

**Sediment oils**

☒ absent ☐ light ☐ moderate ☐ profuse

**Water oils**

☒ none ☐ flecks ☐ globs ☐ sheen ☐ slick

**Sediment odours**

☒ normal/none ☐ sewage ☐ petroleum ☐ chemical

☐ anaerobic ☐ other \_\_\_\_\_

**Water odours**

☐ normal/none ☐ sewage ☐ petroleum ☐ chemical

☐ other DRY

**Turbidity (visual assessment)**

☐ Clear ☐ Slight ☐ Turbid ☐ Opaque

DRY

Is water clarity reduced by:

☐ Suspended material (e.g mud, clay, organics) ☐ Dissolved material (e.g plant leachates)

**Water level at the time of sampling**

☒ Dry ☐ No flow ☐ Low ☐ Baseflow or near baseflow

☐ High ☐ Flood (don't sample)

**Artificial features at the sampling site**

Choose one or more categories

☐ Major ☒ Minor ☐ Ford ☐ Bridge ☐ Culvert ☐ Other weir

Description CULVERTS UNDER BRIDGE

@ UPSTREAM OF BRIDGE

**Large woody debris**









Overall % cover of logs and branches greater than 10cm in diameter

0 % Notes on visibility \_\_\_\_\_

\_\_\_\_\_

**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<b>Waterfall</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Step Height <1m Gradient 5-60° Strong currents		<b>Cascade</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Gradient 3-5° Strong currents Rocks break surface		<b>Rapid</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		<b>Riffle</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small currents Surface unbroken and smooth		<b>Glide</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small but distinct & uniform current Surface unbroken		<b>Run</b>	<u>100</u> % of site <u>20</u> Est. Av. Length (m) <u>1</u> Est. Av. Depth (m) <u>30</u> Est. Av. Width (m)
Area where stream widens or deepens and current declines		<b>Pool</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
A reasonable sized (>20% of channel width) cut off section away from the main channel		<b>Backwater</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)

Note: An additional response variable platform channel pattern is included in the guide

**Macrophyte cover** Assess % cover of the sampling site by each category

Overall % cover of macrophytes 0 % cover of emergent macrophytes  
 % cover of floating macrophytes  
 % cover of submerged macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory  
N denotes a native taxa and I denotes an introduced taxa.**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	
<i>Cyperus</i> (Sedge) I/N	<input type="checkbox"/>	
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	
<i>Juncus</i> (Rush) I/N	<input type="checkbox"/>	
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	
<i>Phragmites</i> (Common Reed) N	<input type="checkbox"/>	
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	

**Floating macrophytes**

	Present	%
<i>Azolla</i> (Azolla) N	<input type="checkbox"/>	
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>	

Overall % cover of native macrophyte taxa \_\_\_\_\_






Overall % cover of native macrophyte taxa \_\_\_\_\_

Total should equal overall % cover of macrophytes from above

Total should equal overall % cover of macrophytes


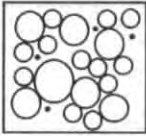
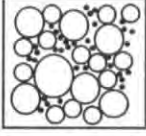
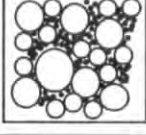
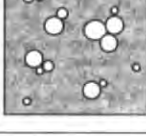
**Bed compaction**

Choose one category only

	<b>Tightly packed, armoured</b> Array of sediment sizes, overlapping, tightly packed and very hard to dislodge	<input type="checkbox"/>
	<b>Packed, unarmoured</b> Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate	<input type="checkbox"/>
	<b>Moderate compaction</b> Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate	<input type="checkbox"/>
	<b>Low compaction (1)</b> Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily	<input checked="" type="checkbox"/>
	<b>Low compaction (2)</b> Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily	<input type="checkbox"/>

**Sediment matrix**






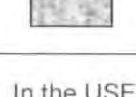
Choose one category only

	<b>Bedrock</b>	<input type="checkbox"/>
	<b>Open framework</b> 0-5% fine sediment, high availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix filled contact framework</b> 5-32% fine sediment, moderate availability of interstitial spaces	<input type="checkbox"/>
	<b>Framework dilated</b> 32-60% fine sediment, low availability of interstitial spaces	<input checked="" type="checkbox"/>
	<b>Matrix dominated</b> >60% fine sediment, interstitial spaces virtually absent	<input type="checkbox"/>

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	<b>Very angular</b>	<input type="checkbox"/>
	<b>Angular</b>	<input type="checkbox"/>
	<b>Sub-angular</b>	<input checked="" type="checkbox"/>
	<b>Rounded</b>	<input type="checkbox"/>
	<b>Well rounded</b>	<input type="checkbox"/>
	<b>Cobble, pebble and gravel fractions not present</b>	<input type="checkbox"/>

In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding

Stable

Unstable - depositing

<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material.	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>1. Epifaunal substrate / available cover</b>	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover: mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient)					40-70% mix of stable habitat, well-suited for full colonisation potential, adequate habitat for maintenance of populations, presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale)					20-40% mix of stable habitat, habitat availability less than desirable, substrate frequently disturbed or removed					Less than 20% stable habitat, lack of habitat is obvious, substrate unstable or lacking					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>2. Embeddedness</b>	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>3. Velocity / depth regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m.					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low)					Dominated by 1 velocity/depth regime (usually slow-deep)					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>4. Sediment deposition</b>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition					Some new increase in bar formation, mostly from gravel, sand or fine sediment, 5-30% of the bottom affected, slight deposition in pools					Moderate deposition of new gravel, sand or fine sediment on old and new bars, 30-50% of the bottom affected, sediment deposits at obstructions, constrictions and bends, moderate deposition in pools prevalent					Heavy deposits of fine material, increased bar development, more than 50% of the bottom changing frequently, pools almost absent due to substantial sediment deposition					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>5. Channel flow status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel, or <25% of channel substrate is exposed					Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed					Very little water in channel and mostly present as standing pools					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>6. Channel alteration</b>	Channelization or dredging absent or minimal, stream with normal pattern.					Some channelization present, usually in areas of bridge abutments, evidence of past channelization, i.e. dredging (greater than 20 yr) may be present but recent channelization is not present.					Channelization may be extensive, embankments or shoring structures present on both banks, and 40 to 60% of stream reach channelized and disrupted.					Banks shored with gabion or cement, over 80% of the stream reach channelized and disrupted, instream habitat greatly altered or removed entirely					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
 Circle a score for each parameter

HIGH GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair			Poor							
7. Frequency of riffles (or bends)	Occurrence of riffles relatively frequent, ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key in streams where riffles are continuous, placement of boulders or other large, natural obstruction is important					Occurrence of riffles infrequent, distance between riffles divided by the width of the stream is between 7 to 15					Occasional riffle or bend, bottom contours provide some habitat, distance between riffles divided by the width of the stream is between 15 to 25			Generally all flat water or shallow riffles, poor habitat, distance between riffles divided by the width of the stream is a ratio of >25							
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
8. Bank stability (score each bank)	Banks stable, evidence of erosion or bank failure absent or minimal, little potential for future problems <5% of bank affected					Moderately stable, infrequent, small areas of erosion mostly healed over 5-30% of bank in reach has areas of erosion					Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods			Unstable, many eroded areas, 'raw' areas frequent along straight sections and bends, obvious bank sloughing, 60-100% of bank has erosional scars							
SCORE	Left bank		10	9	8	7	6	5		4	3	2		1	0						
SCORE	Right bank		10	9	8	7	6	5		4	3	2		1	0						
9. Vegetative protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident, almost all plants allowed to grow naturally					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent, more than one half of the potential plant stubble height remaining					50-70% of the streambank surfaces covered by vegetation, disruption obvious, patches of bare soil or closely cropped vegetation common, less than one-half of the potential plant stubble height remaining			Less than 50% of the streambank surfaces covered by vegetation, disruption of streambank vegetation is very high, vegetation has been removed to 5 centimetres or less in average stubble height							
SCORE	Left bank		10	9	8	7	6	5		4	3	2		1	0						
SCORE	Right bank		10	9	8	7	6	5		4	3	2		1	0						
10. Riparian zone score (score each bank)	Width of riparian zone >18 metres, human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone					Width of riparian zone 12-18 metres, human activities have impacted the riparian zone only minimally					Width of riparian zone 6-12 metres, human activities have impacted the riparian zone a great deal			Width of riparian zone <6 metres, little or no riparian vegetation is present because of human activities							
SCORE	Left bank		10	9	8	7	6	5		4	3	2		1	0						
SCORE	Right bank		10	9	8	7	6	5		4	3	2		1	0						

TOTAL HIGH GRADIENT HABITAT SCORE

## Page 1 of 2

Continued over

Continued over

5.  $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Channel sinuosity</b>	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).					The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.					The bends in the stream increase the stream 1 to 2 times longer than if it was in a straight line.					Channel straight, waterway has been channelized for a long distance.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	<del>6</del>	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable, evidence of erosion or bank failure absent or minimal, little potential for future problems. <5% of bank affected.					Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.					Unstable, many eroded areas, 'raw' areas frequent along straight sections and bends, obvious bank sloughing, 60-100% of bank has erosional scars.					
SCORE	Left bank		10	9		8	7	6			5	<del>4</del>	3			2	1	0			
SCORE	Right bank		10	9		<del>8</del>	7	6			5	4	3			2	1	0			
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes, vegetative disruption through grazing or mowing minimal or not evident, almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented, disruption evident but not affecting full plant growth potential to any great extent, more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation, disruption obvious, patches of bare soil or closely cropped vegetation common, less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation, disruption of streambank vegetation is very high, vegetation has been removed to 5 centimetres or less in average stubble height.					
SCORE	Left bank		10	9		<del>8</del>	7	6			5	4	3			2	1	0			
SCORE	Right bank		10	9		<del>8</del>	7	6			5	4	3			2	1	0			
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres, human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres, human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres, human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres, little or no riparian vegetation is present because of human activities.					
SCORE	Left bank		10	9		8	7	6			5	4	3			2	1	<del>0</del>			
SCORE	Right bank		10	9		8	7	6			5	4	3			2	1	<del>0</del>			

TOTAL LOW GRADIENT HABITAT SCORE

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

LB RB

Bank Full

Water Mark

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number** 1 **of** 2

**Type of bedform at the cross-section**

☐ Riffle ☒ Run ☐ Pool ☐ Cascade ☐ Other

**Bankfull channel width (m)** (=total of boxes A+B+C) 30

**Stream width at the water mark (m)** 5 A

**Stream width at the water surface (m)** 0

**Bank height (m)** 2.2

**Bank width (m)** 1.0 B

**Vertical distance between the water surface and the water mark (m)** 0.2

**Horizontal distances (m)**

**Vertical water depths (cm)**

**Bank height (m)** 1.2

**Bank width (m)** 2.4 C

**Vertical distance between the water surface and the water mark (m)** 0.2

**Notes on cross-section measurement****Riparian zone width**

Left bank 0 (m) Right bank 25 (m)

**Bank material**

Assess % composition for each bank

Left bank Right bank

Bedrock	—	—
Boulder (>256mm)	—	—
Cobble (64-256mm)	—	—
Pebble (16-64mm)	—	—
Gravel (2-16mm)	10	10
Sand (0.06-2mm)	2	2
Fines (silt and clay <0.06mm)	88	88
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section

Bedrock	—
Boulder (>256mm)	—
Cobble (64-256mm)	—
Pebble (16-64mm)	5
Gravel (2-16mm)	20
Sand (0.06-2mm)	30
Fines (silt and clay <0.06mm)	45

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

☒ <10% ☐ 10-35% ☐ 35-55% ☐ 60-90% ☐ >90%

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)**

**Bank height (m)**

**Bank width (m)** B

**Vertical distance between the water surface and the water mark (m)**

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)**

**Bank width (m)** c

**Vertical distance between the water surface and the water mark (m)**

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

Date 22.8.18. Site No. 015 Time 0945 Recorder's Name DION JOKUASI SARAH GLAUBERTRiver Name UN NAMED DRAINAGE LINE Location LOT 31 DP 756010Weather CLEAR + SUNNY Rain in last week? Y [ ] N [☒]

Photograph numbers and details \_\_\_\_\_

Latitude: 

deg	min	sec
28	52	21

 Longitude: 

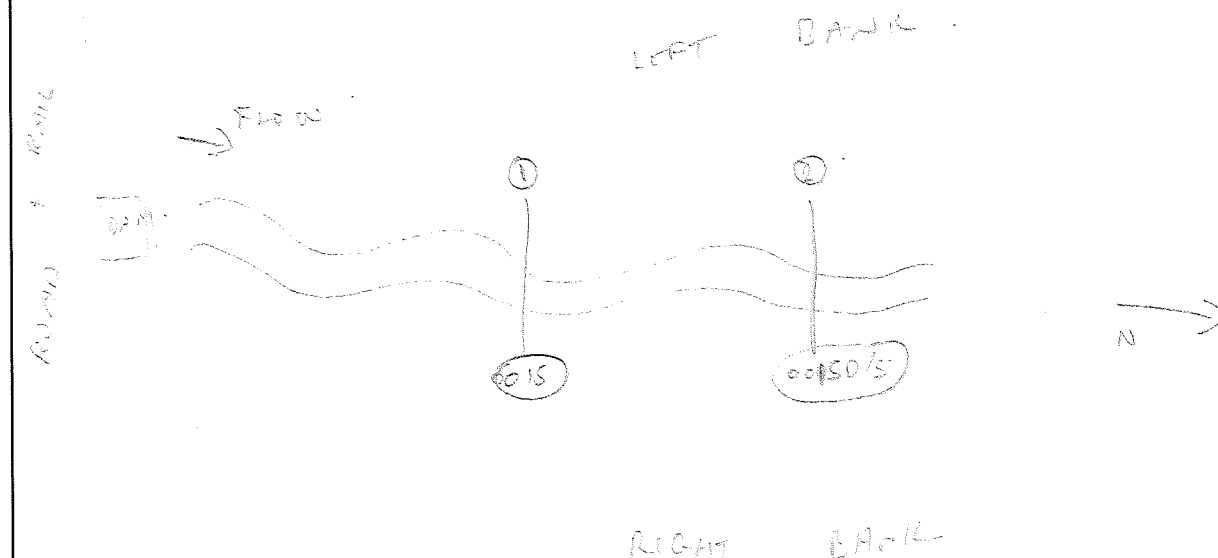
deg	min	sec
150	23	57

GPS Name and Datum \_\_\_\_\_

0015 1+2 WS 3+4 centre S+6 D/S0015 DS 1+2 WS 3+4 centre, S+6 D/S

## PLANFORM SKETCH OF SITE

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features. Left bank is facing downstream.



## LENGTH OF SAMPLING SITE

Bankfull width 69 (m)

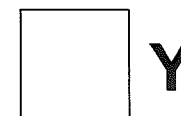
x 10

Length of sampling site 90 (m)

## Notes

~ DRAINAGE LINE IN FLOODPLAIN  
 D/L FRSH HABITAT VALUES  
 - THIS SITE LOCATED D/S OF  
 SITE 14. SITE 13 NOT SAMPLED  
 SEE COLLECTOR NOTES FOR  
 MORE DETAIL.

BEFORE LEAVING THE  
 SITE, CHECK DATA  
 SHEETS TO ENSURE  
 THAT ALL VARIABLES  
 HAVE BEEN RECORDED

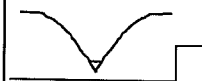



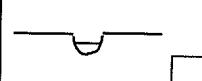
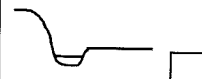


BASIC WATER CHEMISTRY		Units
Temperature	_____	°C
Conductivity	_____	
Dissolved Oxygen	_____	mg l <sup>-1</sup>
Dissolved Oxygen Sat.	_____	%
pH	_____	
Turbidity	_____	
Total phosphorus	<input type="checkbox"/> _____	
Total nitrogen	<input type="checkbox"/> _____	
ALKALINITY		
Amount of water	_____	ml
Amount of H <sub>2</sub> SO <sub>4</sub>	_____	ml
Alkalinity	_____	mg l <sup>-1</sup>

Water sample taken?

**Valley shape**

Choose one category only

	<input type="checkbox"/> Steep valley
	<input checked="" type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

**Local impacts on streams**

Choose one or more categories and describe the detail of each

<input type="checkbox"/> Sand or gravel mining	<input type="checkbox"/> Sewage effluent
<input type="checkbox"/> Other mining	<input type="checkbox"/> Channel straightening
<input type="checkbox"/> Road	<input type="checkbox"/> River improvement works
<input type="checkbox"/> Bridge / culvert / wharf	<input type="checkbox"/> Water extraction
<input type="checkbox"/> Ford / ramp	<input type="checkbox"/> Dredging
<input type="checkbox"/> Discharge pipe	<input type="checkbox"/> Grazing
<input type="checkbox"/> Forestry activities	<input type="checkbox"/> Litter
<input type="checkbox"/> Sugar mill	<input type="checkbox"/> Recreation
<input type="checkbox"/> Irrigation run-off or pipe outlet	<input checked="" type="checkbox"/> Other

Description ON STREAM DAM**Floodplain width**

\_\_\_\_\_ Average \_\_\_\_\_ (m)

WHOLE AREA FLOOD PLAIN**Floodplain features**

Choose one or more features when present

<input type="checkbox"/> Sampling site has no distinct floodplain	<input type="checkbox"/> Scroll systems Short, crescentic strips or patches formed along the inner bank of a stream meander
<input type="checkbox"/> Oxbows / billabongs Body of water occupying a former river meander, isolated by a shift in the stream channel	<input type="checkbox"/> Splays Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain
<input type="checkbox"/> Remnant channels Formed during a previous hydrological regime. May be infilled with sediment	<input type="checkbox"/> Floodplain scours Scour holes formed by the concentrated clearing and digging action of flowing water
<input type="checkbox"/> Flood channels A channel that distributes water onto the floodplain and off the floodplain during floods	<input checked="" type="checkbox"/> No floodplain features present Floodplain present at the sampling site but does not contain any of the above features

**Local landuse**

Choose one category for each bank

Left	Right
<input type="checkbox"/>	<input type="checkbox"/> Native forest
<input type="checkbox"/>	<input type="checkbox"/> Native grassland (not grazed)
<input type="checkbox"/>	<input type="checkbox"/> Grazing (native or non-native pasture)
<input type="checkbox"/>	<input type="checkbox"/> Exotic grassland (lawns etc., no grazing)
<input type="checkbox"/>	<input type="checkbox"/> Forestry Native [ ] [ ] Pine [ ] [ ]
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Cropped Rainfed <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Irrigated [ ] [ ]
<input type="checkbox"/>	<input type="checkbox"/> Urban residential
<input type="checkbox"/>	<input type="checkbox"/> Commercial
<input type="checkbox"/>	<input type="checkbox"/> Industrial or intensive agricultural
<input type="checkbox"/>	<input type="checkbox"/> Recreation
<input type="checkbox"/>	<input type="checkbox"/> Other _____

**Riparian zone composition**

Assess for whole sampling site

	% Cover		Vegetation Description
Trees (>10m in height)	<u>0</u>	} May total more than 100%	
Trees (<10m in height)	<u>6</u>		
Shrubs	<u>5</u>		<u>SANTALUM BUSH +</u>
Grasses / ferns / sedges	<u>50</u>		<u>NATIVE GRASS / MOSTLY WOOLLY</u>

**Shading of channel**
☒ < 5%    ☐ 6 – 25%    ☐ 26 – 50%    ☐ 51 – 75%    ☐ > 76%
**Extent of trailing bank vegetation**
☒ nil    ☐ moderate  
☐ slight    ☐ extensive
**Native and exotic riparian vegetation**

% Native 80 } Total 100%  
 % Exotic 20

**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

		Left bank	Right bank
None		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Isolated / scattered		<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps		<input type="checkbox"/>	<input type="checkbox"/>
Semi-continuous		<input type="checkbox"/>	<input type="checkbox"/>
Continuous		<input type="checkbox"/>	<input type="checkbox"/>

**Regeneration of native woody vegetation**

Is the sampling site in undisturbed forest?

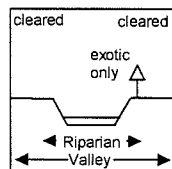
Y [ ] N [☒]

If no, record regeneration category

☐ Abundant (>5% cover) and healthy  
☐ Present  
☒ Very limited (<1% cover)

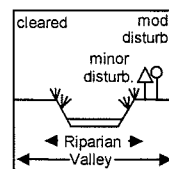
**Overall vegetation disturbance rating**

Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

**Extreme disturbance** ☒

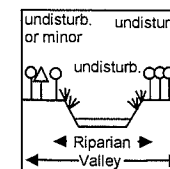
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie. dominated by exotic species with native species rare or completely absent)

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**High disturbance** ☐

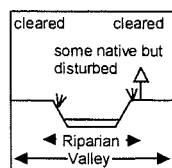
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain

**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

**Low disturbance** ☐

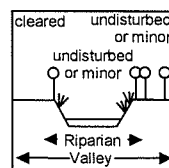
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor.

**Valley vegetation** – native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species

**Very high disturbance** ☐

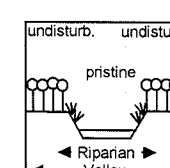
**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover.

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**Moderate disturbance** ☐

**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state







**Very low disturbance** ☐

**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Physical barriers to local fish passage**










Choose one category for each flow condition

		Base flow	Low flow	High flow
	No passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Moderately restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Good passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>




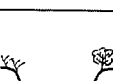
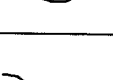
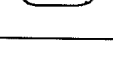



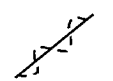
Type and height of barrier(s) \_\_\_\_\_

**Type of bars**


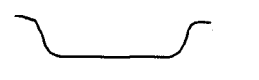

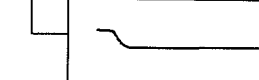


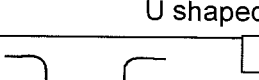
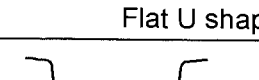
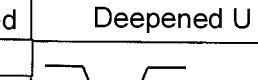
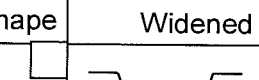
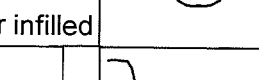
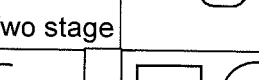
Choose one or more categories

	Bars absent	<input checked="" type="checkbox"/>
	Side/point bars VEGETATED	<input type="checkbox"/>
	Side/point bars UNVEGETATED	<input type="checkbox"/>
	Mid-channel bars VEGETATED	<input type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input type="checkbox"/>
	Bars around obstructions	<input type="checkbox"/>
	Braided channel	<input type="checkbox"/>
	Infilled channel	<input type="checkbox"/>
	High flow deposits	<input type="checkbox"/>

**Extent of bars**% of streambed forming a bar of any type 6 %**Dominant sediment particle size on bars**
 Boulder/cobble [ ] Pebble [ ] Gravel [ ]  
 Sand [ ] Silt/clay [☒] or \_\_\_\_\_ mm
**Channel modifications** Choose one or more categories


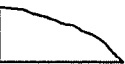
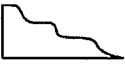


	No modifications	<input checked="" type="checkbox"/>		Reinforced	<input type="checkbox"/>
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>
	Dams and diversions	<input type="checkbox"/>		Infilled	<input type="checkbox"/>
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input checked="" type="checkbox"/>
	Straightened	<input type="checkbox"/>	Signs of work still	Recently channelised	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>	Works old and revegetated	Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	<input checked="" type="checkbox"/>	U shaped		<input type="checkbox"/>	Flat U shaped		<input type="checkbox"/>	Deepened U shape		<input type="checkbox"/>	Widened or infilled		<input type="checkbox"/>	Two stage		<input type="checkbox"/>	Multi stage
	<input type="checkbox"/>	Box		<input type="checkbox"/>	Wide box		<input type="checkbox"/>	V shaped		<input type="checkbox"/>	Trapezoid		<input type="checkbox"/>	Concrete V		<input type="checkbox"/>	Pipe or culvert

**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input type="checkbox"/>	<input type="checkbox"/>
	Convex	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Stepped	<input type="checkbox"/>	<input type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>

**Factors affecting bank stability**

Choose one or more categories

<input type="checkbox"/> None	<input checked="" type="checkbox"/> Cleared vegetation
<input type="checkbox"/> Mining	<input type="checkbox"/> Irrigation draw-down
<input checked="" type="checkbox"/> Runoff	<input type="checkbox"/> Reservoir releases
<input type="checkbox"/> Stock access	<input type="checkbox"/> Seepage
<input type="checkbox"/> Human access	<input type="checkbox"/> Flow and waves
<input type="checkbox"/> Ford, culvert or bridge	<input type="checkbox"/> Drainpipes
<input type="checkbox"/> Feral animals	
<input type="checkbox"/> Other	

Description \_\_\_\_\_

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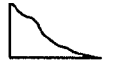
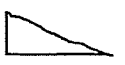
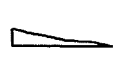
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**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input type="checkbox"/>	<input type="checkbox"/>
	Moderate 30 - 60°	<input type="checkbox"/>	<input type="checkbox"/>
	Low 10 - 30°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Flat <10°	<input type="checkbox"/>	<input type="checkbox"/>

**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops

% bedrock outcrops Left bank 0

Right Bank 0

**Artificial bank protection measures**

Choose one or more categories

<input checked="" type="checkbox"/> None	<input type="checkbox"/> Fenced stock watering points
<input type="checkbox"/> Fence structures	<input type="checkbox"/> Vegetation plantings
<input type="checkbox"/> Levee banks	<input type="checkbox"/> Logs strapped to bank
<input type="checkbox"/> Rock or wall layer	<input type="checkbox"/> Concrete channel lining
<input type="checkbox"/> Rip rap	
<input type="checkbox"/> Fenced human access	
<input type="checkbox"/> Other	

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**Sediment oils**

☒ absent ☐ light ☐ moderate ☐ profuse

**Water oils**

☒ none ☐ flecks ☐ globs ☐ sheen ☐ slick

**Sediment odours**

☒ normal/none ☐ sewage ☐ petroleum ☐ chemical

☐ anaerobic ☐ other \_\_\_\_\_

**Water odours**

☐ normal/none ☐ sewage ☐ petroleum ☐ chemical

☐ other DRY

**Turbidity (visual assessment)**

☐ Clear ☐ Slight ☐ Turbid ☐ Opaque

DRY

Is water clarity reduced by:

☐ Suspended material (e.g mud, clay, organics) ☐ Dissolved material (e.g plant leachates)

**Water level at the time of sampling**

☒ Dry ☐ No flow ☐ Low ☐ Baseflow or near baseflow

☐ High ☐ Flood (don't sample)

**Artificial features at the sampling site**

Choose one or more categories

☐ Major ☐ Minor ☐ Ford ☐ Bridge ☐ Culvert ☐ Other weir

Description \_\_\_\_\_

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**Large woody debris**

Overall % cover of logs and branches greater than 10cm in diameter

0 % Notes on visibility \_\_\_\_\_


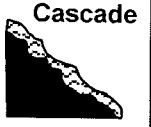






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**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<b>Waterfall</b>	<u>      </u> % of site	<u>      </u> Est. Av. Length (m)	<u>      </u> Est. Av. Height (m)	<u>      </u> Est. Av. Gradient (°)
Step Height <1m Gradient 5-60° Strong currents		<b>Cascade</b>	<u>      </u> % of site	<u>      </u> Est. Av. Length (m)	<u>      </u> Est. Av. Height (m)	<u>      </u> Est. Av. Gradient (°)
Gradient 3-5° Strong currents Rocks break surface		<b>Rapid</b>	<u>      </u> % of site	<u>      </u> Est. Av. Length (m)	<u>      </u> Est. Av. Depth (m)	<u>      </u> Est. Av. Width (m)
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		<b>Riffle</b>	<u>      </u> % of site	<u>      </u> Est. Av. Length (m)	<u>      </u> Est. Av. Depth (m)	<u>      </u> Est. Av. Width (m)
Gradient 1-3° Small currents Surface unbroken and smooth		<b>Glide</b>	<u>      </u> % of site	<u>      </u> Est. Av. Length (m)	<u>      </u> Est. Av. Depth (m)	<u>      </u> Est. Av. Width (m)
Gradient 1-3° Small but distinct & uniform current Surface unbroken		<b>Run</b>	<u>100</u> % of site	<u>30</u> Est. Av. Length (m)	<u>0.5</u> Est. Av. Depth (m)	<u>2.0</u> Est. Av. Width (m)
Area where stream widens or deepens and current declines		<b>Pool</b>	<u>      </u> % of site	<u>      </u> Est. Av. Length (m)	<u>      </u> Est. Av. Depth (m)	<u>      </u> Est. Av. Width (m)
A reasonable sized (>20% of channel width) cut-off section away from		<b>Backwater</b>	<u>      </u> % of site	<u>      </u> Est. Av. Length (m)	<u>      </u> Est. Av. Depth (m)	<u>      </u> Est. Av. Width (m)

Note: An additional response variable planform channel pattern is measured in the office**Macrophyte cover** Assess % cover of the sampling site by each category.

Overall % cover of macrophytes 0.5 % cover of emergent macrophytes 0-5

% cover of floating macrophytes       

% cover of submerged macrophytes       

Total should equal overall % cover of macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory. N denotes a native taxa and I denotes an introduced taxa.

**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	<u>      </u>
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	<u>      </u>
<i>Cyperus</i> (Sedge) I/N	<input checked="" type="checkbox"/>	<u>      </u>
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	<u>      </u>
<i>Juncus</i> (Rush) I/N	<input checked="" type="checkbox"/>	<u>      </u>
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	<u>      </u>
<i>Phragmites</i> (Common Reed) N	<input type="checkbox"/>	<u>      </u>
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	<u>      </u>
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	<u>      </u>
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	<u>      </u>
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	<u>      </u>
Other <u>      </u>	<input type="checkbox"/>	<u>      </u>
Other <u>      </u>	<input type="checkbox"/>	<u>      </u>
Other <u>      </u>	<input type="checkbox"/>	<u>      </u>

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	<u>      </u>
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	<u>      </u>
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	<u>      </u>
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	<u>      </u>
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	<u>      </u>
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	<u>      </u>
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	<u>      </u>
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	<u>      </u>
Other <u>      </u>	<input type="checkbox"/>	<u>      </u>
Other <u>      </u>	<input type="checkbox"/>	<u>      </u>
Other <u>      </u>	<input type="checkbox"/>	<u>      </u>

**Floating macrophytes**

	Present	%
<i>Azolla</i> (Azolla) N	<input type="checkbox"/>	<u>      </u>
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	<u>      </u>
Other <u>      </u>	<input type="checkbox"/>	<u>      </u>
Other <u>      </u>	<input type="checkbox"/>	<u>      </u>
Other <u>      </u>	<input type="checkbox"/>	<u>      </u>




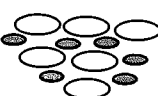

Overall % cover of native macrophyte taxa 100

Overall % cover of native macrophyte taxa 0

Total should equal overall % cover of macrophytes from above


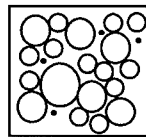
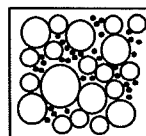
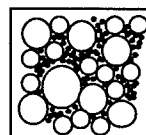
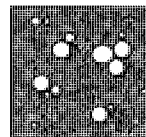
**Bed compaction**

Choose one category only

	<b>Tightly packed, armoured</b> Array of sediment sizes, overlapping, tightly packed and very hard to dislodge	<input type="checkbox"/>
	<b>Packed, unarmoured</b> Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate	<input type="checkbox"/>
	<b>Moderate compaction</b> Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate	<input type="checkbox"/>
	<b>Low compaction (1)</b> Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily	<input type="checkbox"/>
	<b>Low compaction (2)</b> Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily	<input checked="" type="checkbox"/>

**Sediment matrix**







Choose one category only

	<b>Bedrock</b>	<input type="checkbox"/>
	<b>Open framework</b> 0-5% fine sediment, high availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix filled contact framework</b> 5-32% fine sediment, moderate availability of interstitial spaces	<input type="checkbox"/>
	<b>Framework dilated</b> 32-60% fine sediment, low availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix dominated</b> >60% fine sediment, interstitial spaces virtually absent	<input checked="" type="checkbox"/>

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	<b>Very angular</b>	<input type="checkbox"/>
	<b>Angular</b>	<input type="checkbox"/>
	<b>Sub-angular</b>	<input type="checkbox"/>
	<b>Rounded</b>	<input type="checkbox"/>
	<b>Well rounded</b>	<input type="checkbox"/>
	<b>Cobble, pebble and gravel fractions not present</b>	<input checked="" type="checkbox"/>

In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding

Stable

Unstable - depositing

<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material.	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked, but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Site No. \_\_\_\_\_ Date \_\_\_\_\_

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>1. Epifaunal substrate / available cover</b>	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					40-70% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>2. Embeddedness</b>	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>3. Velocity / depth regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep).					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>4. Sediment deposition</b>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>5. Channel flow status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>6. Channel alteration</b>	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent				Good					Fair					Poor						
<b>7. Frequency of riffles (or bends)</b> Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.																					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b> Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.																					
<b>SCORE</b>	Left bank				10	9	8	7	6	5	4	3	2	1	0						
<b>SCORE</b>	Right bank				10	9	8	7	6	5	4	3	2	1	0						
<b>9. Vegetative protection (score each bank)</b> More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.																					
<b>SCORE</b>	Left bank				10	9	8	7	6	5	4	3	2	1	0						
<b>SCORE</b>	Right bank				10	9	8	7	6	5	4	3	2	1	0						
<b>10. Riparian zone score (score each bank)</b> Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.																					
<b>SCORE</b>	Left bank				10	9	8	7	6	5	4	3	2	1	0						
<b>SCORE</b>	Right bank				10	9	8	7	6	5	4	3	2	1	0						

TOTAL HIGH GRADIENT HABITAT SCORE

USEPA Habitat Assessment  
 Circle a score for each parameter

LOW GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																			
	Excellent					Good					Fair					Poor				
1. Epifaunal substrate / available cover	Greater than 50% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					30-50% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
																				0
2. Pool substrate characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.					Mixture of soft sand, mud or clay; mud may be dominant; some root mats and submerged vegetation present.					All mud or clay or sand bottom; little or no root mat; no submerged vegetation.					Hard-pan clay or bedrock; no root mat or vegetation.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
																				0
3. Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.					Majority of pools large-deep; very few shallow.					Shallow pools much more prevalent than deep pools.					Majority of pools small-shallow or pools absent.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
																				0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
																				0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
																				0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 60% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
																				0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Channel sinuosity</b>	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).					The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.					The bends in the stream increase the stream 1 to 2 times longer than if it was in a straight line.					Channel straight; waterway has been channelized for a long distance.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
SCORE	Left bank					10	9	8	7	6	5	4	3	2	1	0					
SCORE	Right bank					10	9	8	7	6	5	4	3	2	1	0					
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
SCORE	Left bank					10	9	8	7	6	5	4	3	2	1	0					
SCORE	Right bank					10	9	8	7	6	5	4	3	2	1	0					
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
SCORE	Left bank					10	9	8	7	6	5	4	3	2	1	0					
SCORE	Right bank					10	9	8	7	6	5	4	3	2	1	0					

TOTAL LOW GRADIENT HABITAT SCORE

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams). Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

LB RB

WATER MARK

5 11 12 13 14

A

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number** 2 of 2

**Type of bedform at the cross-section**

☐ Riffle ☐ Run ☒ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** (=total of boxes A+B+C) 26

**Stream width at the water mark (m)** 14 A

**Stream width at the water surface (m)** 0

**Bank height (m)** 0.2

**Bank width (m)** 7 B

**Vertical distance between the water surface and the water mark (m)** 1.50

**Horizontal distances (m)**

1 2 3 4 5 6 7 8 9 10 11 12 13 14

**Vertical water depths (cm)**

20 40 40 20 0 0 0 50 0

**Bank height (m)** 0.2

**Bank width (m)** 5 C

**Vertical distance between the water surface and the water mark (m)** 1.50

**Notes on cross-section measurement****Riparian zone width**

Left bank 0 (m) Right bank 0 (m)

**Bank material**

Assess % composition for each bank

Left bank Right bank

Bedrock \_\_\_\_\_

Boulder (>256mm) \_\_\_\_\_

Cobble (64-256mm) \_\_\_\_\_

Pebble (16-64mm) \_\_\_\_\_

Gravel (2-16mm) \_\_\_\_\_

Sand (0.06-2mm) \_\_\_\_\_

Fines (silt and clay, <0.06mm) 100

Total 100% each

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock \_\_\_\_\_

Boulder (>256mm) \_\_\_\_\_

Cobble (64-256mm) \_\_\_\_\_

Pebble (16-64mm) \_\_\_\_\_

Gravel (2-16mm) \_\_\_\_\_

Sand (0.06-2mm) \_\_\_\_\_

Fines (silt and clay <0.06mm) 100

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

OK! SO THIS IS CHANNEL / POOL DEPTH.

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number** 1 **of** 1

**Type of bedform at the cross-section**  
☐ Riffle ☒ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** (=total of boxes A+B+C) 9.5

**Stream width at the water mark (m)** 3 **A**

**Stream width at the water surface (m)** \_\_\_\_\_

**Bank height (m)** 0.3

**Bank width (m)** 5 **B**

**Vertical distance between the water surface and the water mark (m)** 0.5

**Horizontal distances (m)**  
0 1 2 3 \_\_\_\_\_

**Vertical water depths (cm)**  
 \_\_\_\_\_

**Bank height (m)** 0.1

**Bank width (m)** 1.5 **C**

**Vertical distance between the water surface and the water mark (m)** 0.5

**Notes on cross-section measurement**  
DEPT. OF CHANNEL

**Riparian zone width**

Left bank 0 (m) Right bank 0 (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	<u>100</u>	<u>100</u>
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	<u>100</u>

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

# Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams). Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)**  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)**

**Bank height (m)**

**Bank width (m)** B

**Vertical distance between the water surface and the water mark (m)**

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)**

**Bank width (m)** c

**Vertical distance between the water surface and the water mark (m)**

## Notes on cross-section measurement

### Riparian zone width

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

### Bank material

Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	} Total 100% each	

### Substrate composition

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	} Total 100%

### Filamentous algae cover

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

### Periphyton cover

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

### Moss cover

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

### Detritus cover

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

Date 22.8.18 Site No. 0016 Time 1140 Recorder's Name SARAH CLAVERTRiver Name FOREST CREEK Location Lot 7 DP 756011Weather CLEAR & SUNNY Rain in last week? Y ☐ N ☒

Photograph numbers and details

Latitude: 

deg	min	sec
28	46	22

 Longitude: 

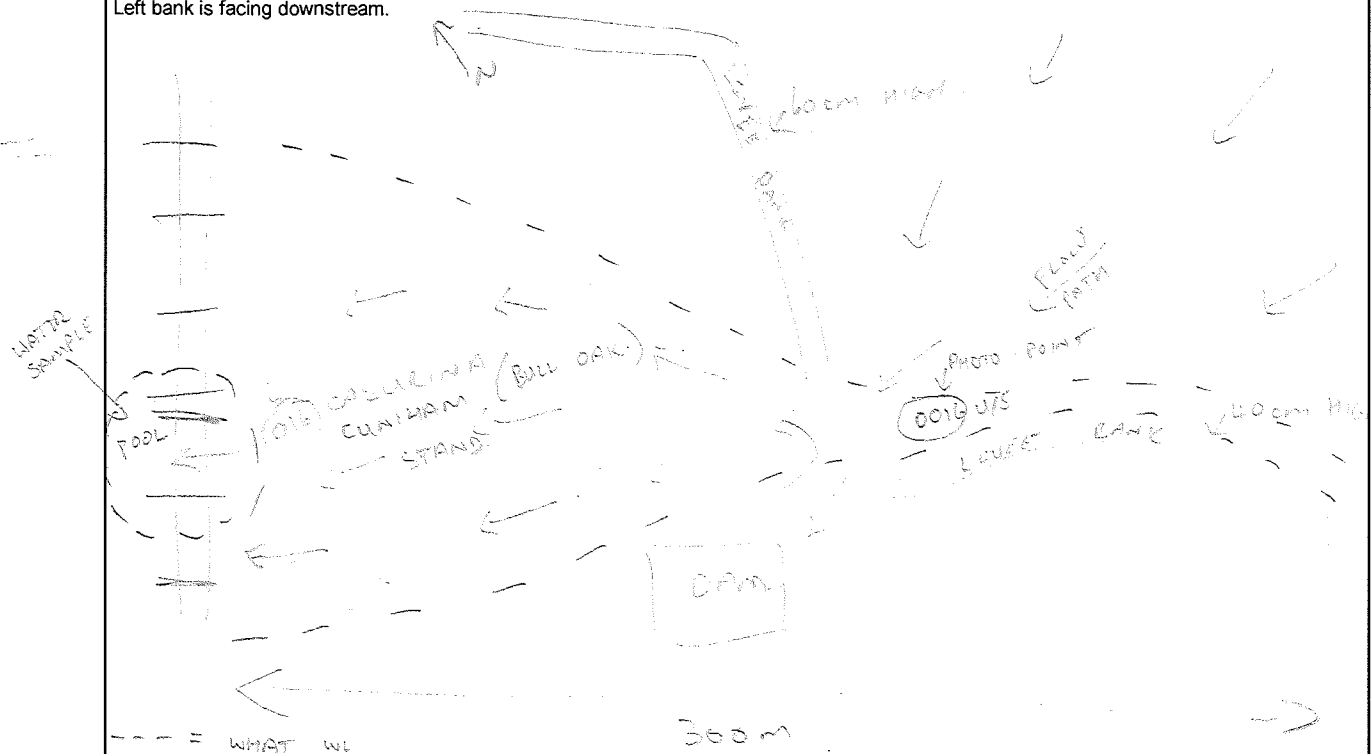
deg	min	sec
150	24	43

GPS Name and Datum

0016 US 1+2 U/S, 3+4 CENTER, 5+6 D/S01610 1+2 U/S, 3+4 CENTER, 5+6 D/S

## PLANFORM SKETCH OF SITE

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features. Left bank is facing downstream.



## LENGTH OF SAMPLING SITE

Bankfull width 77 (m)

x 10

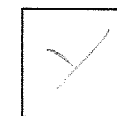
Length of sampling site 300 (m)

## Notes

MANY DETAILS NOT RECORDED.  
 AS SITE DOES NOT HAVE A DEFINED CHANNEL

NO CROSS SECTION COLLECTED

BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES HAVE BEEN RECORDED



Y

**Acknowledgments** - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a), AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven *et al.*, 1998).

BASIC WATER CHEMISTRY		Units
SAL	0.25 PPT	
Temperature	15.7	°C
Conductivity	518.4	$\mu\text{S/cm}$
Dissolved Oxygen	9.29	$\text{mg l}^{-1}$
Dissolved Oxygen Sat.	96.8	%
pH	8.18	
Turbidity	74.5	$\text{NTU}$
Total phosphorus	<input checked="" type="checkbox"/>	
Total nitrogen	<input checked="" type="checkbox"/>	
Water sample taken?		
ALKALINITY		
Amount of water	23	ml
Amount of $\text{H}_2\text{SO}_4$	18	ml
Alkalinity	90	$\text{mg l}^{-1}$
CONDUCTIVITY	622.7	$\mu\text{S/cm}$

## Valley shape

Choose one category only

	<input type="checkbox"/> Steep valley
	<input type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input checked="" type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

## Local impacts on streams

Choose one or more categories and describe the detail of each

<input type="checkbox"/> Sand or gravel mining	<input type="checkbox"/> Sewage effluent
<input type="checkbox"/> Other mining	<input type="checkbox"/> Channel straightening
<input type="checkbox"/> Road	<input type="checkbox"/> River improvement works
<input type="checkbox"/> Bridge / culvert / wharf	<input checked="" type="checkbox"/> Water extraction
<input type="checkbox"/> Ford / ramp	<input type="checkbox"/> Dredging
<input type="checkbox"/> Discharge pipe	<input checked="" type="checkbox"/> Grazing
<input type="checkbox"/> Forestry activities	<input type="checkbox"/> Litter
<input type="checkbox"/> Sugar mill	<input type="checkbox"/> Recreation
<input type="checkbox"/> Irrigation run-off or pipe outlet	<input checked="" type="checkbox"/> Other

Description DIVERSION OF CHANNEL

## Floodplain width

Average 2 (m)

## Floodplain features

Choose one or more features when present

<input type="checkbox"/> Sampling site has no distinct floodplain	<input type="checkbox"/> Scroll systems Short, crescentic strips or patches formed along the inner bank of a stream meander
<input type="checkbox"/> Oxbows / billabongs Body of water occupying a former river meander, isolated by a shift in the stream channel	<input checked="" type="checkbox"/> Splays Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain
<input type="checkbox"/> Remnant channels Formed during a previous hydrological regime. May be infilled with sediment	<input type="checkbox"/> Floodplain scours Scour holes formed by the concentrated clearing and digging action of flowing water
<input type="checkbox"/> Flood channels A channel that distributes water onto the floodplain and off the floodplain during floods	<input type="checkbox"/> No floodplain features present Floodplain present at the sampling site but does not contain any of the above features

GRASSLAND  
IS A  
D/S OF DAM OVER FLOW  
LARGE ALLUVIAL FAN

## Local landuse

Choose one category for each bank

Left	Right
<input type="checkbox"/>	<input type="checkbox"/> Native forest
<input type="checkbox"/>	<input type="checkbox"/> Native grassland (not grazed)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Grazing (native or non-native pasture)
<input type="checkbox"/>	<input type="checkbox"/> Exotic grassland (lawns etc., no grazing)
<input type="checkbox"/>	<input type="checkbox"/> Forestry Native [ ] [ ] Pine [ ] [ ]
<input type="checkbox"/>	<input type="checkbox"/> Cropped Rainfed [ ] [ ] Irrigated [ ] [ ]
<input type="checkbox"/>	<input type="checkbox"/> Urban residential
<input type="checkbox"/>	<input type="checkbox"/> Commercial
<input type="checkbox"/>	<input type="checkbox"/> Industrial or intensive agricultural
<input type="checkbox"/>	<input type="checkbox"/> Recreation
<input type="checkbox"/>	<input type="checkbox"/> Other _____

**Riparian zone composition**

Assess for whole sampling site

	% Cover		Vegetation Description
Trees (>10m in height)	<u>75</u>	} May total more than 100%	<u>Poplar Box</u>
Trees (<10m in height)	<u>1</u>		<u>CASUARINA CUNNINGHAMII</u>
Shrubs	<u>1</u>		
Grasses / ferns / sedges	<u>15</u>		<u>NATIVE + EXOTIC</u>

**Shading of channel**
☐ < 5%    ☐ 6 – 25%    ☐ 26 – 50%    ☒ 51 – 75%    ☐ > 76%
**Extent of trailing bank vegetation**
☒ nil    ☐ moderate  
☐ slight    ☐ extensive
**Native and exotic riparian vegetation**

% Native 30 } Total 100%  
 % Exotic 30

**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

		Left bank	Right bank
None		<input type="checkbox"/>	<input type="checkbox"/>
Isolated / scattered		<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Semi-continuous		<input type="checkbox"/>	<input type="checkbox"/>
Continuous		<input type="checkbox"/>	<input type="checkbox"/>

**Regeneration of native woody vegetation**

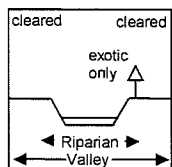
Is the sampling site in undisturbed forest?

Y [ ] N [X]

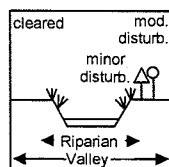
If no, record regeneration category

☐ Abundant (>5% cover) and healthy  
☐ Present  
☒ Very limited (<1% cover)
**Overall vegetation disturbance rating**

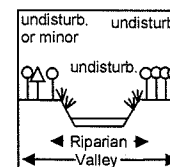
Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

**Extreme disturbance** ☐

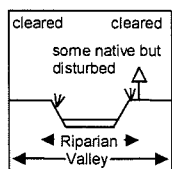
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie. dominated by exotic species with native species rare or completely absent)  
**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**High disturbance** ☐

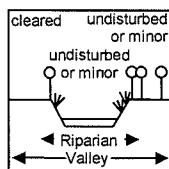
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain  
**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

**Low disturbance** ☐

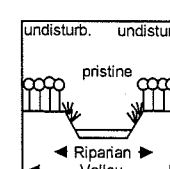
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor.  
**Valley vegetation** – native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species

**Very high disturbance** ☒

**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover.  
**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**Moderate disturbance** ☐

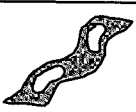





**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate  
**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state

**Very low disturbance** ☐

**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition  
**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Physical barriers to local fish passage**










Choose one category for each flow condition

		Base flow	Low flow	High flow
	No passage	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Moderately restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Good passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



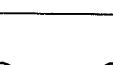
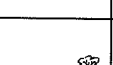

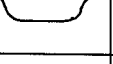
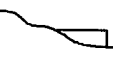



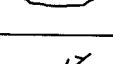
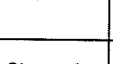
Type and height of barrier(s) \_\_\_\_\_

**Type of bars**


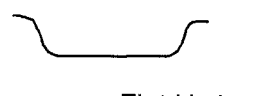

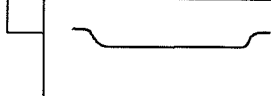


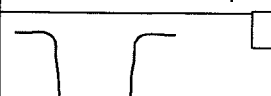
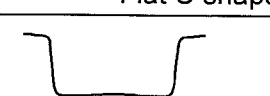
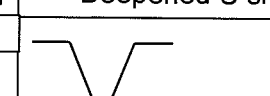
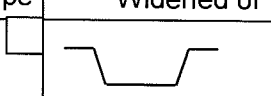


Choose one or more categories

	Bars absent	<input type="checkbox"/>
	Side/point bars VEGETATED	<input type="checkbox"/>
	Side/point bars UNVEGETATED	<input type="checkbox"/>
	Mid-channel bars VEGETATED	<input type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input type="checkbox"/>
	Bars around obstructions	<input checked="" type="checkbox"/>
	Braided channel	<input type="checkbox"/>
	Infilled channel	<input type="checkbox"/>
	High flow deposits	<input type="checkbox"/>

**Extent of bars**% of streambed forming a bar of any type 30 %**Dominant sediment particle size on bars**
 Boulder/cobble [ ] Pebble [ ] Gravel [ ]  
 Sand [ ] Silt/clay ☒ or \_\_\_\_\_ mm
**Channel modifications** Choose one or more categories




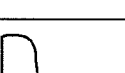
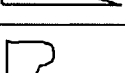
	No modifications	<input type="checkbox"/>		Reinforced	<input type="checkbox"/>
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>
	Dams and diversions	<input checked="" type="checkbox"/>		Infilled	<input type="checkbox"/>
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input type="checkbox"/>
	Straightened	<input type="checkbox"/>		Signs of work still	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>		Works old and revegetated	<input type="checkbox"/>
				Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	U shaped	<input type="checkbox"/>		Flat U shaped	<input type="checkbox"/>		Deepened U shape	<input type="checkbox"/>		Widened or infilled	<input checked="" type="checkbox"/>		Two stage	<input type="checkbox"/>		Multi stage	<input type="checkbox"/>
	Box	<input type="checkbox"/>		Wide box	<input type="checkbox"/>		V shaped	<input type="checkbox"/>		Trapezoid	<input type="checkbox"/>		Concrete V	<input type="checkbox"/>		Pipe or culvert	<input type="checkbox"/>

**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input type="checkbox"/>	<input type="checkbox"/>
	Convex	<input type="checkbox"/>	<input type="checkbox"/>
	Stepped	<input type="checkbox"/>	<input type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>




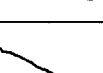

**Factors affecting bank stability**

Choose one or more categories

<input type="checkbox"/> None	<input checked="" type="checkbox"/> Cleared vegetation
<input type="checkbox"/> Mining	<input type="checkbox"/> Irrigation draw-down
<input checked="" type="checkbox"/> Runoff	<input type="checkbox"/> Reservoir releases
<input checked="" type="checkbox"/> Stock access	<input type="checkbox"/> Seepage
<input type="checkbox"/> Human access	<input checked="" type="checkbox"/> Flow and waves
<input type="checkbox"/> Ford, culvert or bridge	<input type="checkbox"/> Drainpipes
<input type="checkbox"/> Feral animals	
<input checked="" type="checkbox"/> Other	

Description DAMOVER FLOW**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input type="checkbox"/>	<input type="checkbox"/>
	Moderate 30 - 60°	<input type="checkbox"/>	<input type="checkbox"/>
	Low 10 - 30°	<input type="checkbox"/>	<input type="checkbox"/>
	Flat <10°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops

% bedrock outcrops Left bank \_\_\_\_\_

Right Bank \_\_\_\_\_

**Artificial bank protection measures**

Choose one or more categories

<input checked="" type="checkbox"/> None	<input type="checkbox"/> Fenced stock watering points
<input type="checkbox"/> Fence structures	<input type="checkbox"/> Vegetation plantings
<input type="checkbox"/> Levee banks	<input type="checkbox"/> Logs strapped to bank
<input type="checkbox"/> Rock or wall layer	<input type="checkbox"/> Concrete channel lining
<input type="checkbox"/> Rip rap	
<input type="checkbox"/> Fenced human access	
<input type="checkbox"/> Other	

**Sediment oils**
☒ absent ☐ light ☐ moderate ☐ profuse
**Water oils**
☒ none ☐ flecks ☐ globs ☐ sheen ☐ slick
**Sediment odours**
☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ anaerobic ☐ other \_\_\_\_\_
**Water odours**
☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ other \_\_\_\_\_
**Turbidity (visual assessment)**
☐ Clear ☐ Slight ☐ Turbid ☐ Opaque

Is water clarity reduced by:

☐ Suspended material (e.g mud, clay, organics) ☐ Dissolved material (e.g plant leachates)
**Water level at the time of sampling**
☒ Dry ☐ No flow ☐ Low ☐ Baseflow or near baseflow  
☐ High ☐ Flood (don't sample)
**Artificial features at the sampling site**

Choose one or more categories


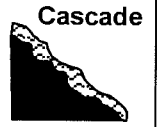






☒ Major ☐ Minor ☐ Ford ☐ Bridge ☐ Culvert ☐ Other weir
Description WEIR BANKS + DAM**Large woody debris**

Overall % cover of logs and branches greater than 10cm in diameter

0.1 % Notes on visibility \_\_\_\_\_

**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<u>NA</u> % of site _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Step Height <1m Gradient 5-60° Strong currents		_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Gradient 3-5° Strong currents Rocks break surface		_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small currents Surface unbroken and smooth		_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small but distinct & uniform current Surface unbroken		_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Area where stream widens or deepens and current declines		_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
A reasonable sized (>20% of channel width) cut-off section away from		_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)

Note: An additional response variable planform channel pattern is measured in the office**Macrophyte cover** Assess % cover of the sampling site by each category.

Overall % cover of macrophytes 0 % cover of emergent macrophytes \_\_\_\_\_  
 % cover of floating macrophytes \_\_\_\_\_  
 % cover of submerged macrophytes \_\_\_\_\_

Total should equal overall % cover of macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory. N denotes a native taxa and I denotes an introduced taxa.

**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	_____
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	_____
<i>Cyperus</i> (Sedge) I/N	<input type="checkbox"/>	_____
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	_____
<i>Juncus</i> (Rush) I/N	<input type="checkbox"/>	_____
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	_____
<i>Phragmites</i> (Common Reed) N	<input type="checkbox"/>	_____
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	_____
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	_____
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	_____
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	_____
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____






**Floating macrophytes**

	Present	%
<i>Azolla</i> (Azolla) N	<input type="checkbox"/>	_____
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

Overall % cover of native macrophyte taxa 0 } Total should equal overall % cover of macrophytes from above  
 Overall % cover of native macrophyte taxa 0


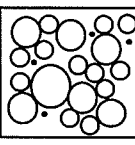
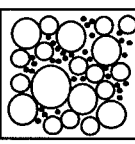
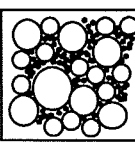
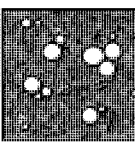
**Bed compaction**

Choose one category only

	<b>Tightly packed, armoured</b> Array of sediment sizes, overlapping, tightly packed and very hard to dislodge	<input type="checkbox"/>
	<b>Packed, unarmoured</b> Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate	<input type="checkbox"/>
	<b>Moderate compaction</b> Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate	<input type="checkbox"/>
	<b>Low compaction (1)</b> Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily	<input type="checkbox"/>
	<b>Low compaction (2)</b> Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily	<input checked="" type="checkbox"/>

**Sediment matrix**







Choose one category only

	<b>Bedrock</b>	<input type="checkbox"/>
	<b>Open framework</b> 0-5% fine sediment, high availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix filled contact framework</b> 5-32% fine sediment, moderate availability of interstitial spaces	<input type="checkbox"/>
	<b>Framework dilated</b> 32-60% fine sediment, low availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix dominated</b> >60% fine sediment, interstitial spaces virtually absent	<input checked="" type="checkbox"/>

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	<b>Very angular</b>	<input type="checkbox"/>
	<b>Angular</b>	<input type="checkbox"/>
	<b>Sub-angular</b>	<input type="checkbox"/>
	<b>Rounded</b>	<input type="checkbox"/>
	<b>Well rounded</b>	<input type="checkbox"/>
	<b>Cobble, pebble and gravel fractions not present</b>	<input checked="" type="checkbox"/>

In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding

Stable

Unstable - depositing

<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material.	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked, but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

USEPA Habitat Assessment  
 Circle a score for each parameter

HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>1. Epifaunal substrate / available cover</b>	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					40-70% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>2. Embeddedness</b>	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>3. Velocity / depth regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep).					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>4. Sediment deposition</b>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>5. Channel flow status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>6. Channel alteration</b>	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Frequency of riffles (or bends)</b>	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
<b>SCORE</b>	Left bank					10	9	8	7	6	5	4	3	2	1	0					
<b>SCORE</b>	Right bank					10	9	8	7	6	5	4	3	2	1	0					
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non-woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
<b>SCORE</b>	Left bank					10	9	8	7	6	5	4	3	2	1	0					
<b>SCORE</b>	Right bank					10	9	8	7	6	5	4	3	2	1	0					
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
<b>SCORE</b>	Left bank					10	9	8	7	6	5	4	3	2	1	0					
<b>SCORE</b>	Right bank					10	9	8	7	6	5	4	3	2	1	0					

TOTAL HIGH GRADIENT HABITAT SCORE

USEPA Habitat Assessment  
 Circle a score for each parameter

LOW GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
1. Epifaunal substrate / available cover	Greater than 50% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).																				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Pool substrate characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.																				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.																				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.																				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.																				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern.																				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

NO BANKS  
 HIGHLY ALTERED

Site No. 216 Date 22.8.18USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Channel sinuosity</b>	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).					The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.					The bends in the stream increase the stream 1 to 2 times longer than if it was in a straight line.					Channel straight; waterway has been channelized for a long distance.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			<del>2</del>	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			<del>2</del>	1	0			
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	<del>0</del>			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	<del>0</del>			

ARTIFICIAL  
NO BENDS

NO BANKS

TOTAL LOW GRADIENT HABITAT SCORE

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams). Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** \_\_\_\_\_ **A**

**Stream width at the water surface (m)** \_\_\_\_\_

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** \_\_\_\_\_ **B**

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

**Horizontal distances (m)**


**Vertical water depths (cm)**

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** \_\_\_\_\_ **C**

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

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**Cross-section sketch**

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**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)**

**Bank height (m)**

**Bank width (m)** B

**Vertical distance between the water surface and the water mark (m)**

**Horizontal distances (m)**

**Vertical water depths (cm)**

**Bank height (m)**

**Bank width (m)** C

**Vertical distance between the water surface and the water mark (m)**

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material**

Assess % composition for each bank

Left bank Right bank

Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	} Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

# Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

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**Cross-section sketch**

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**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)** \_\_\_\_\_

## Notes on cross-section measurement

### Riparian zone width

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

### Bank material

Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

### Substrate composition

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	Total 100%

### Filamentous algae cover

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

### Periphyton cover

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

### Moss cover

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

### Detritus cover

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

Date 22.8.18 Site No. 017 Time 1300 Recorder's Name DION JORVASRiver Name FOREST CREEK Location LOT 7 DP 756011Weather CLEAR + SUNNY Rain in last week? Y [ ] N [☒]

Photograph numbers and details

Latitude: 

deg	min	sec
28	46	45

 Longitude: 

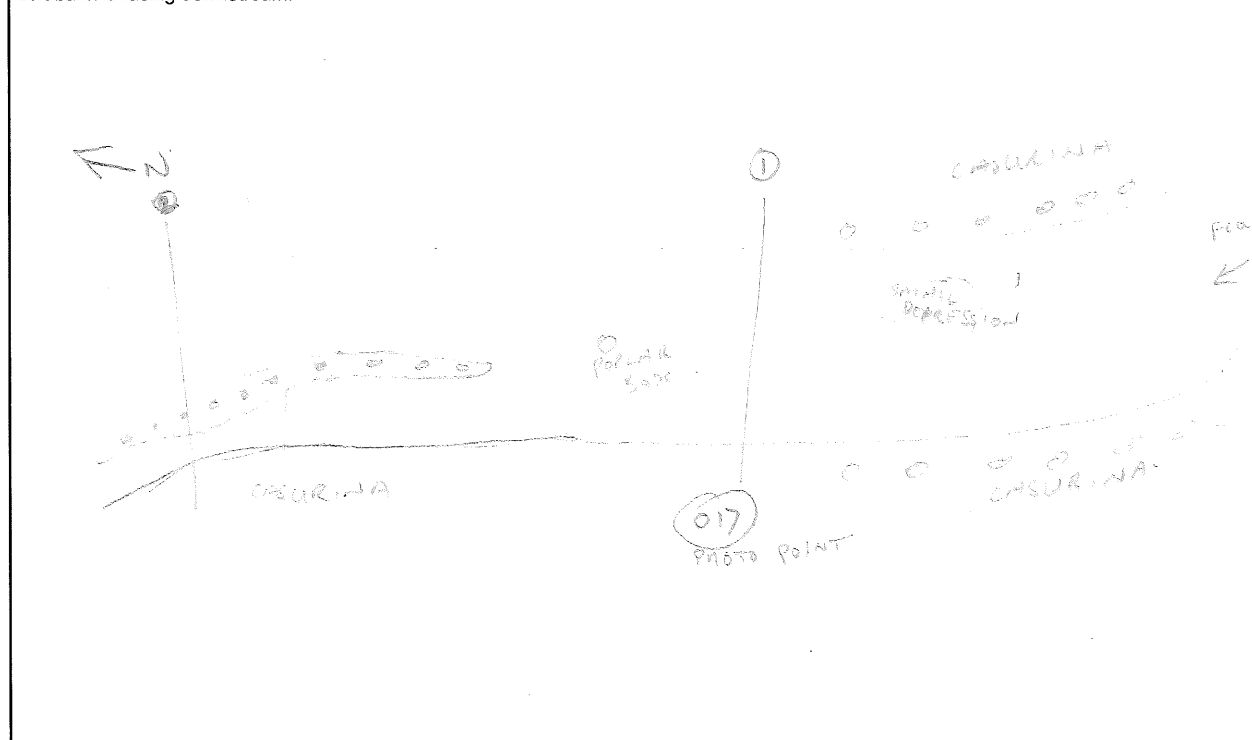
deg	min	sec
150	24	52

GPS Name and Datum

(017) 122 WS, 3-4 CENTRE, S46 D/S  
7- DEBRIS PILES

## PLANFORM SKETCH OF SITE

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.  
 Left bank is facing downstream.



## LENGTH OF SAMPLING SITE

Bankfull width 41 (m)

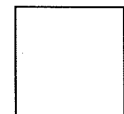
x 10

Length of sampling site 400 (m)

## Notes

- WIDE BROAD SHALLOW FLOOD  
 WAY / WETLAND  
 - ONLY ONE CROSS SECTION  
 UNIFORM SHALLOW DEPRESSION  
 BANKS POORLY DEFINED  
 VERY LOW GRADIENT

BEFORE LEAVING THE  
 SITE, CHECK DATA  
 SHEETS TO ENSURE  
 THAT ALL VARIABLES  
 HAVE BEEN RECORDED



Y

BASIC WATER CHEMISTRY		Units
Temperature	_____	°C
Conductivity	_____	
Dissolved Oxygen	_____	mg l <sup>-1</sup>
Dissolved Oxygen Sat.	_____	%
pH	_____	
Turbidity	_____	
Total phosphorus	<input type="checkbox"/> _____	
Total nitrogen	<input type="checkbox"/> _____	
ALKALINITY		
Amount of water	_____	ml
Amount of H <sub>2</sub> SO <sub>4</sub>	_____	ml
Alkalinity	_____	mg l <sup>-1</sup>

DRY.

Water sample taken?

## Valley shape

Choose one category only

	<input type="checkbox"/> Steep valley
	<input type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input checked="" type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

## Local impacts on streams

Choose one or more categories and describe the detail of each

<input type="checkbox"/> Sand or gravel mining	<input type="checkbox"/> Sewage effluent
<input type="checkbox"/> Other mining	<input type="checkbox"/> Channel straightening
<input type="checkbox"/> Road	<input type="checkbox"/> River improvement works
<input type="checkbox"/> Bridge / culvert / wharf	<input type="checkbox"/> Water extraction
<input type="checkbox"/> Ford / ramp	<input type="checkbox"/> Dredging
<input type="checkbox"/> Discharge pipe	<input checked="" type="checkbox"/> Grazing
<input type="checkbox"/> Forestry activities	<input type="checkbox"/> Litter
<input type="checkbox"/> Sugar mill	<input type="checkbox"/> Recreation
<input type="checkbox"/> Irrigation run-off or pipe outlet	<input checked="" type="checkbox"/> Other

Description CROPPING

## Floodplain width

\_\_\_\_\_ Average \_\_\_\_\_ (m)

## Floodplain features

Choose one or more features when present

<input type="checkbox"/> Sampling site has no distinct floodplain	<input type="checkbox"/> Scroll systems Short, crescentic strips or patches formed along the inner bank of a stream meander
<input type="checkbox"/> Oxbows / billabongs Body of water occupying a former river meander, isolated by a shift in the stream channel	<input type="checkbox"/> Splays Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain
<input type="checkbox"/> Remnant channels Formed during a previous hydrological regime. May be infilled with sediment	<input type="checkbox"/> Floodplain scours Scour holes formed by the concentrated clearing and digging action of flowing water
<input type="checkbox"/> Flood channels A channel that distributes water onto the floodplain and off the floodplain during floods	<input checked="" type="checkbox"/> No floodplain features present Floodplain present at the sampling site but does not contain any of the above features

SITE DRAINING IN OVER FLOOD PLAIN  
HIGH GROUND TO THE EAST.

## Local landuse

Choose one category for each bank

Left	Right
<input type="checkbox"/>	<input type="checkbox"/> Native forest
<input type="checkbox"/>	<input type="checkbox"/> Native grassland (not grazed)
<input type="checkbox"/>	<input type="checkbox"/> Grazing (native or non-native pasture)
<input type="checkbox"/>	<input type="checkbox"/> Exotic grassland (lawns etc., no grazing)
<input type="checkbox"/>	<input type="checkbox"/> Forestry Native [ ] [ ] Pine [ ] [ ]
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Cropped Rainfed [X] [X] Irrigated [ ] [ ]
<input type="checkbox"/>	<input type="checkbox"/> Urban residential
<input type="checkbox"/>	<input type="checkbox"/> Commercial
<input type="checkbox"/>	<input type="checkbox"/> Industrial or intensive agricultural
<input type="checkbox"/>	<input type="checkbox"/> Recreation
<input type="checkbox"/>	<input type="checkbox"/> Other _____

**Riparian zone composition**

Assess for whole sampling site

	% Cover		Vegetation Description
Trees (>10m in height)	<u>40</u>	} May total more than 100%	<u>CASUARINA + PORPOPHOLLOID</u>
Trees (<10m in height)	<u>10</u>		<u>" "</u>
Shrubs	<u>1</u>		
Grasses / ferns / sedges	<u>25</u>		<u>NATIVE + EXOTIC GRASSES</u>

**Shading of channel**
☒ < 5%    ☐ 6 – 25%    ☐ 26 – 50%    ☐ 51 – 75%    ☐ > 76%
**Extent of trailing bank vegetation**
☒ nil    ☐ moderate  
☐ slight    ☐ extensive
**Native and exotic riparian vegetation**
 % Native 99  
 % Exotic 1 } Total 100%
**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

		Left bank	Right bank
None		<input type="checkbox"/>	<input type="checkbox"/>
Isolated / scattered		<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Semi-continuous		<input type="checkbox"/>	<input type="checkbox"/>
Continuous		<input type="checkbox"/>	<input type="checkbox"/>

**Regeneration of native woody vegetation**

Is the sampling site in undisturbed forest?

Y [ ] N [ ☒ ]

If no, record regeneration category

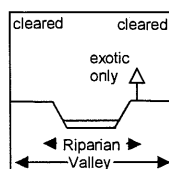
☐ Abundant (>5% cover) and healthy

☒ Present

☐ Very limited (<1% cover)

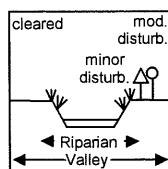
**Overall vegetation disturbance rating**

Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

**Extreme disturbance** ☐

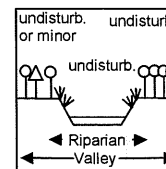
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie. dominated by exotic species with native species rare or completely absent)

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**High disturbance** ☐

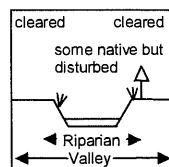
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain

**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

**Low disturbance** ☐

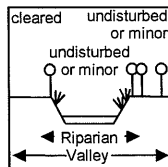
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor.

**Valley vegetation** – native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species

**Very high disturbance** ☒

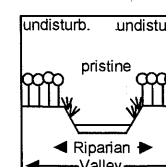
**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover.

**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**Moderate disturbance** ☐

**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state







**Very low disturbance** ☐

**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Physical barriers to local fish passage**










Choose one category for each flow condition

		Base flow	Low flow	High flow
	No passage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Moderately restricted passage	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Good passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Type and height of barrier(s)

WATER DEPTH WILL RESTRICT PASSAGE**Type of bars**







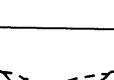


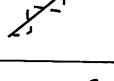
Choose one or more categories

	Bars absent	<input checked="" type="checkbox"/>
	Side/point bars VEGETATED	<input type="checkbox"/>
	Side/point bars UNVEGETATED	<input type="checkbox"/>
	Mid-channel bars VEGETATED	<input checked="" type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input type="checkbox"/>
	Bars around obstructions	<input type="checkbox"/>
	Braided channel	<input type="checkbox"/>
	Infilled channel	<input type="checkbox"/>
	High flow deposits	<input type="checkbox"/>




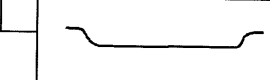


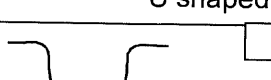
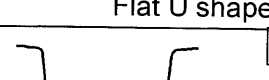
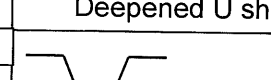
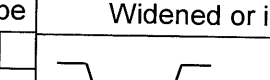

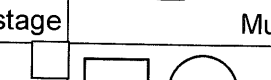
**Extent of bars**% of streambed forming a bar of any type 10 %**Dominant sediment particle size on bars**

Boulder/cobble [ ] Pebble [ ] Gravel [ ]

Sand [ ] Silt/clay ☒ or \_\_\_\_\_ mm**Channel modifications** Choose one or more categories


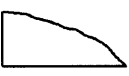



	No modifications	<input checked="" type="checkbox"/>		Reinforced	<input type="checkbox"/>
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>
	Dams and diversions	<input type="checkbox"/>		Infilled	<input type="checkbox"/>
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input type="checkbox"/>
	Straightened	<input type="checkbox"/>	Signs of work still	Recently channelised	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>	Works old and revegetated	Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	U shaped	<input type="checkbox"/>		Flat U shaped	<input type="checkbox"/>		Deepened U shape	<input type="checkbox"/>		Widened or infilled	<input checked="" type="checkbox"/>		Two stage	<input type="checkbox"/>		Multi stage	<input type="checkbox"/>
	Box	<input type="checkbox"/>		Wide box	<input type="checkbox"/>		V shaped	<input type="checkbox"/>		Trapezoid	<input type="checkbox"/>		Concrete V	<input type="checkbox"/>		Pipe or culvert	<input type="checkbox"/>

**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input type="checkbox"/>	<input type="checkbox"/>
	Convex	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Stepped	<input type="checkbox"/>	<input type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>

**Factors affecting bank stability**

Choose one or more categories

- |                                                  |                                                        |
|--------------------------------------------------|--------------------------------------------------------|
| <input type="checkbox"/> None                    | <input checked="" type="checkbox"/> Cleared vegetation |
| <input type="checkbox"/> Mining                  | <input type="checkbox"/> Irrigation draw-down          |
| <input checked="" type="checkbox"/> Runoff       | <input type="checkbox"/> Reservoir releases            |
| <input checked="" type="checkbox"/> Stock access | <input type="checkbox"/> Seepage                       |
| <input type="checkbox"/> Human access            | <input type="checkbox"/> Flow and waves                |
| <input type="checkbox"/> Ford, culvert or bridge | <input type="checkbox"/> Drainpipes                    |
| <input type="checkbox"/> Feral animals           |                                                        |
| <input type="checkbox"/> Other                   |                                                        |

Description \_\_\_\_\_

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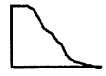

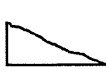

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**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input type="checkbox"/>	<input type="checkbox"/>
	Moderate 30 - 60°	<input type="checkbox"/>	<input type="checkbox"/>
	Low 10 - 30°	<input type="checkbox"/>	<input type="checkbox"/>
	Flat <10°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops

% bedrock outcrops Left bank 0

Right Bank 0

**Artificial bank protection measures**

Choose one or more categories

- |                                              |                                                       |
|----------------------------------------------|-------------------------------------------------------|
| <input checked="" type="checkbox"/> None     | <input type="checkbox"/> Fenced stock watering points |
| <input type="checkbox"/> Fence structures    | <input type="checkbox"/> Vegetation plantings         |
| <input type="checkbox"/> Levee banks         | <input type="checkbox"/> Logs strapped to bank        |
| <input type="checkbox"/> Rock or wall layer  | <input type="checkbox"/> Concrete channel lining      |
| <input type="checkbox"/> Rip rap             |                                                       |
| <input type="checkbox"/> Fenced human access |                                                       |
| <input type="checkbox"/> Other               |                                                       |

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**Sediment oils**
☒ absent ☐ light ☐ moderate ☐ profuse
**Water oils**
☒ none ☐ flecks ☐ globs ☐ sheen ☐ slick
**Sediment odours**
☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ anaerobic ☐ other \_\_\_\_\_
**Water odours**
☒ normal/none ☐ sewage ☐ petroleum ☐ chemical  
☐ other \_\_\_\_\_
**Turbidity (visual assessment)**
☐ Clear ☐ Slight ☐ Turbid ☐ Opaque

D/L+

Is water clarity reduced by:

☐ Suspended material (e.g mud, clay, organics) ☐ Dissolved material (e.g plant leachates)
**Water level at the time of sampling**
☒ Dry ☐ No flow ☐ Low ☐ Baseflow or near baseflow  
☐ High ☐ Flood (don't sample)
**Artificial features at the sampling site**

Choose one or more categories

☐ Major ☐ Minor ☐ Ford ☐ Bridge ☐ Culvert ☐ Other weir
Description N/A


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**Large woody debris**

Overall % cover of logs and branches greater than 10cm in diameter

1 % Notes on visibility \_\_\_\_\_


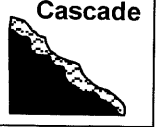






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**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<b>Waterfall</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Step Height <1m Gradient 5-60° Strong currents		<b>Cascade</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Height (m) _____ Est. Av. Gradient (°)
Gradient 3-5° Strong currents Rocks break surface		<b>Rapid</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		<b>Riffle</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small currents Surface unbroken and smooth		<b>Glide</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)
Gradient 1-3° Small but distinct & uniform current Surface unbroken		<b>Run</b>	<u>95</u> % of site <u>4.00</u> Est. Av. Length (m) <u>0.15</u> Est. Av. Depth (m) <u>4.0</u> Est. Av. Width (m)
Area where stream widens or deepens and current declines		<b>Pool</b>	<u>5</u> % of site <u>10</u> Est. Av. Length (m) <u>0.2</u> Est. Av. Depth (m) <u>8</u> Est. Av. Width (m)
A reasonable sized (>20% of channel width) cut-off section away from		<b>Backwater</b>	_____ % of site _____ Est. Av. Length (m) _____ Est. Av. Depth (m) _____ Est. Av. Width (m)

Note: An additional response variable planform channel pattern is measured in the office**Macrophyte cover** Assess % cover of the sampling site by each category.

Overall % cover of macrophytes 3 % cover of emergent macrophytes 1  
 % cover of floating macrophytes 2  
 % cover of submerged macrophytes 0

Total should equal overall % cover of macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory. N denotes a native taxa and I denotes an introduced taxa.

**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	_____
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	_____
<i>Cyperus</i> (Sedge) I/N	<input type="checkbox"/>	_____
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	_____
<i>Juncus</i> (Rush) I/N ?	<input checked="" type="checkbox"/>	<u>1</u>
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	_____
<i>Phragmites</i> (Common Reed) N	<input type="checkbox"/>	_____
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	_____
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	_____
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	_____
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	_____
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	_____
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	_____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	_____
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

**Floating macrophytes**

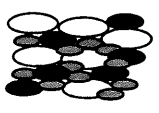
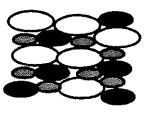
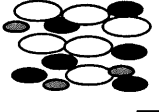
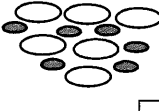

	Present	%
<i>Azolla</i> (Azolla) N	<input type="checkbox"/>	_____
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	_____
Other <u>NARDOO</u>	<input type="checkbox"/>	<u>1</u>
Other _____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____

Overall % cover of native macrophyte taxa 160  
 Overall % cover of native macrophyte taxa 0

Total should equal overall % cover of macrophytes from above


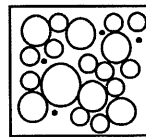
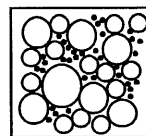
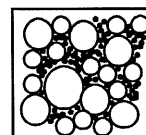
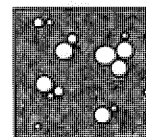
**Bed compaction**

Choose one category only

	Tightly packed, armoured Array of sediment sizes, overlapping, tightly packed and very hard to dislodge	<input type="checkbox"/>
	Packed, unarmoured Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate	<input type="checkbox"/>
	Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate	<input type="checkbox"/>
	Low compaction (1) Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily	<input type="checkbox"/>
	Low compaction (2) Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily	<input checked="" type="checkbox"/>

**Sediment matrix**





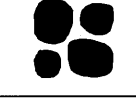
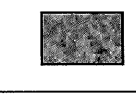
Choose one category only

	Bedrock	<input type="checkbox"/>
	Open framework 0-5% fine sediment, high availability of interstitial spaces	<input type="checkbox"/>
	Matrix filled contact framework 5-32% fine sediment, moderate availability of interstitial spaces	<input type="checkbox"/>
	Framework dilated 32-60% fine sediment, low availability of interstitial spaces	<input type="checkbox"/>
	Matrix dominated >60% fine sediment, interstitial spaces virtually absent	<input checked="" type="checkbox"/>

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	Very angular	<input type="checkbox"/>
	Angular	<input type="checkbox"/>
	Sub-angular	<input type="checkbox"/>
	Rounded	<input type="checkbox"/>
	Well rounded	<input type="checkbox"/>
	Cobble, pebble and gravel fractions not present	<input checked="" type="checkbox"/>

In the USEPA Habitat Assessment on the  
following pages, be sure to use the correct form  
for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding

Stable

Unstable - depositing

<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked, but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

USEPA Habitat Assessment  
 Circle a score for each parameter

HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>1. Epifaunal substrate / available cover</b>	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					40-70% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>2. Embeddedness</b>	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>3. Velocity / depth regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep).					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>4. Sediment deposition</b>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>5. Channel flow status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>6. Channel alteration</b>	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Frequency of riffles (or bends)</b>	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7;1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	0			

TOTAL HIGH GRADIENT HABITAT SCORE

USEPA Habitat Assessment  
 Circle a score for each parameter

LOW GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
1. Epifaunal substrate / available cover	Greater than 50% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					30-50% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Pool substrate characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.					Mixture of soft sand, mud or clay; mud may be dominant; some root mats and submerged vegetation present.					All mud or clay or sand bottom; little or no root mat; no submerged vegetation.					Hard-pan clay or bedrock; no root mat or vegetation.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.					Majority of pools large-deep; very few shallow.					Shallow pools much more prevalent than deep pools.					Majority of pools small-shallow or pools absent.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

Site No. 017Date 22-8-18USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Channel sinuosity</b>	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note -- channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).					The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.					The bends in the stream increase the stream 1 to 2 times longer than if it was in a straight line.					Channel straight; waterway has been channelized for a long distance.					
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2	1	0			
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2	1	0			
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2				0	
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2				0	
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
<b>SCORE</b>	Left bank		10	9		8	7	6			5	4	3			2				0	
<b>SCORE</b>	Right bank		10	9		8	7	6			5	4	3			2				0	

BROAD STRAIGHT  
FLOOD WAY

NO TRUE BANKS

TOTAL LOW GRADIENT HABITAT SCORE

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams). Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

**Cross-section number** 2 of 2

**Type of bedform at the cross-section**  
☐ Riffle ☒ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** (=total of boxes A+B+C) 72

**Stream width at the water mark (m)** 64 A

**Stream width at the water surface (m)** 0

**Bank height (m)** 0.1

**Bank width (m)** 3.0 B

**Vertical distance between the water surface and the water mark (m)** 0.2

**Horizontal distances (m)**

**Vertical water depths (cm)**

**Bank height (m)** 0.1

**Bank width (m)** 5 C

**Vertical distance between the water surface and the water mark (m)** 0.15

**Notes on cross-section measurement****Riparian zone width**

Left bank 5 (m) Right bank 7 (m)

**Bank material** Assess % composition for each bank

Left bank Right bank

Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	<u>100</u>	<u>100</u>
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	<u>100</u>

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number** 1 **of** 1

**Type of bedform at the cross-section**

☐ Riffle  
 ☒ Run  
 ☐ Pool  
 ☐ Cascade  
 ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** 76  
(=total of boxes A+B+C)

**Stream width at the water mark (m)** 39 **A**

**Stream width at the water surface (m)**

**Bank height (m)** 0.1

**Bank width (m)** 31 **B**

**Vertical distance between the water surface and the water mark (m)** 0.1

Horizontal distances (m)													
Vertical water depths (cm)													

**Bank height (m)** 0.1

**Bank width (m)** 6 **C**

**Vertical distance between the water surface and the water mark (m)** 0.2

Left bank 32 (m) Right bank 6 (m)

POORLY	DEFINED	SITE	ALL	SHALLOW	FLOOD WAY	WITH
		CHANNEL	AT THIS	ONE		

Grain Size	Sample 1	Sample 2
Bedrock		
Boulder (>256mm)		
Cobble (64-256mm)		
Pebble (16-64mm)		
Gravel (2-16mm)		
Sand (0.06-2mm)		
Fines (silt and clay, <0.06mm)	15.0	10.0
	Total 100% each	

Bedrock	
Boulder (>256mm)	
Cobble (64-256mm)	
Pebble (16-64mm)	
Gravel (2-16mm)	
Sand (0.06-2mm)	
Fines (silt and clay <0.06mm)	100

Total 100%

☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%☒ <10%   ☐ 10-35%   ☐ 35-65%   ☐ 65-90%   ☐ >90%☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%☒ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

# Channel cross-sections and variables to be measured in the area around a cross section

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**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)**  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)**

**Bank height (m)**

**Bank width (m)** B

**Vertical distance between the water surface and the water mark (m)**

**Horizontal distances (m)**

**Vertical water depths (cm)**

**Bank height (m)**

**Bank width (m)** c

**Vertical distance between the water surface and the water mark (m)**

## Riparian zone width

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

## Notes on cross-section measurement

## Bank material Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	} Total 100% each	

## Substrate composition

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	} Total 100%

## Filamentous algae cover

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

## Periphyton cover

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

## Moss cover

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

## Detritus cover

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

Date 22.8.18 Site No. 018 Time 1420 Recorder's Name SARAH CLAUDERiver Name FOREST CREEK Location ROAD RESERVEWeather CLOUD + SUNNY Rain in last week? Y ☐ N ☒

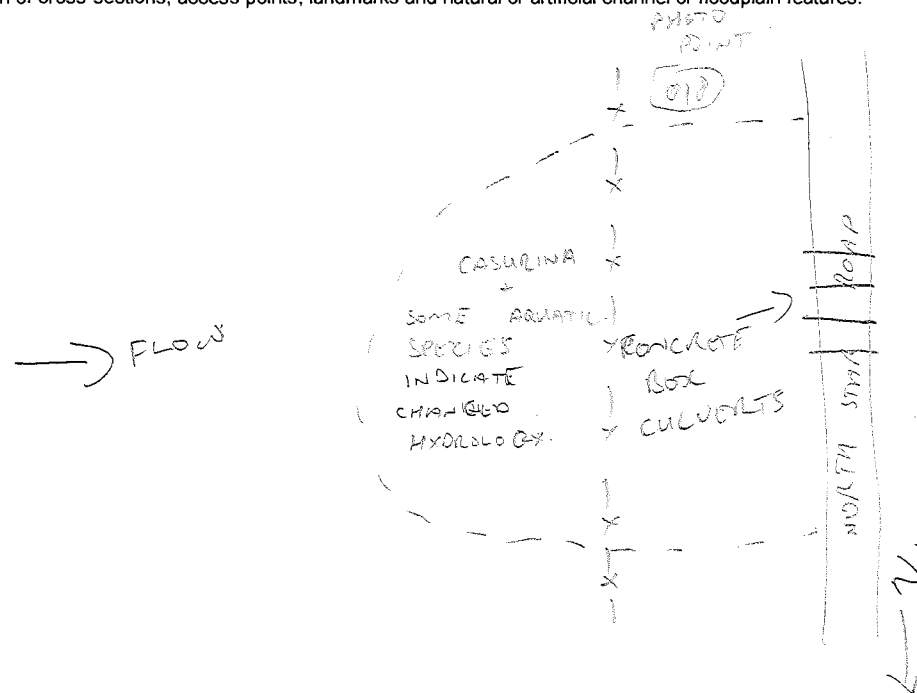
Photograph numbers and details

Latitude: deg min sec  
28 46 06 Longitude: deg min sec  
150 24 27

GPS Name and Datum

(018) 1+2 4/5, 3+4 CENTRE, 5+6 D/S

## PLANFORM SKETCH OF SITE

Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.  
Left bank is facing downstream.

## LENGTH OF SAMPLING SITE

Bankfull width NOT DETERMINED (m)

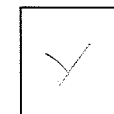
x 10

Length of sampling site \_\_\_\_\_ (m)

## Notes

BROAD UNDEFINED FLOODWAY  
NO CROSS SECTIONS AND SOME  
DATA NOT COLLECTED

BEFORE LEAVING THE  
 SITE, CHECK DATA  
 SHEETS TO ENSURE  
 THAT ALL VARIABLES  
 HAVE BEEN RECORDED



Y

BASIC WATER CHEMISTRY		Units
Temperature	<u>21.7</u>	°C
Conductivity	_____	_____
Dissolved Oxygen	_____	mg l <sup>-1</sup>
Dissolved Oxygen Sat.	_____	%
pH	_____	_____
Turbidity	_____	_____
Total phosphorus	<input type="checkbox"/>	_____
Total nitrogen	<input type="checkbox"/>	_____
ALKALINITY		
Amount of water	_____	ml
Amount of H <sub>2</sub> SO <sub>4</sub>	_____	ml
Alkalinity	_____	mg l <sup>-1</sup>

Water sample taken?

**Valley shape**

Choose one category only

	<input type="checkbox"/> Steep valley
	<input type="checkbox"/> Shallow valley
	<input type="checkbox"/> Broad valley
	<input type="checkbox"/> Gorge
	<input checked="" type="checkbox"/> Symmetrical floodplain
	<input type="checkbox"/> Asymmetrical floodplain

**Local impacts on streams**

Choose one or more categories and describe the detail of each

<input type="checkbox"/> Sand or gravel mining	<input type="checkbox"/> Sewage effluent
<input type="checkbox"/> Other mining	<input type="checkbox"/> Channel straightening
<input checked="" type="checkbox"/> Road	<input type="checkbox"/> River improvement works
<input checked="" type="checkbox"/> Bridge / culvert / wharf	<input type="checkbox"/> Water extraction
<input type="checkbox"/> Ford / ramp	<input type="checkbox"/> Dredging
<input type="checkbox"/> Discharge pipe	<input checked="" type="checkbox"/> Grazing
<input type="checkbox"/> Forestry activities	<input type="checkbox"/> Litter
<input type="checkbox"/> Sugar mill	<input type="checkbox"/> Recreation
<input type="checkbox"/> Irrigation run-off or pipe outlet	<input type="checkbox"/> Other

Description LEVEE CREATED BY ROAD.**Floodplain width**

\_\_\_\_\_ Average ? (m)

BROAD UNDEFINED FLOOD PLAIN

**Floodplain features**

Choose one or more features when present

<input type="checkbox"/> Sampling site has no distinct floodplain	<input type="checkbox"/> Scroll systems
<input type="checkbox"/> Oxbows / billabongs	Short, crescentic strips or patches formed along the inner bank of a stream meander
Body of water occupying a former river meander, isolated by a shift in the stream channel	<input type="checkbox"/> Splays
<input type="checkbox"/> Remnant channels	Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain
Formed during a previous hydrological regime. May be infilled with sediment	<input type="checkbox"/> Floodplain scours
<input type="checkbox"/> Flood channels	Scour holes formed by the concentrated clearing and digging action of flowing water
A channel that distributes water onto the floodplain and off the floodplain during floods	<input checked="" type="checkbox"/> No floodplain features present
	Floodplain present at the sampling site but does not contain any of the above features

**Local landuse**

Choose one category for each bank

Left	Right
<input type="checkbox"/>	<input type="checkbox"/> Native forest
<input type="checkbox"/>	<input type="checkbox"/> Native grassland (not grazed)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Grazing (native or non-native pasture)
<input type="checkbox"/>	<input type="checkbox"/> Exotic grassland (lawns etc., no grazing)
<input type="checkbox"/>	<input type="checkbox"/> Forestry Native [ ] [ ] Pine [ ] [ ]
<input type="checkbox"/>	<input type="checkbox"/> Cropped Rainfed [ ] [ ] Irrigated [ ] [ ]
<input type="checkbox"/>	<input type="checkbox"/> Urban residential
<input type="checkbox"/>	<input type="checkbox"/> Commercial
<input type="checkbox"/>	<input type="checkbox"/> Industrial or intensive agricultural
<input type="checkbox"/>	<input type="checkbox"/> Recreation
<input type="checkbox"/>	<input type="checkbox"/> Other _____

**Riparian zone composition**

Assess for whole sampling site

ASSESSED ARE INDICATED IN  
DIAGRAM

	% Cover		Vegetation Description
Trees (>10m in height)	40	} May total more than 100%	CASUARINA
Trees (<10m in height)	1		"
Shrubs	0		NA
Grasses / ferns / sedges	50		NATIVE + EXOTIC GRASSES

**Shading of channel**
☐ < 5%    ☐ 6 – 25%    ☐ 26 – 50%    ☒ 51 – 75%    ☐ > 76%    NA
**Extent of trailing bank vegetation**
☒ nil    ☐ moderate  
☐ slight    ☐ extensive
**Native and exotic riparian vegetation**

% Native 90 } Total 100%  
 % Exotic 10

**Longitudinal extent of riparian vegetation**

Choose one category for each bank. Do not include ground layer except where site is in native grassland.

BANKS UNOBTAINED

		Left bank	Right bank
None		<input type="checkbox"/>	<input type="checkbox"/>
Isolated / scattered		<input type="checkbox"/>	<input type="checkbox"/>
Regularly spaced		<input type="checkbox"/>	<input type="checkbox"/>
Occasional clumps		<input type="checkbox"/>	<input type="checkbox"/>
Semi-continuous		<input type="checkbox"/>	<input type="checkbox"/>
Continuous		<input type="checkbox"/>	<input type="checkbox"/>

**Regeneration of native woody vegetation**

Is the sampling site in undisturbed forest?

Y [ ] N [X]

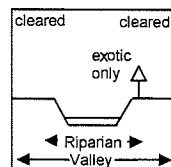
If no, record regeneration category

☐  
☒  
☐

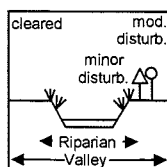
Abundant (>5% cover) and healthy  
 Present  
 Very limited (<1% cover)

**Overall vegetation disturbance rating**

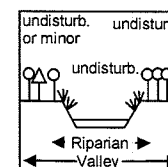
Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

**Extreme disturbance** ☐

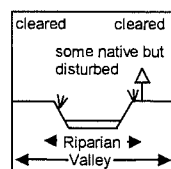
**Riparian vegetation** – absent or severely reduced. Vegetation is extremely disturbed (ie. dominated by exotic species with native species rare or completely absent)  
**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**High disturbance** ☐

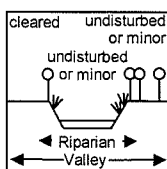
**Riparian vegetation** – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain  
**Valley vegetation** – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

**Low disturbance** ☐

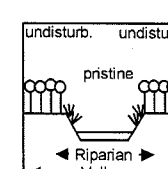
**Riparian vegetation** – native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor.  
**Valley vegetation** – native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species

**Very high disturbance** ☒

**Riparian vegetation** – some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and cover.  
**Valley vegetation** – agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

**Moderate disturbance** ☐






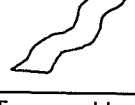
**Riparian vegetation** – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate  
**Valley vegetation** – agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state

**Very low disturbance** ☐

**Riparian vegetation** – native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition  
**Valley vegetation** – native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

**Physical barriers to local fish passage**

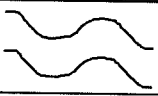








Choose one category for each flow condition

		Base flow	Low flow	High flow
	No passage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Very restricted passage	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Moderately restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Partly restricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Good passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unrestricted passage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Type and height of barrier(s)

WATER DEPTH WIDE RESTRICTED PASSAGE**Type of bars**

Choose one or more categories







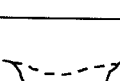

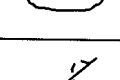
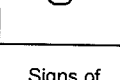
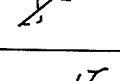
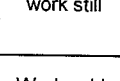
	Bars absent	<input type="checkbox"/>
	Side/point bars VEGETATED	<input type="checkbox"/>
	Side/point bars UNVEGETATED	<input type="checkbox"/>
	Mid-channel bars VEGETATED	<input type="checkbox"/>
	Mid-channel bars UNVEGETATED	<input type="checkbox"/>
	Bars around obstructions	<input type="checkbox"/>
	Braided channel	<input type="checkbox"/>
	Infilled channel	<input type="checkbox"/>
	High flow deposits	<input type="checkbox"/>

**Extent of bars**% of streambed forming a bar of any type 0 %**Dominant sediment particle size on bars**

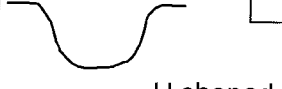






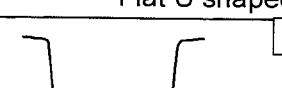
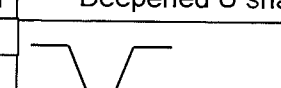
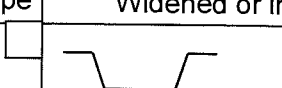

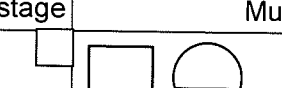
Boulder/cobble [ ] Pebble [ ] Gravel [ ]

Sand [ ] Silt/clay [ ] or \_\_\_\_\_ mm

**Channel modifications** Choose one or more categories




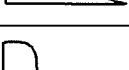

	No modifications	<input checked="" type="checkbox"/>		Reinforced	<input type="checkbox"/>
	Desnagged	<input type="checkbox"/>		Revegetated	<input type="checkbox"/>
	Dams and diversions	<input type="checkbox"/>		Infilled	<input type="checkbox"/>
	Resectioned	<input type="checkbox"/>		Berms or embankments	<input type="checkbox"/>
	Straightened	<input type="checkbox"/>		Signs of work still	<input type="checkbox"/>
	Realigned	<input type="checkbox"/>		Works old and revegetated	<input type="checkbox"/>
				Channelised in the past	<input type="checkbox"/>

**Channel shape** Choose one category only

	U shaped	<input type="checkbox"/>		Flat U shaped	<input type="checkbox"/>		Deepened U shape	<input type="checkbox"/>		Widened or infilled	<input checked="" type="checkbox"/>		Two stage	<input type="checkbox"/>		Multi stage	<input type="checkbox"/>
	Box	<input type="checkbox"/>		Wide box	<input type="checkbox"/>		V shaped	<input type="checkbox"/>		Trapezoid	<input type="checkbox"/>		Concrete V	<input type="checkbox"/>		Pipe or culvert	<input type="checkbox"/>





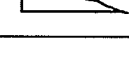
**Bank shape**

Choose one category for each bank

		Left bank	Right bank
	Concave	<input type="checkbox"/>	<input type="checkbox"/>
	Convex	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <i>NO DEFINED BANKS</i>
	Stepped	<input type="checkbox"/>	<input type="checkbox"/>
	Wide lower bench	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut	<input type="checkbox"/>	<input type="checkbox"/>

**Bank slope**

Choose one category for each bank

		Left bank	Right bank
	Vertical 80 - 90°	<input type="checkbox"/>	<input type="checkbox"/>
	Steep 60 - 80°	<input type="checkbox"/>	<input type="checkbox"/>
	Moderate 30 - 60°	<input type="checkbox"/>	<input type="checkbox"/>
	Low 10 - 30°	<input type="checkbox"/>	<input type="checkbox"/>
	Flat <10°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

**Factors affecting bank stability**

Choose one or more categories

<input type="checkbox"/> None	<input checked="" type="checkbox"/> Cleared vegetation
<input type="checkbox"/> Mining	<input type="checkbox"/> Irrigation draw-down
<input checked="" type="checkbox"/> Runoff	<input type="checkbox"/> Reservoir releases
<input type="checkbox"/> Stock access	<input type="checkbox"/> Seepage
<input type="checkbox"/> Human access	<input type="checkbox"/> Flow and waves
<input type="checkbox"/> Ford, culvert or bridge	<input type="checkbox"/> Drainpipes
<input type="checkbox"/> Feral animals	
<input type="checkbox"/> Other	

Description \_\_\_\_\_

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**Bedrock outcrops**

Assess % of each bank covered by bedrock outcrops

% bedrock outcrops Left bank 0

Right Bank 0

**Artificial bank protection measures**

Choose one or more categories

<input checked="" type="checkbox"/> None	<input type="checkbox"/> Fenced stock watering points
<input type="checkbox"/> Fence structures	<input type="checkbox"/> Vegetation plantings
<input type="checkbox"/> Levee banks	<input type="checkbox"/> Logs strapped to bank
<input type="checkbox"/> Rock or wall layer	<input type="checkbox"/> Concrete channel lining
<input type="checkbox"/> Rip rap	
<input type="checkbox"/> Fenced human access	
<input type="checkbox"/> Other	

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**Sediment oils**

☒ absent ☐ light ☐ moderate ☐ profuse

**Water oils**

☒ none ☐ flecks ☐ globs ☐ sheen ☐ slick

**Sediment odours**

☒ normal/none ☐ sewage ☐ petroleum ☐ chemical

☐ anaerobic ☐ other \_\_\_\_\_

**Water odours**

☐ normal/none ☐ sewage ☐ petroleum ☐ chemical

☒ other OK \_\_\_\_\_

**Turbidity (visual assessment)**

☐ Clear ☐ Slight ☐ Turbid ☐ Opaque

Is water clarity reduced by:

☐ Suspended material (e.g mud, clay, organics) ☐ Dissolved material (e.g plant leachates)

**Water level at the time of sampling**

☒ Dry ☐ No flow ☐ Low ☐ Baseflow or near baseflow

☐ High ☐ Flood (don't sample)

**Artificial features at the sampling site**

Choose one or more categories

☐ Major ☐ Minor ☐ Ford ☐ Bridge ☒ Culvert ☐ Other weir

Description CULVERT AT DOWN STREAM END OF SITE**Large woody debris**

Overall % cover of logs and branches greater than 10cm in diameter

2 % Notes on visibility \_\_\_\_\_


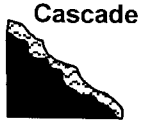
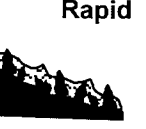



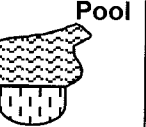

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**Extent of bedform features**

Total % composition for all features must equal 100%

Height >1m Gradient >60°		<u>NA</u> % of site ____ Est. Av. Length (m) ____ Est. Av. Height (m) ____ Est. Av. Gradient (°)
Step Height <1m Gradient 5-60° Strong currents		____ % of site ____ Est. Av. Length (m) ____ Est. Av. Height (m) ____ Est. Av. Gradient (°)
Gradient 3-5° Strong currents Rocks break surface		____ % of site ____ Est. Av. Length (m) ____ Est. Av. Depth (m) ____ Est. Av. Width (m)
Gradient 1-3° Moderate currents Surface unbroken but unsmooth		____ % of site ____ Est. Av. Length (m) ____ Est. Av. Depth (m) ____ Est. Av. Width (m)
Gradient 1-3° Small currents Surface unbroken and smooth		____ % of site ____ Est. Av. Length (m) ____ Est. Av. Depth (m) ____ Est. Av. Width (m)
Gradient 1-3° Small but distinct & uniform current Surface unbroken		____ % of site ____ Est. Av. Length (m) ____ Est. Av. Depth (m) ____ Est. Av. Width (m)
Area where stream widens or deepens and current declines		____ % of site ____ Est. Av. Length (m) ____ Est. Av. Depth (m) ____ Est. Av. Width (m)
A reasonable sized (>20% of channel width) cut-off section away from		____ % of site ____ Est. Av. Length (m) ____ Est. Av. Depth (m) ____ Est. Av. Width (m)

Note: An additional response variable planform channel pattern is measured in the office**Macrophyte cover** Assess % cover of the sampling site by each category.

Overall % cover of macrophytes 2 % cover of emergent macrophytes 2  
 % cover of floating macrophytes 0  
 % cover of submerged macrophytes 0

Total should equal overall % cover of macrophytes

**Macrophyte composition**

Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification.

Listed macrophytes can be changed to reflect the common taxa present in each State or Territory. N denotes a native taxa and I denotes an introduced taxa.

**Emergent macrophytes**

	Present	% cover
<i>Brachiaria</i> (Para Grass) I	<input type="checkbox"/>	____
<i>Crassula</i> (Crassula) N	<input type="checkbox"/>	____
<i>Cyperus</i> (Sedge) I/N	<input type="checkbox"/>	____
<i>Eleocharis</i> (Spikerush) N	<input type="checkbox"/>	____
<i>Juncus</i> (Rush) I/N	<input type="checkbox"/>	____
<i>Paspalum</i> (Water Couch) N	<input type="checkbox"/>	____
<i>Phragmites</i> (Common Reed) N	<input type="checkbox"/>	____
<i>Ranunculus</i> (Buttercup) I	<input type="checkbox"/>	____
<i>Scirpus</i> (Clubrush) N	<input type="checkbox"/>	____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	____
<i>Typha</i> (Cumbungi) N	<input type="checkbox"/>	____
Other _____	<input type="checkbox"/>	____
Other _____	<input type="checkbox"/>	____
Other _____	<input type="checkbox"/>	____

**Submerged macrophytes**

	Present	% cover
<i>Ceratophyllum</i> (Hornwort) N	<input type="checkbox"/>	____
<i>Chara</i> (Stonewort) N	<input type="checkbox"/>	____
<i>Elodea</i> (Canadian Pondweed) I	<input type="checkbox"/>	____
<i>Myriophyllum</i> (Water Milfoil) I/N	<input type="checkbox"/>	____
<i>Nitella</i> (Stonewort) N	<input type="checkbox"/>	____
<i>Potamogeton</i> (Pondweed) N	<input type="checkbox"/>	____
<i>Triglochin</i> (Water Ribbon) N	<input type="checkbox"/>	____
<i>Vallisneria</i> (Ribbonweed) N	<input type="checkbox"/>	____
Other _____	<input type="checkbox"/>	____
Other _____	<input type="checkbox"/>	____
Other _____	<input type="checkbox"/>	____

**Floating macrophytes**






	Present	%
<i>Azolla</i> (Azolla) N	<input type="checkbox"/>	____
<i>Callitriche</i> (Starwort) I	<input type="checkbox"/>	____
Other <u>NAZ DGO</u>	<input checked="" type="checkbox"/>	<u>2</u>
Other _____	<input type="checkbox"/>	____
Other _____	<input type="checkbox"/>	____

Overall % cover of native macrophyte taxa 2Overall % cover of native macrophyte taxa 0

Total should equal overall % cover of macrophytes from above


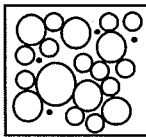
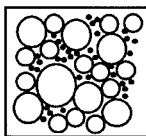
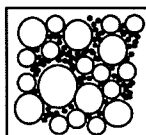
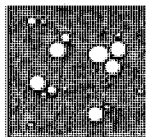
**Bed compaction**

Choose one category only

	<b>Tightly packed, armoured</b> Array of sediment sizes, overlapping, tightly packed and very hard to dislodge	<input type="checkbox"/>
	<b>Packed, unarmoured</b> Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate	<input type="checkbox"/>
	<b>Moderate compaction</b> Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate	<input type="checkbox"/>
	<b>Low compaction (1)</b> Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily	<input type="checkbox"/>
	<b>Low compaction (2)</b> Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily	<input checked="" type="checkbox"/>

**Sediment matrix**







Choose one category only

	<b>Bedrock</b>	<input type="checkbox"/>
	<b>Open framework</b> 0-5% fine sediment, high availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix filled contact framework</b> 5-32% fine sediment, moderate availability of interstitial spaces	<input type="checkbox"/>
	<b>Framework dilated</b> 32-60% fine sediment, low availability of interstitial spaces	<input type="checkbox"/>
	<b>Matrix dominated</b> >60% fine sediment, interstitial spaces virtually absent	<input checked="" type="checkbox"/>

**Sediment angularity**

Choose one category only

Assess cobble, pebble and gravel fractions only

	<b>Very angular</b>	<input type="checkbox"/>
	<b>Angular</b>	<input type="checkbox"/>
	<b>Sub-angular</b>	<input type="checkbox"/>
	<b>Rounded</b>	<input type="checkbox"/>
	<b>Well rounded</b>	<input type="checkbox"/>
	<b>Cobble, pebble and gravel fractions not present</b>	<input checked="" type="checkbox"/>

In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

**Bed stability rating** Choose one category only

Unstable - eroding

Stable

Unstable - depositing

<b>Severe erosion</b> Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.	<b>Moderate erosion</b> Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material.	<b>Bed stable</b> A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.	<b>Moderate deposition</b> Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.	<b>Severe deposition</b> Extensive build up of fine sediments to form a flat bed. Channel blocked, but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

USEPA Habitat Assessment  
 Circle a score for each parameter

HIGH GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
1. Epifaunal substrate / available cover	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					40-70% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Embeddedness	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Velocity / depth regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep).					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

USEPA Habitat Assessment  
Circle a score for each parameter

## HIGH GRADIENT STREAMS

Habitat parameter	Condition category															
	Excellent				Good				Fair				Poor			
<b>7. Frequency of riffles (or bends)</b> Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.																
<b>SCORE</b>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5
<b>8. Bank stability (score each bank)</b> Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.																
<b>SCORE</b>	Left bank	10	9			8	7	6			5	4	3		2	1
<b>SCORE</b>	Right bank	10	9			8	7	6			5	4	3		2	1
<b>9. Vegetative protection (score each bank)</b> More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.																
<b>SCORE</b>	Left bank	10	9			8	7	6			5	4	3		2	1
<b>SCORE</b>	Right bank	10	9			8	7	6			5	4	3		2	1
<b>10. Riparian zone score (score each bank)</b> Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.																
<b>SCORE</b>	Left bank	10	9			8	7	6			5	4	3		2	1
<b>SCORE</b>	Right bank	10	9			8	7	6			5	4	3		2	1

TOTAL HIGH GRADIENT HABITAT SCORE

USEPA Habitat Assessment  
 Circle a score for each parameter

LOW GRADIENT STREAMS

Page 1 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
1. Epifaunal substrate / available cover	Greater than 50% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					30-50% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).					10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Pool substrate characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.					Mixture of soft sand, mud or clay; mud may be dominant; some root mats and submerged vegetation present.					All mud or clay or sand bottom; little or no root mat; no submerged vegetation.					Hard-pan clay or bedrock; no root mat or vegetation.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.					Majority of pools large-deep; very few shallow.					Shallow pools much more prevalent than deep pools.					Majority of pools small-shallow or pools absent.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued over

Site No. 018 Date 22-8-18USEPA Habitat Assessment  
Circle a score for each parameter

## LOW GRADIENT STREAMS

Page 2 of 2

Habitat parameter	Condition category																				
	Excellent					Good					Fair					Poor					
<b>7. Channel sinuosity</b>	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).					The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.					The bends in the stream increase the stream 1 to 2 times longer than if it was in a straight line.					Channel straight; waterway has been channelized for a long distance.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
<b>8. Bank stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
SCORE	Left bank																				
SCORE	Right bank																				
<b>9. Vegetative protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
SCORE	Left bank																				
SCORE	Right bank																				
<b>10. Riparian zone score (score each bank)</b>	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.					Width of riparian zone 6-12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
SCORE	Left bank																				
SCORE	Right bank																				

NO DEFINED BANKS

UN DEFINED

TOTAL LOW GRADIENT HABITAT SCORE

**Channel cross-sections and variables to be measured in the area around a cross section**

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams). Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** \_\_\_\_\_ A

**Stream width at the water surface (m)** \_\_\_\_\_

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** \_\_\_\_\_ B

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** \_\_\_\_\_ C

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

**Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Notes on cross-section measurement****Bank material**

Assess % composition for each bank

Left bank Right bank

Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____

Total 100% each

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

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Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)** \_\_\_\_\_

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** B

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

Horizontal distances (m)

Vertical water depths (cm)

**Bank height (m)** \_\_\_\_\_

**Bank width (m)** C

**Vertical distance between the water surface and the water mark (m)** \_\_\_\_\_

**Notes on cross-section measurement****Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Bank material**

Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____

Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Channel cross-sections and variables to be measured in the area around a cross section**

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Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams). Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

**Cross-section sketch**

The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.

**Cross-section number \_\_\_\_\_ of \_\_\_\_\_**

**Type of bedform at the cross-section**  
☐ Riffle ☐ Run ☐ Pool ☐ Cascade ☐ Other \_\_\_\_\_

**Bankfull channel width (m)** \_\_\_\_\_  
 (=total of boxes A+B+C)

**Stream width at the water mark (m)** A

**Stream width at the water surface (m)**

Bank height (m)

Bank width (m) B

Vertical distance between the water surface and the water mark (m)

Horizontal distances (m)

Vertical water depths (cm)

Bank height (m)

Bank width (m) C

Vertical distance between the water surface and the water mark (m)

**Riparian zone width**

Left bank \_\_\_\_\_ (m) Right bank \_\_\_\_\_ (m)

**Notes on cross-section measurement****Bank material** Assess % composition for each bank

	Left bank	Right bank
Bedrock	_____	_____
Boulder (>256mm)	_____	_____
Cobble (64-256mm)	_____	_____
Pebble (16-64mm)	_____	_____
Gravel (2-16mm)	_____	_____
Sand (0.06-2mm)	_____	_____
Fines (silt and clay, <0.06mm)	_____	_____
	Total 100% each	

**Substrate composition**

Assess % composition in the area of bed 5m either side of the cross-section.

Bedrock	_____
Boulder (>256mm)	_____
Cobble (64-256mm)	_____
Pebble (16-64mm)	_____
Gravel (2-16mm)	_____
Sand (0.06-2mm)	_____
Fines (silt and clay <0.06mm)	_____
	Total 100%

**Filamentous algae cover**

Assess in the area 5m either side of the cross section

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Periphyton cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Moss cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

**Detritus cover**

☐ <10% ☐ 10-35% ☐ 35-65% ☐ 65-90% ☐ >90%

## Henderson, Courtney

---

**From:** Billington, Jonathan  
**Sent:** Monday, 26 November 2018 5:44 PM  
**To:** Henderson, Courtney  
**Cc:** Monte, Anneke  
**Subject:** Further information surface water quality

Hi Courtney

In response to your queries.

- There are no calibration certificates available for the water quality meter used to collect in-situ readings. This is Dion's personal unit and whilst he completes regular field calibrations. General parameters were collected using YSI pro Multi-parameter water quality meter and turbidity using a Hach 2100Q portable turbidimeter.
- Raw in-situ water quality is provided in our ecology technical report, this report details both terrestrial and aquatic investigations. I can provide you the initial spreadsheet taken off of the tablet but the data in the report is the same. Our report is saved on project-wise [here](#). Also of use may be the photos of the surveyed reach of each site. If you want the full size photos I can link you to these so let me know but probably easier to just use our report which has identified upstream and downstream photos.
- Descriptions of each site reach are provided in the above linked technical report. In speaking to Dion who completed the work I understand that there was no rainfall either immediately prior to or during the survey program but as he isn't based out there he can't provide a lot more intel than that. You'd need to look at BOM observations to get a better overall picture of preceding rainfall but most of the sites sampled are highly ephemeral and the region was considered to be in drought at the time of assessment.

I'll be around tomorrow so we can talk then.

Thanks

**Jonathan Billington**

Senior Ecologist

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[Jonathan.Billington@aeacom.com](mailto:Jonathan.Billington@aeacom.com)

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