




# Derwent Catchment Characterisation Survey

Electrofishing Report,  
Summer 2017



Project	Report No.	Revision No.	Date of Issue
Derwent Catchment Characterisation Survey 2017	003	001	February 2018

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# 1 Introduction

## 1.1 Background

- 1.1.1 West Cumbria Rivers Trust (WCRT) undertook a third year of catchment characterisation and electrofishing surveys in the River Derwent catchment during the summer of 2017. This project is the third year of a long term study to obtain scientific data on fish numbers in the River Derwent catchment and yearly surveys will be carried out as part of WCRT's priority activities. This type of fisheries surveys are ideal for providing information to characterise and provide a general indication of the health of stretches of river and will inform where habitat improvement works are required and elicit future funding to carry out necessary measures.
- 1.1.2 The River Derwent is designated as a SSSI and SAC with Atlantic Salmon making up one of the key species for this designation. Other species included in this are brook lamprey, river lamprey and otters.
- 1.1.3 The Environment Agency (EA) is the statutory body responsible for fish, rivers and the environment in general and their fisheries monitoring programme provides comprehensive coverage of the catchment at a level appropriate to current legislative responsibilities. Monitoring by the EA has however been greatly reduced due to funding cuts and WCRT aims to share all the results, experience and knowledge from this project with them and interested parties. WCRT had also designed its programme to complement, rather than duplicate, the EA's programme and collaboration will take place to deliver many aspects of this work.
- 1.1.4 The project has been funded by a variety of sources including the Rivers Corridor Group, Derwent Owners Association, United Utilities, Keswick Anglers Association, Cockermouth Anglers Association and other fishing organisations.

## 1.2 Project Objectives

- 1.2.1 This project aims to determine the health and state of the Derwent Catchment with science based evidence along with investigating the effectiveness of habitat improvement work that has been completed or is planned for the future. This will be informed by assessing the status and distribution of the juvenile salmonid population, namely Salmon fry (*Salmo salar*) and Trout fry (*Salmo trutta*)- aged at less than one year.
- 1.2.1 The project objectives which were set out in the Project Plan were to undertake the following:
- Collect, analyse and record data for juvenile salmonid fry populations (and other fish species) to determine their distribution within the Derwent catchment at approximately 150 sites during the summer of 2017, following on from the previous two years' surveys and the devastating floods of December 2015.
  - Use the data collected to characterise the habitat in the catchment to determine what habitat improvements could be done to encourage greater fish numbers. This will be split into the categories of '*maintain*' the current habitat, '*repair*' the existing habitat to enhance its future survival and '*restore*' the river to having appropriate habitat where this is currently missing.
  - Work in collaboration with the EA to calibrate the different survey methods used in order to ensure wider application of the results and to enable the River Derwent results to be categorised using the National Fisheries Classification Scheme.

## 2 Methodology

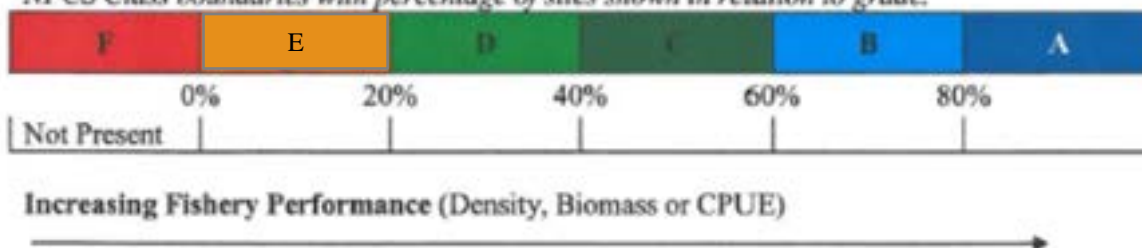
### 2.1 Survey Method

- 2.1.1 Licences were applied for and granted by the Fish Movements Team within the EA to carry out surveys and fish rescues within the Derwent Catchment over the summer of 2017.
- 2.1.2 Volunteers were recruited from a variety of sources including local fishing clubs, local secondary education institutions, university students, local businesses and any other interested parties.
- 2.1.3 Suitable sites were identified and land custodian consent was obtained, for permission to access the river and carry out the surveys at each of these sites. A risk assessment of each site was compiled with safe parking and safe river access points noted, along with land custodian contact details for use by the survey team.
- 2.1.4 A standard semi-quantitative fish survey method was followed using a back pack electro fishing set. A five-minute time period is programmed into the kit which only times when the electric pulse is being used. All fish species captured in the survey were then identified and recorded with the size of salmonid varieties also recorded. Salmonid fry were identified from parr following the method of Scottish Fisheries Co-ordination Centre, (2007) whereby the frequency of each fish length in discrete areas were plotted as histograms and the point where the distribution bell curves intersect is the cut-off point between fry and parr for Salmon and Trout individually.
- 2.1.5 In 2016 the WCRT team also worked with the EA to carry out calibration at 26 sites. This involved fully quantitative surveys which are area based to calculate the number of fish per 100m<sup>2</sup>, which is the nationally used unit and allows comparison with the data collected by other researchers. To do a fully quantitative survey, a 100m<sup>2</sup> stretch of river is netted off at both ends and the whole area is fished multiple times (usually three) until no fish remain and the total number of fish per 100m<sup>2</sup> is discovered. However, this year the WCRT team couldn't calibrate with the EA as the EA team didn't have the time. But WCRT had been commissioned to do fish rescues for the United Utilities West Cumbria Supplies Project in the Derwent catchment using the same fully quantitative method and it was thought we could use these results to calibrate this year's data.
- 2.1.6 Habitat survey data was collected for each site and included: type of channel substrate (boulders, cobbles, gravel, silt etc.), occurrence of plant life, and large wooded debris (LWD). For each bankside, details of erosion and damage, fencing, vegetation, and adjacent land use were also recorded along with any signs of invasive species. Other details such as potential pollution sources, human activity in the river and signs of terrestrial species such as otter were also recorded. All the habitat survey data were scored, with a weighted scoring system to give an overall habitat condition for each site surveyed. Then additional in-house knowledge of each tributary's overall condition and potential for habitat improvements was added to the site score to determine an overall tributary habitat score.
- 2.1.7 Data analysis consisted of statistically assigning the recorded fish densities to the national fisheries classification scheme (NFCS) using the calibration results, so that the data could be compared year on year, and also with data from across the country and collected using different survey methods. (Please note that a direct comparison of sites is not statistically robust as fish densities are extremely variable in space and time, and multiple years' worth of data are required to build up a picture of trends in fish density) The NFCS has classifications ranging from A to F as shown in Figure 1.
- 2.1.8 All of the data collected were plotted using Geographical Information System (GIS) software to provide maps of the distribution of survey results.

*National Fishery Classification Scheme Grades.*

Grade	Class	Description
A	Excellent	In the top 20% for a fishery of this type
B	Good	In the top 40% for a fishery of this type
C	Fair	In the middle 20% of fisheries
D	Fair	In the bottom 40% for a fishery of this type
E	Poor	In the bottom 20% for a fishery of this type
F	Fishless	No fish of this type present

*NFCS Class boundaries with percentage of sites shown in relation to grade.*



**Figure 1:** NFCS grades from A (the top 20% of fisheries performance in England and Wales) to E (the bottom 20% of fisheries performance in England and Wales), with F as no fish present

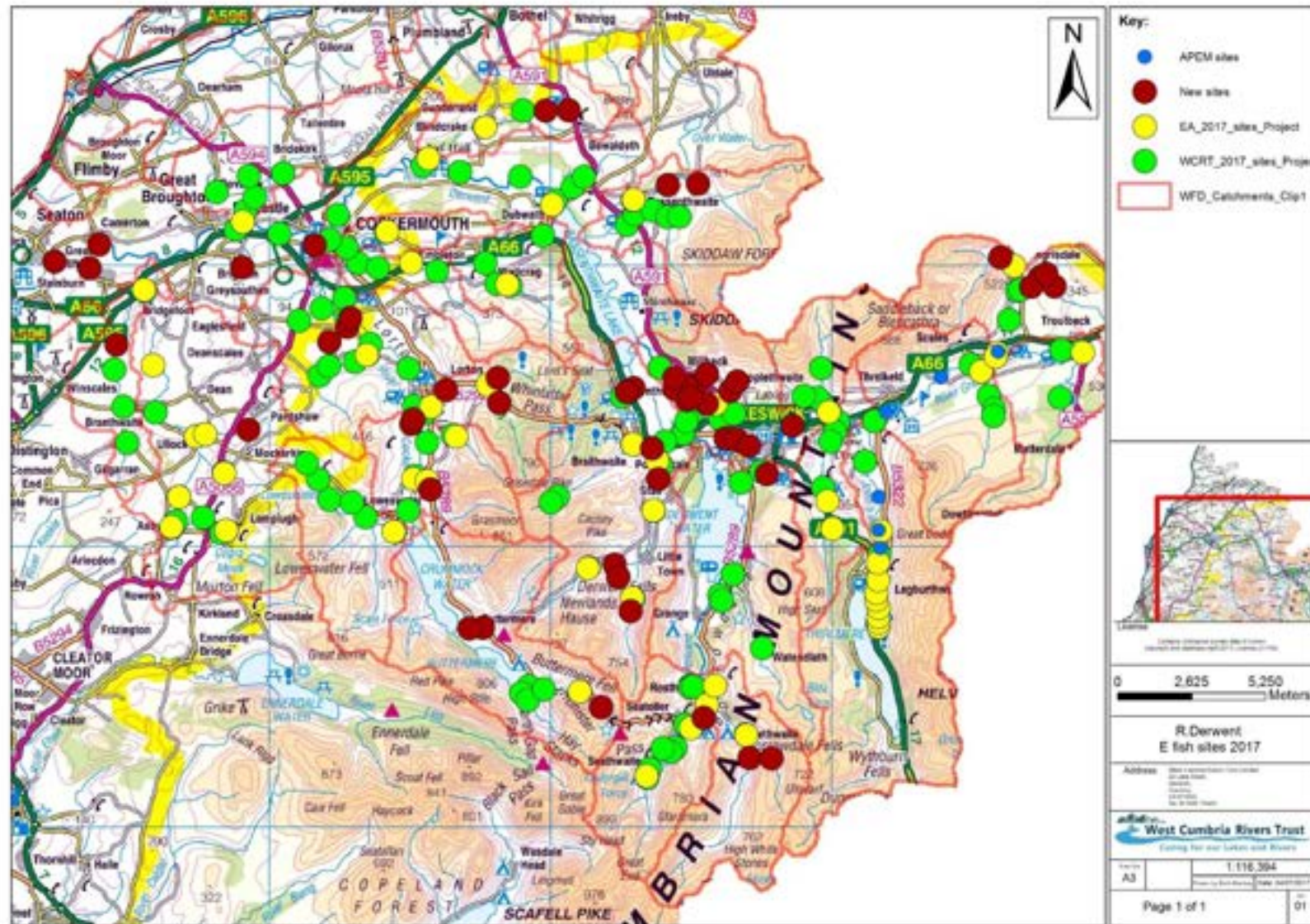
## 2.2 Survey Locations

- 2.2.1 The survey sites were all within the River Derwent Catchment. The majority of tributaries were surveyed, access permitting, usually with multiple sites per tributary. The proposed sites for 2017 can be seen in Figure 2. All of the tributaries from the 2015 and 2016 surveys were to be repeated, with additional locations included in the 2017 survey, chosen because habitat improvement works have either been carried out in the new sites or are proposed. Due to a very wet summer and time restrictions, unfortunately several of the sites that were proposed didn't get surveyed.
- 2.2.2 In 2016 a new approach was trialled for main river sites. This involved locating areas of the main Rivers Derwent and Cocker where it was shallow enough to use the backpack in order to estimate the fry distributions there. However, due to unprecedented rainfall throughout the summer of 2017, the water levels in the main rivers were too high, and for health and safety reasons, weren't surveyed.
- 2.2.3 The EA carried out surveys at 43 sites including on Helvellyn Gill. This year as we couldn't calibrate with them, WCRT made sure that our survey sites complimented those of the EA rather than replicate. This meant that the tributaries WCRT didn't manage to survey due to the weather and time, still have some results.
- 2.2.4 As part of the West Cumbria Supplies Project by United Utilities we were asked to undertake 16 fish rescues where the new pipeline crosses watercourses. This is all essential additional data which can be used in our catchment characterisation.

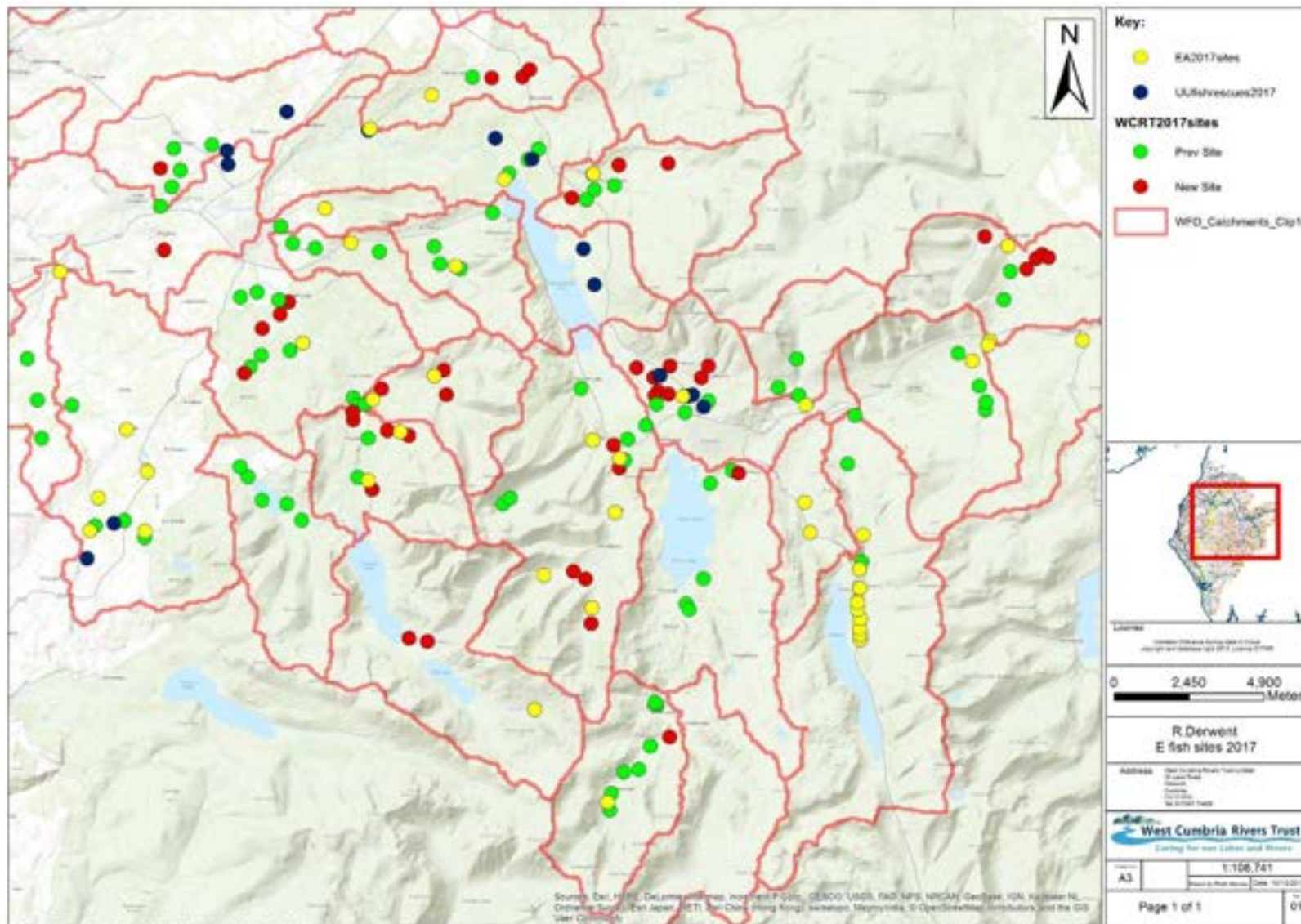
## 2.3 Survey Timings

- 2.3.1 Surveys were undertaken between late July and early October 2017 when the salmonid fry were of a reasonable size to capture without damage.

Figure 2: Proposed survey sites for Derwent Catchment Characterisation Survey 2017.



**Figure 3:** Actual survey sites achieved in the Derwent Catchment Characterisation Survey 2017.





## 3 Results

### 3.1 Summary

3.1.1 120 sites were surveyed by WCRT in the River Derwent Catchment during the summer of 2017 using a semi quantitative method. An additional 16 were fish rescues conducted for United Utilities using the fully quantitative method. In total, 136 sites were surveyed; Figure 3 shows the sites surveyed towards the 2017 Derwent Catchment Characterisation Project.

3.1.2 43 sites were surveyed by the EA using the fully quantitative, area based surveys. Figure 3 shows the 43 EA sites as well as the WCRT sites.

3.1.3 All fish numbers in 2017 were higher than in the summer of 2016, which strongly suggests that numbers in 2016 were affected by the impacts of Storm Desmond happening during spawning season. At first glance it looks like we caught similar numbers of fish to 2015, however this year we surveyed more sites than 2015, which suggest fish numbers still aren't quite the same levels as 2015, but are improving. A way better way of comparing the years together was to look at the average numbers of fish per site. As you can see in Table 1, the average number of salmon per site has stayed the same with a small dip in 2016. Whereas the average number of Trout was 10, dipped to 3 post Storm Desmond in 2016, but in 2017 has recovered and improved to 14.

3.1.4 In total 2712 salmonids were caught in the 2017 summer surveys, 2496 of these were fry with more Trout than Salmon (1890 and 606 respectively).

3.1.5 115 sites or 85% of those surveyed had Trout fry present, whilst 52 sites or 38% of those surveyed had Salmon present.

3.1.6 83 sites (61%) had minor fish species such as eels, lamprey, sticklebacks, minnows and stone loach. See Appendix 1 for the number of fish found at each site.

3.1.7 There were only five sites where no fish of any species were found, these are:

- Two of which are unnamed tributaries of Brides Beck where UU fish rescues took place, the tributaries are small, shallow and habitat is poor and currently in the middle of a construction site as you can see in Figure 4.
- One is Applethwaite Gill, up on the moorland above the village. There is a weir in the village, potentially stopping fish getting up this high, that and the substrate is predominantly bedrock and boulders, not ideal fish habitat.
- One is Gale Gill which flows into Lair Beck, the site is above Burnside Caravan Park. Something is preventing fish getting up this far, as they have been found downstream of this site and the habitat is ok and fish have been found on similar streams nearby such as Applethwaite Gill and Millbeck this far up.
- The final one is Coledale Beck up above Force Cragg Mine. Work has occurred up here to reduce the amount of mine waste flowing into the beck. Fish have started to return to the beck as the site below the mine, trout have been found. But they haven't quite made it up as far as this site.



*Figure 4: Photo of an unnamed tributary of Brides Beck where a fish rescue took place and no fish were found.*

	2017 Trout	2017 Salmon	2016 Trout	2016 Salmon	2015 Trout	2015 Salmon
Number of sites surveyed	<b>136</b> (not including EA and APEM)		<b>138</b>		<b>89</b>	
Total numbers of fry and parr caught	<b>2034</b>	<b>678</b>	614	551	1412	700
Total number of fry caught	<b>1890</b>	<b>606</b>	451	461	1118	631
Number of sites with fry	<b>115</b>	<b>52</b>	92	61	82	38
Average number of fry per site	<b>14</b>	<b>4</b>	3	3	10	4
Number of sites with no fry or parr	<b>13</b>	<b>75</b>	29	66	4	48
Number of sites with no fish species	<b>5</b>		<b>2</b>		<b>0</b>	

**Table 1:** Summary of the results obtained from the 2017, 2016, and 2015 fish surveys.

### 3.2 National Fisheries Classification Scheme

3.2.1 In 2016 the calibration of semi quantitative five minute surveys to the EA's fully quantitative area based surveys involved plotting the five minute surveys on a graph against the fully quantitative surveys and using the resulting trend lines to give the following equations which had randomly distributed residuals:

**Table 2:** Calibration trend lines with coefficients of determination which can be used to convert numbers of fish per 5 minute survey to number of fish per 100m<sup>2</sup>.

	Calibration trend line	Coefficient of determination (r <sup>2</sup> )
Trout	Y = 3.8712 x - 1.7945	0.6137
Salmon	Y = 3.0923 x - 05313	0.6326

3.2.2 Using the equations in Table 2, the number of fish per 100m<sup>2</sup> could be calculated and therefore the NFCS could be used to classify fry numbers in the River Derwent.

3.2.3 The same equations were used for 2017 in the end, as we didn't calibrate with the EA this year due to lack of time on the EA's behalf. However, we did originally think we could use the data collected at the 16 fish rescues we conducted for UU using the fully quantitative method to calibrate, however unfortunately there wasn't enough data to produce suitable trend lines and it was decided to use the same equation as the previous two years. Table 3 shows the number of

sites within the Derwent catchment for each category of the National Fisheries Classification Scheme for all the years surveyed so far. 2016 data includes all the EA data, as we calibrated with them that year, whereas 2017 and 2015 is just WCRT data only.

**Table 3:** Number of sites within the River Derwent catchment in each category of the National Fisheries Classification Scheme for 2015, 2016, 2017.

Classification	Trout			Salmon		
	2017	2016	2015	2017	2016	2015
A	22	15	25	7	4	4
B	10	29	24	1	3	7
C	17	12	15	4	16	10
D	28	22	10	8	22	8
E	37	22	6	31	23	7
F	22	48	9	85	80	53
Total	136	148 (includes EA data)	89	136	148 (includes EA data)	89

- 3.2.4 Figure 5 and Figure 6 shows the NFCS results for just the 2017 survey for Trout and Salmon respectively.
- 3.2.5 Figures 7 to 27 show the NFCS results for both Trout and Salmon broken down by tributary area for more clarity.

Figure 5: 2017 NFCS results for Trout

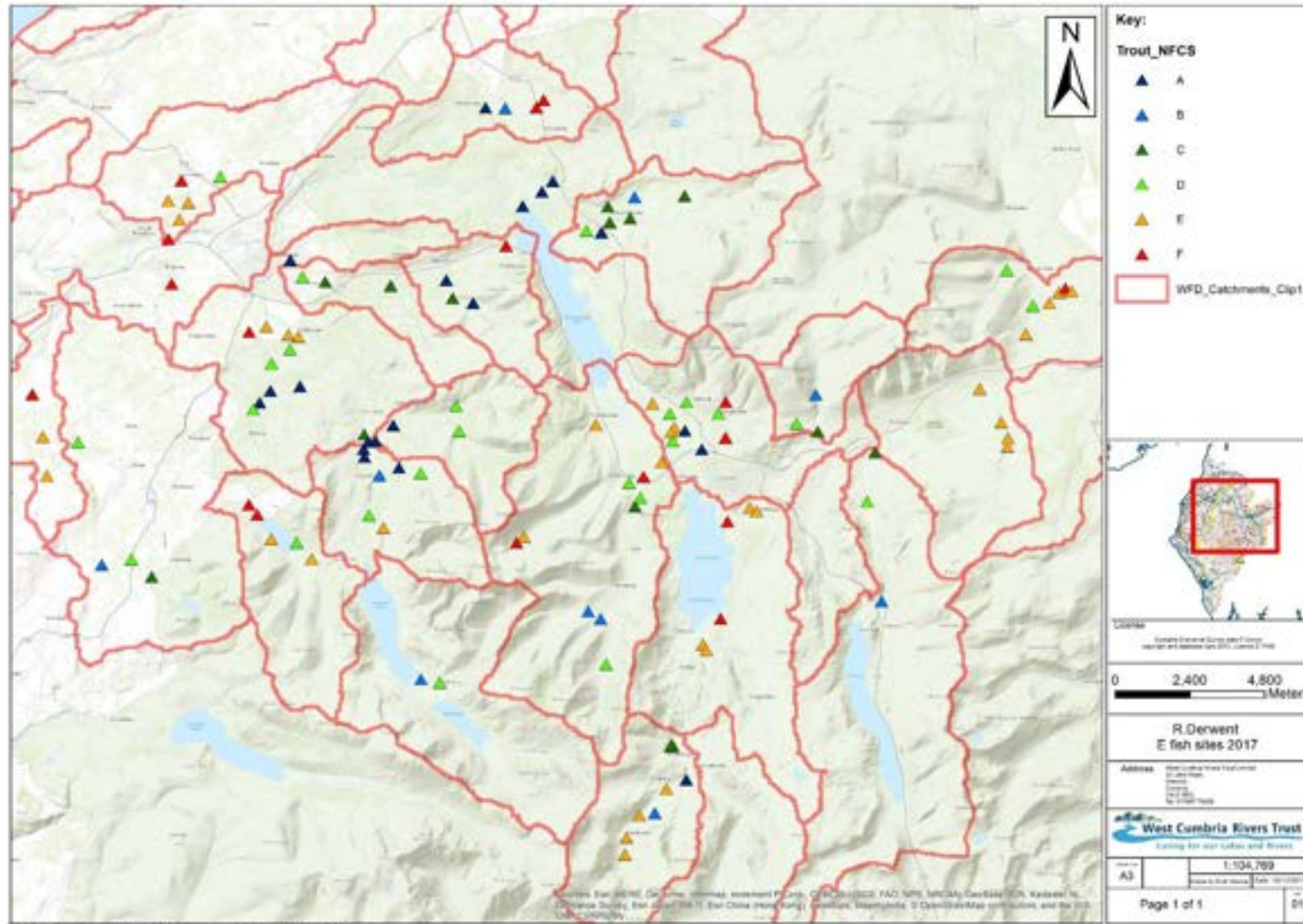
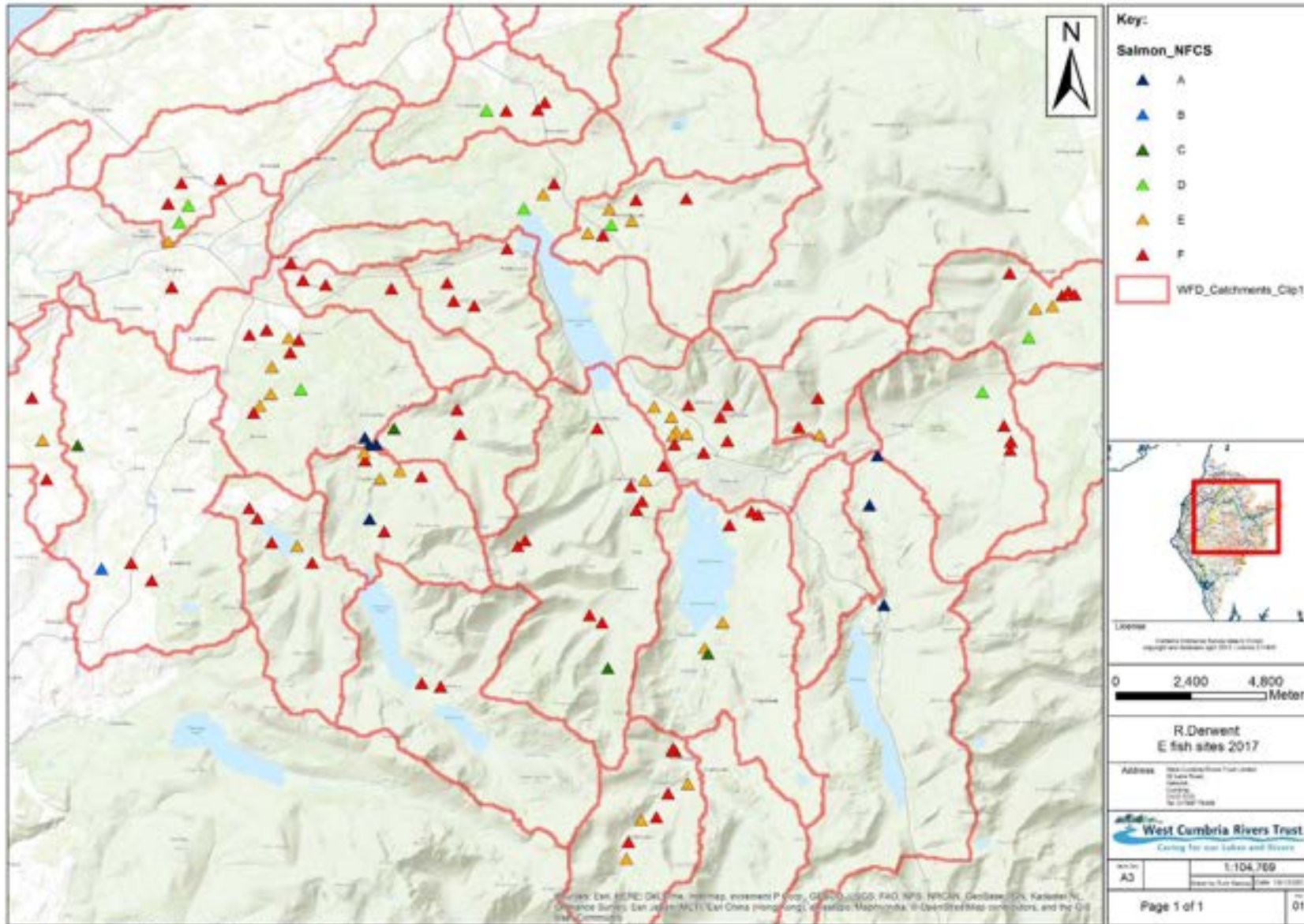
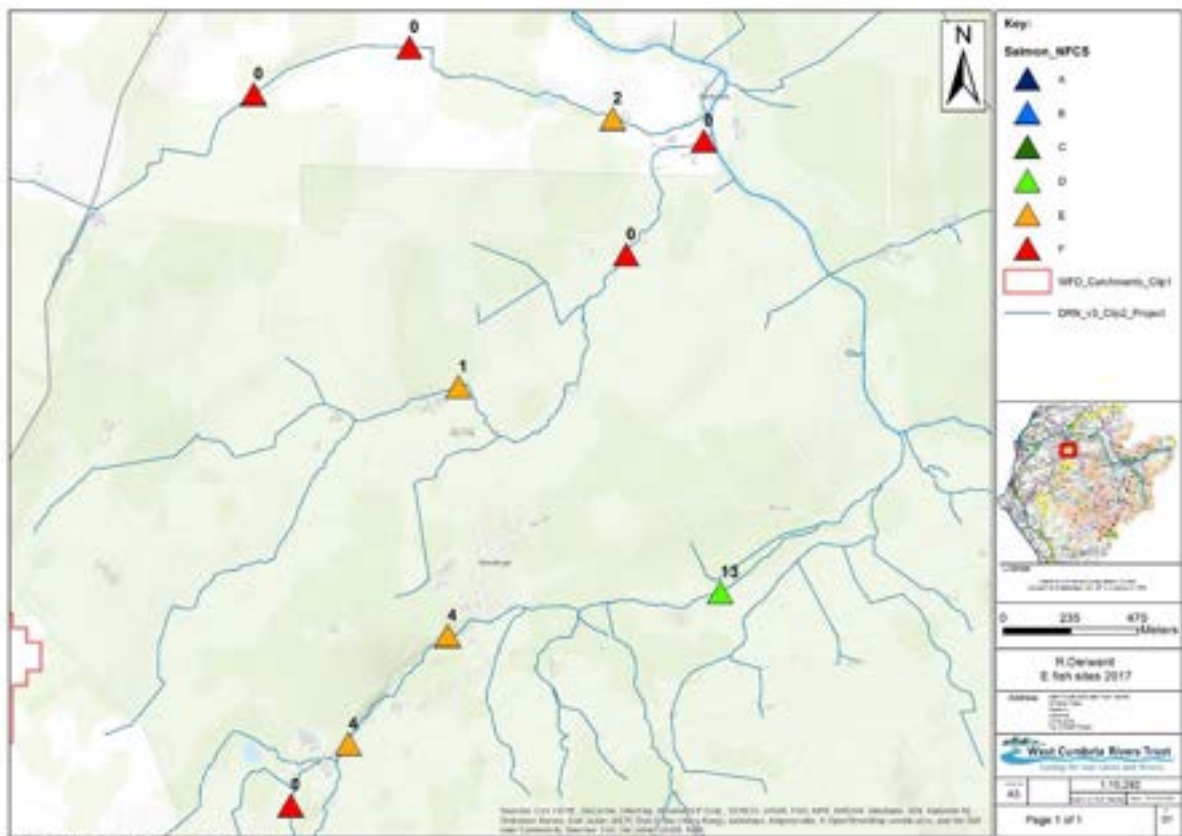
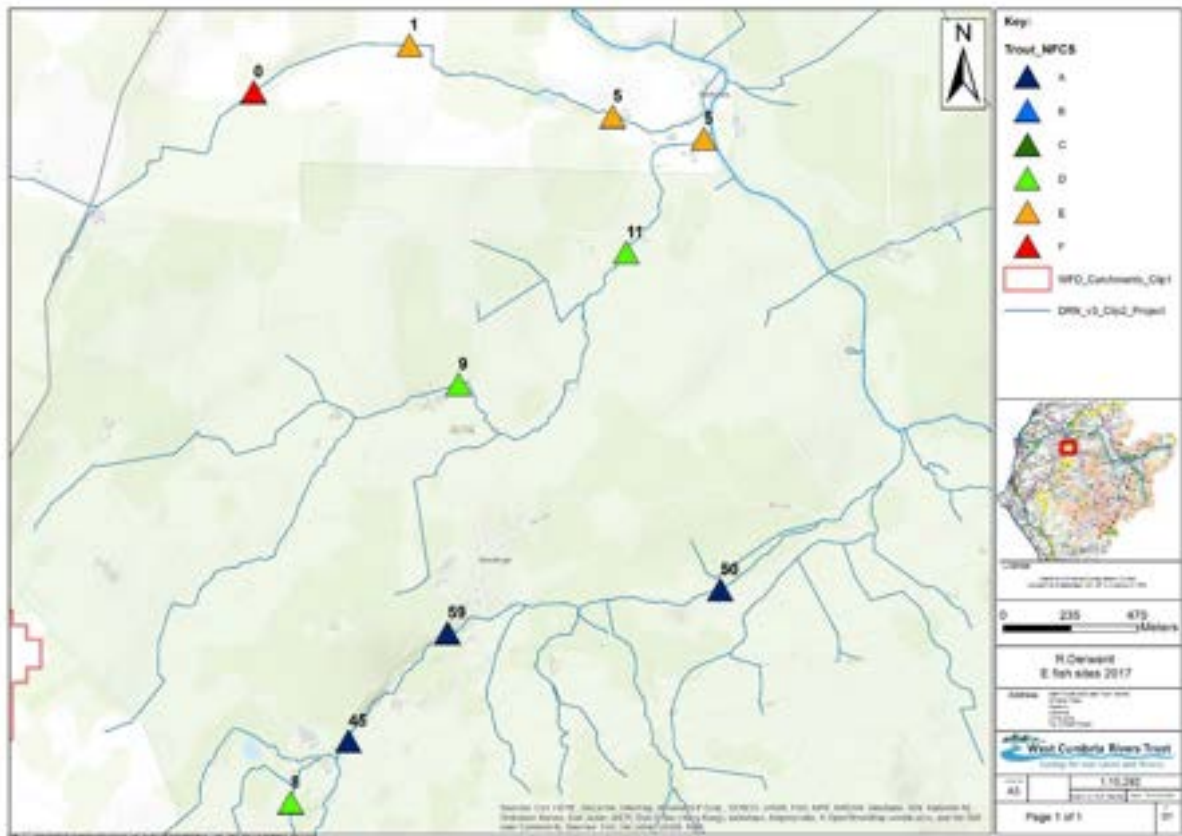


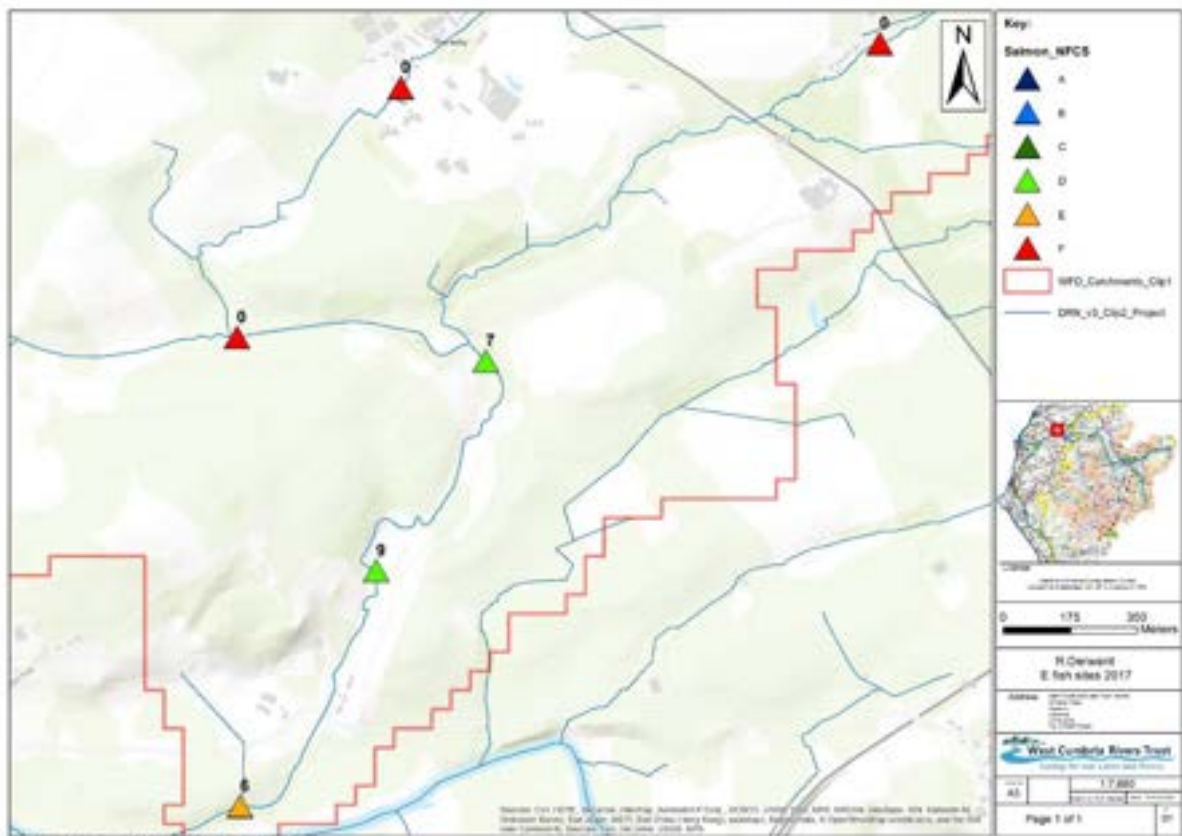
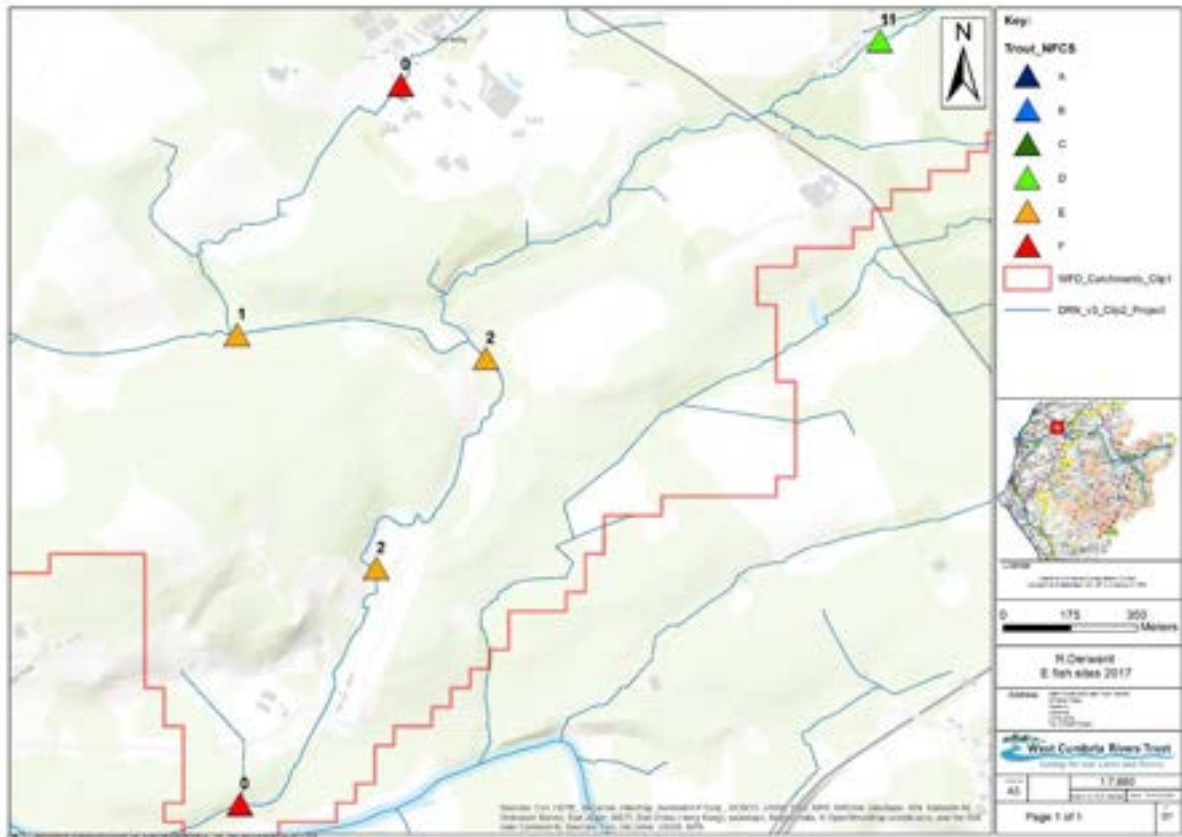
Figure 6: 2017 NFCS results for Salmon



**Figure 7: 2017 NFCS Classification and fish numbers for Lower Lorton (Includes: Paddle Beck, Little Sandy Beck and Sandy Beck). Top image Trout, bottom Salmon.**



**Figure 8:** 2017 NFCS Classification and fish numbers for Broughton Beck (includes: Carr Beck, Dovenby Beck and Brides Beck). Top image Trout, bottom Salmon.



**Figure 9:** 2017 NFCS Classification and fish numbers for Upper Lorton (includes: Whit Beck, Mergill Beck, Hope Beck and Liza Beck). Top image Trout, bottom Salmon.

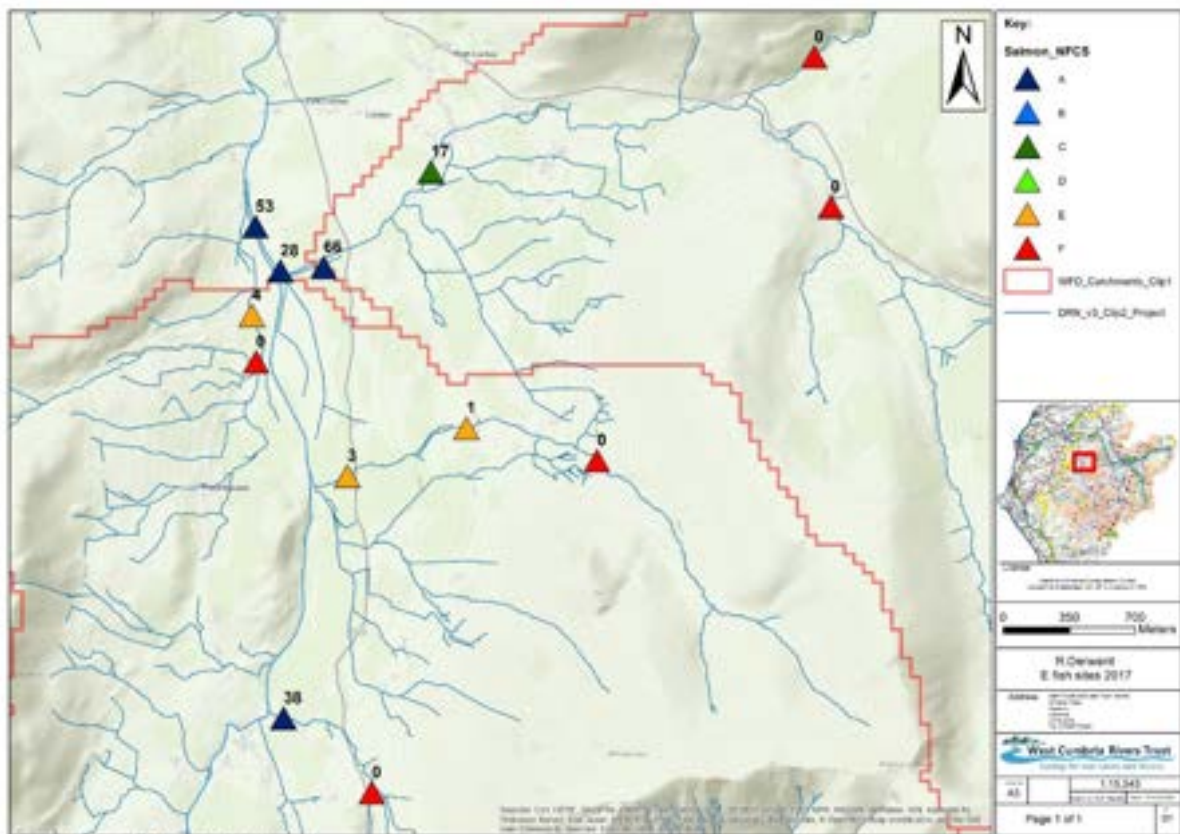
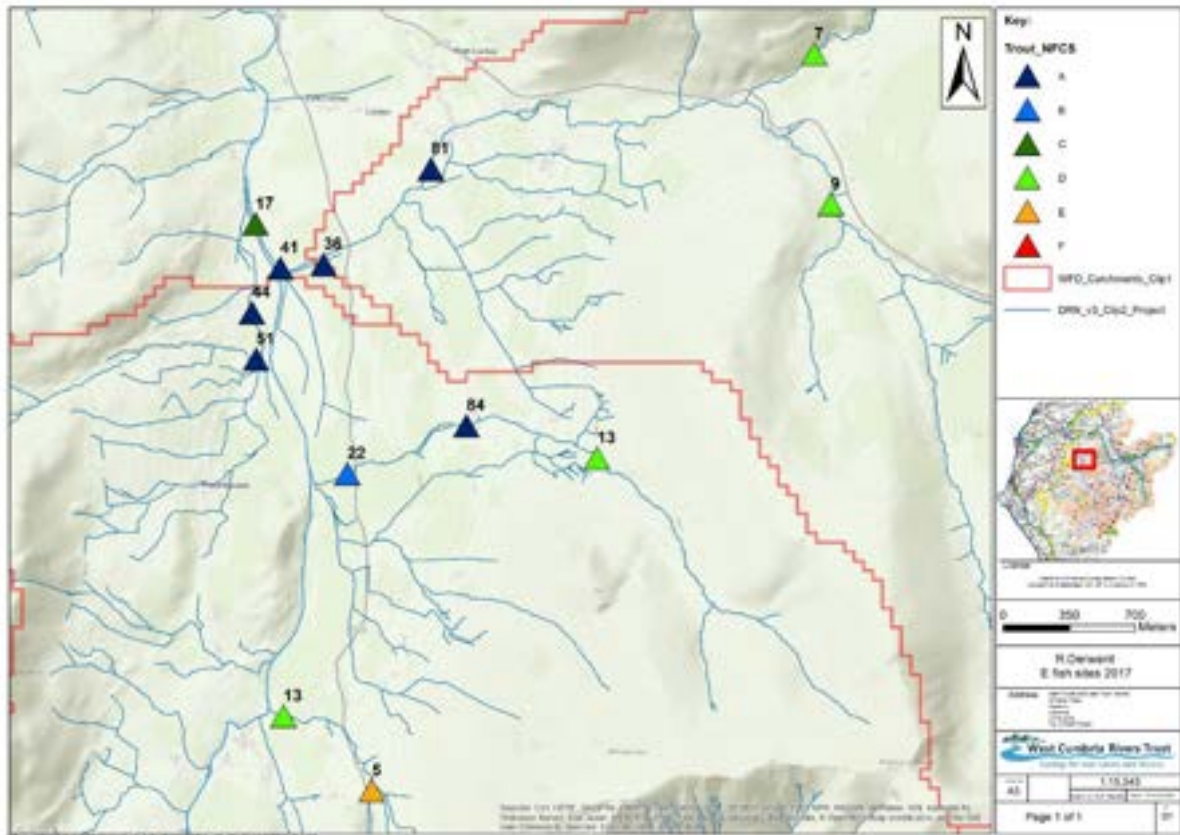
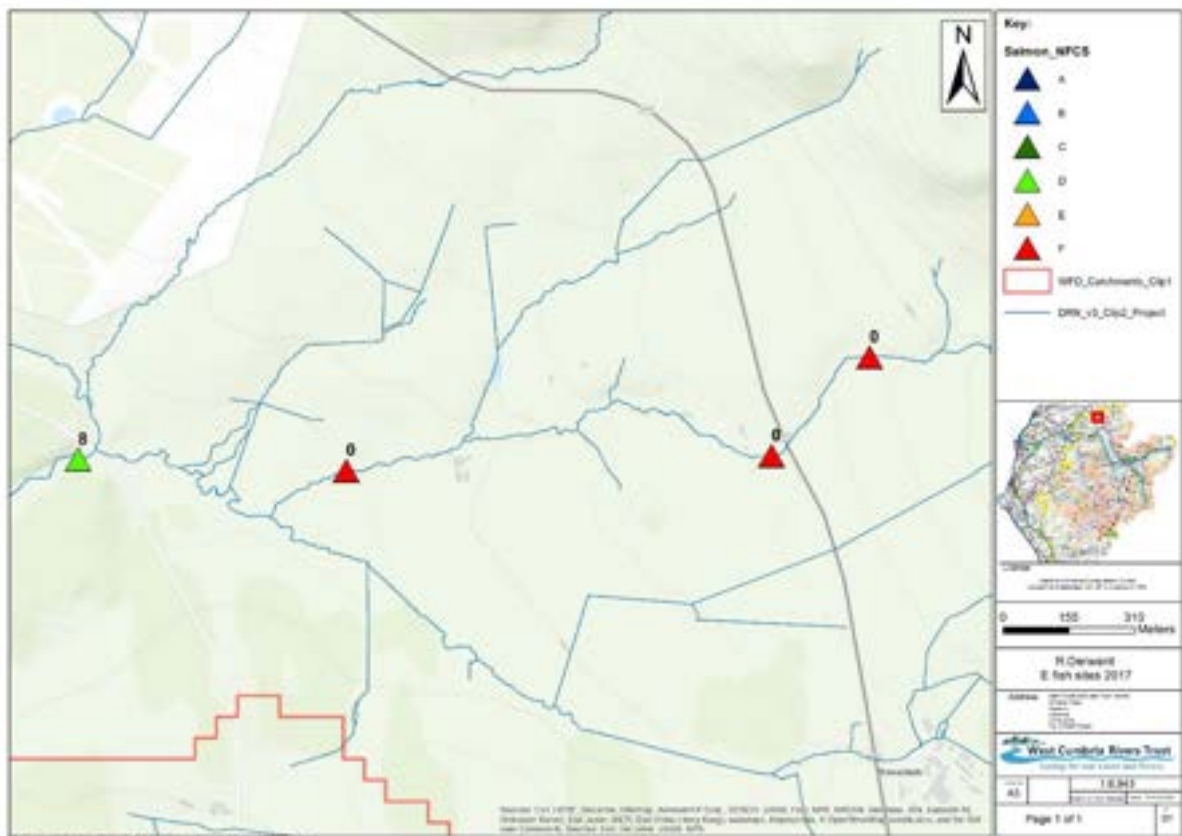
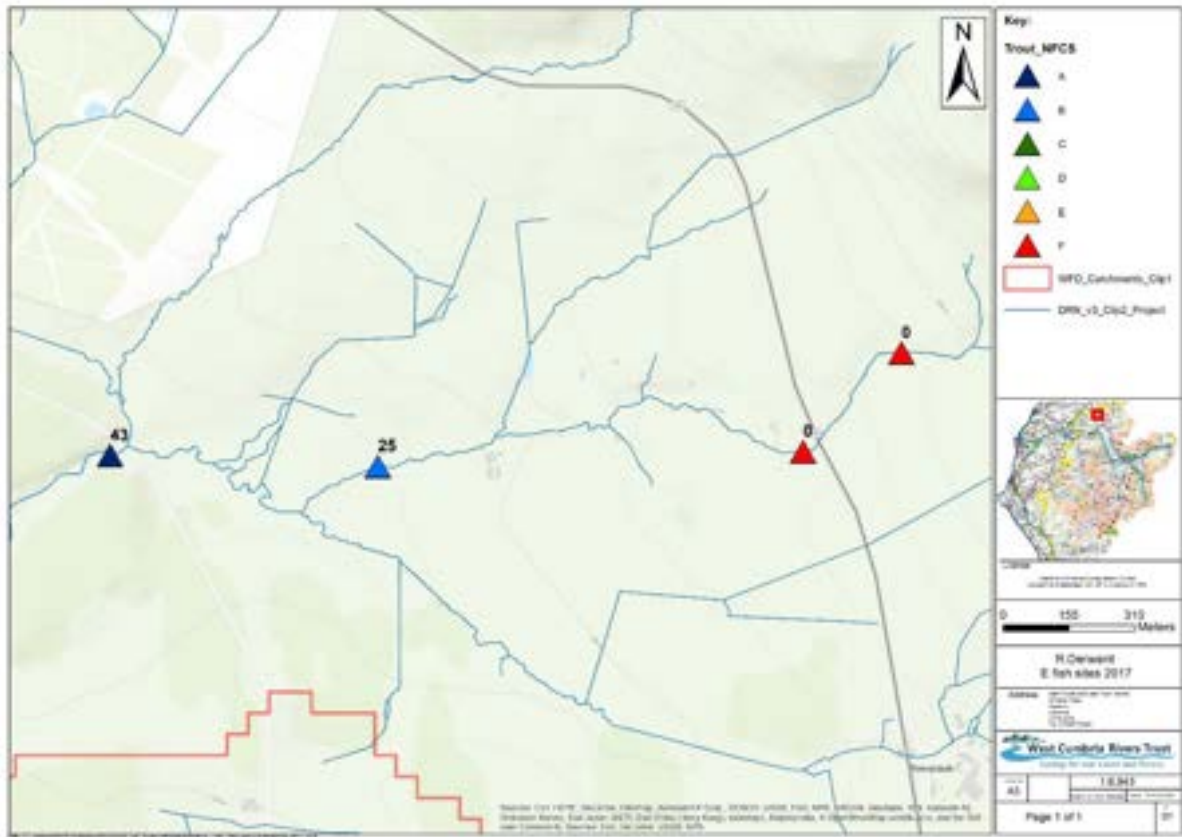
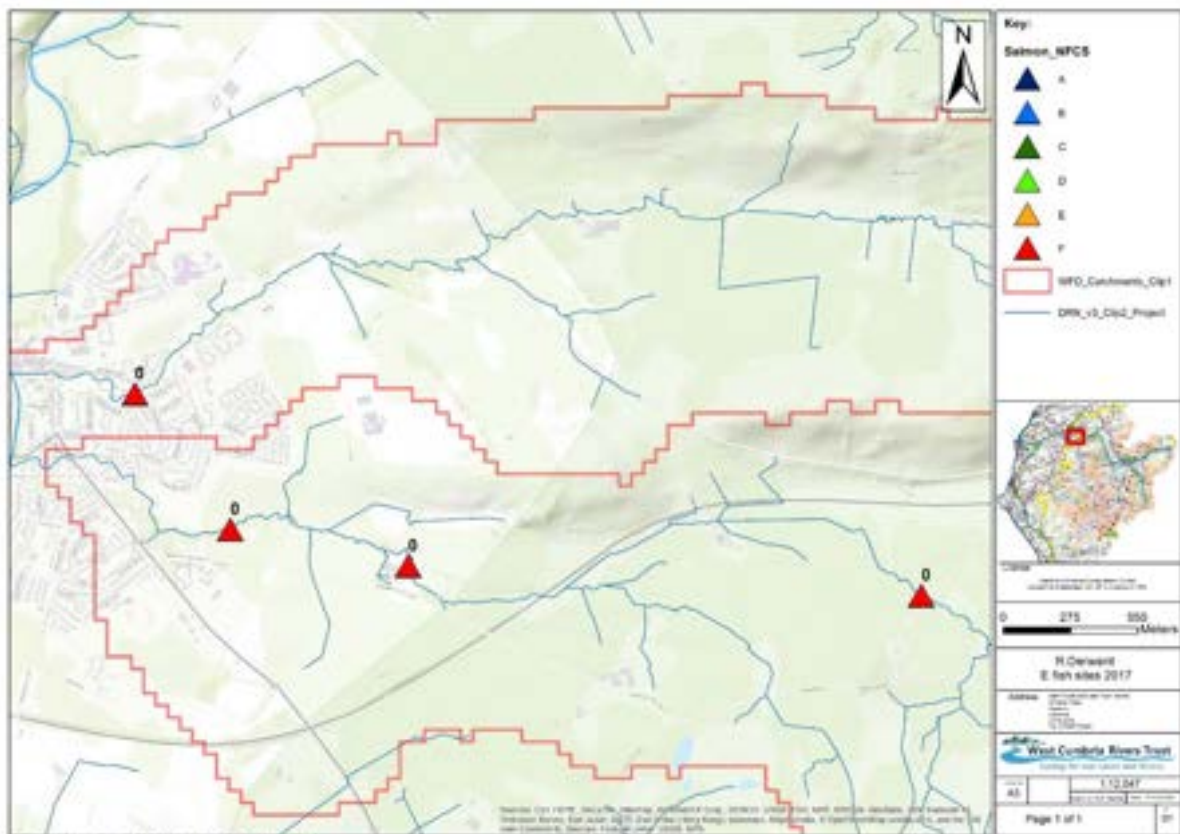
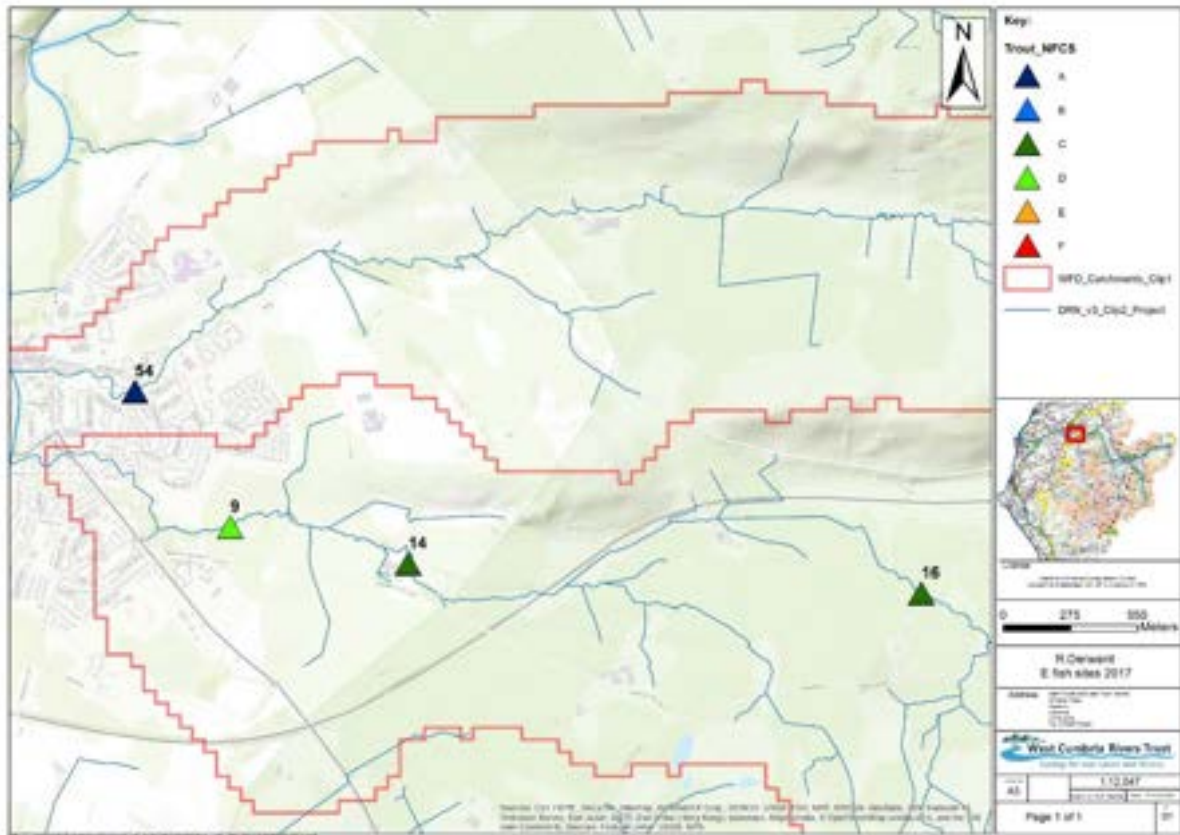




Figure 10: 2017 NFCS Classification and fish numbers for Blumer Beck. Top image Trout, bottom Salmon.



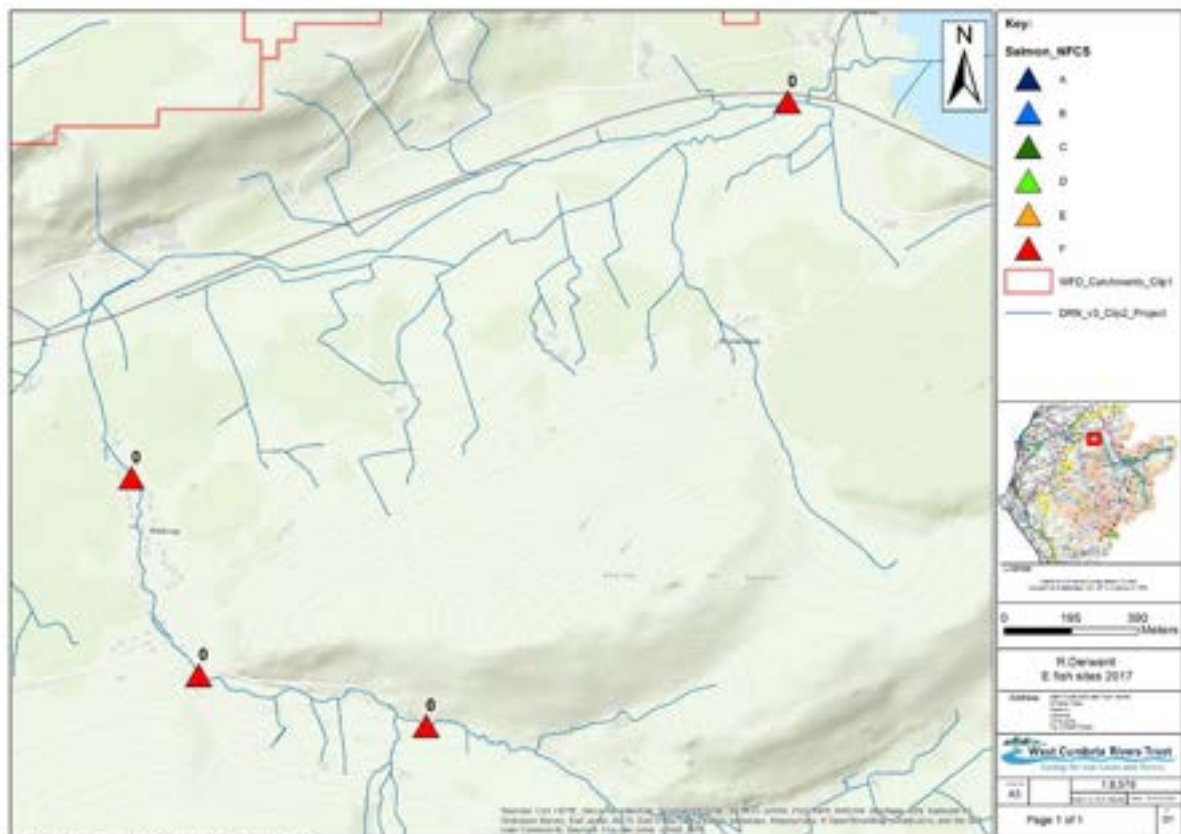
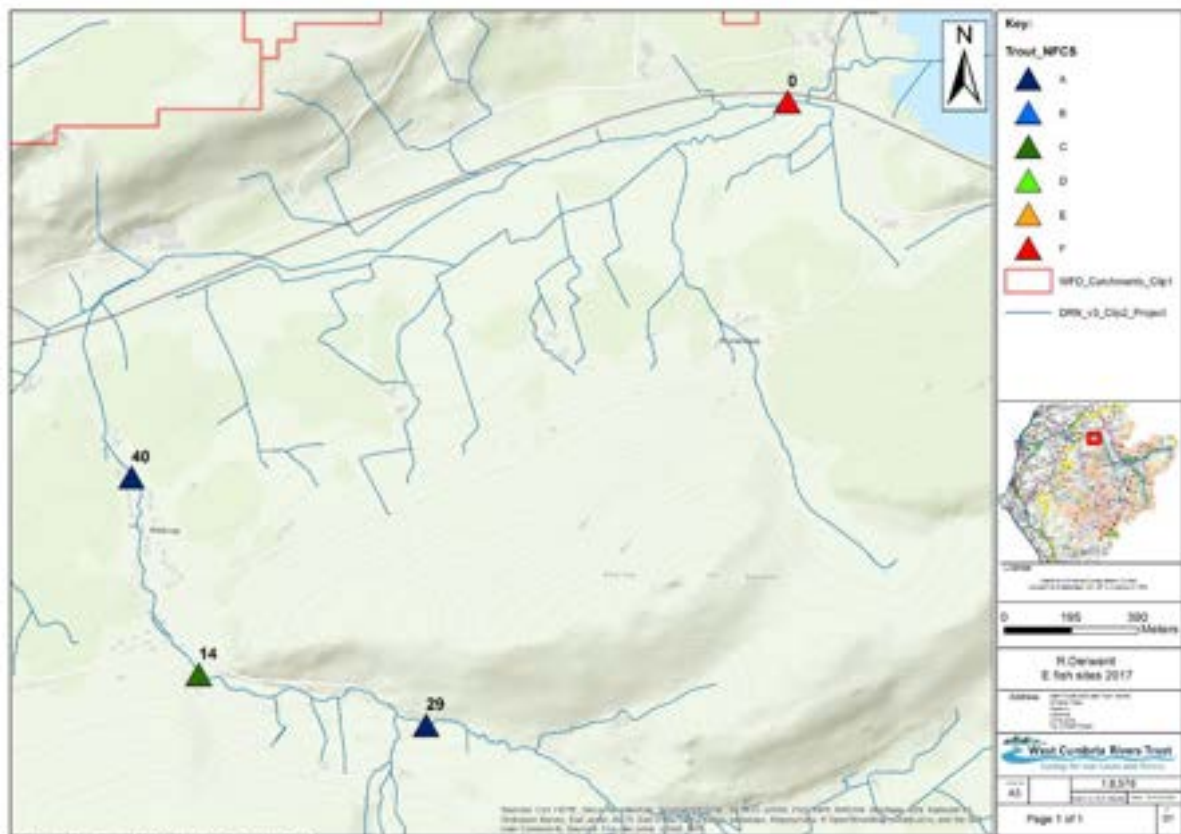
**Figure 11: 2017 NFCS Classification and fish numbers for Cockermouth Tributaries (includes: Bitter Beck and Tom Rudd Beck). Top image Trout, bottom Salmon.**



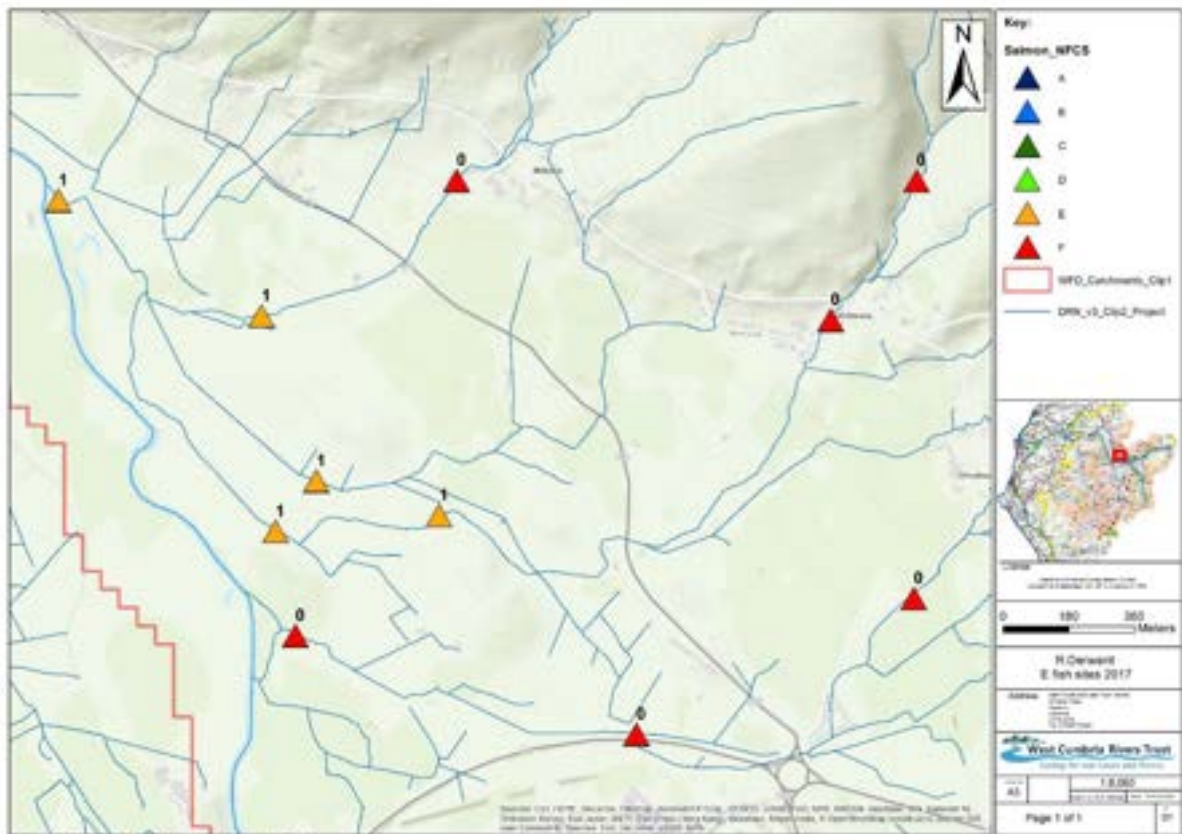
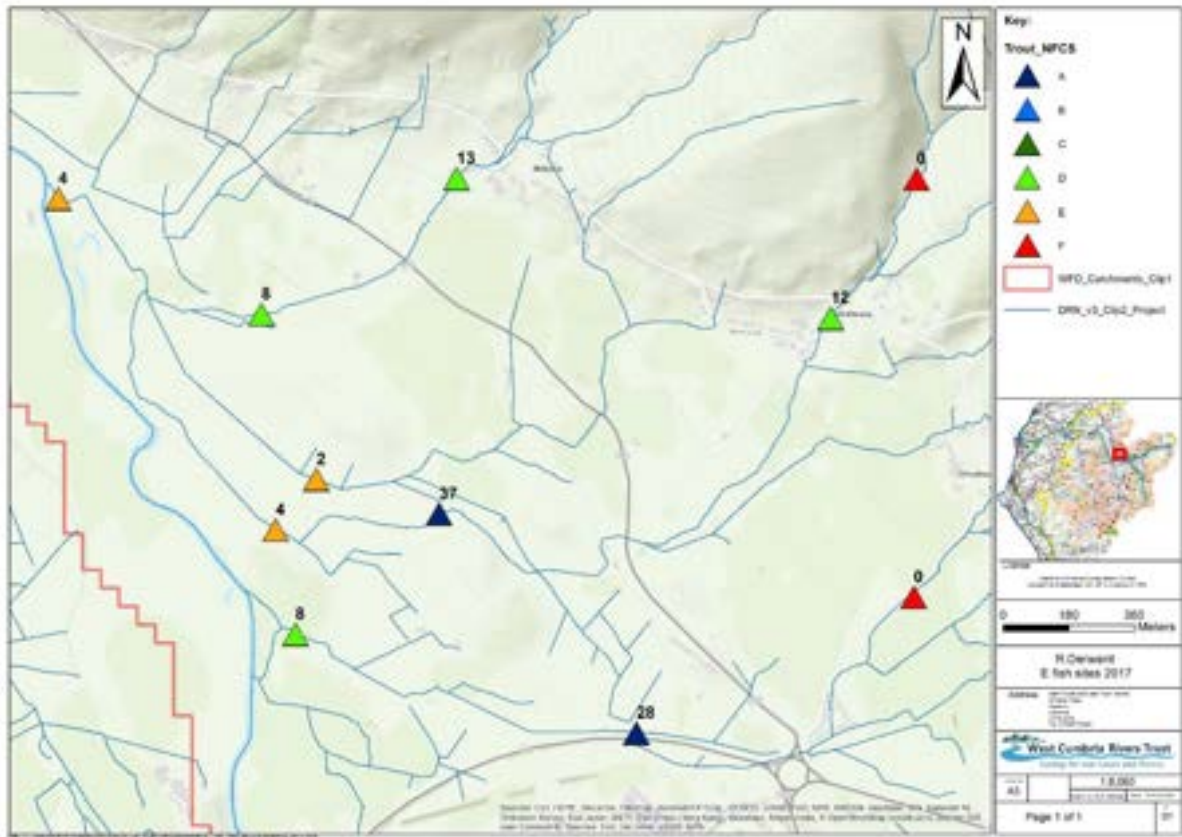
**Figure 12:** 2017 NFCS Classification and fish numbers for Lower Bassenthwaite (includes: Coal Beck, Dash Beck and Chapel Beck). Top image Trout, bottom Salmon.



**Figure 13:** 2017 NFCS Classification and fish numbers for Wythop Beck. Top image Trout, bottom Salmon.



**Figure 14:** 2017 NFCS Classification and fish numbers for Skiddaw Tribes (includes: Millbeck, Applethwaite Gill, Wath Beck, Lair Beck). Top image Trout, bottom Salmon.



**Figure 15:** 2017 NFCS Classification and fish numbers for Braithwaite (includes: Coledale Beck and Chapel Beck). Top image Trout, bottom Salmon.

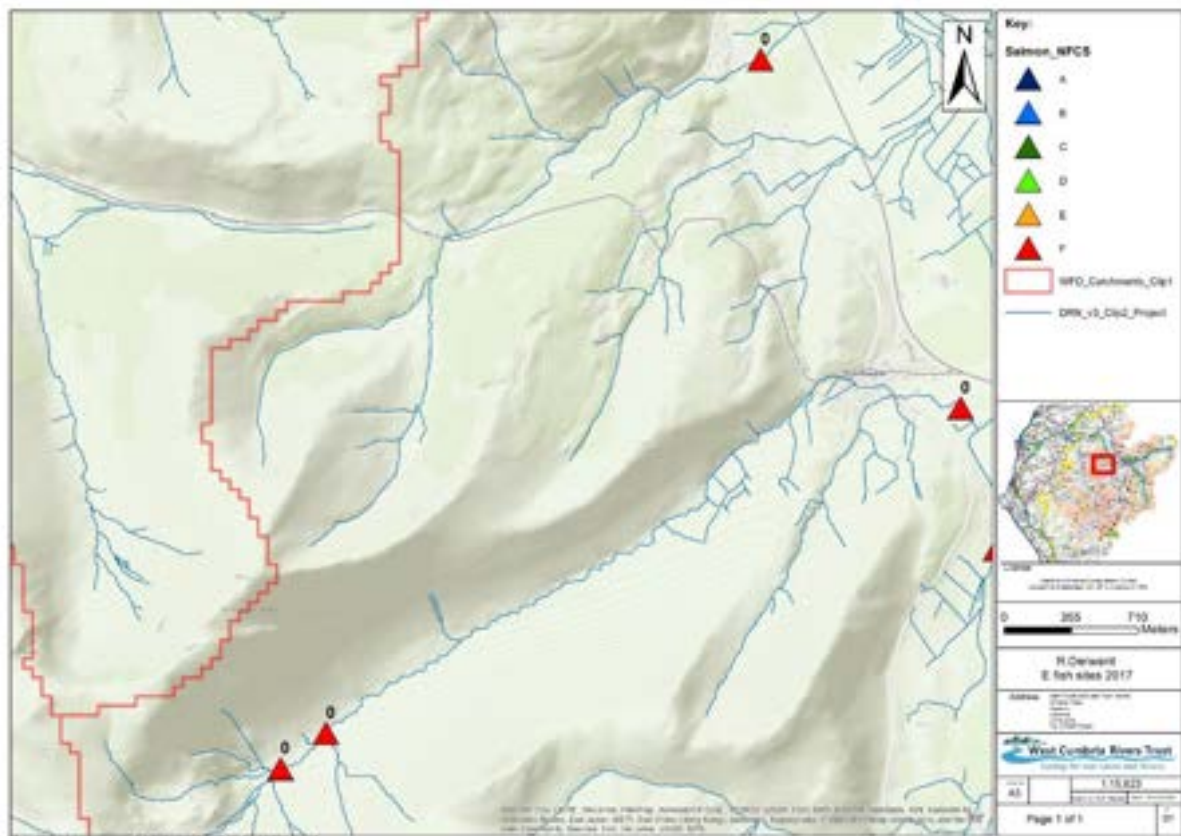
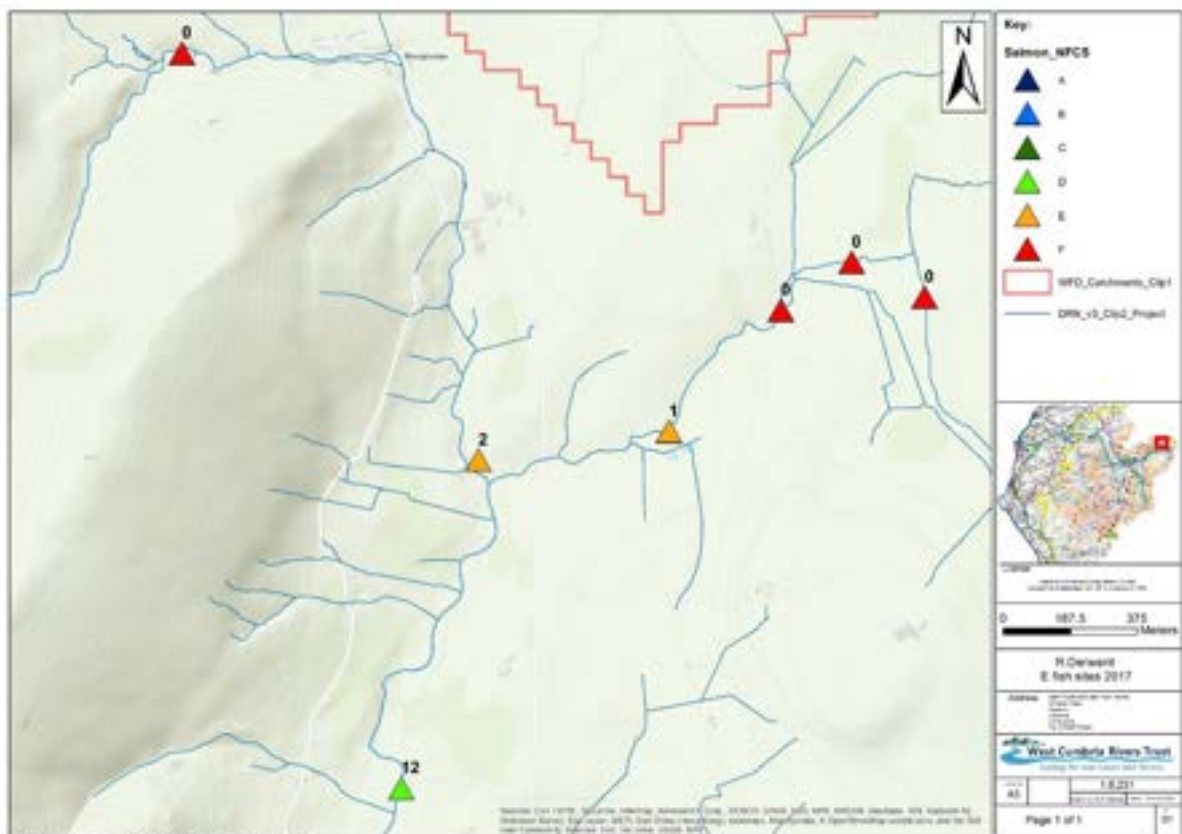
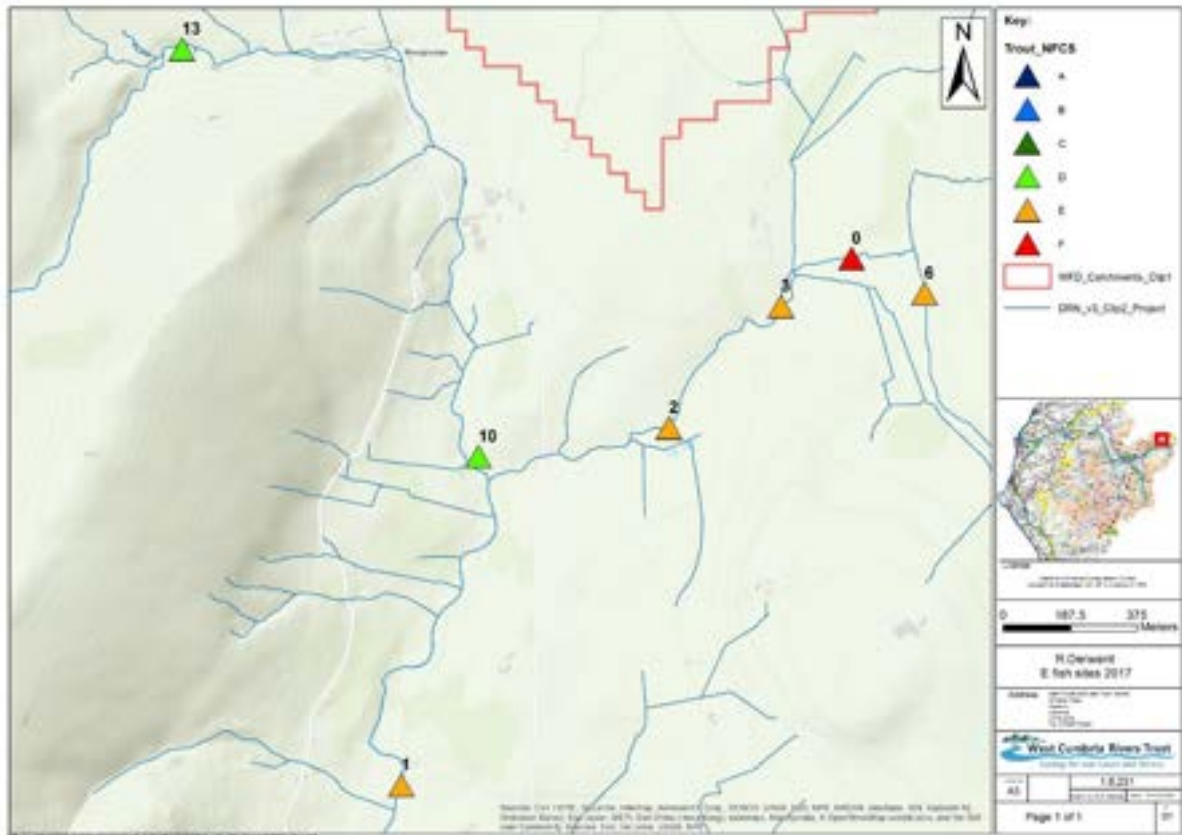
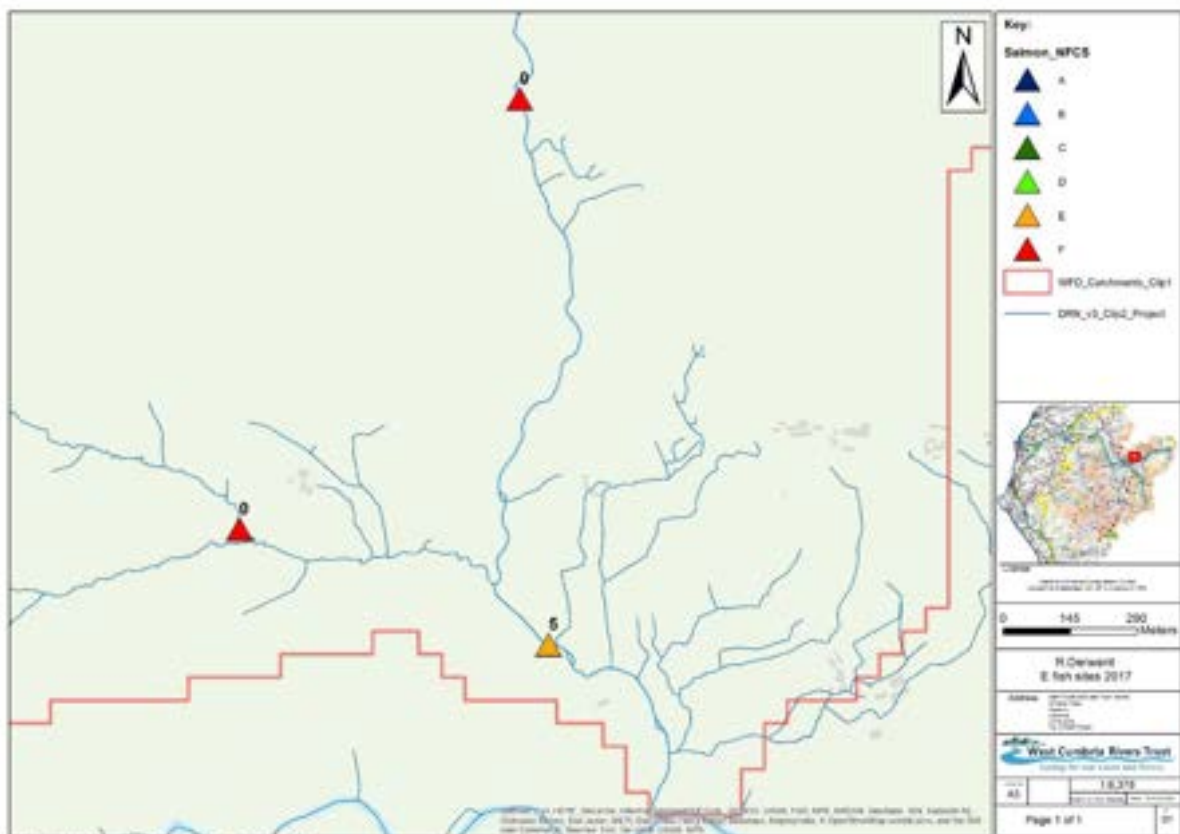
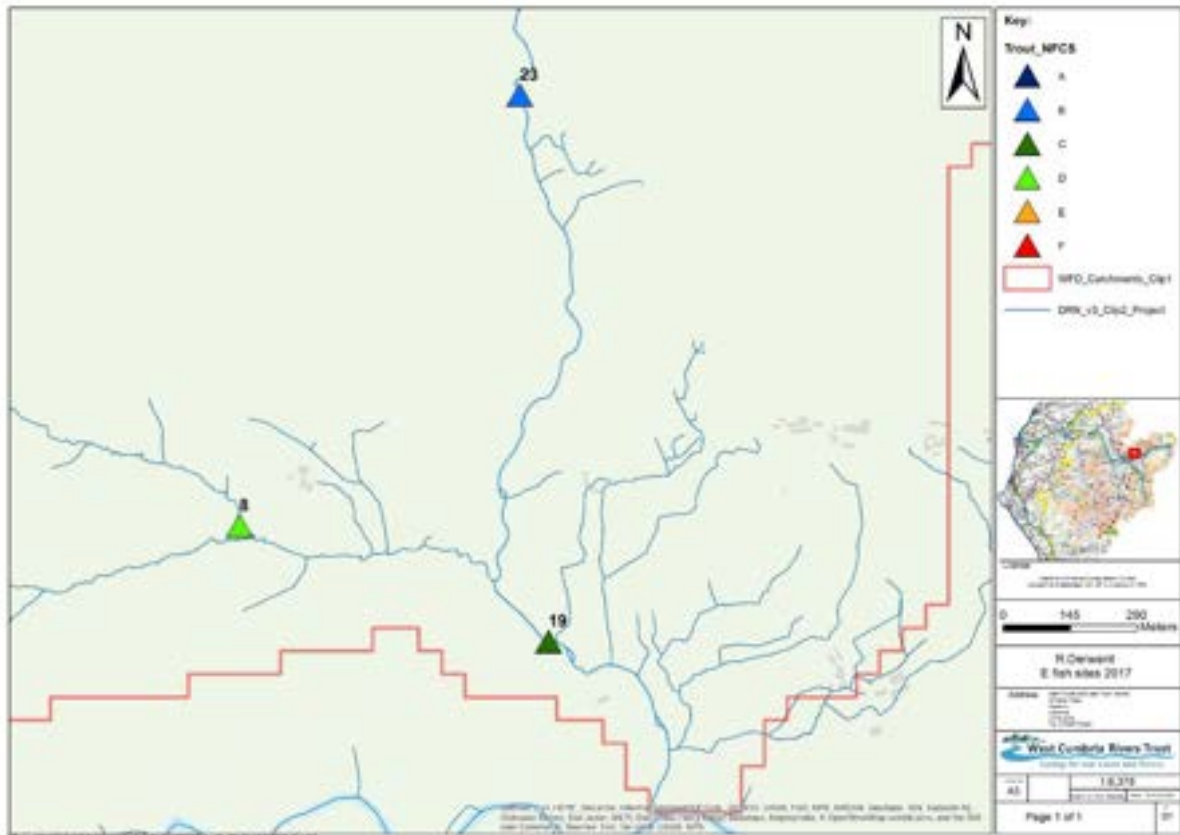


Figure 16: 2017 NFCS Classification and fish numbers for Glenderamackin (includes: Barrow Beck). Top image Trout, bottom Salmon.

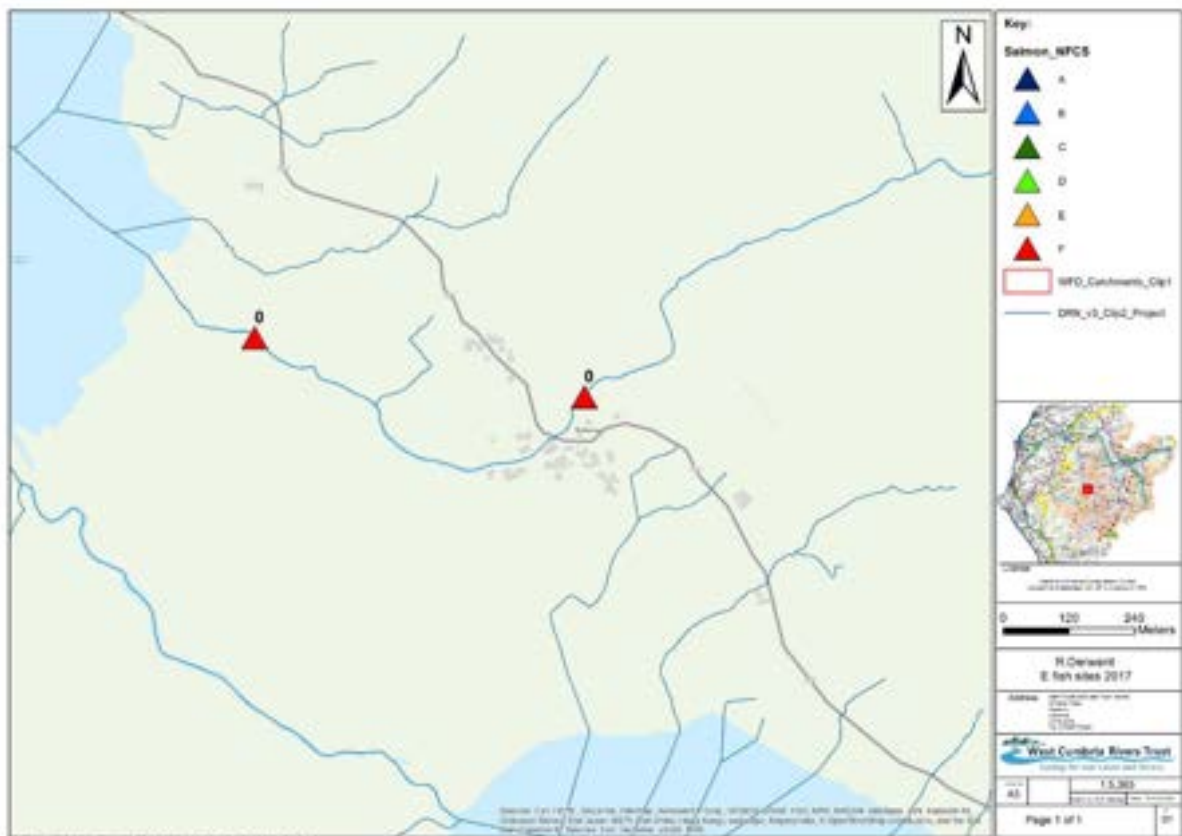
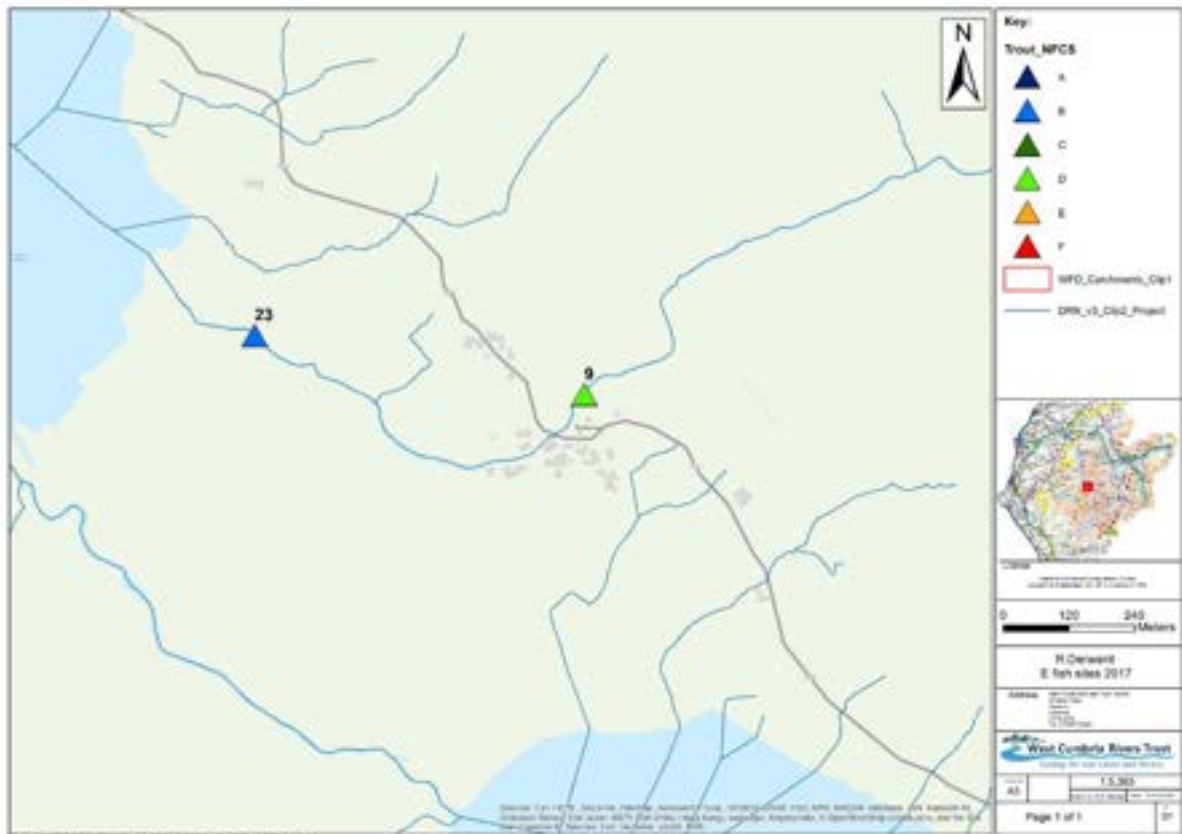


**Figure 17:** 2017 NFCS Classification and fish numbers for Glenderaterra (including Whit Beck). Top image Trout, bottom Salmon.

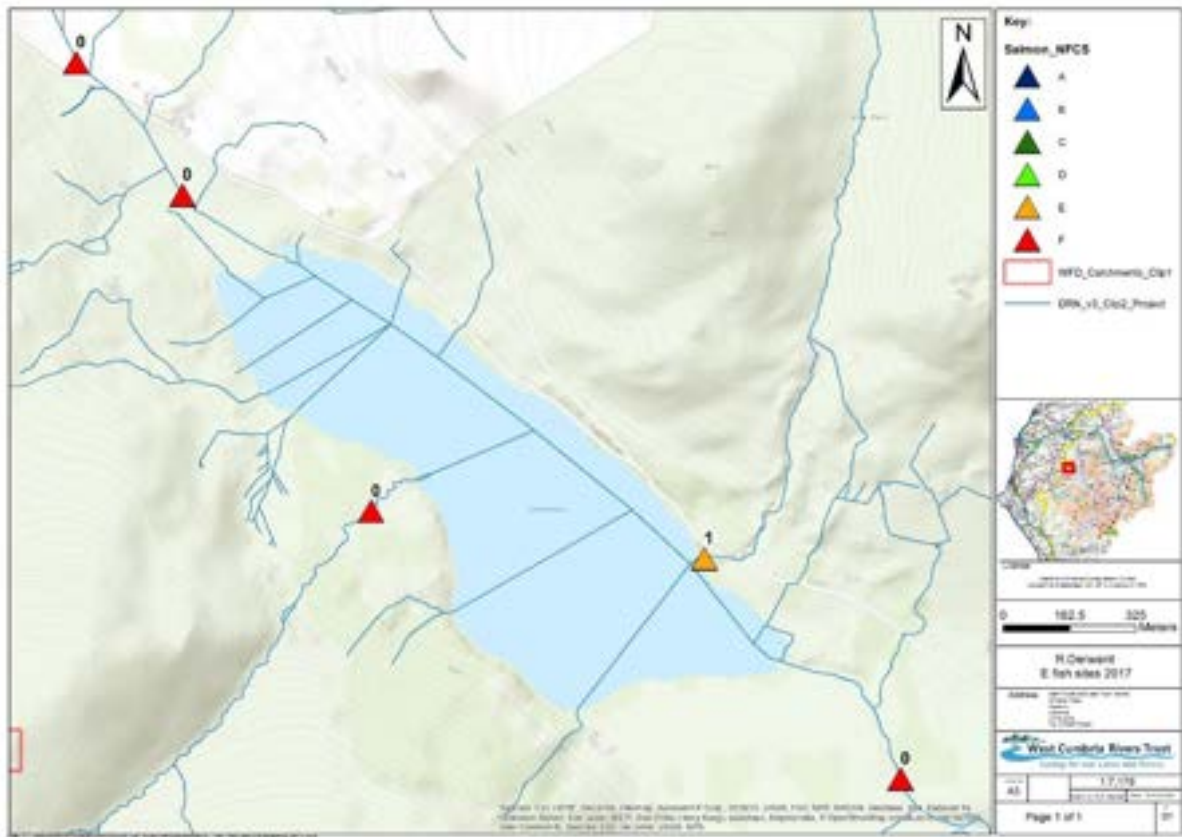
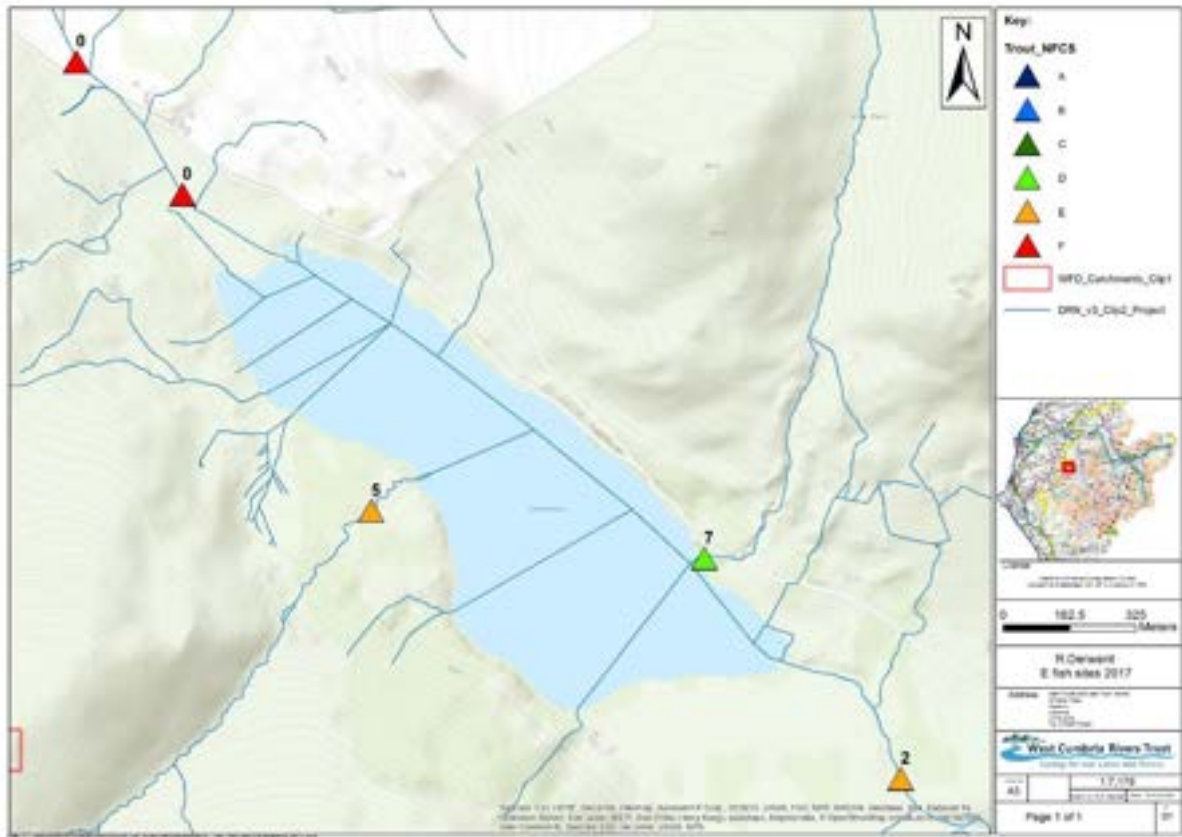




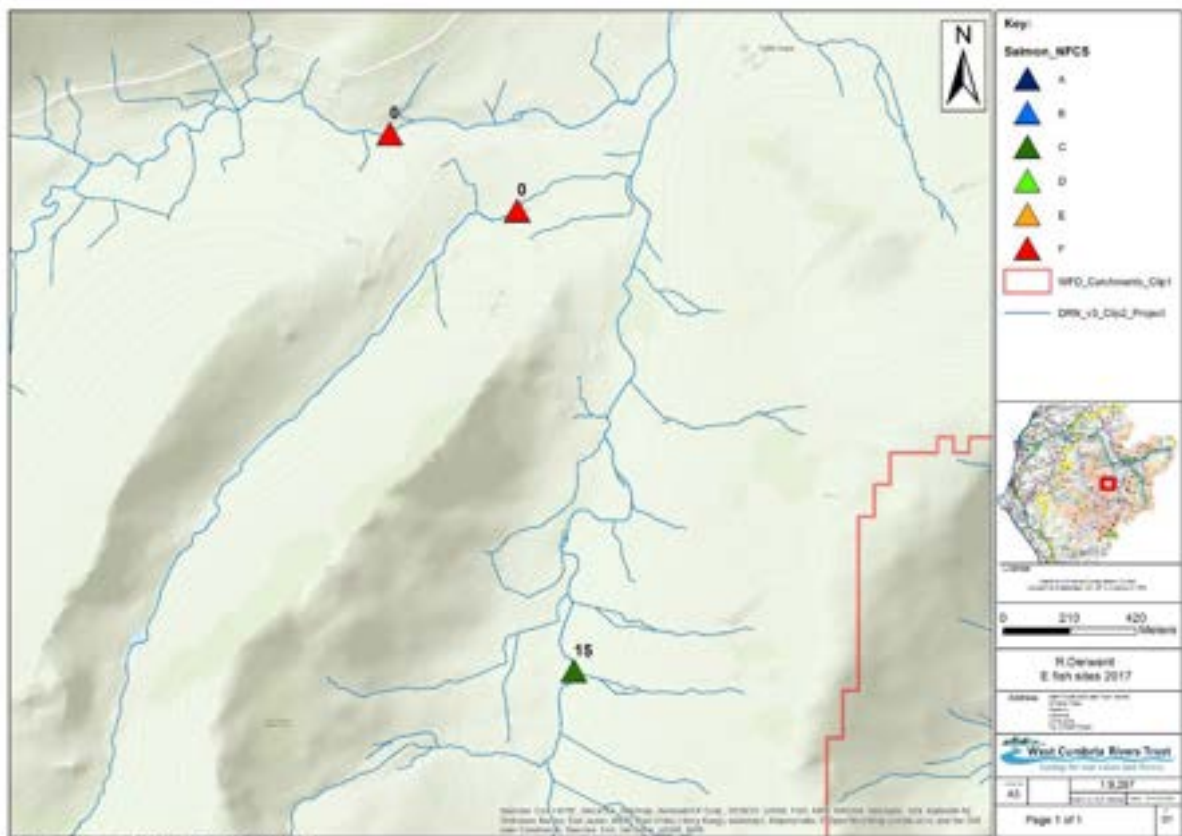
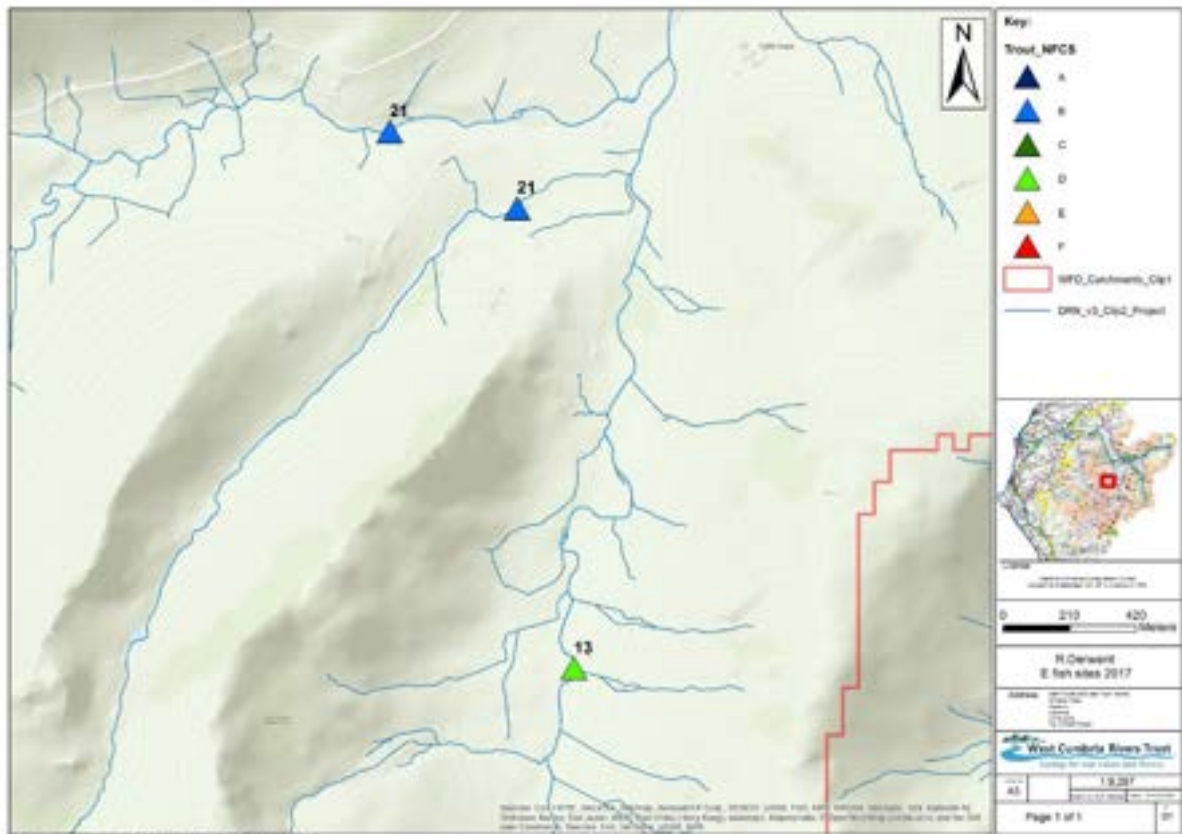
**Figure 18:** 2017 NFCS Classification and fish numbers for Buttermere (includes: Millbeck). Top image Trout, bottom Salmon.



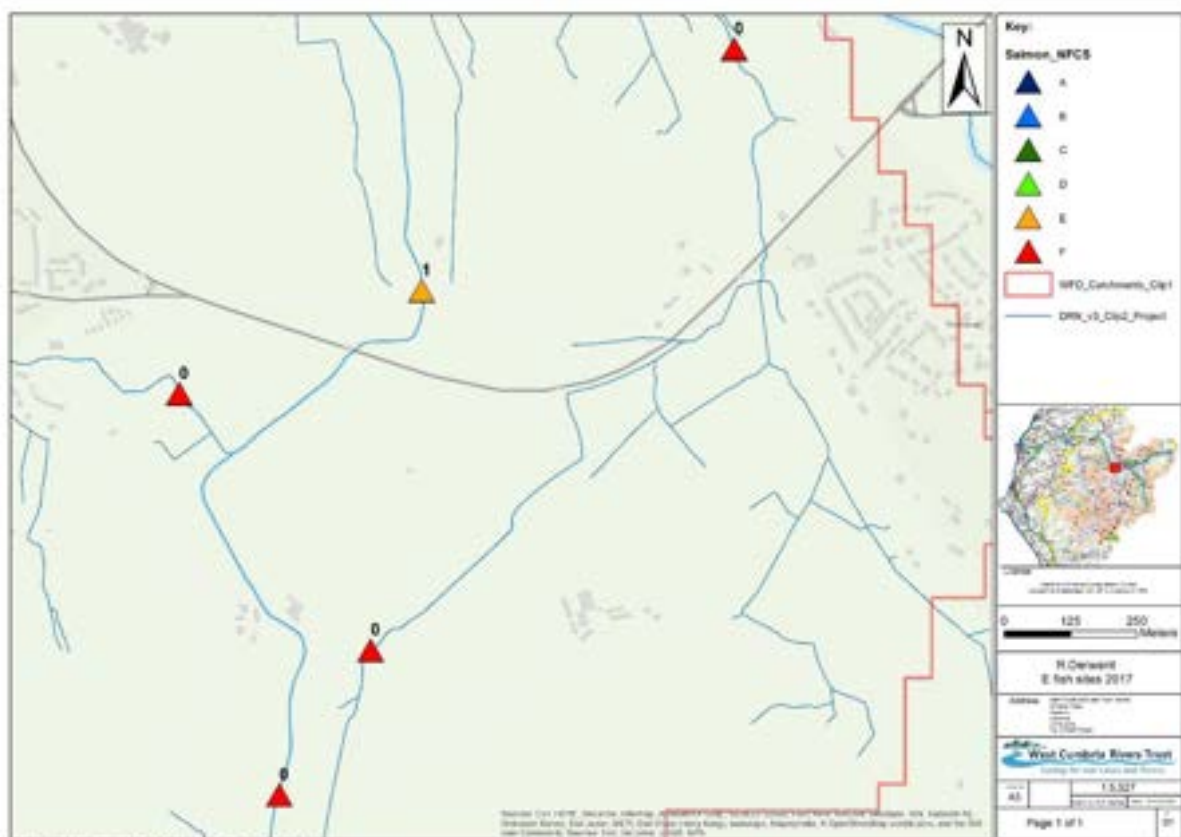
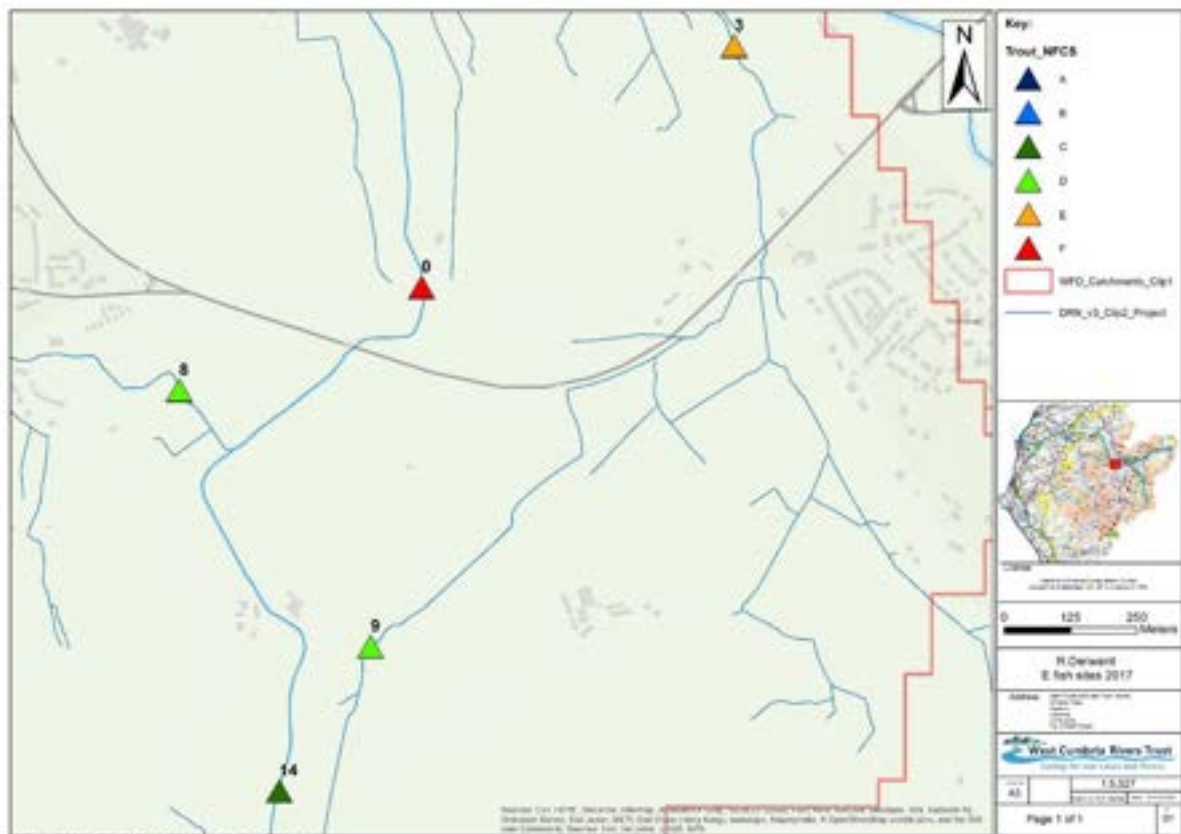
**Figure 19:** 2017 NFCS Classification and fish numbers for Loweswater (includes: Dub Beck, Holme Beck, and Crab Tree Beck). Top image Trout, bottom Salmon.



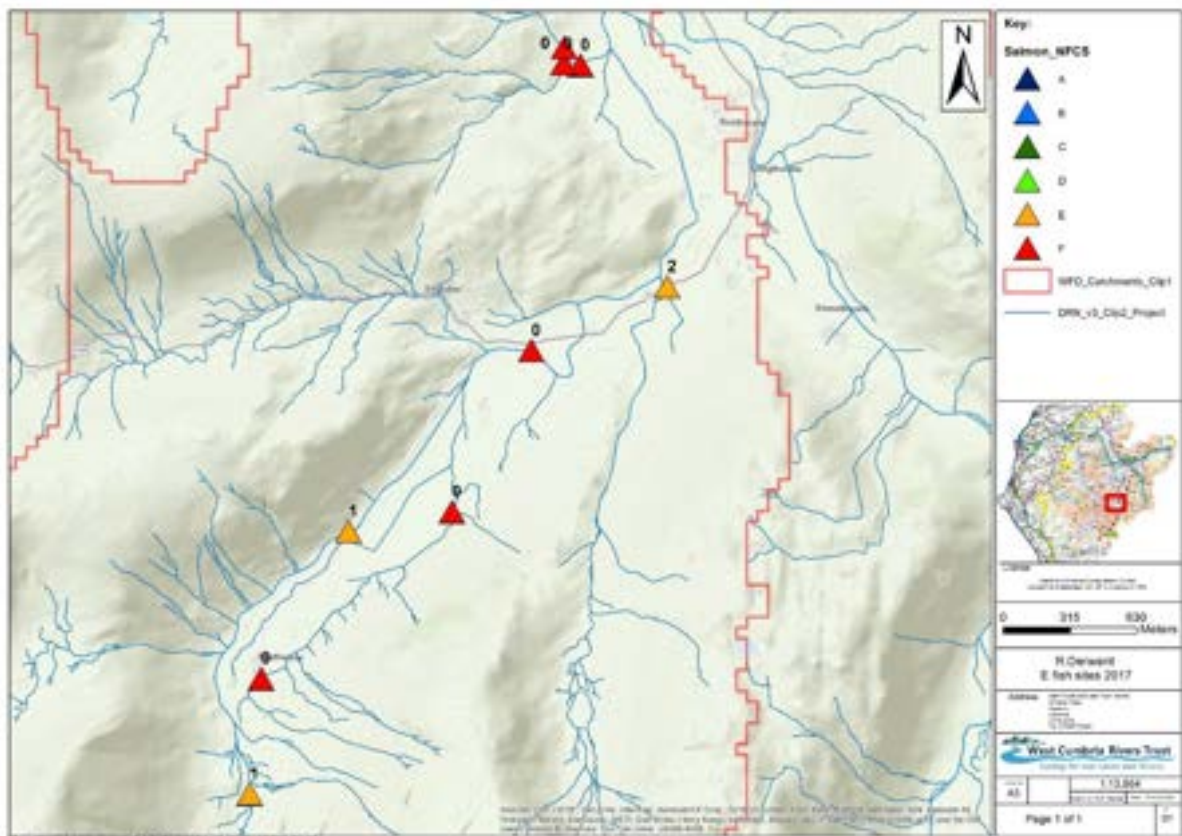
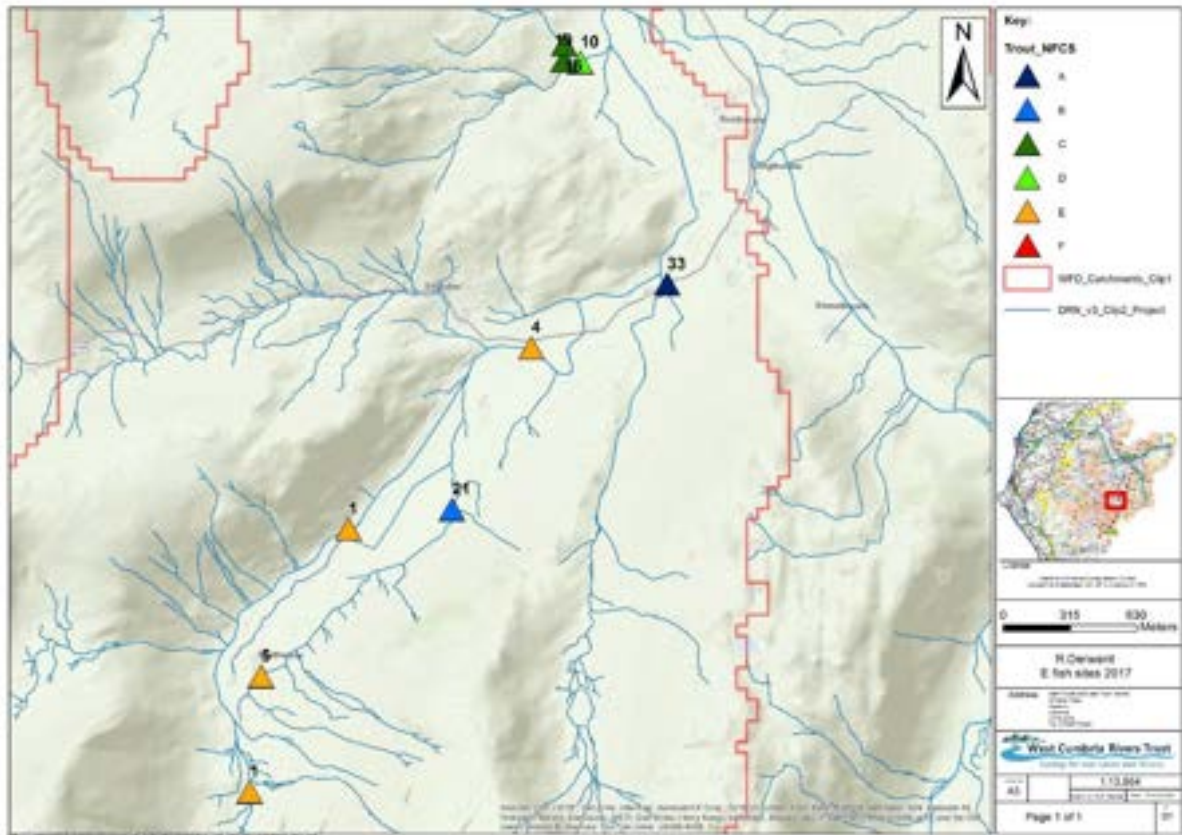
**Figure 20:** 2017 NFCS Classification and fish numbers for Upper Newlands (includes: Upper Newlands, Scope Beck and Keskadale Beck). Top image Trout, bottom Salmon.



**Figure 21:** 2017 NFCS Classification and fish numbers for Lower Newlands (includes: Pow Beck, Coledale Beck). Top image Trout, bottom Salmon.



**Figure 22:** 2017 NFCS Classification and fish numbers for Borrowdale (includes: Upper Derwent, Tongue Gill, Black Syke and Combe Gill). Top image Trout, bottom Salmon.



**Figure 23:** 2017 NFCS Classification and fish numbers for Derwent Water Tributaries (includes: Watendlath Beck, Comb Gill and Brockle Beck). Top image Trout, bottom Salmon.

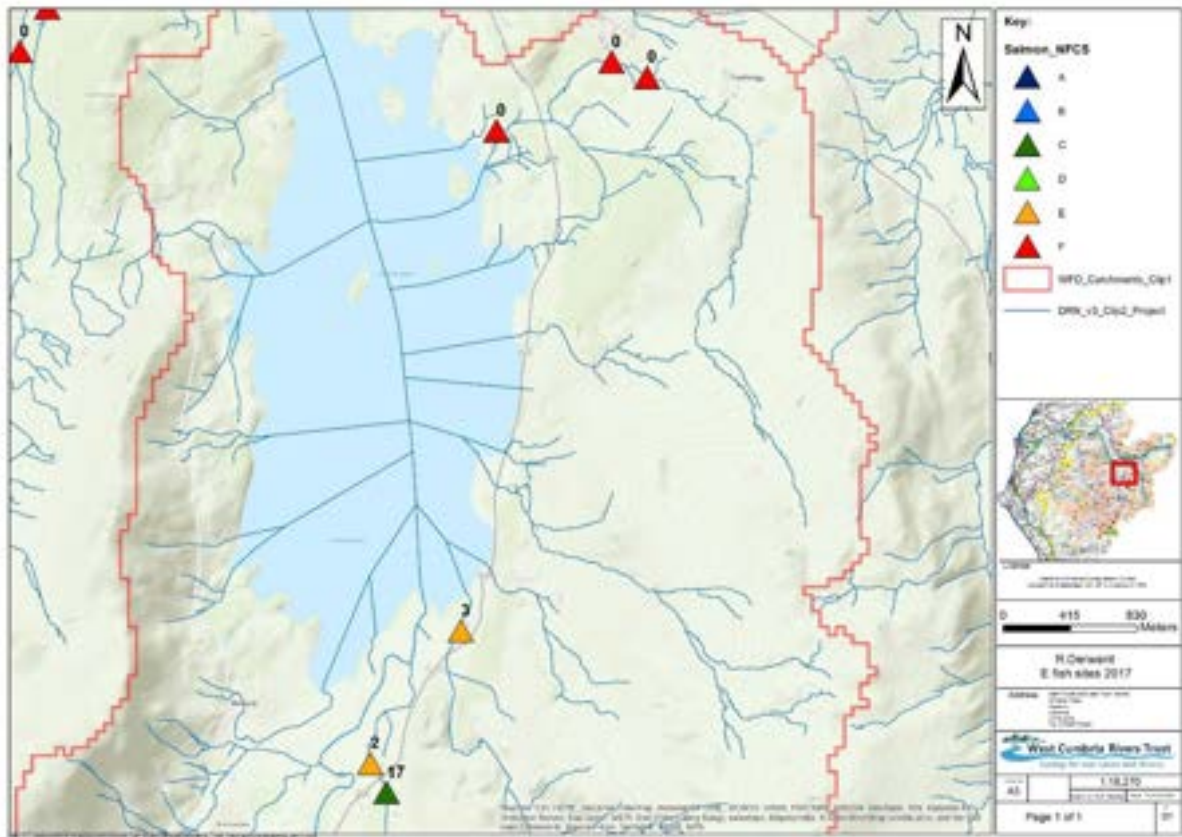
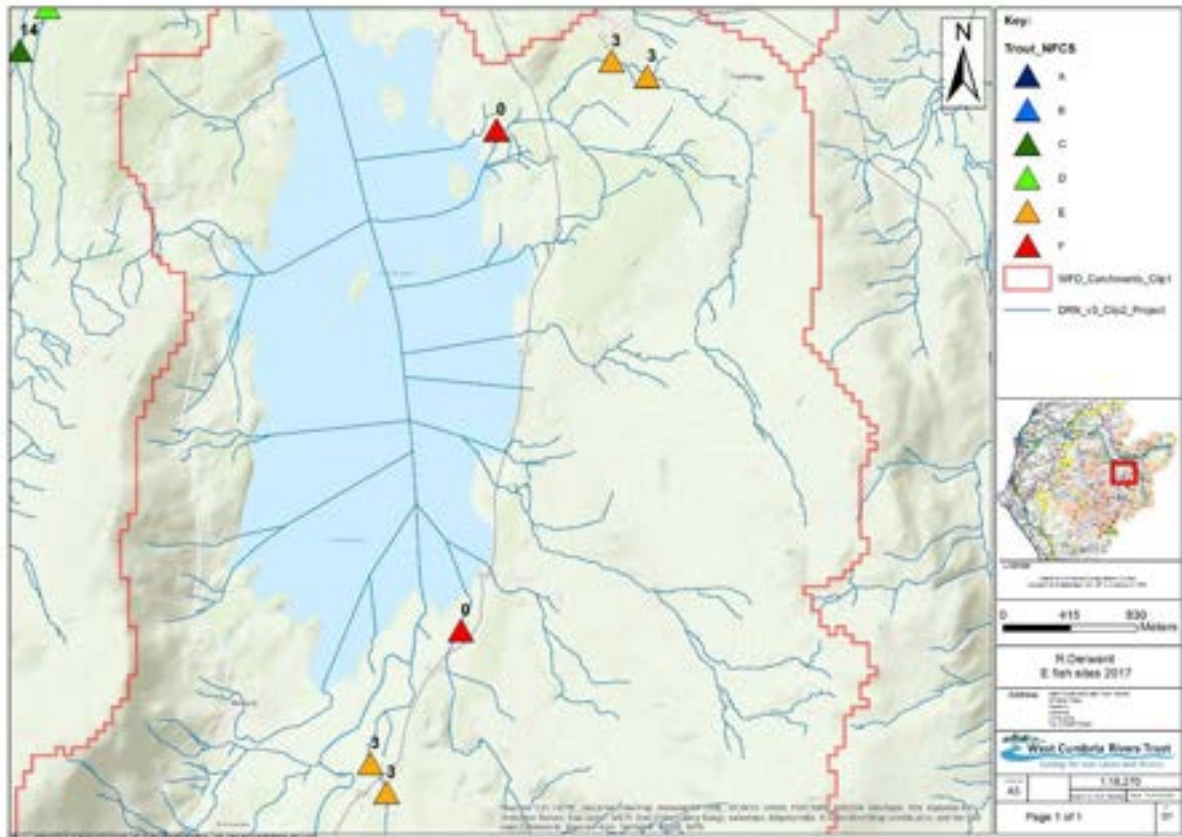
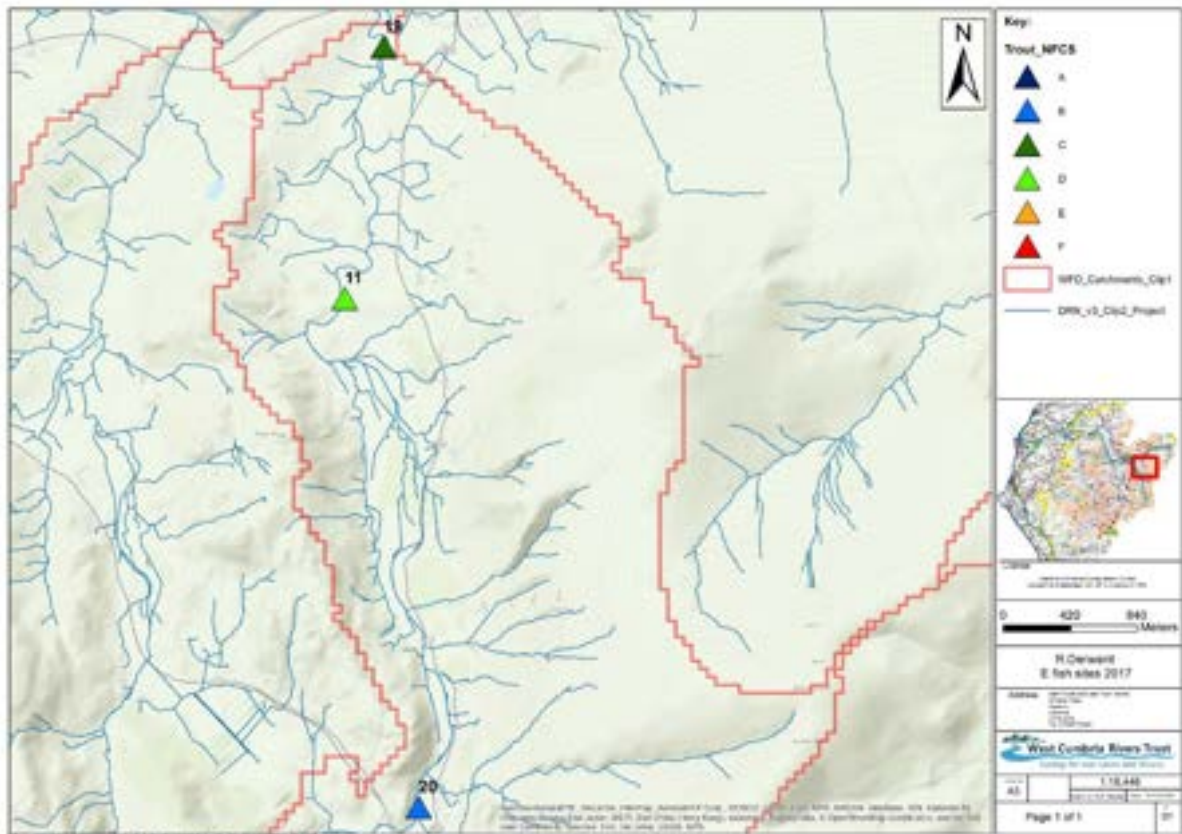
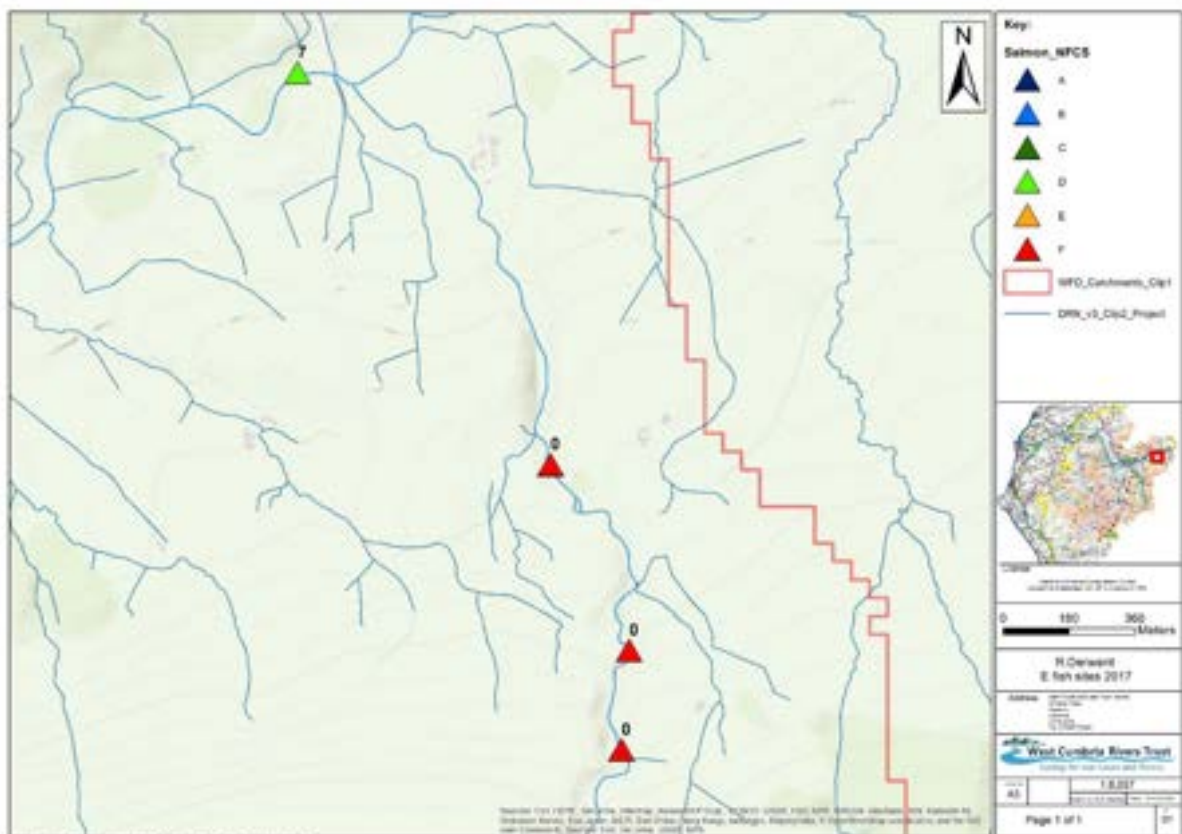
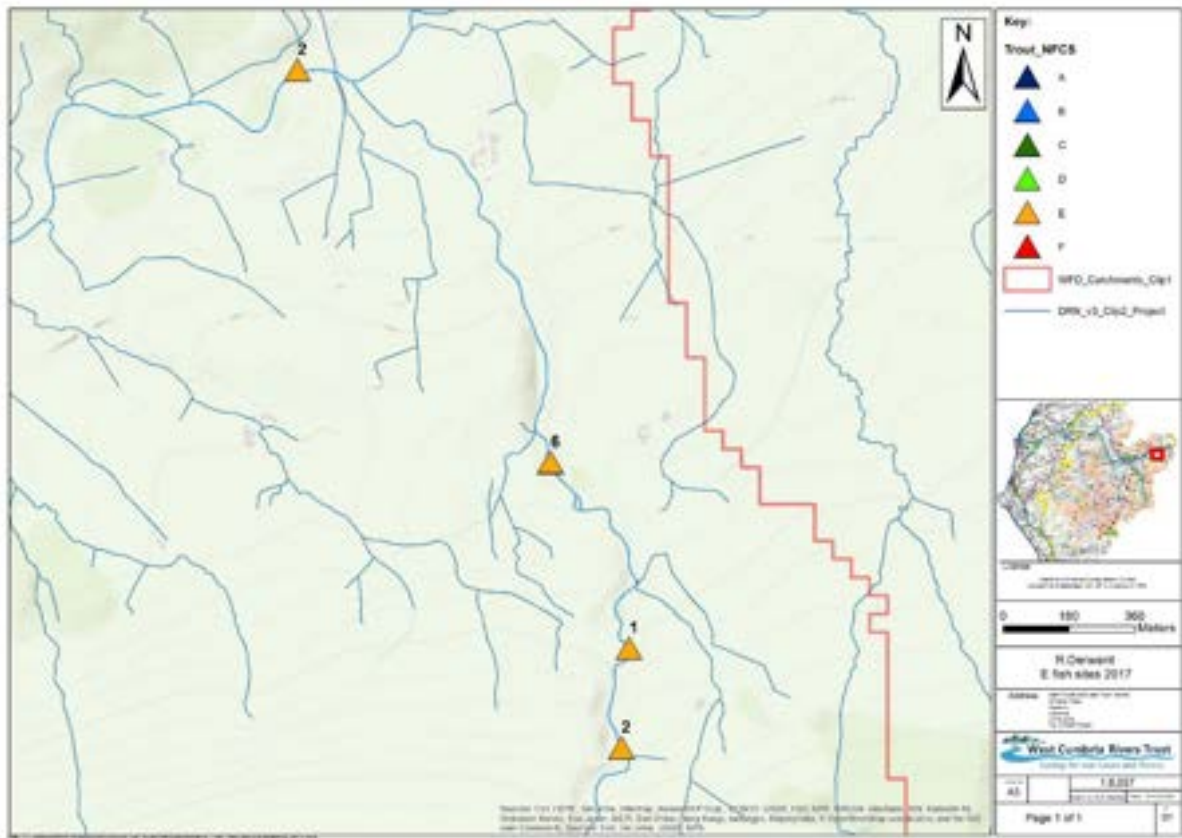


Figure 24: 2017 NFCS Classification and fish numbers for St John's Beck. Top image Trout, bottom Salmon.

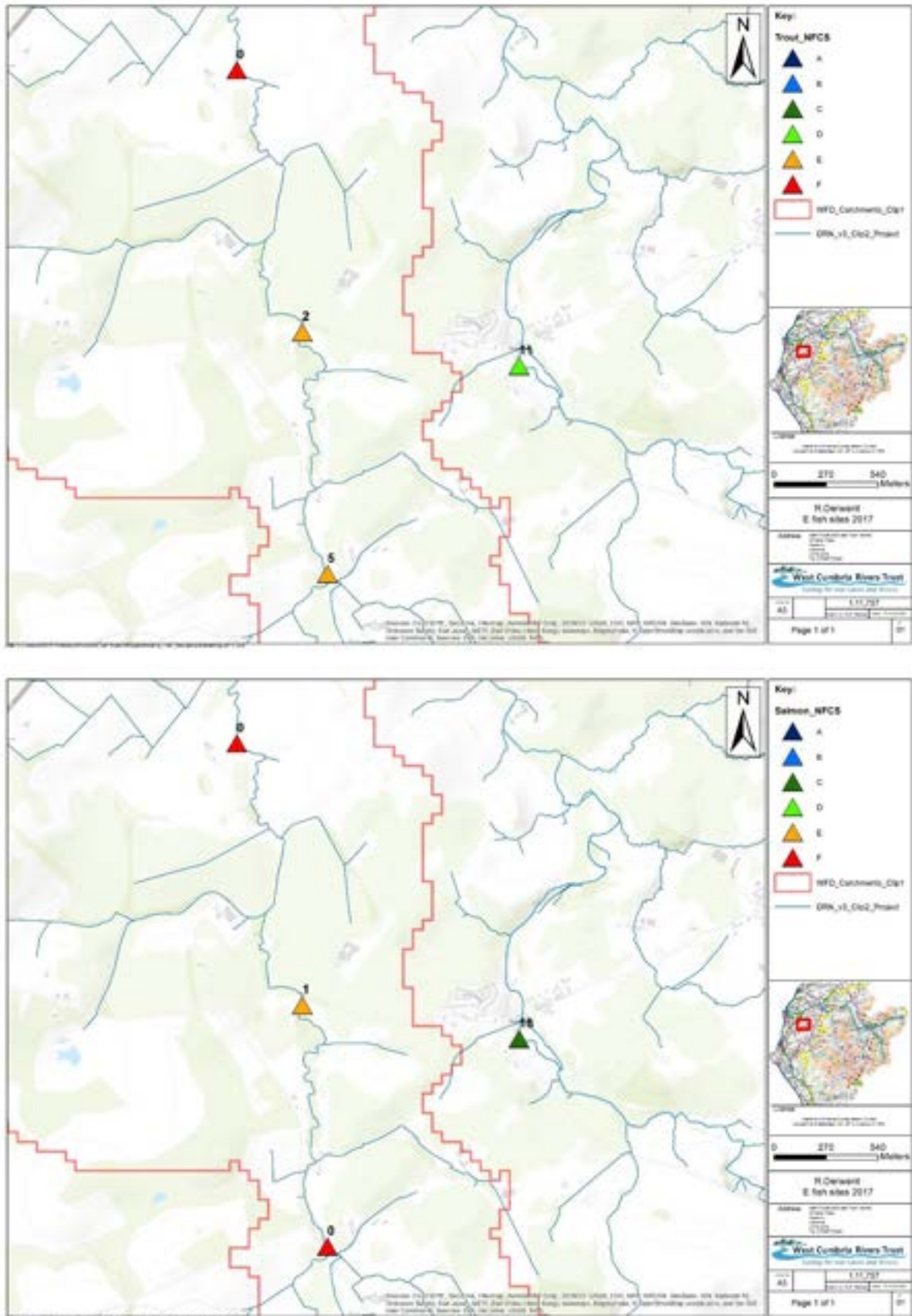


**Figure 25:** 2017 NFCS Classification and fish numbers for Mosedale (includes: Glenderamackin). Top image Trout, bottom Salmon.

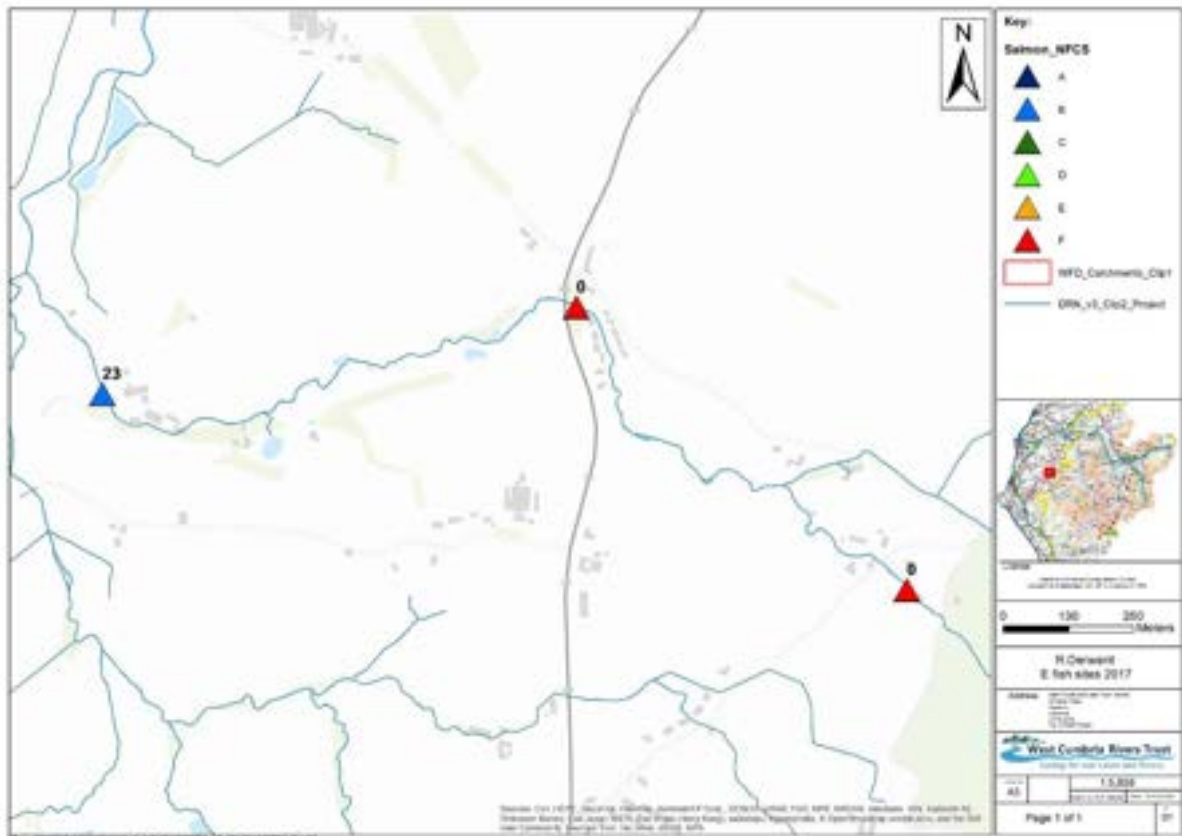
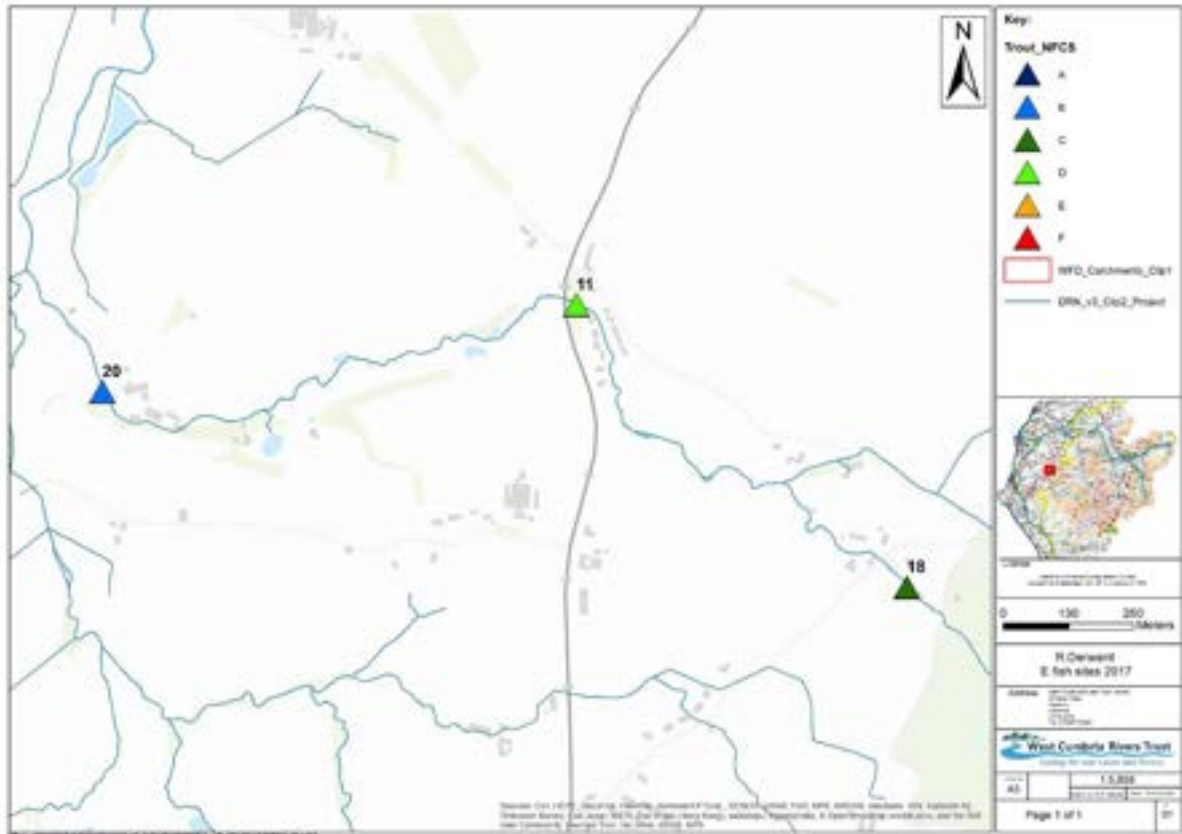




**Figure 26:** 2017 NFCS Classification and fish numbers for Lostrigg (includes: River Marron). Top image Trout, bottom Salmon.

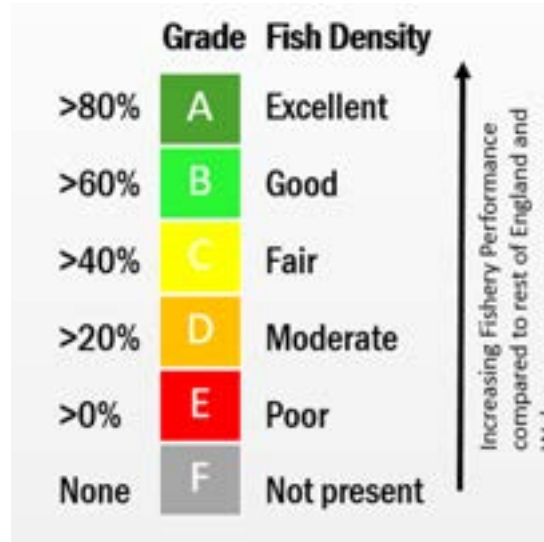


**Figure 27:** 2017 NFCS Classification and fish numbers for Wood Beck. Top image Trout, bottom Salmon.



### 3.3 Comparison of NFCS classification results between the years 2017, 2016, 2015.

The project has had a couple of different project officers and the previous officer used a different colour scheme to the one used in this report, so for the comparison section, the colour scheme has been changed to the one in Figure 28 to make the comparison between the years easier.



*Figure 28: National Fisheries Classification Scheme colour scheme used in 2016 and 2015 reports.*

**Figures 29, 30 and 31:** are the NFCS results for the Derwent Catchment in 2017, 2016 and 2015 respectively.

To remember when comparing the data between years.

- Fish populations are naturally extremely variable, both within rivers and through time.
- Results from one or two years cannot provide statistically robust measures of fish populations and changes in that population over time.
- Therefore, these results give a rough indication of Salmon and Trout Fry numbers in the Derwent catchment.

**Figure 29:** 2017 NFCS results for Derwent catchment, Trout and Salmon.

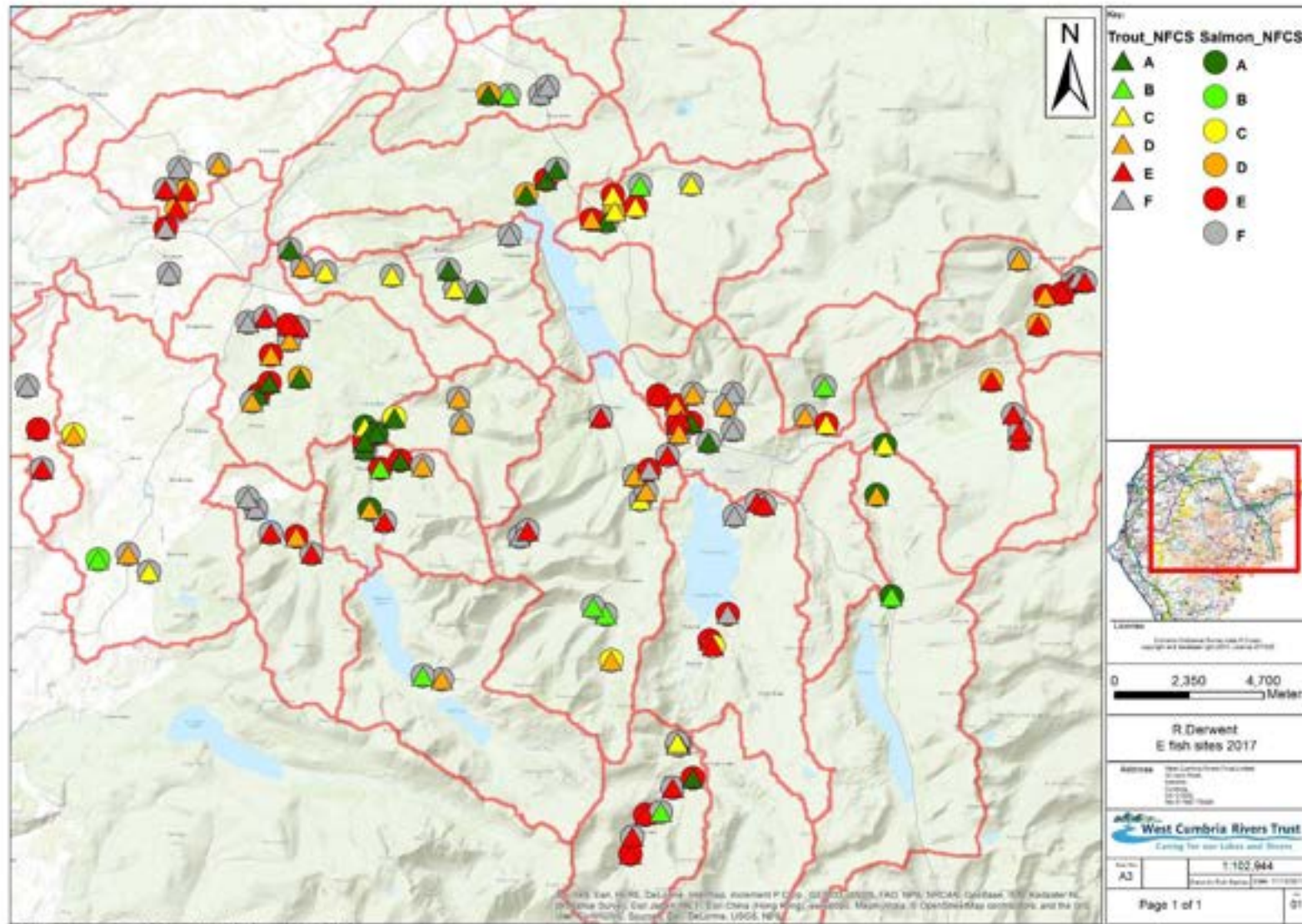
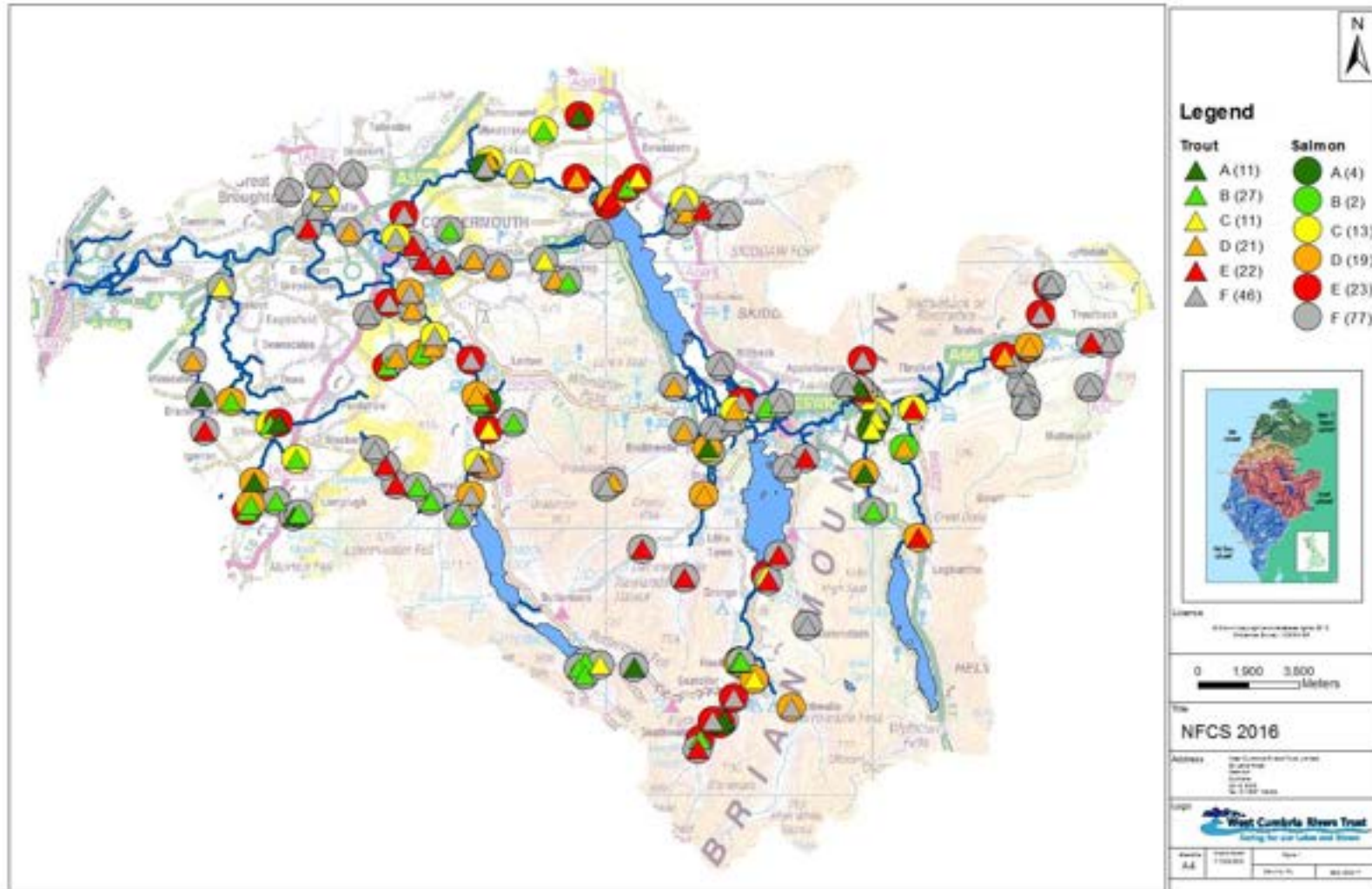
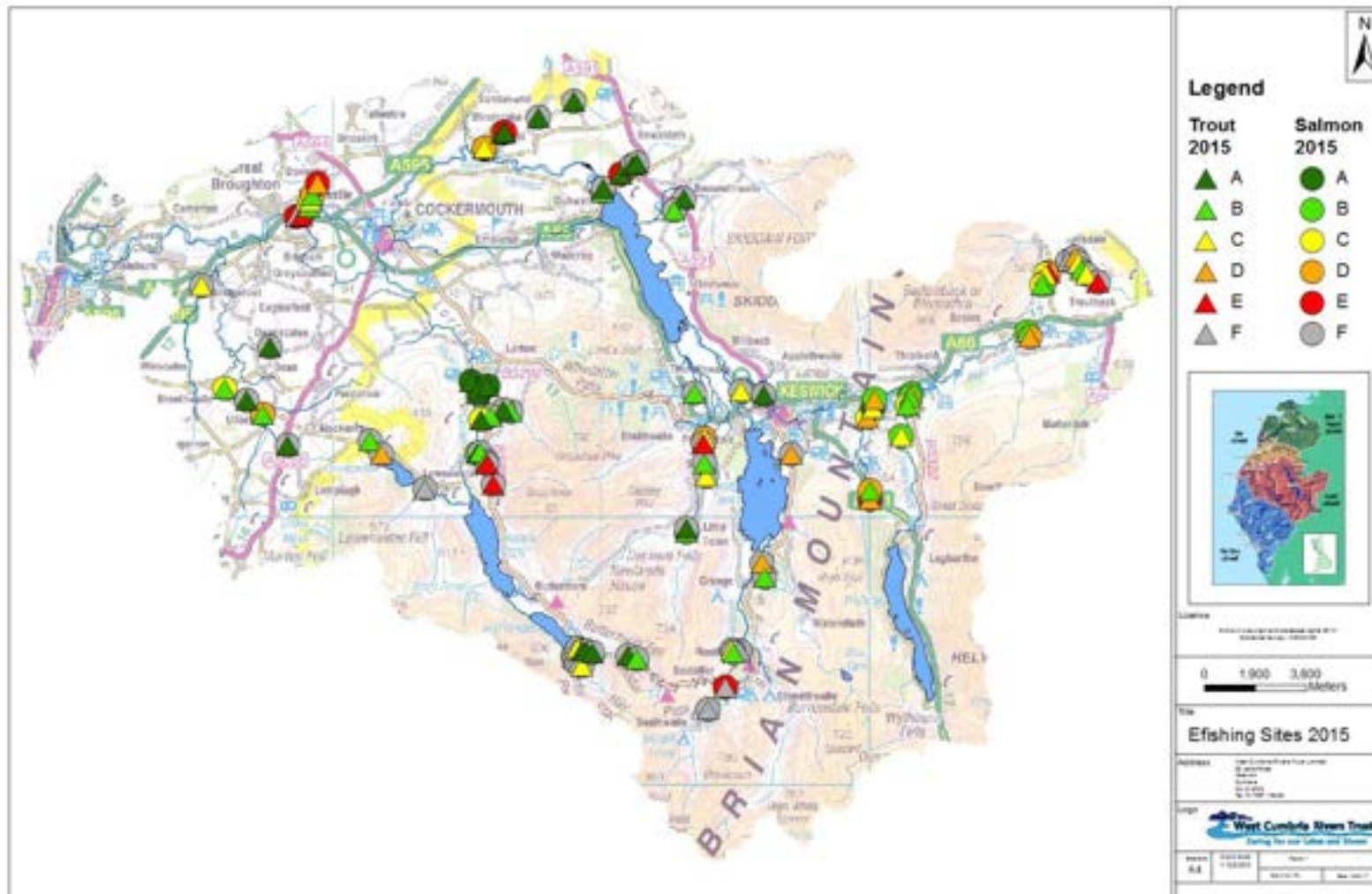


Figure 30: 2016 NFCS results for the Derwent catchment for Trout and Salmon.



**Figure 31:** 2015 NFCS results for Derwent catchment for Trout and Salmon.



### 3.4 Habitat characterisation

3.4.1 The survey sites were scored using a weighted scoring system, with higher scores meaning better habitat for fish. For example, the highest scoring sites had large riparian width, dappled shade, and no stock access, gravel provision with minimal silt, no barriers, no invasive species, and large wooded debris provision.

3.4.2 These scores were then split into three categories which were defined as requiring the following levels of work to provide the best habitat for fish;

- **Maintain** - limited small scale work required such as insertion of large woody debris or tree maintenance (for example, Figure 32).
- **Repair** - modest work such as fencing off buffer strips, provision of new gravels, willow spiling, invasive species control and tree planting (for example, Figure 33).
- **Restore** - major restoration works such as re-routing the channel required (for example, Figure 34).



*Figure 32: An example of a survey site classified as Maintain, with dappled shade, gravel provision, minimal silt and no stock access.*



*Figure 33: An example of a survey site classified as Repair, which even though it is fenced and has a reasonable buffer strip and good substrate - lots of cobbles and gravel, there is loads of Himalayan Balsam, no trees or woody debris to create dappled shade or places for fish to hide.*





**Figure 34:** An example of a survey site classified as *Restore*, which has a major siltation problem, no shade from trees and minimal riparian fencing, livestock have access on the right and are damaging the banks.

### 3.5 Site Habitat Scores

- 3.5.1 Figure 35 shows the site specific habitat scores, please bear in mind these scores are only for an area about 10-20m in length.
- 3.5.2 Out of the 136 sites; 49 were classed as *Maintain* (36%), 70 as *Repair* (51%), and 17 as *Restore* (13%).
- 3.5.3 After categorising the sites using the weighted scoring system, it was felt that the scoring system next year needs updating to take into account the fact that the bigger and wider the river, the in-river habitat and substrate are more important, whereas the smaller and narrower the river is, the marginal and bank habitats are more important. It will need small tweaks in the level of importance for various habitat characteristics based on the average width measurements taken when surveying.

### 3.6 Tributary Habitat Scores

- 3.6.1 Figure 36 shows the tributary habitat scores; these scores were calculated by finding the average habitat score for all the sites surveyed on that watercourse or tributary. Some of the final categories were then adjusted accordingly based on local knowledge, known works in area or proposed works, as the averages didn't quite fully represent the complete watercourse as they were just based on the sites surveyed. Which just shows that site selection can skew the data when looking at the whole catchment or watercourse.
- 3.6.2 It was also noted that some of the tributary habitat classifications had changed between the 2016 and 2017 surveys. This is because some of the site locations and number of sites surveyed have changed between the two years.
- 3.6.3 Out of the 48 tributaries surveyed 11 were classed as Maintain (23%), 31 as Repair (65%), and 6 as Restore (12%).
- 3.6.4 Appendix 2 is a summary of habitat scores and shows more details about each tributary and the local knowledge which was used to adjust the categories.

### 3.7 Invasive non-native species (INNS)

- 3.7.1 As part of the habitat surveys the presence of INNS on each river bank was one of the things to note. Himalayan Balsam is the main and only invasive species found during the 2017 surveys. Figure 38 shows the distribution of INNS within the River Derwent Catchment. 26 out of 136 sites (19%) had INNS present on the left river banks and 23 sites out of 136 sites (17%) had INNS present on the right river bank. Most of the INNS seen were located in the lower catchment.

### 3.8 Substrate

- 3.8.1 Another part of the habitat survey was the percentage of the different river substrates; the different categories used were bedrock, boulders, cobbles, gravel, sand and silt. Figure 39 shows the survey sites and a stacked bar chart for each site, which has bands that are proportional to the different percentages of the different substrates found at each site. Gravel is the substrate required for successful salmonid spawning and this is a bright green colour. Silt usually prevents successful salmonid reproduction, reducing the amount of oxygen in the bed of the river, this is represented on the charts by a blue colour. Bedrock is also not particularly good for fish as it has few places to hide and shelter and adult fish are less likely to spawn where lots of bedrock is present. Bedrock is represented in the charts by a red colour. The sites with lots of bedrock tend to be higher up the catchments in the headwaters.

Figure 35: Site habitat scores 2017.

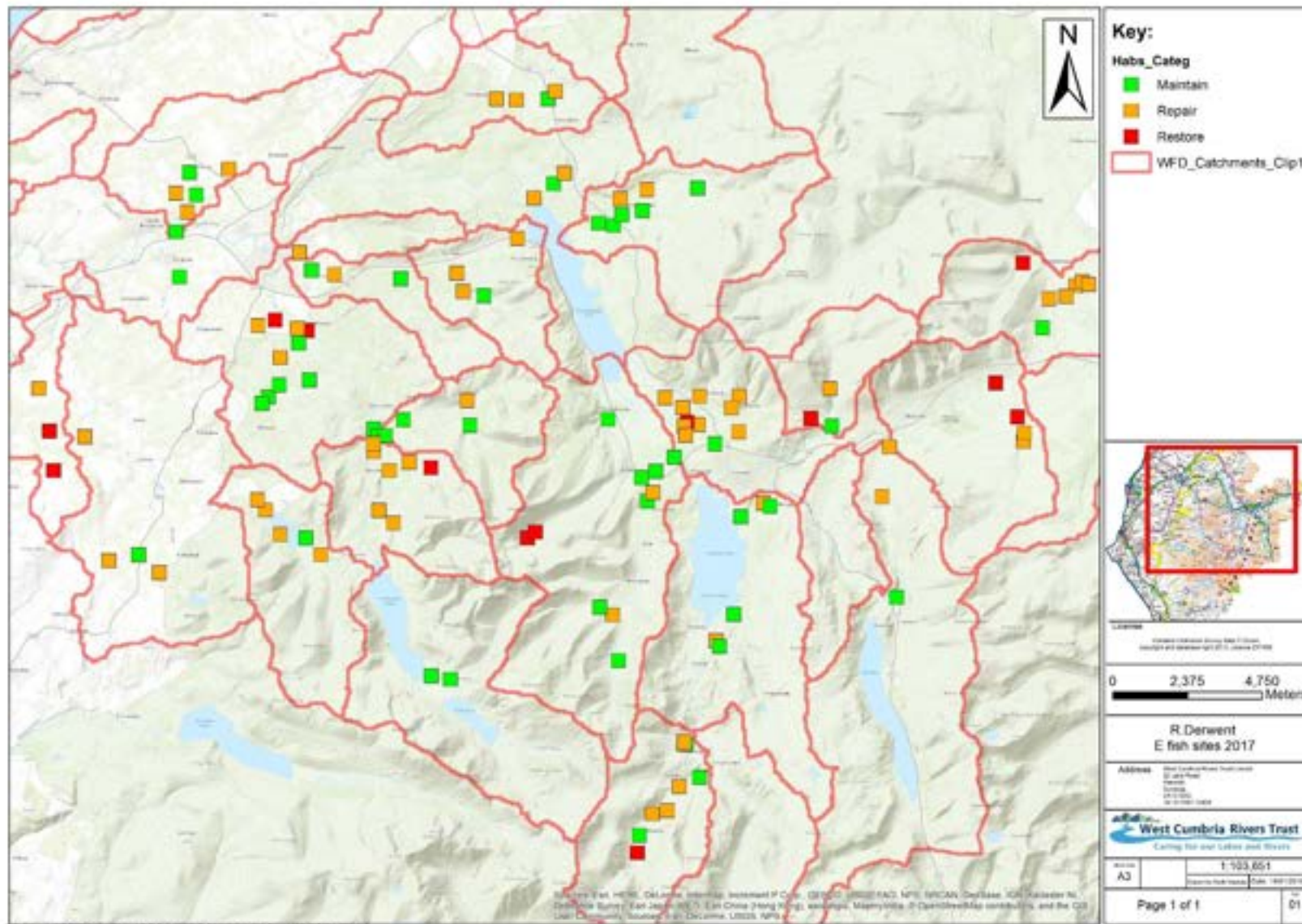


Figure 36: Tributary habitat scores 2017.

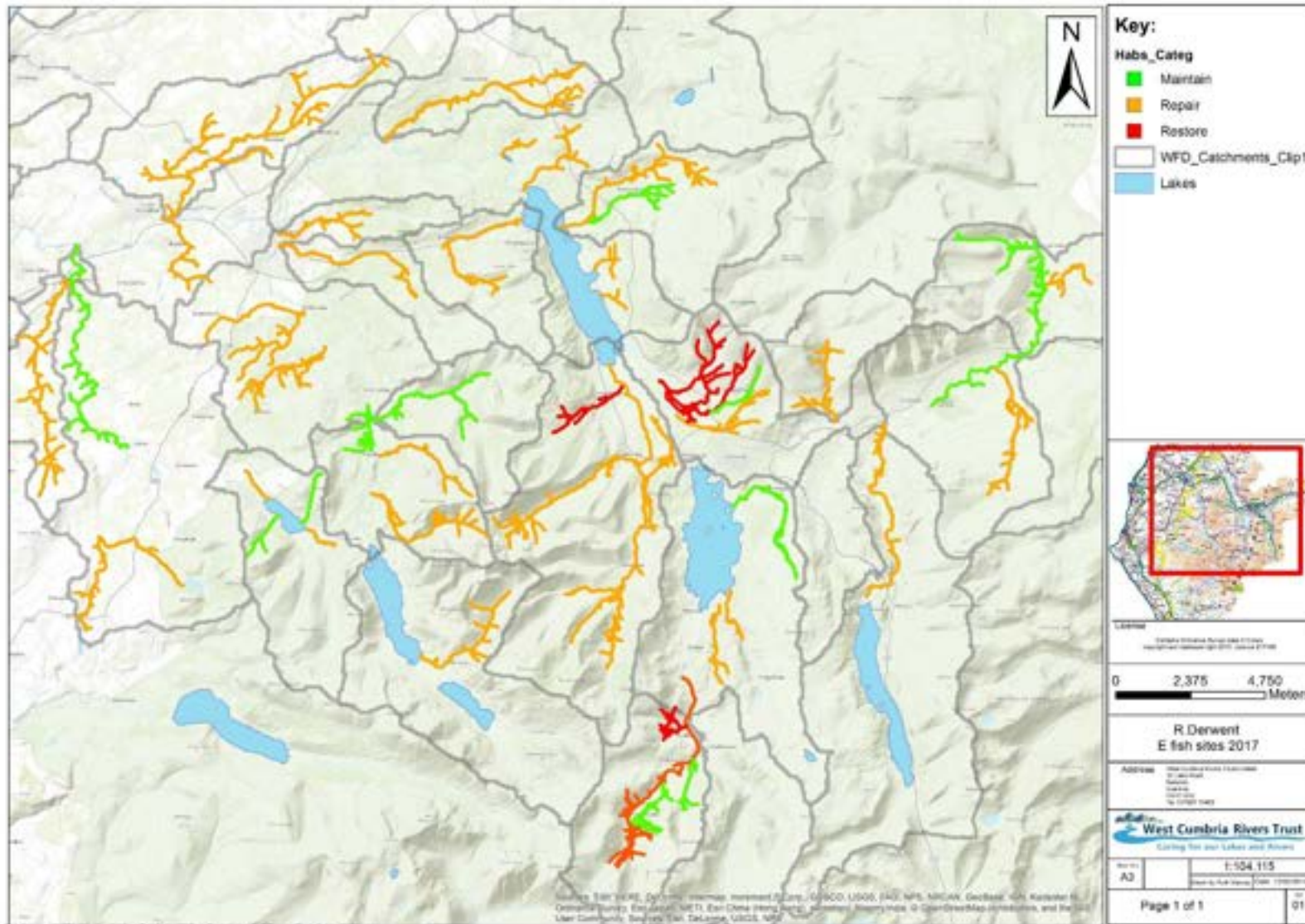
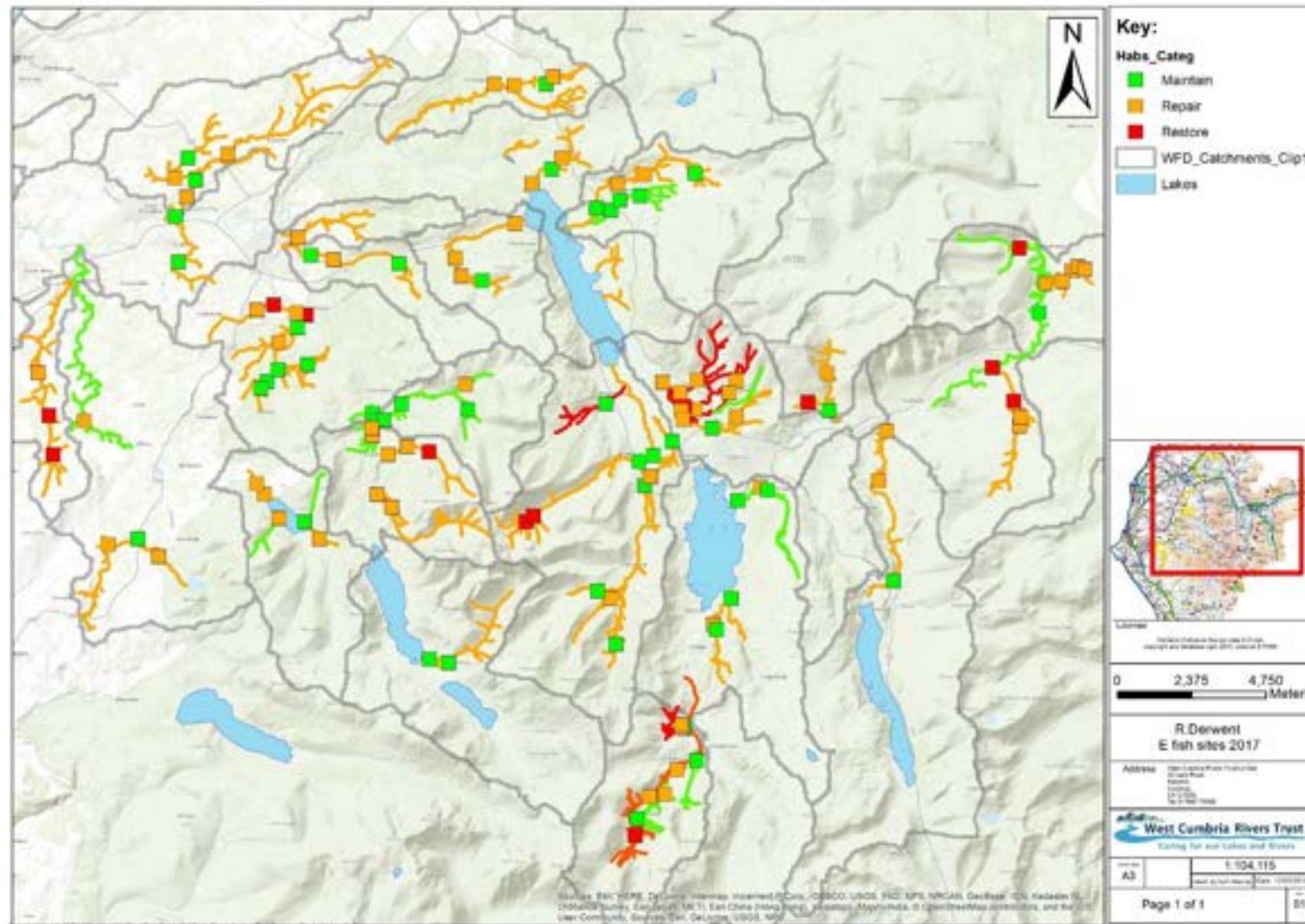


Figure 37: Combined site and tributary habitat scores for Derwent Catchment in 2017.



**Figure 38:** Presence and absence of INNS at survey sites.

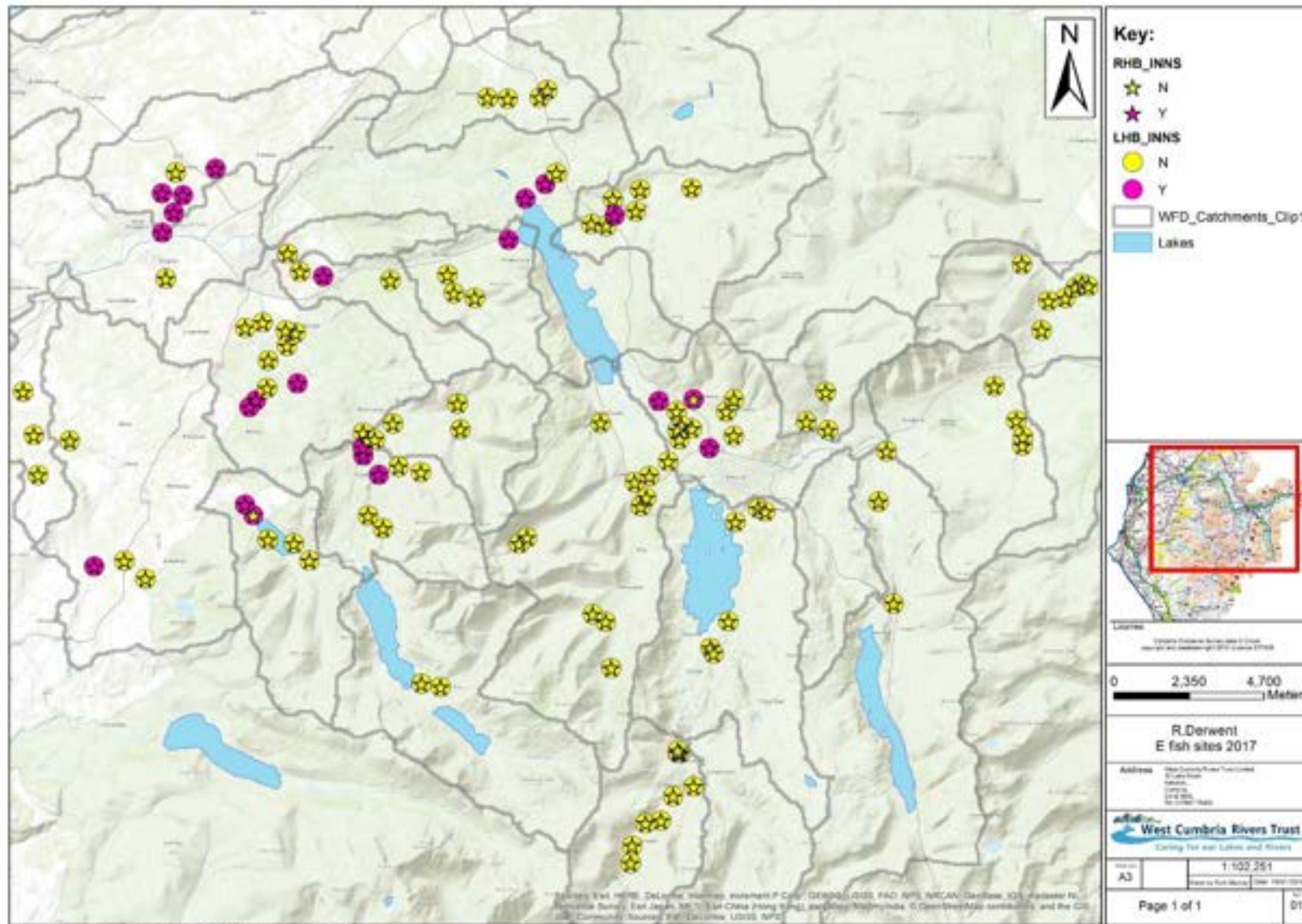
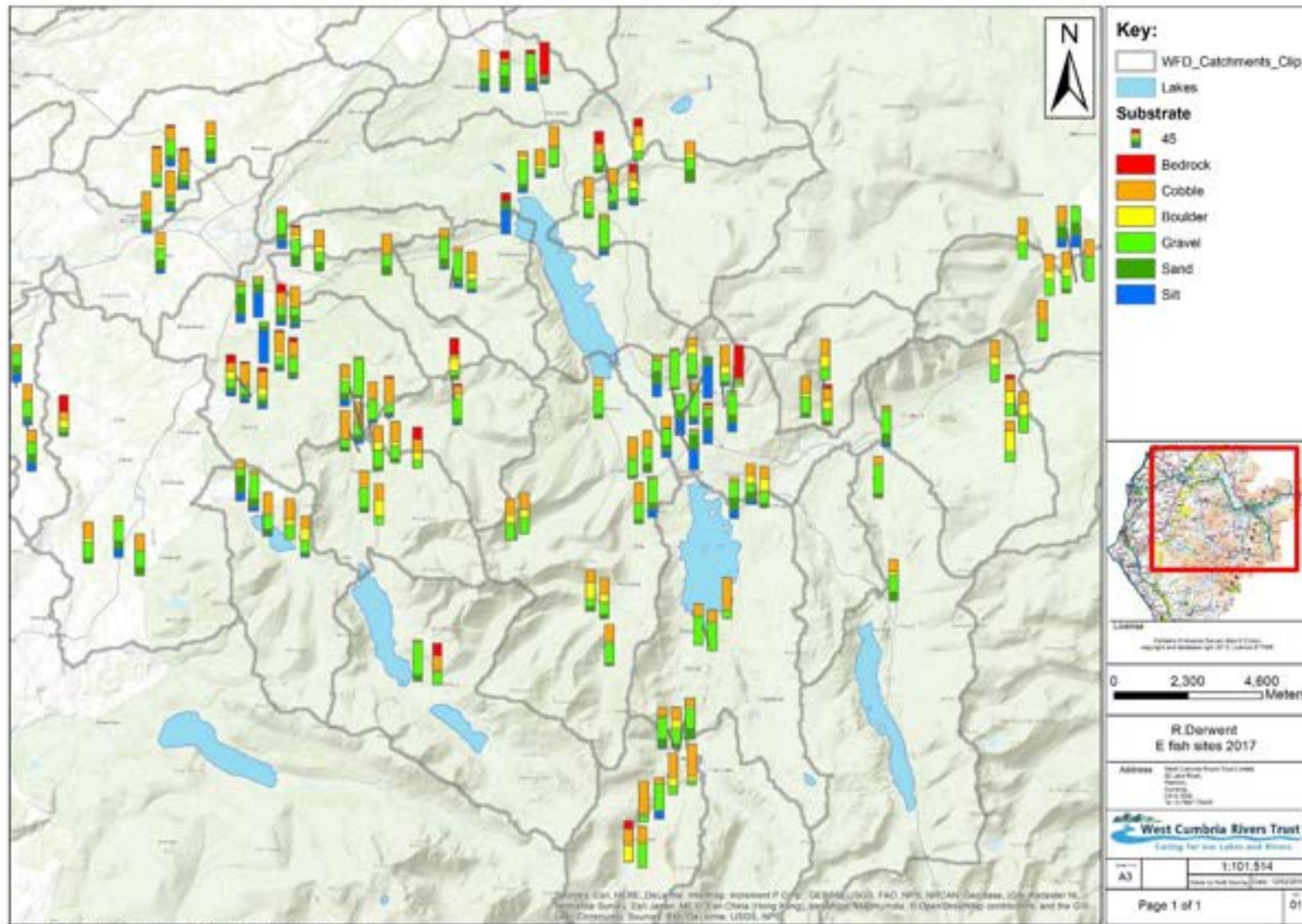


Figure 39: Percentage of Bedrock at each of the sites.



## 4 Summary

### 4.1 Findings from 2017 salmonid numbers

- 4.1.1 Post Storm Desmond, trout numbers in particular seem to be recovering well. Less salmon than trout were found and more sites had no or few salmon, but in several places such as Sandy Beck, St John's Beck and Whit Beck, salmon numbers were good.
- 4.1.2 This is the third year of surveying juvenile salmonids in the River Derwent catchment so whilst the results cannot yet be used to detect trends, a database is being built using the results and minor comparisons between the years have been made. It is obvious that Storm Desmond affected fry numbers in 2016.
- 4.1.3 Following the calibration of WCRT surveys with those of the EA in 2016, the results produced from the River Derwent can be compared to those in the rest of England and Wales which have also used the NFCS. In proceeding years this will enable general trends in salmonid populations to be understood from a country wide perspective rather than just comparisons within the catchment.
- 4.1.4 Whilst these surveys are primarily to determine juvenile salmonid populations it is important not to ignore other fish species present in the surveys. Other species can be good indicators of potential problems in the river system which salmonids are more sensitive to. For example, some sites which had low or no salmonids present had large numbers of Stoneloach, this species is out competed by salmonids but feeds on similar food and requires gravel for spawning in a similar manner to salmonids, however it is more resilient to siltation than Salmon and Trout and so indicates that by reducing silt in these areas salmonids would benefit.

### 4.2 Findings from 2017 habitat surveys

- 4.2.1 With new sites added to the project and surveyed in 2017 a greater database of habitat conditions has been built. This database will then be used to inform areas where habitat work would provide the greatest benefit for fish populations. Also considered in the tributary habitat scorings was the feasibility of doing the required habitat work, so that any potentially improvements undertaken have the best chance of being successful.
- 4.2.2 It was noted that sites with greater fish densities reflect the sections of river with good habitat.
- 4.2.3 In order to test the effectiveness of previous habitat work, and any undertaken as a result of these surveys, it is essential that any habitat work completed is recorded. To be most useful this data would include the exact location with a grid reference, GPS tagged photographs, a description of the work and when it was completed. This would enable the choosing of future survey sites to incorporate known habitat work and to build up a database of the most effective techniques employed and the timescales required for habitat work to be effective. Other sites without habitat improvements would still have to be surveyed in order to provide a contrast to those where work has been completed. Some of the new sites added in 2017 were based on the knowledge that habitat improvement works have either been undertaken there or are proposed to occur soon. Gathering data in these areas is vital to prove that these techniques work, although the impact of the works may take a few years to effect fish numbers and densities, depending on the techniques used.



## 5 Acknowledgements

5.1.1 There are many organisations and individuals who have contributed to make this project, not only work but to become a success. Without all those mentioned below, this project would not be possible and WCRT is extremely grateful to all those who helped in a variety of different ways including;

- Approximately 100 landowners and tenants who gave permission to access the river from their land, encouraged us to do so and showed great interest in the results.
- Financial contributions from the Rivers Corridor Group, the Derwent Owners Association, Keswick Anglers, Cockermouth Anglers, United Utilities, Lord and Lady Egremont and Bowland Game Fishing.
- The many dedicated volunteers who helped undertake the surveys throughout the summer. We had 39 different volunteers in total from students, professionals to anglers and members of Bassenthwaite Rotary Club. They dedicated over 650 volunteer hours to make this project happen.
- United Utilities for the WCRT truck which greatly helped and improved the logistics of conducting surveys like this.
- Advice from other Rivers Trusts, especially Ribble Rivers Trust, the EA and Scotland's Rural College.

## 6 References

Scottish Fisheries Co-ordination Centre, 2007. Electrofishing Team Leader Training Manual. Fisheries Management SVQ Level 3. Manage Electrofishing Operations. Inverness College.

## 7 Appendix 1: Table of fish data for each of the WCRT 2017 sites.

Date	Tributary	Grid Reference	Trout Fry	Trout Parr	Trout Fry NFCS	Salmon Fry	Salmon Parr	Salmon Fry NFCS	Eels	Lamprey	Stone loach	Minnow	Stickle back
11/07/17	Little Sandy Beck	NY 13009 28142	5	0	E	0	0	F	1	6	20	>100	1
11/07/17	Little Sandy Beck	NY 12737 27744	11	0	D	0	0	F	0	0	5	5	0
11/07/17	Sandy Beck	NY 13066 26563	50	0	A	13	3	D	0	0	0	0	0
12/07/17	Sandy Beck	NY 11764 26032	45	2	A	4	0	E	0	0	0	0	1
12/07/17	Mosser Beck	NY 11562 25817	8	4	D	0	0	F	0	0	0	0	0
12/07/17	Sandy Beck	NY 12111 26411	59	1	A	4	0	E	1	0	0	0	0
12/07/17	Little Sandy Beck	NY 12149 27282	9	0	D	1	0	E	1	0	9	0	0
12/07/17	Paddle Beck	NY 12690 28220	5	0	E	2	0	E	0	0	25	7	0
14/07/17	Broughton Beck	NY 08835 31285	0	0	F	6	0	E	1	2	75	0	0
14/07/17	Broughton Beck	NY 09477 32449	2	1	E	7	4	D	3	3	13	>100	0
14/07/17	Broughton Beck	NY 09191 31901	2	0	E	9	0	D	2	2	70	>100	0

Date	Tributary	Grid Reference	Trout Fry	Trout Parr	Trout Fry NFCS	Salmon Fry	Salmon Parr	Salmon Fry NFCS	Eels	Lamprey	Stone loach	Minnow	Stickle back
18/07/17	Whit Beck	NY 15122 25021	17	0	C	53	0	A	0	1	0	0	0
18/07/17	Whit Beck	NY 15254 24787	41	1	A	28	1	A	1	2	3	30	11
18/07/17	Whit Beck	NY 15482 24805	36	0	A	66	0	A	1	0	2	0	1
20/07/17	Meregill Beck	NY 15126 24305	51	0	A	0	0	F	0	0	0	0	1
20/07/17	Meregill Beck	NY 15104 24551	44	1	A	4	0	E	0	0	0	0	1
20/07/17	Whit Beck	NY 18078 25919	7	0	D	0	0	F	1	0	0	0	0
20/07/17	Whit Beck	NY 18166 25125	9	3	D	0	0	F	0	0	0	0	0
21/07/17	Whit Beck	NY 16050 25311	81	0	A	17	8	C	0	0	0	0	0
21/07/17	Paddle Beck	NY 11432 28306	0	0	F	0	0	F	1	0	0	0	0
21/07/17	Paddle Beck	NY 11978 28470	1	0	E	0	0	F	0	0	2	0	0
02/08/17	Blumer Beck	NY 19645 35471	25	0	B	0	0	F	0	1	1	0	0
02/08/17	Blumer Beck	NY 20650 35506	0	1	F	0	0	F	0	0	0	0	0

Date	Tributary	Grid Reference	Trout Fry	Trout Parr	Trout Fry NFCS	Salmon Fry	Salmon Parr	Salmon Fry NFCS	Eels	Lamprey	Stone loach	Minnow	Stickle back
02/08/17	Blumer Beck	NY 20882 35739	0	1	F	0	0	F	0	0	0	0	0
02/08/17	Blumer Beck	NY 19012 35497	43	2	A	8	0	D	0	0	3	0	0
04/08/17	Carr Beck	NY 08827 32511	1	0	E	0	0	F	3	0	40	30	3
04/08/17	Dovenby Beck	NY 09255 33163	0	0	F	0	0	F	0	0	5	0	10
04/08/17	Brides Beck	NY 10507 33279	11	0	D	0	0	F	0	0	5	0	3
04/08/17	Bitter Beck	NY 12752 30616	54	2	A	0	0	F	1	0	15	2	10
08/08/17	Coal Beck	NY 20829 32804	32	2	A	2	1	E	0	0	2	0	0
08/08/17	Coal Beck	NY 21172 33141	49	1	A	0	0	F	0	0	13	0	0
08/08/17	Coal Beck	NY 20205 32346	41	1	A	9	0	D	1	0	4	2	0
08/08/17	Wythop Beck	NY 19676 31061	0	3	F	0	0	F	1	0	0	7	0
09/08/17	Wythop Beck	NY 18620 29240	29	4	A	0	0	F	0	0	0	0	0
09/08/17	Wythop Beck	NY 17956 29388	14	2	C	0	0	F	0	0	0	0	0

Date	Tributary	Grid Reference	Trout Fry	Trout Parr	Trout Fry NFCS	Salmon Fry	Salmon Parr	Salmon Fry NFCS	Eels	Lamprey	Stone loach	Minnow	Stickle back
09/08/17	Wythop Beck	NY 17760 29964	40	0	A	0	1	F	1	0	0	0	0
09/08/17	Eller Beck	NY 08944 29841	0	0	F	0	0	F	3	0	0	0	24
14/08/17	Millbeck	NY 24372 26005	4	2	E	1	0	E	0	0	1	7	1
14/08/17	Millbeck	NY 24929 25688	8	0	D	1	0	E	0	0	0	0	0
14/08/17	Millbeck	NY 25465 26060	13	0	D	0	0	F	0	0	0	0	0
15/08/17	Applethwaite Gill	NY 26727 26059	0	0	F	0	0	F	0	0	0	0	0
15/08/17	Applethwaite Gill	NY 26491 25677	12	1	D	0	0	F	0	0	0	0	0
15/08/17	Applethwaite Gill	NY 25417 25141	37	1	A	1	0	E	2	0	0	0	0
15/08/17	Drainage ditch (Wath Beck)	NY 25080 25235	2	0	E	1	0	E	2	4	0	3	19
16/08/17	Hope Beck	NY 15608 23701	22	0	B	3	0	E	1	0	1	0	0
16/08/17	Tom Rudd Beck	NY 15976 29789	16	2	C	0	0	F	0	0	10	0	0
16/08/17	Tom Rudd Beck	NY 13872 29910	14	1	C	0	0	F	5	0	20	57	7

Date	Tributary	Grid Reference	Trout Fry	Trout Parr	Trout Fry NFCS	Salmon Fry	Salmon Parr	Salmon Fry NFCS	Eels	Lamprey	Stone loach	Minnow	Stickle back
16/08/17	Tom Rudd Beck	NY 13143 30060	9	0	D	0	0	F	3	0	10	31	1
21/08/17	Wath Beck	NY 24968 25097	4	0	E	1	0	E	0	0	0	9	12
21/08/17	Liza Beck	NY 15738 22026	5	2	E	0	0	F	0	0	0	0	0
21/08/17	Liza Beck	NY 15270 22420	13	0	D	38	1	A	0	0	0	0	0
21/08/17	Hope Beck	NY 16238 23954	84	1	A	1	0	E	0	0	0	0	0
22/08/17	Dash Beck	NY 23795 32624	21	0	B	0	0	F	1	0	0	0	0
22/08/17	Chapel Beck	NY 22731 31487	55	0	A	0	0	F	0	0	0	0	0
22/08/17	Hope Beck	NY 16929 23783	13	1	D	0	0	F	0	0	0	0	0
23/08/17	Lair Beck	NY 26719 24913	0	0	F	0	0	F	0	0	0	0	0
23/08/17	Lair Beck	NY 25958 24540	28	3	A	0	0	F	0	0	0	16	0
23/08/17	Lair Beck	NY 25023 24811	8	0	D	0	0	F	0	5	5	4	0
23/08/17	Coledale Beck	NY 20007 21553	0	0	F	0	0	F	0	0	0	0	0

Date	Tributary	Grid Reference	Trout Fry	Trout Parr	Trout Fry NFCS	Salmon Fry	Salmon Parr	Salmon Fry NFCS	Eels	Lamprey	Stone loach	Minnow	Stickle back
23/08/17	Coledale Beck	NY 20249 21741	4	2	E	0	0	F	0	0	0	0	0
24/08/17	Glenderamackin	NY 36358 28226	1	0	E	12	0	D	0	0	12	0	0
24/08/17	Glenderaterra	NY 29608 26293	23	2	B	0	0	F	0	0	0	0	0
24/08/17	Glenderaterra	NY 29000 25359	8	0	D	0	0	F	0	0	0	0	0
24/08/17	Glenderaterra	NY 29671 25108	19	1	C	5	1	E	0	0	0	0	0
25/08/17	Dash Beck	NY 25406 32670	17	3	C	0	0	F	0	0	0	0	0
25/08/17	Dash Beck	NY 22942 32322	14	0	C	6	1	E	0	0	0	0	0
25/08/17	Dash Beck	NY 22258 31552	11	0	D	5	0	E	1	0	0	0	0
25/08/17	Chapel Beck	NY 23001 31816	18	0	C	8	0	D	2	0	0	0	0
25/08/17	Chapel Beck	NY 23653 31952	14	0	C	1	0	E	0	0	0	0	0
28/08/17	Millbeck Buttermere	NY 17544 17061	9	4	D	0	0	F	0	0	0	0	0
28/08/17	Millbeck Buttermere	NY 16942 17169	23	3	B	0	0	F	0	0	0	50	0

Date	Tributary	Grid Reference	Trout Fry	Trout Parr	Trout Fry NFCS	Salmon Fry	Salmon Parr	Salmon Fry NFCS	Eels	Lamprey	Stone loach	Minnow	Stickle back
29/08/17	Loweswater	NY 13436 21018	2	1	E	0	0	F	6	0	0	0	0
29/08/17	Loweswater	NY 12142 21672	5	0	E	0	0	F	0	0	0	0	0
29/08/17	Loweswater	NY 12956 21556	7	3	D	1	0	E	0	0	0	0	0
29/08/17	Loweswater	NY 11682 22444	0	2	F	0	0	F	0	0	1	6	0
29/08/17	Loweswater	NY 11422 22768	0	1	F	0	0	F	0	0	0	25	0
30/08/17	Upper Newlands	NY 22889 17649	13	0	D	15	0	C	0	0	0	0	0
30/08/17	Scope Beck	NY 22709 19103	21	3	B	0	1	F	0	0	0	0	0
30/08/17	Keskadale Beck	NY 22307 19345	21	2	B	0	1	F	1	0	0	0	0
30/08/17	Middle Newlands	NY 23811 22717	14	0	C	0	1	F	0	0	1	0	0
31/08/17	Pow Beck	NY 23983 22989	9	0	D	0	0	F	0	0	0	0	0
31/08/17	Coledale Beck	NY 23623 23471	8	3	D	0	0	F	0	0	0	0	0
31/08/17	Newlands Beck	NY 24079 23665	0	0	F	1	0	E	0	0	1	0	0



Date	Tributary	Grid Reference	Trout Fry	Trout Parr	Trout Fry NFCS	Salmon Fry	Salmon Parr	Salmon Fry NFCS	Eels	Lamprey	Stone loach	Minnow	Stickle back
31/08/17	Pow Beck	NY 24667 24119	3	0	E	0	0	F	0	24	0	0	19
31/08/17	Chapel Beck (Thornthwaite)	NY 22559 25324	3	2	E	0	0	F	1	0	0	0	0
01/09/17	Glenderamackin	NY 35744 30286	13	2	D	0	0	F	0	0	0	0	0
01/09/17	Barrow Beck	NY 37422 29566	3	2	E	0	0	F	0	0	7	75	10
01/09/17	Barrow Beck	NY 37620 29700	0	3	F	0	0	F	0	0	1	>1000	2
01/09/17	Naddles Beck	NY 37824 29602	6	0	E	0	0	F	0	0	3	4	3
01/09/17	Barrow Beck	NY 37108 29226	2	1	E	1	0	E	2	0	19	54	13
01/09/17	Glenderamackin	NY 36574 29146	10	2	D	2	2	E	0	0	5	0	0
06/09/17	Tongue Gill	NY 25052 14991	10	2	D	0	0	F	0	0	0	3	0
06/09/17	Tongue Gill	NY 24973 14997	19	0	C	0	1	F	0	0	0	0	0
06/09/17	Tongue Gill	NY 24976 15074	16	2	C	0	0	F	0	0	0	0	0
06/09/17	Brockle Beck	NY 26777 22225	0	0	F	0	0	F	0	0	>100	>100	0

Date	Tributary	Grid Reference	Trout Fry	Trout Parr	Trout Fry NFCS	Salmon Fry	Salmon Parr	Salmon Fry NFCS	Eels	Lamprey	Stone loach	Minnow	Stickle back
06/09/17	Brockle Beck	NY 27491 22652	3	1	E	0	2	F	0	0	13	0	0
07/09/17	St John's Beck	NY 31506 24444	19	1	C	35	3	A	0	0	1	2	8
07/09/17	St John's Beck	NY 31261 22864	11	1	D	47	3	A	0	0	0	2	1
07/09/17	St John's Beck	NY 31726 19669	20	2	B	103	13	A	0	0	8	0	0
08/09/17	Brockle Beck	NY 27713 22557	3	2	E	0	0	F	0	0	0	0	0
20/09/17	Black Sike	NY 23546 12096	5	0	E	0	0	F	0	0	0	0	0
20/09/17	Derwent	NY 23492 11551	1	3	E	1	3	E	0	0	0	0	0
20/09/17	Derwent	NY 23959 12790	1	0	E	1	2	E	0	0	0	0	0
20/09/17	Derwent	NY 24822 13644	4	0	E	0	0	F	0	0	0	0	0
26/09/17	Black Syke	NY 24447 12882	21	4	B	0	3	F	0	0	0	0	0
26/09/17	Combe Beck	NY 25462 13945	33	2	A	2	4	E	2	0	0	0	0
26/09/17	Comb Gill	NY 25992 18288	3	1	E	2	4	E	0	0	>50	>50	0

Date	Tributary	Grid Reference	Trout Fry	Trout Parr	Trout Fry NFCS	Salmon Fry	Salmon Parr	Salmon Fry NFCS	Eels	Lamprey	Stone loach	Minnow	Stickle back
26/09/17	Comb Gill	NY 26093 18108	3	3	E	17	0	C	0	0	1	1	0
26/09/17	Watendlath Beck	NY 26555 19114	0	0	F	3	3	E	0	0	16	0	0
29/09/17	Glenderamackin	NY 34876 26475	2	1	E	7	0	D	0	0	>100	0	0
29/09/17	Mosedale Beck	NY 35568 25402	6	1	E	0	1	F	0	0	0	0	0
29/09/17	Mosedale Beck	NY 35762 24622	2	2	E	0	0	F	0	0	0	0	0
29/09/17	Mosedale Beck	NY 35783 24894	1	6	E	0	0	F	0	0	0	0	0
09/10/17	R.Marron	NY 05936 24771	11	0	D	18	1	C	4	0	3	0	0
09/10/17	Lostrigg	NY 04473 26304	0	1	F	0	1	F	0	0	12	24	2
09/10/17	Lostrigg	NY 04812 24946	2	1	E	1	0	E	0	0	25	6	0
09/10/17	Lostrigg	NY 04943 23694	5	1	E	0	0	F	0	0	27	>100	0
10/10/17	Wood Beck	NY 07645 21011	11	3	D	0	0	F	0	0	0	0	0
10/10/17	Wood Beck	NY 08304 20448	18	5	C	0	0	F	1	0	0	0	0

Date	Tributary	Grid Reference	Trout Fry	Trout Parr	Trout Fry NFCS	Salmon Fry	Salmon Parr	Salmon Fry NFCS	Eels	Lamprey	Stone loach	Minnow	Stickle back
10/10/17	Wood Beck	NY 06700 20838	20	1	B	23	2	B	0	0	0	0	0

## 8 Appendix 2: Table of habitat data for each of the 2017 sites

Please note that due to changes in site locations and number of site surveyed, some of the tributary scores (averages) have changed compared to last year.

Date	Tributary	No of sites and fish rescues	Range of habitat scores	Site habitat categories	Tributary habitat category	Comments / notes
11 <sup>th</sup> -12 <sup>th</sup> July 2017	Little Sandy Beck	3 sites	30 – 71	1 x Restore, 1 x Repair, 1 x Maintain	<b>Repair</b>	Middle reach - recent work to improve habitat, yet to take effect. Lower reaches suffer from high flows in Cocker (sediment drop out). Upper reach near farm modified, lots of silt and potential pollution from farm runoff.
11 <sup>th</sup> -12 <sup>th</sup> July 2017	Sandy Beck	4 sites	66 – 109	4 x Maintain	<b>Repair</b>	Good fish numbers despite being raised, straightened, not in its original course. Needs some tree management to allow day light in. Some work has already been done just above the confluence but more is needed further upstream, possible river restoration project. Himalayan Balsam is a big issue.
12 <sup>th</sup> -21 <sup>st</sup> July 2017	Paddle Beck	3 sites	39 – 62	2 x Repair, 1 x Restore	<b>Repair</b>	Very shallow beck, potential pollution issues, bit by the school, very overgrown, lots of weeds, silt and difficult to fish.
14 <sup>th</sup> July – 4 <sup>th</sup> August 2017	Broughton Beck (includes Dovenby Beck)	5 sites	40 – 91	3 x Maintain, 2 x Repair	<b>Repair</b>	Needs fencing, big silt issues, intermittent pollution from farms. Carr Beck very little flow and has barrier to fish where embankments have fallen in. Dovenby Beck needs tree management to allow daylight in. Himalayan Balsam issues.
1 <sup>st</sup> -30 <sup>th</sup> August 2017	Brides Beck	1 site 4 fish rescues	19 – 59	4 x Repair, 1 x Restore	<b>Repair</b>	Needs fencing and has historic dredging. UU pipeline crossing this beck in several places, potential silt & sediments inputs and pollution issues. Himalayan Balsam an issue.
18 <sup>th</sup> -21 <sup>st</sup> July 2017	Whit Beck (includes Blaze Beck)	6 sites	55 – 118	5 x Maintain, 1 x Repair	<b>Maintain</b>	Loads of fish both salmon and trout, river restoration sites doing really well. Upper reaches predominantly trout as more upland habitat.
20 <sup>th</sup> July 2017	Meregill Beck	2 sites	57 – 63	2 x Repair	<b>Maintain</b>	Gravels have recently been placed in beck at several locations, it has also recently been fenced off, its taking a while to recover but the effects of this work should improve both habitat and fish numbers in the next few years. Big Himalayan Balsam issues.
2 <sup>nd</sup> August 2017 and 3 <sup>rd</sup> October 2017	Blumer Beck	4 sites 1 fish rescue	41 – 73	4 x Repair, 1 x Maintain	<b>Repair</b>	Most sites in upper reaches, so look at site selection next year. But possible blockage/ barrier to fish under A591. Potential for fencing projects, gravel movement and tree planting.

Date	Tributary	No of sites and fish rescues	Range of habitat scores	Site habitat categories	Tributary habitat category	Comments / notes
4 <sup>th</sup> August 2017	Bitter Beck	1 site	60	1 x Repair	Repair	Upstream needs tree management to allow light in, stock proofing, and the fish easement needs maintenance, lower reaches heavily modified and culverted as heads into town.
8 <sup>th</sup> August 2017 and 10 <sup>th</sup> -18 <sup>th</sup> October 2017	Coal Beck	3 sites 2 fish rescue	49 – 73	2 x Maintain, 3 x Repair	Repair	Dense trees and therefore needs tree maintenance to allow light in, big balsalm issue, and lots of silt, heavily modified in places, especially in caravan parks. Himalayan Balsam issues.
8 <sup>th</sup> -9 <sup>th</sup> August 2017	Wythop Beck	4 sites	44 – 78	3 x Repair, 1 x Maintain	Repair	Full of silt in lower reaches and Himalayan Balsam an issue at Dubwath. Potential river restoration project in middle reaches. Modified through village. Needs an additional site near to Embleton near to A66.
9 <sup>th</sup> August 2017	Eller Beck	1 site	83	1 x Maintain	Repair	Pollution incident, no fish, dries up in lower reaches below fish farm due to limestone. Otherwise good habitat where surveyed. Upstream habitat unknown.
8 <sup>th</sup> -14 <sup>th</sup> August 2017 and 10 <sup>th</sup> October 2017	Millbeck	3 sites 1 fish rescue (x2 times)	30 – 52	2 x Restore, 3 x Repair	Restore	Very similar to Applethwaite Gill, steep in top part of catchment, heavily modified in village and below, historically dredged, Himalayan Balsam present. Proposed river restoration project in scoping phase.
11 <sup>th</sup> -15 <sup>th</sup> August 2017	Applethwaite Gill	3 sites 1 fish rescue	54 - 64	4 x Repair	Restore	Really steep at top of catchment, barrier to fish at top end of village, through village and below all heavily modified and historically dredged. In places it has been known to dry up. Proposed river restoration project in scoping phase.
15 <sup>th</sup> August 2017	Burr Gill	1 fish rescue	101	1 x Maintain	Maintain	Good nursery for fish. Decent habitat and gravels.
15 <sup>th</sup> -21 <sup>st</sup> August 2017	Wath Beck	2 sites	34 – 47	1 x Restore, 1 x Repair	Restore	Almost sow/ ditch like in character, very deep and full of silt. Heavily dredged, heavily poached.
16 <sup>th</sup> August 2017	Tom Rudd Beck	3 sites	43 – 81	2 x Maintain, 1 x Repair	Repair	Needs fencing and suspected pollution from farms and construction site. Issues at confluence for fish access. Some Himalayan Balsam.

Date	Tributary	No of sites and fish rescues	Range of habitat scores	Site habitat categories	Tributary habitat category	Comments / notes
16 <sup>th</sup> -22 <sup>nd</sup> August 2017	Hope Beck	3 sites	39 – 59	2 x Repair, 1 x Restore	<b>Repair</b>	Straightened, periodically dredged, flood issues. Himalayan Balsam present.
21 <sup>st</sup> August 2017	Liza Beck	2 sites	49 – 50	2 x Repair	<b>Repair</b>	Barrier to fish, huge bedload for its size, very flashy system, flood issues.
22 <sup>nd</sup> -25 <sup>th</sup> August 2017	Dash Beck	4 sites	58 – 95	2 x Repair, 2 x Maintain	<b>Repair</b>	Some parts are over shaded, modified in lower reaches, some waterfalls, just about to stop abstraction on it when pipeline commissioned.
22 <sup>nd</sup> -25 <sup>th</sup> August 2017	Chapel Beck	3 sites	71 – 83	3 x Maintain	<b>Maintain</b>	Good habitat in middle reaches, upper reaches not surveyed this time, potential restoration site below road, between road and lake. Also needs an e fish site here next year.
23 <sup>rd</sup> August 2017 and 5 <sup>th</sup> October 2017	Lair Beck	3 sites 1 fish rescue	38 – 74	1 x Restore, 2 x Repair, 1 x Maintain	<b>Repair</b>	Manmade barrier at Burnside, road runoff, historical dredging, pollution incident above Burnside due forestry runoff.
23 <sup>rd</sup> -31 <sup>st</sup> August 2017	Coledale Beck	3 sites	31 – 66	2 x Restore, 1 x Maintain	<b>Repair</b>	Mine drain issues, but improving! Two impassable barriers to fish (one man made (gravel trap) other due to landslide), lots of landslips, seriously engineered through village and below. Upper end is improving, lower reaches can't improve much do a lot due to village and flood risk.
24 <sup>th</sup> August – 29 <sup>th</sup> September 2017	Glenderamackin	4 sites	33 – 66	2 x Restore, 1 x Repair, 1 x Maintain	<b>Maintain</b>	Geomorphological events (floods) are currently effecting spawning success. Otherwise good in river habitat, and lots of sections with good marginal habitat. Upper reaches maybe need some tree cover.
24 <sup>th</sup> August 2017	Glenderaterra	3 sites	38 – 68	1 x Maintain, 1 x Repair, 1 x Restore	<b>Repair</b>	Flood issues affecting spawning success, mine drainage, lower reaches need tree management to allow light in, upper reaches need more trees to provide cover.
28 <sup>th</sup> August 2017	Millbeck (Buttermere)	2 sites	67 – 76	2 x Maintain	<b>Repair</b>	Not in its original course, needs fencing and tree planting in places. Upper reaches rockier with less vegetation.

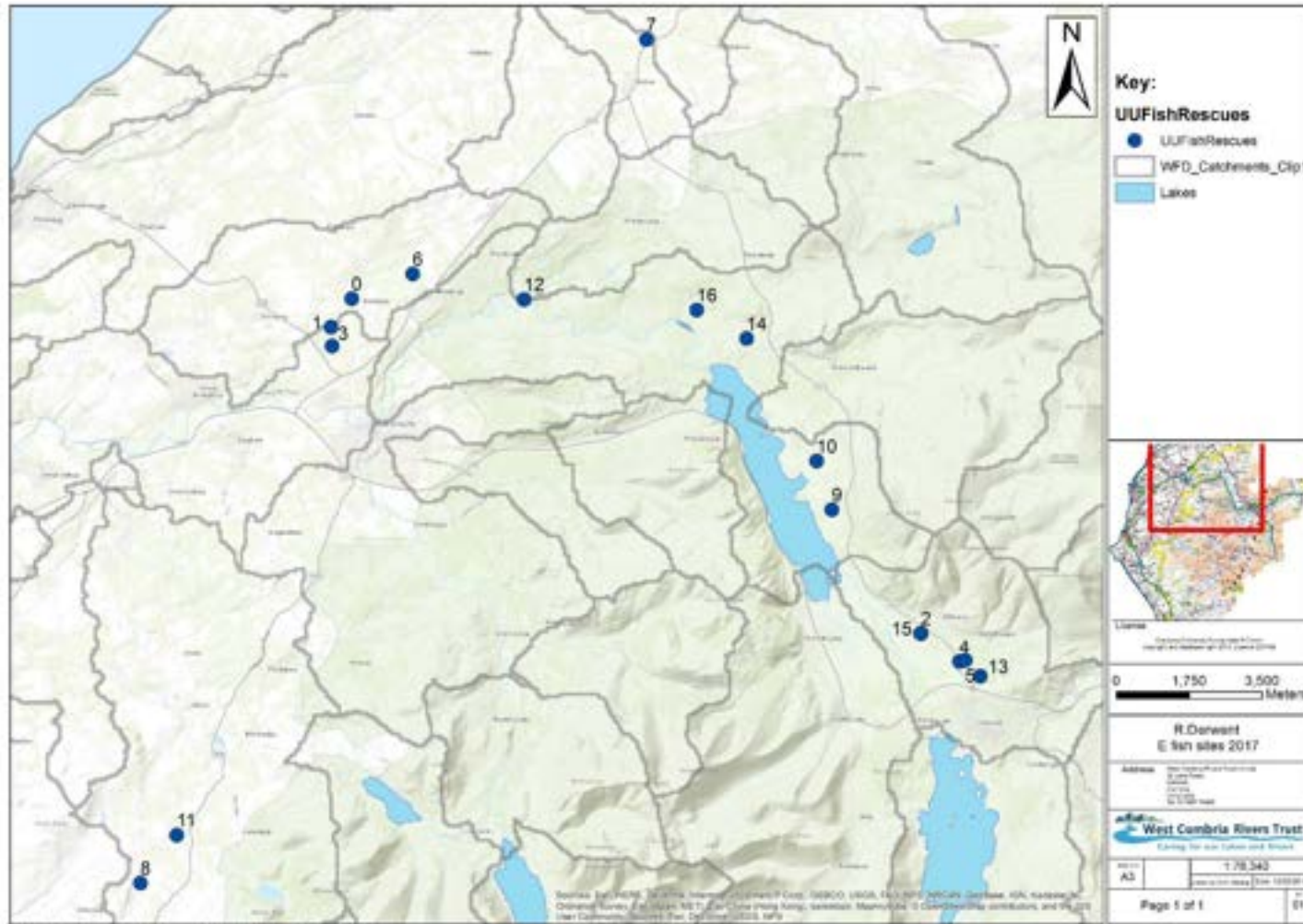
Date	Tributary	No of sites and fish rescues	Range of habitat scores	Site habitat categories	Tributary habitat category	Comments / notes
29 <sup>th</sup> August 2017	Loweswater	5 sites	49 – 76	4 x Repair, 1 x Maintain	<b>Repair/ Maintain</b>	Dub Beck – Repair, historically dredged and potential farm pollution, it is starting to recover but areas that need fencing to reduce poaching. Himalayan Balsam an issue. Crab Tree Beck – Maintain, barrier to fish when it goes under road through culvert. Holme Dub Beck – Maintain – doing ok.
30 <sup>th</sup> -31 <sup>st</sup> August 2017	Newlands (includes Scope Beck and Keskadale Beck)	5 sites	61 – 90	4 x Maintain, 1 x Repair	<b>Repair</b>	Upper reaches need fencing, tree management and tree planting. Below Stair some parts need major restoration. Middle reaches very minimal instream habitat, very homogeneous and straight, with large embankments. Affected by mine waste.
31 <sup>st</sup> August 2017	Pow Beck	2 sites	60 – 79	1 x Maintain, 1 x Repair	<b>Repair</b>	Over widened due to Storm Desmond, railway embankments falling in, lots of silt, dredged historically. Some areas where fencing would be beneficial.
31 <sup>st</sup> August 2017	Chapel Beck (Thorntwaite)	1 site	75	1 x Maintain	<b>Restore</b>	Need fencing in places to keep stock out, very straight and raised due to dredging.
1 <sup>st</sup> September 2017	Barrow Beck	4 sites	43 - 50	4 x Repair	<b>Repair</b>	A lot of work recently taken place, which will eventually take effect, including placing gravels in beck.
6 <sup>th</sup> September 2017	Tongue Gill	3 sites	51 – 67	2 x Repair, 1 x Maintain	<b>Restore</b>	Not in original course, bottom section dries up, historically a great tributary for salmon. In need of dappled shade, so scope to do some tree planting. National Trust looking into doing some work on this beck.
6 <sup>th</sup> -8 <sup>th</sup> September 2017	Brockle Beck	3 sites	60 – 74	2 x Maintain, 1 x Repair	<b>Maintain</b>	Needs tree maintenance to allow light in, suspect intermittent farm effluent pollution. At time of survey bridge repairs were ongoing making river very brown and muddy.
7 <sup>th</sup> September 2017	St John's Beck	3 sites	44 – 79	2 x Repair, 1 x Maintain	<b>Repair</b>	Great numbers of fish due to good in river habitat and compensatory flows, but improvement to habitat could be made such as fencing, tree planting. Has been modified in places.
20 <sup>th</sup> -26 <sup>th</sup> September 2017	Black Syke	2 sites	63 – 75	1 x Repair, 1 x Maintain	<b>Maintain</b>	Lower reach was gravel starved, is it still? But starting to improve. Mostly all fenced and good habitat.
20 <sup>th</sup> September 2017	Upper Derwent	3 sites	37 – 61	2 x Repair, 1 x Restore	<b>Restore</b>	Sections dry up, as its raised and not in original channel for much of reach. Very little tree cover so potential for tree planting.



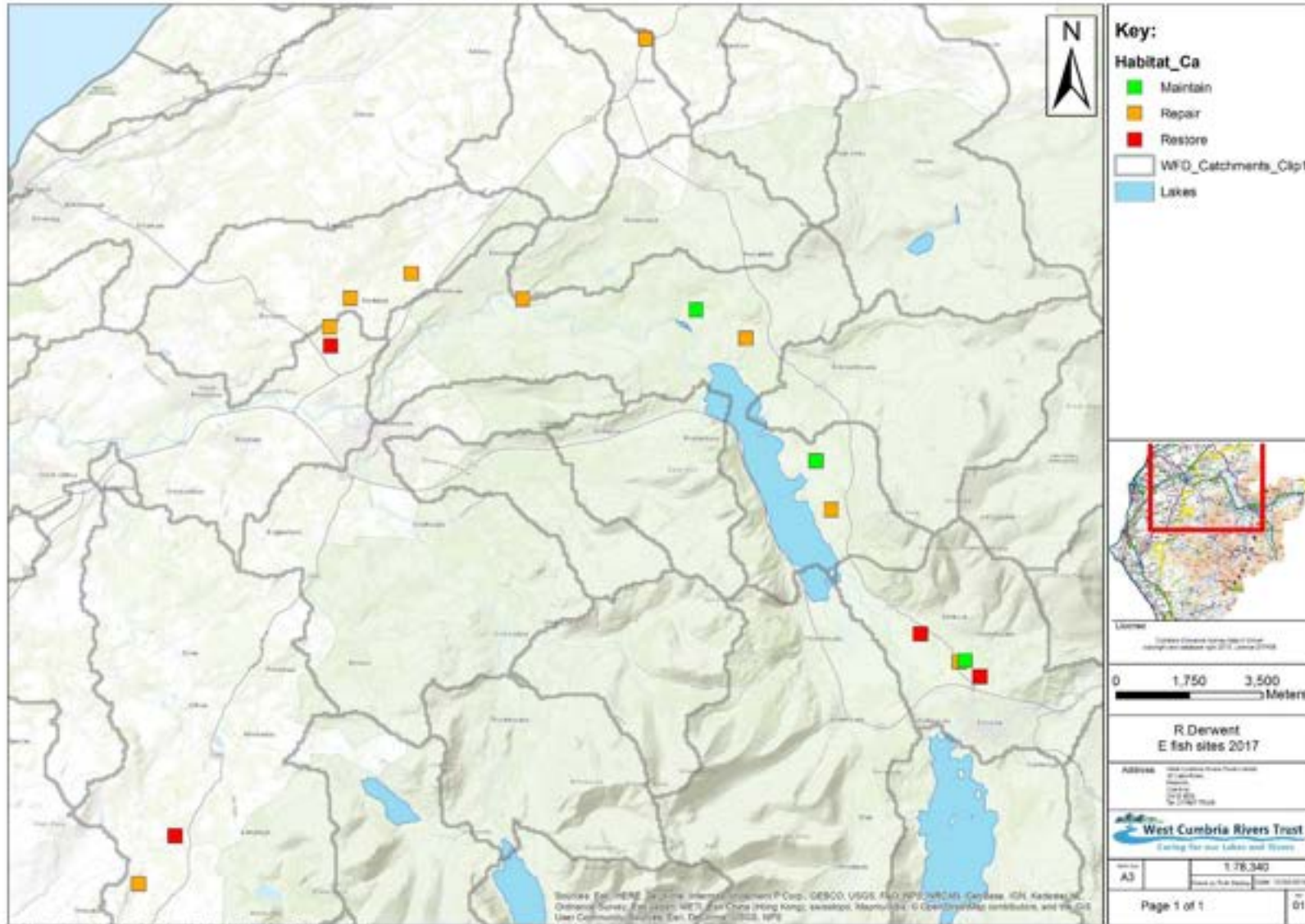
Date	Tributary	No of sites and fish rescues	Range of habitat scores	Site habitat categories	Tributary habitat category	Comments / notes
25 <sup>th</sup> September 2017	Collier Gate Beck	1 fish rescue	47	1 x Repair	<b>Repair</b>	Good for trout, up stream of manmade barrier, the site was located in a field with no fencing and no trees but in stream habitat good.
26 <sup>th</sup> September 2017	Combe Beck (Upper Derwent)	1 site	78	1 x Maintain	<b>Maintain</b>	Suffers from low flows, waterfall above site, historically dredged, and needs a bit more cover/ trees in lower reaches.
26 <sup>th</sup> September 2017	Comb Gill (Borrowdale Hotel)	2 sites	41 – 78	1 x Repair, 1 x Maintain	<b>Repair</b>	Historically dredged, but gravels are working way down system now.
26 <sup>th</sup> September 2017	Watendlath Beck	1 site	70	1 x Maintain	<b>Repair</b>	Lower reaches need fencing and tree management to allow sunlight in. Upper reaches need some tree planting to provide dappled shade.
29 <sup>th</sup> September 2017	Mosedale Beck	3 sites	37 – 48	2 x Repair, 1 x Restore	<b>Repair</b>	Needs fencing, tree management and tree planting in places. Flood damage so will take a while to recover.
3 <sup>rd</sup> -10 <sup>th</sup> October 2017	Wood Beck	3 sites 1 fish rescue	37 – 67	2 x Repair, 1 x Restore, 1 x Maintain	<b>Repair</b>	No fish access beyond Gatra Farm due to manmade barrier. Some fencing and tree planting needed.
9 <sup>th</sup> October 2017	R.Marron	1 sites	50	1 x Repair	<b>Maintain</b>	Only one site this year (more sites next year?), Himalayan Balsam and issue.
9 <sup>th</sup> October 2017	Lostrigg	3 sites	32 – 52	2 x Restore 1 x Repair	<b>Repair</b>	Intermittent farm pollution, needs fencing in places, good mix of substrates and habitat, should be better fish numbers than there are.
27 <sup>th</sup> September 2017	Unnamed trib at Scarness	1 fish rescue	71	Maintain	<b>Repair</b>	Sow/ Ditch – very silty, found 4 Pike.
25 <sup>th</sup> September 2017	Unnamed trib at Mirehouse	1 fish rescue	64	Repair	<b>Repair</b>	Surprising to find any fish as historically not had any, suspected acidic waters. Quite sandy and silty.

## 9 Appendix 3: Data from fish rescues conducted for United Utilities West Cumbria Supplies Project.

9.1 *Figure 40: Location map of sites* - The numbers on the diagram are the site ID numbers in Table 6 below.



9.2 Figure 41: Habitat scores for Fish Rescue Sites



9.3 Table 6: Fish Data for Fish Rescue Sites

ID No	Date	River	Grid Ref	5 min Survey Trout NFCS	5 min Survey Salmon NFCS	Total Trout in full Quantitative Survey	Total Salmon in full Quantitative Survey	Eels	Lamprey	Stone loach	Minnow	Stickle back	Pike	Habitat Category
0	01/08/17	Brides Beck	NY 11493 33774	E	F	25	0	1	0	3	12	3	0	Repair
1	03/08/17	Trib of Brides Beck	NY 10993 33091	F	F	0	0	0	0	0	0	0	0	Repair
2	08/08/17	Millbeck	NY 25138 25750	E	E	9	7	0	0	0	0	0	0	Restore
3	09/08/17	Unnamed Trib	NY 11025 32637	F	F	0	0	0	0	0	0	0	0	Restore
4	11/08/17	Applethwaite Gill	NY 26058 25076	E	F	1	0	0	0	0	0	0	0	Repair
5	15/08/17	Burr Gill	NY 26198 25112	C	F	63	0	0	0	0	0	0	0	Maintain
6	30/08/17	Brides Beck	NY 12950 34363	F	F	0	0	1	0	0	2	3	0	Repair
7	23/09/17	Eller Beck	NY 18552 39978	F	F	70	0	3	0	30	>200	0	0	Repair
8	25/09/17	Collier Gate Beck	NY 06431 19769	A	F	66	0	1	0	0	0	0	0	Repair
9	25/09/17	Unnamed Trib	NY 23001 28718	D	E	10	2	0	0	0	7	0	0	Repair
10	27/09/17	Scarness	NY 22638 29880	F	F	3	0	0	2	0	0	0	5	Maintain

ID No	Date	River	Grid Ref	5 min Survey Trout NFCS	5 min Survey Salmon NFCS	Total Trout in full Quantitative Survey	Total Salmon in full Quantitative Survey	Eels	Lamprey	Stone loach	Minnow	Stickle back	Pike	Habitat Category
11	03/10/17	Wood Beck	NY 07302 20917	A	F	90	0	3	2	0	0	0	0	Restore
12	03/10/17	Blumer Beck	NY 15623 33751	C	F	24	3	2	0	24	13	0	0	Repair
13	05/10/17	Gale Gill	NY 26558 24726	E	F	1	0	1	0	0	0	0	0	Restore
14	10/10/17	Coal Beck	NY 20957 32817	D	E	57	7	3	0	15	2	0	0	Repair
15	10/10/17	Millbeck	NY 25125 25752	E	E	13	8	0	0	0	0	0	0	Restore
16	18/10/17	Trib of Coal Beck	NY 19760 33501	C	F	22	0	0	0	1	1	0	0	Maintain