NS 2 FRESHWATER PEARL MUSSEL SUB-BASIN MANAGEMENT PLANS

REPORT ON MORPHOLOGICAL MONITORING AND CATCHMENT WALKOVER RISK ASSESSMENTS IN THE OWENMORE CATCHMENT

September 2009

TABLE OF CONTENTS

1.0 INTRODUCTION

In order to assess the hydromorphological alterations within the Owenmore catchment the EPA WFD classification tool called the River Hydromorphology Assessment Technique (RHAT) was utilised by RPS. This tool was developed through the North South Share project, to classify rivers in terms of their morphology. It is a field technique which assigns a channel typology. This influences the rivers physical attributes assessed in the field. The technique assigns a morphological classification directly related to that of the WFD – high, good, moderate, poor and bad.

RHAT surveys were carried out at high risk areas located within pearl mussel populations. The methodology classifies river hydromorphology based on a departure from naturalness, and assigns a morphological classification, based on semi-quantitative criteria. It is designed to be a rapid visual assessment based on information from desktop studies, using GIS data, aerial photography, historical data and data obtained from previous field surveys as well as observations in the field.

A catchment walkover risk assessment survey sheet was also designed by the project team in conjunction with NPWS in order to focus the collation of the pressure data in the field with respect to the Freshwater Pearl Mussel. The risk sheet was divided into eight categories designed to highlight the main pressures within the catchment. The eight categories are as follows:

- Source of erosion
- Diffuse Nutrient
- Diffuse Silt
- Current Riparian Zone
- Field Drainage
- Outfalls
- Abstractions
- Barriers to Migration

Each sub-pressure within the eight categories is analysed and an overall risk assessment of High, Medium or Low is assigned to that category. The “one out all out principle” is then used to assign the river stretch or point an overall risk category. A detailed description, together with a series of photographs outlining the pressures is also taken. The risk assessment sheets will assist the project team in focussing the specific freshwater pearl mussel measures within the catchment.

Location of survey stretches and points are shown in **Figure 3.1**

2.0 METHODOLOGY

Sampling was carried out on the 19th May 2009.

2.1 RIVER HYDROMORPHOLOGY ASSESSMENT TECHNIQUE (RHAT)

Classification of hydromorphology can be used to contribute to the status classification of water bodies at high ecological status only. However, RHAT plays a vital role in identifying why a water body might be failing to achieve Good Ecological Status as it is based on the observed impact in the field. It can assist in deciding what indirect and direct efforts are needed to improve status and in helping to prevent further deterioration.

The eight criteria that are scored are:

1. Channel morphology and flow types
2. Channel vegetation
3. Substrate diversity and embeddedness
4. Channel flow status
5. Bank and bank top stability
6. Bank and bank top vegetation
7. Riparian land use
8. Floodplain connectivity

Sheet 1 of the RHAT form contains the Field Health and Safety sheet which is filled on arrival at the site. Before the field survey, a desk study is required this element of the survey was completed as part of the development of the draft sub-basin management plans. The reach identification and physical characterisation sections for each field site are recorded on Sheet 2 (see Appendix 1) with all information available from GIS and aerial photographs, including:

a. expected stream type and the description of various stream types
b. catchment and reach-scale pressures (these may help to identify, confirm or explain field observations);
c. expected riparian vegetation types (for high quality status);
d. the weather conditions on the day of the survey, and those immediately preceding the day of the survey. This information is important to interpret the effects of storm events on the survey results;
e. the estimated stream width and the reach length to be assessed (~ 40 x width).
f. any other notable issues (e.g. from previous surveys).

A score is allocated to each relevant attribute (the number of attributes to be assessed will depend on the stream type). Where the condition departs from the reference condition, note should be made if this condition results from a particular identifiable pressure. Where possible and where relevant, all attributes should be included in the assessment, using the assessment sheet (Sheet 3, see Appendix 1). If an attribute is not assessed, the score-summary table should be amended (cells shaded) and a note made as to why the assessment was not carried out. The WFD status can still be calculated on the basis of other attributes, but with a note that a particular attribute was omitted.

Transfer scores for individual attributes to the summary table on the survey Sheet 2. Finally the overall WFD category can be calculated using the following values:

> 0.8	= high
0.6 – 0.8	= good
0.4 – 0.6	= moderate
0.2 – 0.4	= poor
< 0.2	= bad

For the purposes of the assessment as part of the NS2 project, a high status for morphology is desirable for pearl mussel habitats. Through work carried out by the Shannon IRBD project on the Freshwater Morphology Programme of Measures Study, it was found that an observed relationship exists between biological data and a RHAT score. The study confirmed that morphological pressure can impact biology and therefore ecological status. In general, sites with RHAT scores less than 0.6 also have less than good Q scores. Similarly high levels of siltation affecting macrophyte populations are reflected by less than good RHAT scores.

Grid references were recorded at all sites using a GPS together with site photographs which were taken using a digital camera.

2.2 CATCHMENT WALKOVER RISK ASSESSMENT

During the development of the draft sub-basin management plans throughout 2008 a complete desk study was conducted of all relevant biological, water quality and pressure source data within the Owenmore catchment. Best use was made of all available datasets such as the pressure source data collated by the River Basin District Projects for the Article V Characterisation and Programme of Measures Studies. This work allowed the NS 2 project team to assess the catchment through the combined availability of aerial imagery and digitised pressure information. Where gaps in this data existed together with areas that required ground truthing such as physical barriers to migration, catchment walkover risk assessments were focussed throughout the 2009 field survey season.

The catchment walkover risk assessment sheet (See Appendix 3) covers eight main categories or pressures which are subsequently sub-divided into the various sources. Each source is ticked if present and an overall risk assessment for each pressure assigned from High to Medium to Low over the survey length or point. All eight pressures are combined to give an overall risk assessment to the catchment based on the “one out all out principle”.

3.0 RESULTS

Figure 3.1 indicates where the Owenmore RHAT assessments were carried out throughout the catchment.

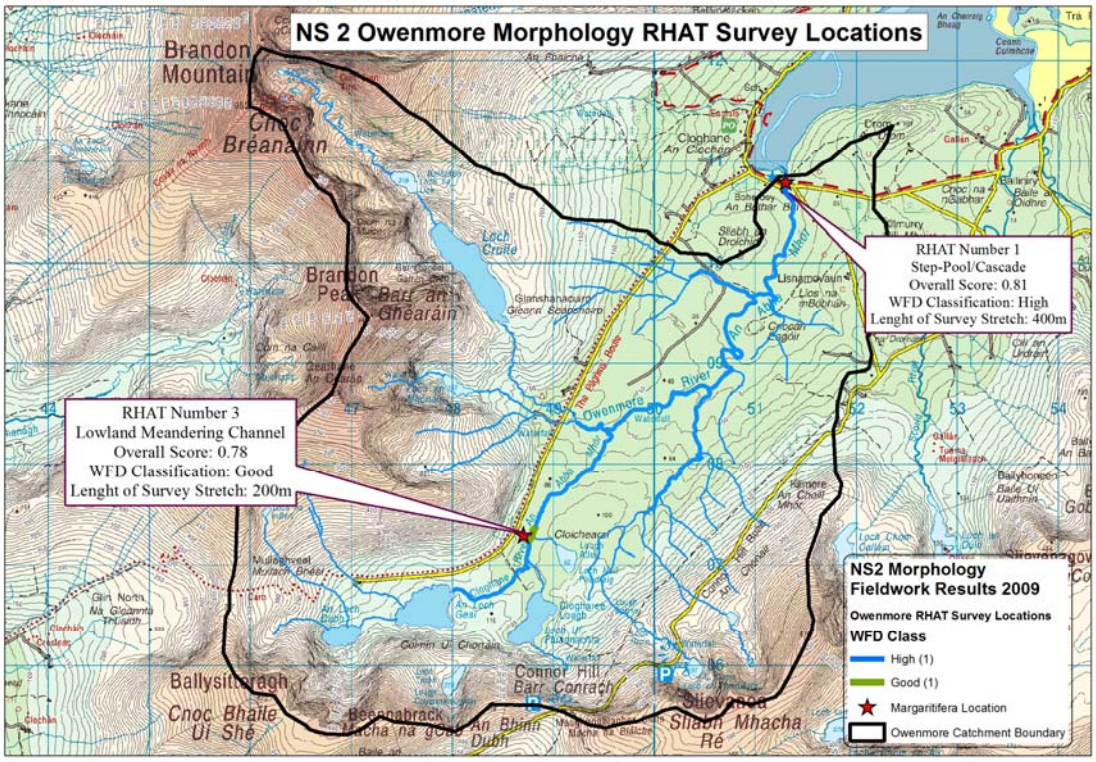


Figure 3.1 Morphology RHAT Assessment Locations

(The RHAT numbering system corresponds to the site code which may mean they are not sequential where a RHAT was not carried out at a particular site)

3.1 RHAT Survey Results

Two RHAT surveys were carried out throughout the Owenmore catchment. The results of these surveys can be found in the electronic appendix. One was deemed to be at high status in the lower reaches of the catchment at Boherboy where as the survey stretch at the upper end of the catchment was at good status. RHAT number 1 scored well on all attributes except for barriers to continuity which scored two out of four. Filmenteous algae were recorded on some of the cobbles and boulders within the survey stretch. A number of stone weirs and deflectors were also found along the survey stretch. The Owenmore fishery is operated along this stretch, an embankment runs along a considerable length of the survey stretch on the left bank. Overall this stretch was classified as being at good status. Dead mussels were also found along the banks of this survey stretch. Gunnera was recorded on the left bank which may be a sign of previous

disturbance along the bank. The inflowing tributary on the right bank upstream of the bridge had some fine silts contained in it also.

RHAT number 3 was carried out on the Cloghan River. This is a lowland meandering channel which is surrounding by areas of peat. This is largely a remote channel with no physical modifications to the river stretch. Two attributes were downgraded – channel vegetation and substrate condition. This is due to the presence of macrophytes in greater than expected quantities for a channel of this type indicating the presence of silt and perhaps nutrients in channel to allow the macrophytes to flourish.

Plate 3.1 Representative photographs from reach:

RHAT 1 Site 1 Photo 11	**RHAT 1 Site 1 Photo 9**
	
RHAT 3 Site 3 Photo 1	**RHAT 3 Site 3 Photo 3**
	

Details in relation to photographs are tabulated in Appendix 2.

3.2 Catchment Walkover Risk Assessment Results

A total of seven sites were surveyed in the Owenmore sub-basin catchment, with a risk assessment carried out at five of these sites (two stopping points). **Figure 3.2** outlines the locations of the High to Low Risk Assessments from the Catchment Walkover Risk Assessments in addition to the stopping points. Four high risk sites were recorded out of the five that were assessed; only one medium risk site was recorded with no low risk sites being recorded within this catchment. **Figure 3.3** outlines the percentage of sites classified at high and medium risk throughout the catchment along with the stopping points.

The most common high risk categories identified were:

- Diffuse Silt – at 50% of high risk sites.
- Diffuse Nutrient – at 50% of high risk sites,
- Current Riparian Zone – at 50% of high risk sites,

The Current Riparian Zone category of the Catchment Walkover Risk Assessment slightly varies from the seven other categories or pressures. The Current Riparian Zone is not a pressure in itself; however the aspects listed in this category are the interceptors to the pressure and convey the extent or lack of buffer provided by the riparian zone. A high risk riparian zone indicates that the pressures acting on the river are more likely to have significant impact. For example the lack of fencing along a river stretch can lead to excessive trampling and/or poaching which in turn may lead to siltation within a pearl mussel habitat. The various categories and pressures listed in the Catchment Walkover Risk Assessment sheet were designed to assist the project in focusing the measures which will be needed to combat the pressure along its pathway, rather than removing a source which may not always be possible such as intensive agriculture. Recording the Riparian Zone in terms of its current performance as a buffer is important in this regard.

Current Riparian Zone has ten aspects as follows:

- Fencing

- Buffer
- Tree line at bank
- Tree line buffer
- Plantation with no buffer
- Urbanisation
- Flood Protection
- Marshy Land
- Landuse at bank
- Other Sources

Where one or any of these aspects is found to be the cause of significant impact to the riparian zone, or the channel along the stretch then this category may be assigned a high risk score.

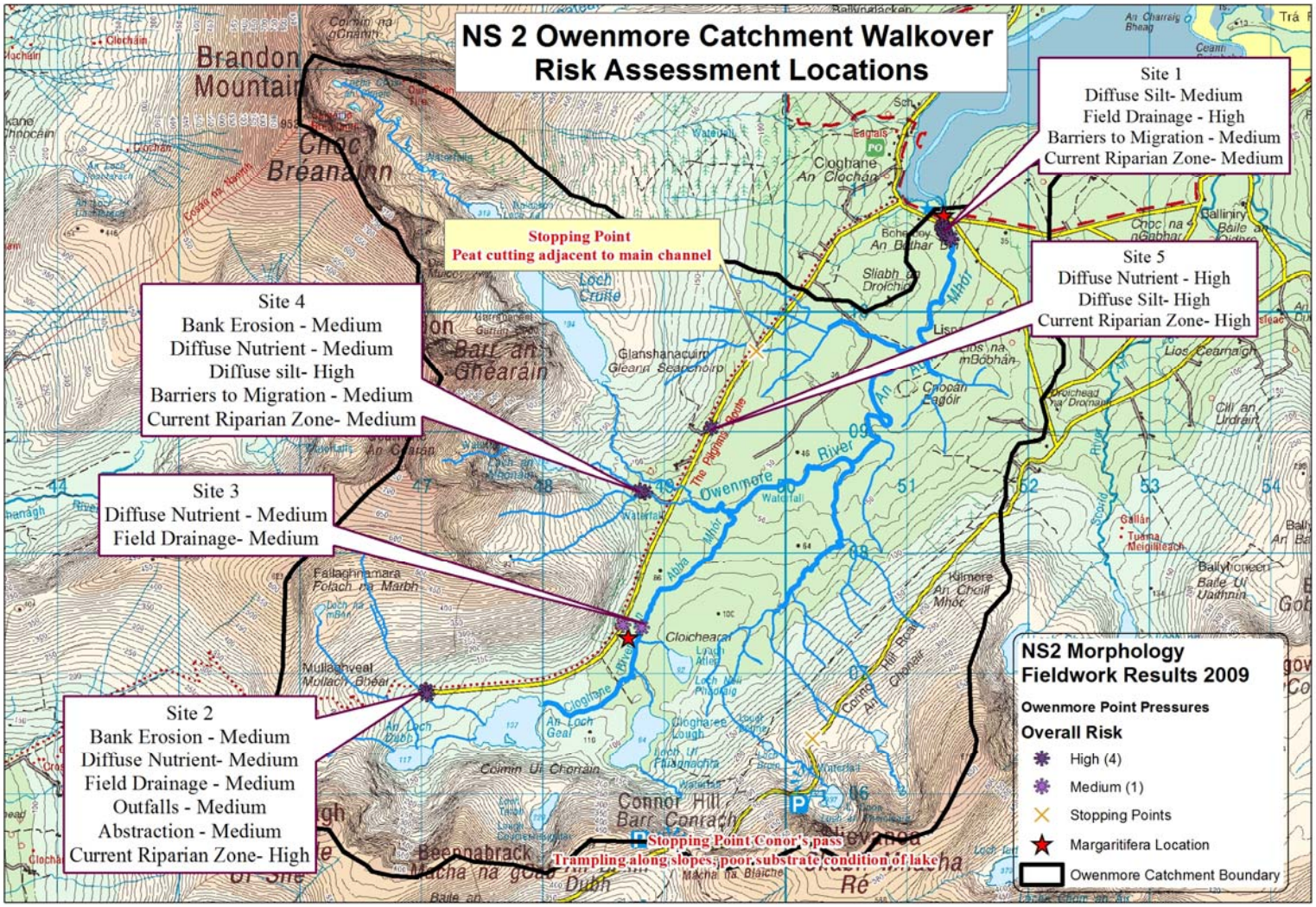
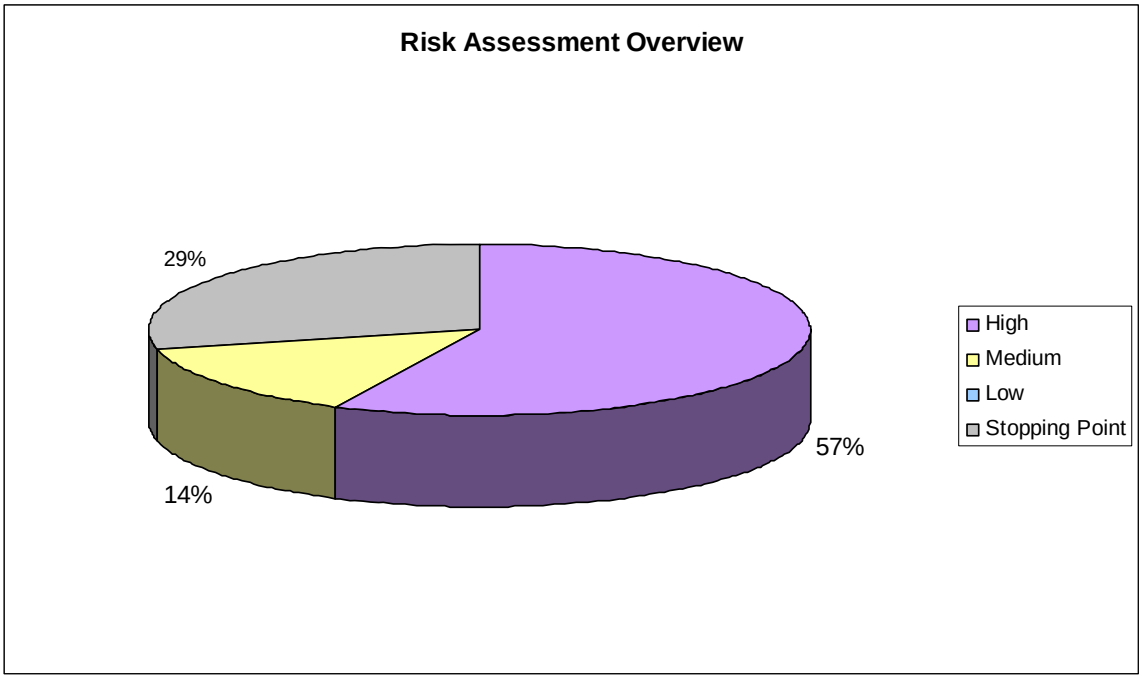


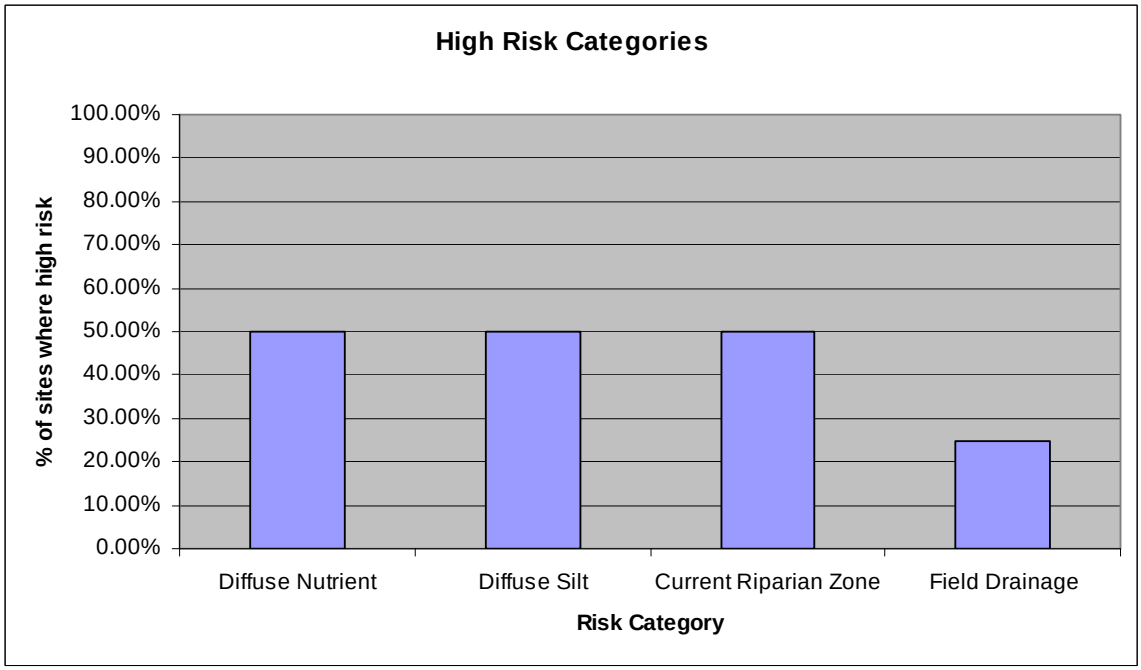
Figure 3.2 Location of Stopping points and Catchment Walkover Risk Assessment

Figure 3.3 Risk Assessment Overview



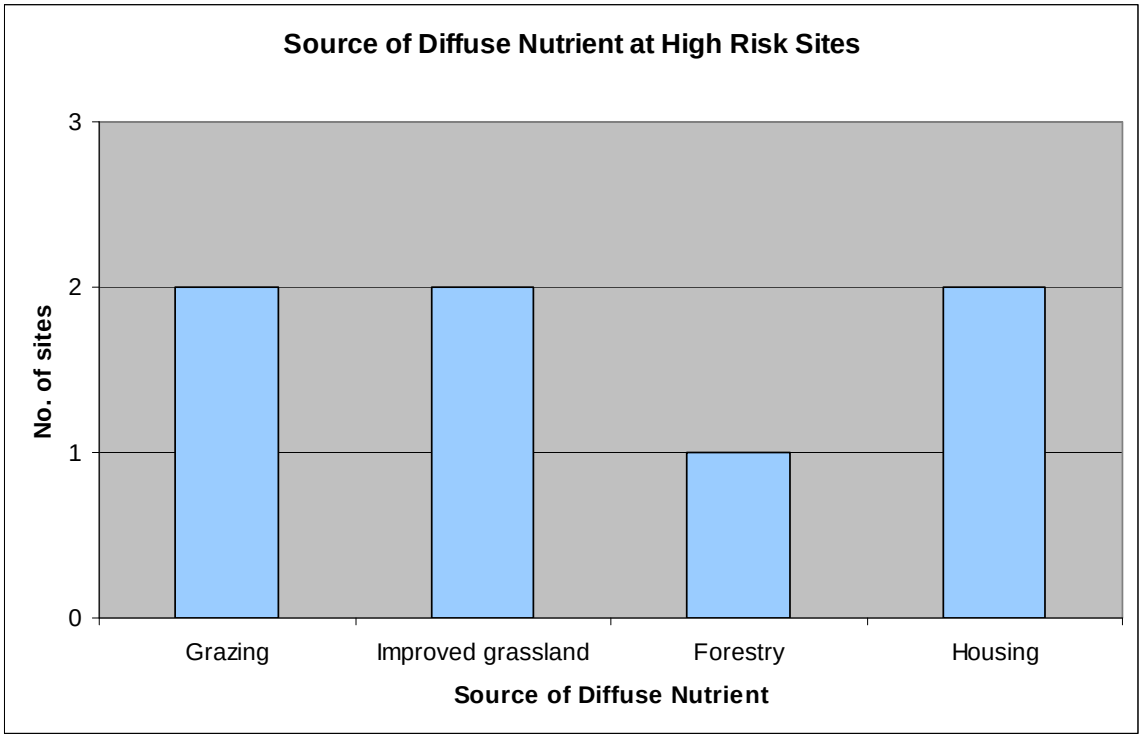
The break-down of pressure categories identified as high risk are outlined in **Figure 3.4**

Figure 3.4 Breakdown of High Risk Categories



The most common sources of diffuse nutrient at high risk sites were grazing, improved grassland and housing. The additional high risk diffuse nutrient categories can be seen below in **Figure 3.5.**

Figure 3.5 Sources of Diffuse Nutrient at High Risk Sites



The most common source of diffuse silt was housing which was evident at both sites high risk for diffuse silt. Other sources of diffuse silt evident at high risk sites are outlined below in **Figure 3.6.**

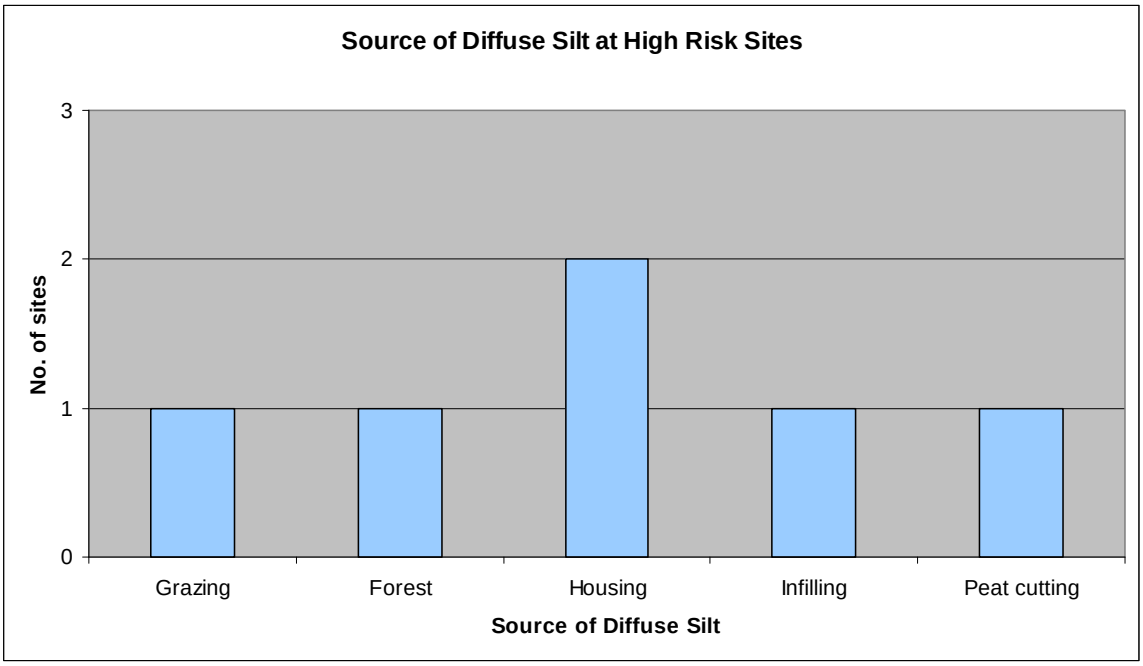


Figure 3.6 Sources of Diffuse Silt at High Risk Sites

The current riparian zone is another pressure evident within this catchment, however generally this pressure relates to how a poor riparian buffer can intensify other pressures e.g. animal trampling caused by a lack of fencing or increased pressure from diffuse nutrient as a result of a poor buffer zone. Within the Owenmore catchment the main cause of a high risk from riparian zone is:

- A poor riparian buffer zone in areas where the grassland banks are improved significantly increasing the impact from diffuse nutrient and diffuse silt.

4.0 CONCLUSIONS

Freshwater Pearl Mussel populations are recorded in two specific locations along the Owenmore River, risk assessments were carried out in close proximity to these two points. Of the two risk assessments one was considered high risk; recorded at the most downstream end of the catchment at Boherboy, and one medium risk recorded further upstream in the catchment near Lough Atlea. This catchment appears to be in a poor condition from a morphological perspective with a high percentage of high risk sites identified. Pressures are arising from diffuse silt and diffuse nutrient; with problems exacerbated through a poor riparian buffer zone, particularly in areas of improved grassland.

APPENDIX A

RHAT Field Sheet

Field Health and Safety sheet

River Name_____ Site Code_____ Date_____

1 = Low risk 5 = High risk

Please circle applicable number

PARKING	1	2	3	4	5
FENCES/BARRIERS	1	2	3	4	5
GROUND STABILITY	1	2	3	4	5
DENSE VEGETATION	1	2	3	4	5
BANK STEEPNESS OR STABILITY	1	2	3	4	5
RISK FROM ANIMALS	1	2	3	4	5
PHONE COVERAGE	1	2	3	4	5

Previous RHS/RAT/RHAT surveys - year and code _____

Details of access _____

RHAT (VERSION 2)

TRIBUTARY / MAIN CHANNEL*

Site Identification

River Name _____ Site Code _____

Nearest WFD site FF10 _____

Water Body ID _____ Start U / S or D / S*

First IGR _____ Last IGR _____

Bank surveyed from L / R / Both / in-Channel*

Desk-study notes		Field Notes
ACTION TO TAKE PRIOR TO FIELDWORK General overall shape of river Check weirs, impoundments etc. on catchment		River type Date
Floodplain connectivity and land use Expected river type Rain last week Estimated river width Estimated survey length Riparian land cover(s) River Agency designated? Other comments including geology - limestone / siliceous / peat*		Time Surveyors Weather conditions now Estimated river width (m) (average 3 readings) Estimated survey length (m) (40 X wetted width) Estimated river depth (m) Channel characteristics (e.g. different stream types on the reach)
RESULTS		Pressures
Hydromorph score WFD class		*Circle as appropriate

Photograph details include IGR or approximate location

_____

_____

_____

_____

N.B. The survey length should be 40x the wetted width with a minimal stretch of 160m but not exceeding 1km.

NS RHAT

Anthropogenic Impacts

River Name _____ Site Code _____ Date _____

Feature		Tick if present, record as E if > 30%		
Resectioning		None ☐	Left bank ☐	Right bank ☐
Reinforcement		None ☐	Left bank ☐	Right bank ☐
Embankments	NO*	LB ☐	RB ☐	Set back LB ☐ SB RB ☐
Culverts**		Y / N / Unknown*		
Over deepening		Y / N / Unknown*		
Wver widened		Y / N / Unknown*		
Narrowing		Y / N / Unknown*		
Fords**		Y / N*		
		Major	Intermediate	Minor
Bridges**	NO*			
Weirs**	NO*			
Fish Pass**	NO*			

Physical features or resource use if applicable. *

Deflectors / Jetties / Arterial drainage / Side channels / Mid channel bar / Field Drains / Mill Race

Navigation / Fishing / Recreation / Forestry/ Urban / Industry / HEP

Trashline present (height __ m) above water / Buffer zone (LBm / RBm back from water edge)

Other observations - Invasives - Trees - Birds - Pollution indicators - Invertebrates*

Rhododendron / Himalayan Balsam / Japanese Knotweed / Giant hogweed / Snowberry / Cherry-Laurel/ Gunnera

Sycamore / Beech / Conifers / Oak / Ash / Alder / Willow / Birch / Hazel / Hawthorn / Blackthorn / Holly

Heron / Sand martin / Grey wagtail / Dippers / Kingfishers /

Sewage fungus / Diatomaceous algae / Oil / Cladophora / Vaucheria / Dumping / Silt on Substrate

Other comments:

_____

** Circle as appropriate E - extensive. ** Tally as appropriate. LB - left bank / RB - right bank*

RHAT RIVER HYDROMORPHOLOGY ASSESSMENT TECHNIQUE

Field Assessment of Morphological Condition

River Name _____ Site Code _____ Date _____

If river in spate ignore 3 and 4 but deduct individual scores from overall if either feature not visible. Greyed boxes may be scored but note why in Comments/Notes.

	Bedrock	Cascade / Step-pool	Pool-riffle-glide	Lowland Meandering
1. Channel form and flow types	4	4	4	4
2. Channel vegetation	4	4	4	4
3. Substrate condition	4	4	4	4
4. Barriers to continuity	4	4	4	4
5. Bank structure & stability L+R	4	4	4	4
6. Bank vegetation L+R	4	4	4	4
7. Riparian land cover L+R	4	4	4	4
8. Floodplain connectivity L+R	4	4	4	4
TOTAL	32	32	32	32
Hydromorph Score *				
WFD class **				

* Hydromorph score - Assessment score = Maximum Possible score

** WFD Class
> 0.8 = high
>0.6 – 0.8 = good
>0.4 – 0.6 = moderate
>0.2 - 0.4 = poor
< 0.2 = bad.

SHEET 5

NOTES

APPENDIX 2

PHOTOGRAPHS

Photographs of site locations and catchment pressures on the Owenmore River and tributaries 2009. All field work photographs can be found in the accompanying electronic appendix.

Overall Risk * uses the “one out all out” principle

Site No.	Catchment Name	Location	X	Y	Photo No.	Bank Erosion	Diffuse Nutrient	Diffuse Silt	Field Drainage	Outfalls	Abstraction	Barriers to Migration	Current Riparian Zone	Overall Risk*	Pressure/Photo Details
1	Owenmore	Main Channel at Boherboy	51292	110709	1	Low	Low	Medium	High	Low	Low	Medium	Medium	High	Fisheries permit
1	Owenmore	Main Channel at Boherboy	51292	110709	2	Low	Low	Medium	High	Low	Low	Medium	Medium	High	Looking upstream from starting point
1	Owenmore	Main Channel at Boherboy	51292	110709	3	Low	Low	Medium	High	Low	Low	Medium	Medium	High	Looking downstream from starting point
1	Owenmore	Main Channel at Boherboy	51295	110690	4	Low	Low	Medium	High	Low	Low	Medium	Medium	High	Fisheries weir
1	Owenmore	Main Channel at Boherboy	51293	110688	5	Low	Low	Medium	High	Low	Low	Medium	Medium	High	Unmanaged land drain
1	Owenmore	Main Channel at Boherboy	51298	110677	6	Low	Low	Medium	High	Low	Low	Medium	Medium	High	Unmanaged land drainage ditch with land cleared behind it for development
1	Owenmore	Main Channel at Boherboy	51313	110665	7	Low	Low	Medium	High	Low	Low	Medium	Medium	High	Managed land drain opened for site clearance & housing development
1	Owenmore	Main Channel at Boherboy	51313	110665	8	Low	Low	Medium	High	Low	Low	Medium	Medium	High	Unmanaged land drain opened for site clearance & housing development
1	Owenmore	Main Channel at Boherboy	51323	110645	9	Low	Low	Medium	High	Low	Low	Medium	Medium	High	Second weir, local stones placed in channel, possibly by fisheries
1	Owenmore	Main Channel at Boherboy	51321	110640	10	Low	Low	Medium	High	Low	Low	Medium	Medium	High	Mid channel bar
1	Owenmore	Main Channel at Boherboy	51321	110640	11	Low	Low	Medium	High	Low	Low	Medium	Medium	High	Land drain possibly trib, sewage fungus on entry point
1	Owenmore	Main Channel at Boherboy	51329	110628	12	Low	Low	Medium	High	Low	Low	Medium	Medium	High	Third weir
1	Owenmore	Main Channel at Boherboy	51360	110600	13	Low	Low	Medium	High	Low	Low	Medium	Medium	High	Mid channel island
1	Owenmore	Main Channel	51364	110603	14	Low	Low	Medium	High	Low	Low	Medium	Medium	High	Dead mussels

		at Boherboy													on left bank
2	Owenmore	Inflowing Trib of Lough Geal	47035	106866	1	Medium	Medium	Medium	Medium	Medium	Medium	Low	High	High	Looking upstream from starting point
2	Owenmore	Inflowing Trib of Lough Geal	47035	106866	2	Medium	Medium	Medium	Medium	Medium	Medium	Low	High	High	Looking downstream from starting point
2	Owenmore	Inflowing Trib of Lough Geal	47035	106866	3	Medium	Medium	Medium	Medium	Medium	Medium	Low	High	High	Sheep grazing, unimproved grassland
2	Owenmore	Inflowing Trib of Lough Geal	47035	106866	4	Medium	Medium	Medium	Medium	Medium	Medium	Low	High	High	Set back fencing approx 4m, re-development of house in background
2	Owenmore	Inflowing Trib of Lough Geal	47035	106866	5	Medium	Medium	Medium	Medium	Medium	Medium	Low	High	High	Improved/ heavily fertilised grass down to lake on both right and left bank
2	Owenmore	Inflowing Trib of Lough Geal	47044	106832	6	Medium	Medium	Medium	Medium	Medium	Medium	Low	High	High	Land drainage/ outfall pipe on right bank
2	Owenmore	Inflowing Trib of Lough Geal	47044	106832	7	Medium	Medium	Medium	Medium	Medium	Medium	Low	High	High	Small farm on both banks
2	Owenmore	Inflowing Trib of Lough Geal	47044	106832	8	Medium	Medium	Medium	Medium	Medium	Medium	Low	High	High	Black abstraction pipes in stream plus second black land drain (perforated)
3	Owenmore	Trib of Main Channel :Cloghane river	48660	107405	1	Low	Medium	Low	Medium	Low	Low	Low	Low	Medium	Looking downstream from starting point
3	Owenmore	Trib of Main Channel :Cloghane river	48660	107405	2	Low	Medium	Low	Medium	Low	Low	Low	Low	Medium	Looking upstream from starting point
3	Owenmore	Trib of Main Channel :Cloghane river	48815	107384	3	Low	Medium	Low	Medium	Low	Low	Low	Low	Medium	Poached left bank
3	Owenmore	Trib of Main Channel :Cloghane river	48815	107384	4	Low	Medium	Low	Medium	Low	Low	Low	Low	Medium	Excessive macrophyte growth in channel - potamogeton
4	Owenmore	Confluence of Inflowing	48800	108520	1	Medium	Medium	High	Low	Low	Low	Medium	Medium	High	Ford

		Tributaries to Main Channel													
4	Owenmore	Confluence of Inflowing Tributaries to Main Channel	48840	108510	2	Medium	Medium	High	Low	Low	Low	Medium	Medium	High	Looking upstream from starting point
4	Owenmore	Confluence of Inflowing Tributaries to Main Channel	48840	108510	3	Medium	Medium	High	Low	Low	Low	Medium	Medium	High	Looking downstream from starting point
4	Owenmore	Confluence of Inflowing Tributaries to Main Channel	48840	108510	4	Medium	Medium	High	Low	Low	Low	Medium	Medium	High	Landuse: Sheep grazing
4	Owenmore	Confluence of Inflowing Tributaries to Main Channel	48800	108520	5	Medium	Medium	High	Low	Low	Low	Medium	Medium	High	Silty plume at ford
5	Owenmore	Inflowing Trib: E of Glanchanacurip	49391	109041	1	Low	High	High	Low	Low	Low	Low	High	High	Looking upstream from road no buffer / fence
5	Owenmore	Inflowing Trib: E of Glanchanacurip	49391	109041	2	Low	High	High	Low	Low	Low	Low	High	High	Tributary running along by the road
5	Owenmore	Inflowing Trib: E of Glanchanacurip	49391	109041	3	Low	High	High	Low	Low	Low	Low	High	High	Peat cutting adjacent to main channel
5	Owenmore	Inflowing Trib: E of Glanchanacurip	49391	109041	4	Low	High	High	Low	Low	Low	Low	High	High	Forestry along main channel
5	Owenmore	Inflowing Trib: E of Glanchanacurip	49391	109041	5	Low	High	High	Low	Low	Low	Low	High	High	Extensive peat cutting along Owenmore
Stopping point 1	Owenmore	Inflowing Trib: E of Glanchanacurip	49760	109676											Extensive peat cutting vertical to main channel of Owenmore, current cutting in place
Stopping point 1	Owenmore	Inflowing Trib: E of Glanchanacurip	49760	109676											Extensive peat cutting vertical to main channel of Owenmore, current cutting in place
Stopping point 1	Owenmore	Inflowing Trib: E of Glanchanacurip	49760	109676											Extensive peat cutting vertical to main channel of Owenmore,

															current cutting in place
Stopping point 2	Owenmore	Inflowing Trib: Crossing Connor Hill Road	50222	106461											Lake substrate
Stopping point 2	Owenmore	Inflowing Trib: Crossing Connor Hill Road	50222	106461											Overview of lakes and trampling
Stopping point 2	Owenmore	Inflowing Trib: Crossing Connor Hill Road	50222	106461											Overview of lakes and Connor Hill road

Appendix 3 – Catchment Walkover Risk Assessment Survey Sheet

Sheet 1: Catchment Walkovers	Version 1. 07/04/2009
Tributary/Main Channel*	
Site Identification	
River Name	Site Code
Water Body ID	Start U/S or D/S*
First site IGR	Last site IGR
Bank surveyed from L/R/In-channel*	
Photograph details include IGR or approximate location.	

* Select as appropriate

	Present?					
	Yes	No		Grid Reference of specific pressure	No.of Photographs	Comments
Source of Erosion						
Bank erosion						
Land clearance						
In river clearance						
Arable ploughing						
Animal trampling						
Fords						
Channel manipulation						
Hard bank protection measures						
Other sources						
Overall Risk	High	Medium	Low			
Diffuse Nutrient						
Arable						
Grazing						
Improved grassland						
Silage						
Forestry						
Housing						
Industry and associated works						
Other sources						
Overall Risk	High	Medium	Low			
Diffuse Silt						
Arable						
Grazing						
Over-grazing						
Improved grassland (Re-seeding)						
Forest						
Silage						
Industry						
Construction stages						
Housing						
Infilling						
Peat cutting						
Quarries						
Other sources						
Overall Risk	High	Medium	Low			

	Present?					
	Yes	No		Grid Reference of specific pressure	No.of Photographs	Comments
Current Riparian Zone						
Fencing						
Buffer						
Tree line at bank						
Tree line buffer						
Plantation with no buffer						
Urbanisation						
Flood protection						
Marshy land						
Landuse at bank						
Other sources						
Overall Risk	High	Medium	Low			
Field Drainage						
Ditch managed						
Ditch unmanaged						
Drainage on high slope						
Drainage on low slope						
Land drainage (perforated pipes)						
Other sources						
Overall Risk	High	Medium	Low			
Outfalls						
Industrial discharges						
Storm drains						
Culvert outfalls						
Other sources						
Overall Risk	High	Medium	Low			
Abstractions						
Small						
Large						
Overall Risk	High	Medium	Low			
Barriers to migration						
Culverts						
Bridge aprons						
Weirs						
Stone weirs						
Other sources						
Overall Risk	High	Medium	Low			