COASTWATCH AUTUMN 2017 SURVEY

All Ireland – Preliminary WATER RESULTS

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COASTWATCH AUTUMN 2017 SURVEY RESULTS

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Compiled from Coastwatch volunteer survey reports

Extra Research and mapping of Bannow Bay data in this Preliminary results by Antoine Warrant

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Results Part 1: Water Quality

Water quality and water pollution is covered in several sections of the annual Coastwatch survey. Question B2 is devoted to the character and quality parameters of 'Inflows' - that is fresh water streams, drains, pipes and seepage entering the sea. Question B3 asks those who know the area well about sewage pollution incidents. Question D3 includes green seaweed cover of the shore as a potential nutrient enrichment indicator and in question F4 surveyors indicate whether they see water pollution as a threat in that survey unit and if so, what type of pollution is present. Further information can be gathered from the comments section of the survey. In 2017 question 2 was changed with EPA sponsorship in order to gain more information (described in more detail in section 1 below).

The water quality and indicator results for 2017 are presented in the following order in this paper.

1. Inflows: a description of the fresh water entering the survey unit, a check for positive and negative signs and nitrate testing.
2 Sewage pollution incidents in the area. Background knowledge and opinion from those who know their area well.
3 Threat (risk) of sea water pollution.

1.1. INFLOWS

A note about the weather in 2017

Generally, in late summer and autumn 2017 rainfall levels were higher in the West and it was relatively dryer in the East. There can be a delayed impact on water quality after heavy rains, for example where slurry may be washed into the rivers. So nitrate tests results may be higher as a result.

1.1.1. Characterisation of inflows

During Autumn 2017, surveyors reported coming across 532 inflows in 530 survey units. After a very wet start in September in Donegal especially, the weather was drier than usual in October. The two successive storms (Ophelia and Brian) made a big difference to the mouth of streams in its path. This is being dealt with in more detail in the Storm and Climate Change chapter. The number of inflows – 1 per survey unit, is within the range reported in previous years.

Picture 1: Stream/river; Mick Berry

As shown in figure 1, most of the inflows reported are defined as rivers or streams (29.7%). The next most frequent category is pipe (28.2%). This refers also to streams culverted as they pass under a road next to a shore. Water seeping through a cliff, appearing as diffuse source in the splash zone or even in the intertidal area, made up 22.6% of inflows.

Surveyors were also asked to categorise their inflows as large, medium or small, as was typical for that inflow type.

Results show that the description 'small' was the most common size for all inflow types, followed by medium size (Figure 1 below).

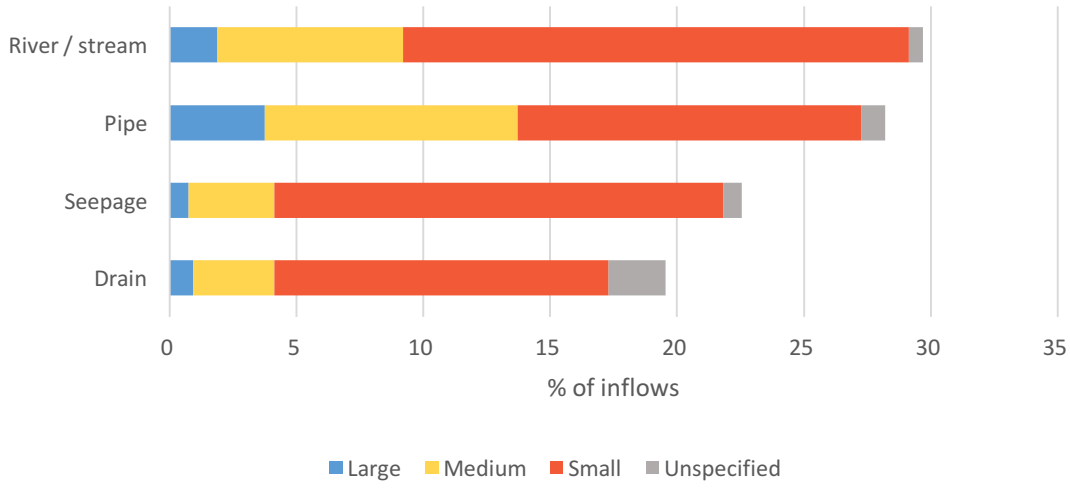

Figure 1 : Percentage of inflows by type and by size. N=532 inflows.

1.1.2. Inflows health and pollution signs

In addition to the classification, surveyors carried out a detailed check of the inflows and were looking for indicators of good or bad water quality such as animal life, life or dead fish. Then also noted any bad smell, discoloration, sewage pollution, Invasive Alien Species, waste, litter, filamentous algae or sewage fungus and oil or petrol (Figure 2).

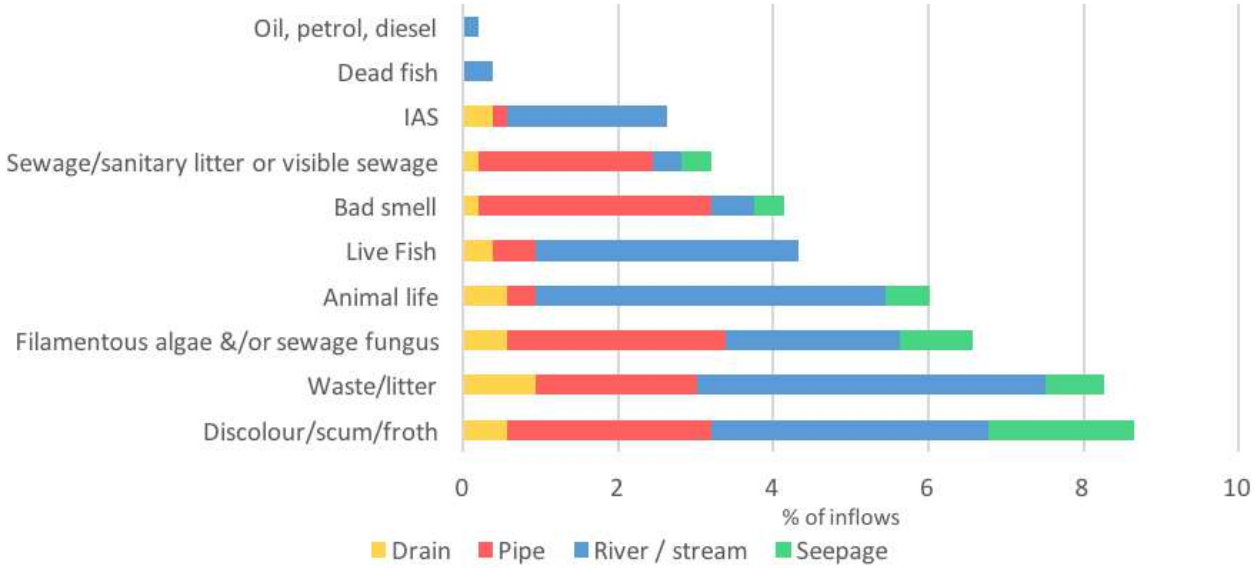

Figure 2: Percentage of inflows where a quality indicator was noted. N=532 inflows.

1.1.2.1. Good Quality signs

Surprisingly **Animal life** was not the most frequent quality indicator reported by Coastwatchers this year. Compared to last year where 9.5% of inflows tested had animal life, this year only 6.6% of the inflows showed any animal life. If one considers that this year there were more streams in the sample than the previous, this is extra surprising and may be explored further in follow up work and workshops.

Picture 2: Animal life; Mick Berry

Picture 3: Animal life; John Cullen

It should be noted that surveyors carry out a visual check of the inflows only and don't do kick sampling, netting or other aided search for animal life. According to Michael Walsh (Broadmeadow Estuary), "shore is too narrow for much plant or animal life to be seen". Other coastwatchers, Mich and Shem Berry Mick (Ballymadder) wrote "Inflow is from a large reedbed & is the main source of fresh drinking water for seabirds in the area. Full of freshwater creatures: Sticklebacks, Waterscorpion, Shrimp, waterboarman, snails. A dead octopus found in freshwater after hurricane Ophelia."

In some cases, there was extra siltation in water this year making it harder to spot animal life in water. For example, this is the case in the Dargle river in Bray (County Wicklow) where there has been intensive river bed work. There were few reports of animal life in the inflows after storm Ophelia but we do not know the reason for this. Further research would be required.

This information remains valuable even if the presence of animal life or live fish is actually much higher than recorded. Over time it is hoped to roll out more detailed stream and drain biota research, which would be carried out over the summer months and could be linked to the coastwatch survey in autumn. Some pilot projects were completed in Wexford this summer and selected results are included in the final section of this report.

1.1.2.2. Bad and 'Of Concern' signs

The most frequent negative indicator in 2017 was discolouration/scum/froth and was reported in 8.5% of the inflows tested - mainly streams and piped discharges. However, discolouration is a natural phenomenon after a heavy rainfall or due to brown humic acid. In September and with the two storms, part of the discolouration could have been created by heavy rains. One surveyor group commented: (the O'Reilly family–Garretstown beach) "At the rocky outcrop of our survey area there was a wide area (~ 40m) adversely effected by seepage. There was a distinct lack of plant and animal life here in contrast to other rock pools close by. The smell was pungent, the water very heavily discoloured with a whitish/grey slick over many pools. When some were disturbed there was a strong smell of H2S gas."

Picture 4: Pipe discharge

Waste/litter ranked second as bad quality indicator, reported from 8% of the inflows. Here the new wording of the question may have contributed to an increase of the results. While previously we looked for 'dumped waste' we now specify: Waste/litter (not sewage litter) dumped or washed down. Because of this modification in the questionnaire, comparison between previous years is not exact. Ophelia has a role in some waste reports as for example in Duncannon, where Walter Foley described waste including a lot of polystyrene and drinks bottles being pushed up to 60m up the Little stream mouth. From here the waste will feed back down into the sea in spate flow unless it is cleaned up. But cleaning a stream mouth with pools and soft sands is challenging and requires health and safety planning.

Picture 5: Filamnetous algae; Bernie Connolly

Filamentous algae and sewage fungus were reported in 6.5% of the inflows checked. On the 35 inflows observed, 15 were pipes and 12 were streams. Several surveyors

reported sewage discharges like the Wild Bunch group in the Bredagh River Estuary (su 8/18/231/9): "Town sewage discharges into river. Also individual houses discharge into river."

Surveyors reported in 3.2% of the inflows checked a **sewage/sanitary litter or visible sewage** mainly found in pipes. In 4.1% of those, surveyors reported a **bad smell,** again piped inflows were most frequently affected. A surveyor's description of one in Kerry (su 8/9/29/5): "Sewage is discharged into the estuary. The Main Drainage Scheme is not connecting up to these pipes." Things seem to have improved significantly – the 2000 survey results had sewage or sewage fungus report from 8% of RoI and 3% of NI.

Invasive alien species were found in 2.6% of the inflows checked. The surveys with IAS included Hogweed along the banks of the Shanganagh river, sea buckthorn and new zealan flax in both cases were found in Glascarrig North, Japanese Knotweed in Mittown, in Greencastle. The Global Invasive Species Programme categorises Japanese knotweed as one of the world's 100 worst invasive alien species and after the risk assessment process undertaken as part of the Invasive Species Ireland project Japanese knotweed was classed as one of the highest risk non-native invasive species in Ireland.

The presence of **Oil/diesel/petrol** was reported in 2 inflows - one in Stonehouse in Wexford and one in Ballydehob in County Cork. For the last one, a small amount of oil/petrol/diesel was found in sediment along a stream.

In the past we had up to 4 % with oil pollution. While some have been false positives where the natural oil bacteria - see picture 6 - were mistaken for oil pollution, others were certainly oil from garages, burst heating oil tanks and other sources.

Picture 6 Oil like shine, but cracking of surface shows this is not oil pollution but iron bacteria at work. Photo by Ellis Sheehy.

Picture 7: Dead fish; Mick Berry

Dead fishs were reported from 2 streams, one of the dead fish was a seatrout and the other want was reported without additional comment.

1.1.3. Nitrate and Nitrite levels in Inflows

1.1.3.1. Inflows Testing

Many human activities produce nutrients – agriculture, traffic, industrial processes, sewage, etc. If these are not carefully controlled, they get in to our waters with a negative impact on marine ecosystems. This is why we are testing nitrate/nitrite levels in the inflows.

1.1.3.2. Nitrite levels

Surveyors tested nitrite and nitrate concentrations in 214 inflows of the 532 inflows reported. Two different type of nitrite/nitrate tests were used this year on a trial. Over 96 % of surveyors used the usual Merck Quantum individually wrapped sticks which Coastwatch supplies. However, in one area of Cork and one in Wexford, an equivalent field test from Hach was tried. The Hach test is more sensitive to nitrite, but provides a poor colour match for nitrates. The Hach test used is likely to be the explanation for 4 of the 15 positive nitrite results, which are of concern as nitrites are toxic for animals. Because of these unusual results, further investigations were made to find potential sources of nitrite pollution, which are being investigated. Further investigations included checking of point sources on the EPA catchment.ie website.

With the number of inflows in Ireland, monitoring of all across Ireland by authorities is not feasible. However, citizen science could help to collect information in order to alert authorities to where problems may exist.

1.1.3.3. Nitrate levels

As shown in figure 3, more than a third of the inflows tested presented nitrate levels below detection which means that the test kit didn't register any colour. In 21% of the cases, the surveyors observed that a slight colour change occurred. These two categories represent the data where the water is clean to slightly polluted. We see that almost 3/5 of all the inflows tested (57%) are inflows with clean to slightly polluted water.

Picture 8: Inflows testing; Paul Leahy

However, a significant part (29%) of the nitrate pollution is between 25 mg/L to 49 mg/L. In addition, 14% of the inflows tested are in breach of the nitrates directive's "50mg/L NO3" where 7% is at 100mg/L which can be considered as a heavily polluted inflow.

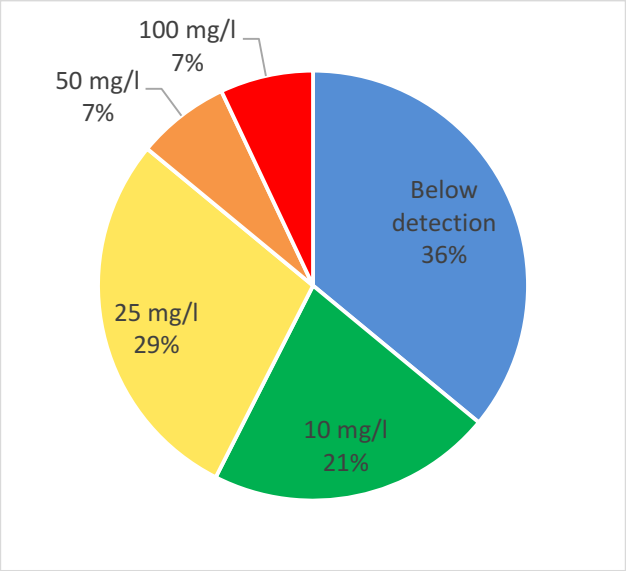

Figure 3: Nitrate levels in inflows tested. N=214 inflows tested

The 2017 results are the worst results seen in the past 6 years (Figure 4). Only 35% of nitrate checks were below detection. The 57% of clean to slightly polluted inflows is lower than any of the last 6 years (65% in 2015, 72% in 2016). 14% are in breach of the nitrate directive and national nitrate regulations. This year, we also observe a significant increase in the highly polluted (>100mg/L) inflows.

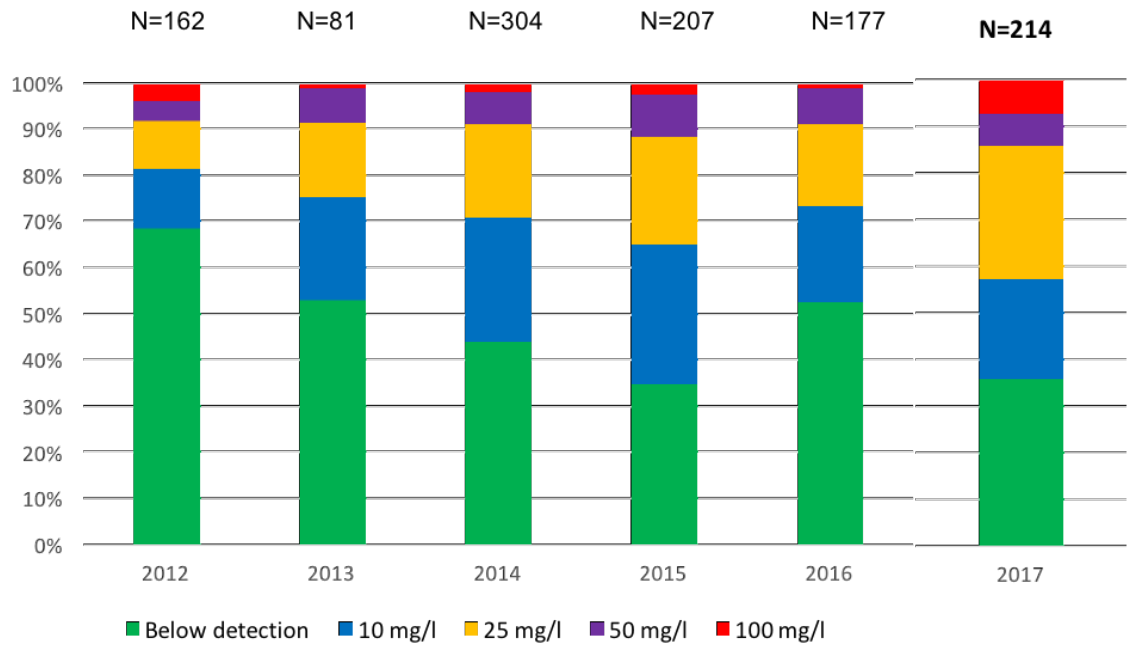

Figure 4: Nitrate level in inflows tested 2012-2017 (Coastwatch Autumn Survey; N=number of inflows tested)

1.1.3.3.1. Nitrate levels across the country

A further analysis of the data by geographical area (Figure 5) shows that the nitrate levels can be extremely variable across Ireland. The nitrate data collected from West Coast show the best results. Only 21% of the inflows checked were above 25mg/L and no breaches of the 50mg/L NO_3 limits.

However, the picture for the South and the East coast is worrying. Concerning the South, of the 72 inflows tested, 24% were in breach of the nitrates directive's "50mg/L NO_3". On the other hand, 58% of the inflows tested were either below detection or with 10 mg/L NO_3. This means that along the South coast, the nitrate situation is good in parts and bad in parts.

On the East coast, half of the inflows tested were at 25 mg/L or higher and in 11% of these the levels were in breach of nitrate legislation[1]. In Northern Ireland, more than half of the inflows checked were below detection (60%) for a total of 67% of the inflows tested with no to slighty polluted which is good. Nevertheless, 13% are in breach of the nitrates directive's "50mg/L NO_3".

Looking at results over the last 6 years we see the general quality picture across the country is similar to previous years. While the West coast continues to be of high quality, the East and mainly the South coasts have some areas with consistently high nitrate levels.

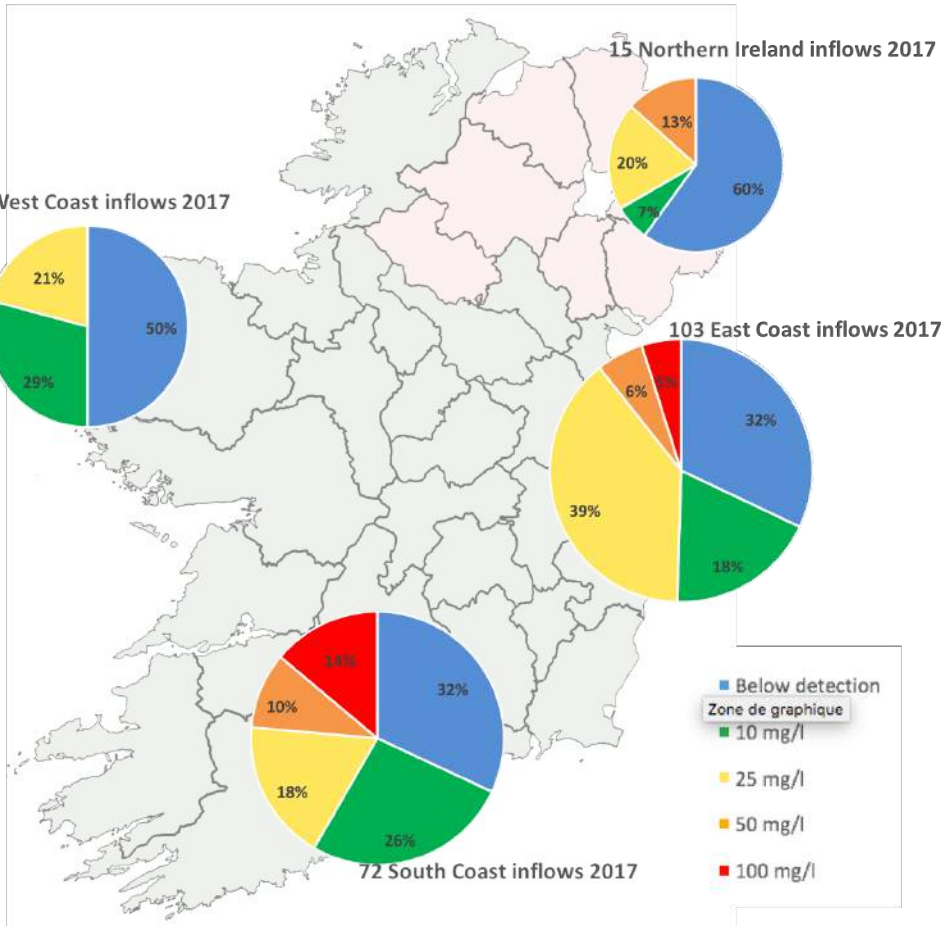

Figure 5 Inflow nitrate levels pooled by region where they were taken

[1] Water pollution - Nitrates directives ; European Commision - http://ec.europa.eu/environment/water/water-framework/index_en.html

1.1.3.3.2. High variability of nitrate

According to data returned, they are general differences between regions but there can still be large differences at micro level. Some nitrate levels in neighbouring inflows, tested on the same survey occasion, so only minutes apart, varied greatly. One may be 100 mg/L, and the next below detection, suggesting that there are different causal factors.

Nitrates are naturally in our surface waters but should be below detection using or field tests. An increase in nitrate levels is generally related to man-made sources such as septic tank systems, fertilizer run-off and improperly treated wastewater. The type of soil, the weather, the type of cover, the topography are also factors that could have some influences on the nitrate levels.

Some of these general factors are already taken into account by the authorities to create susceptibility maps (Sub Surface Nitrate Susceptibility, Near Surface Nitrate Susceptibility). These maps are created using data related to the likelihood of nutrient transfer due to soil and geological properties along the near surface and/or subsurface pathway.

For the first time, we tried to match our coastwatch survey data to a susceptibility map in one area – Bannow Bay, County Wexford. This area had been subject to a FLAG supported streams project and sufficient data was available.

1.1.3.3.3. Bannow Bay case study

Background information:

This sheltered enclosed bay on the South coast of Ireland (see map in Figure 6) has a highly variable immediate hinterland. When standing in the bay one notes steep to moderately sloping land on all sides, except around the 'Little Sea', Clonmines and Wellington bridge where the river floodplain, meadow, reedbed and marshes dominate. Several saltmarshes form a buffer between land and sea. Most land around the bay is fertile and used for agriculture (both tillage and intensive grazing) with residential, commercial and small industry units dotted in between.

There are many traditional and new uses of the bay including boating, walking, bait digging, angling. Bannow Bay is on the 'Norman Way' and historic and ecotourism are increasing.

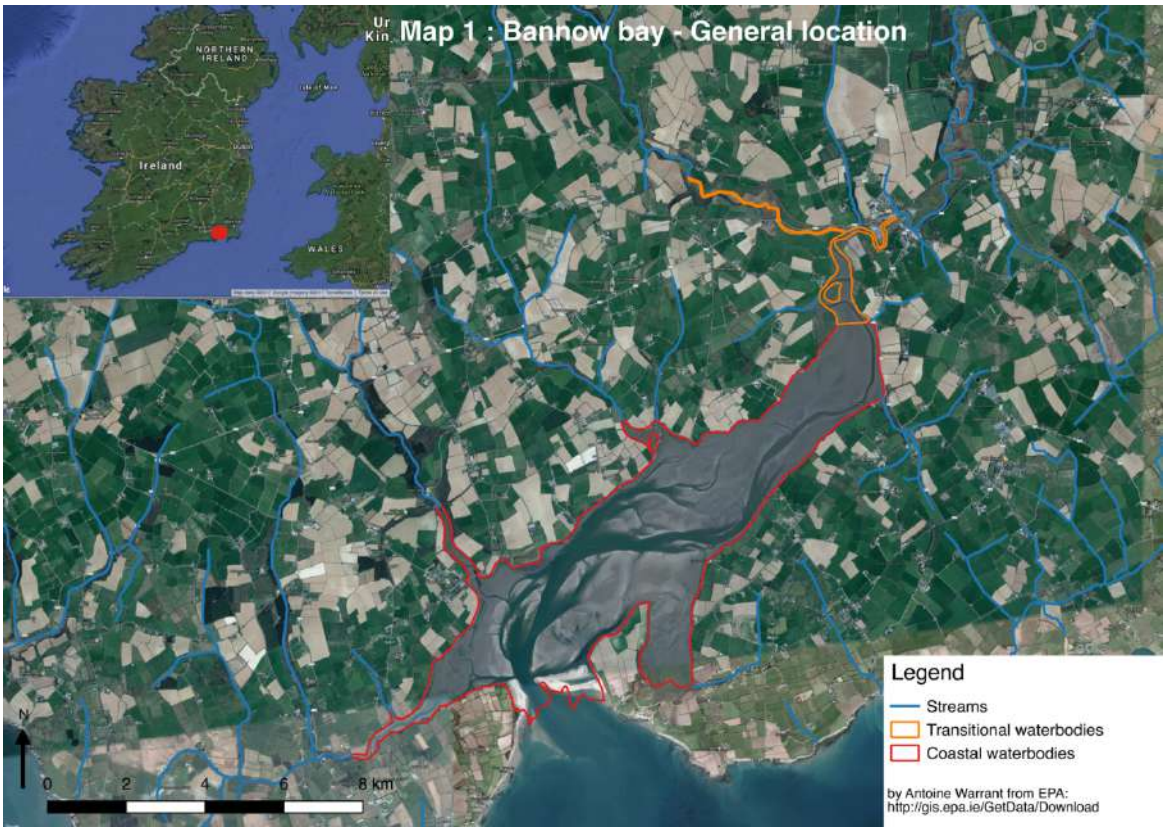

Figure 6 : Map 1: Bannow Bay - general location

The bay is of international importance for birds and habitats and is designated as a SPA, SAC and RAMSAR sites. It is also valuable as a seafood growing and harvest area and designated shellfish water see figure 7.

For shellfish waters designated under EU law the development of Pollution Reduction Programmes (PRPs) to support shellfish life and growth (Figure 7) and to contribute to the high quality of directly edible shellfish products is required[2].

Figure 7. Map 2: Bannow Bay Shellfish water from http://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/Environment/Water/FileDownLoad%2C19482%2Cen.pdf

[2] Shellfish Pollution Reduction Programme - http://www.housing.gov.ie/sites/default/files/publications/files/filedownload21930en.pdf

There are 14 discharges licenses in the watershed as shown on the current (October 2017) catchments.ie website. Seven of these are in the immediate bay hinterland (Figure 7).

The EPA has classed Bannow Bay waters as mainly coastal with some upper estuary transitional waters as shown in Figure 8. It has not been assigned a water quality status yet. Extra citizen science information may help in status assignment and prioritising measures to ensure the bay and its rivers and streams reach and maintain a good quality status.

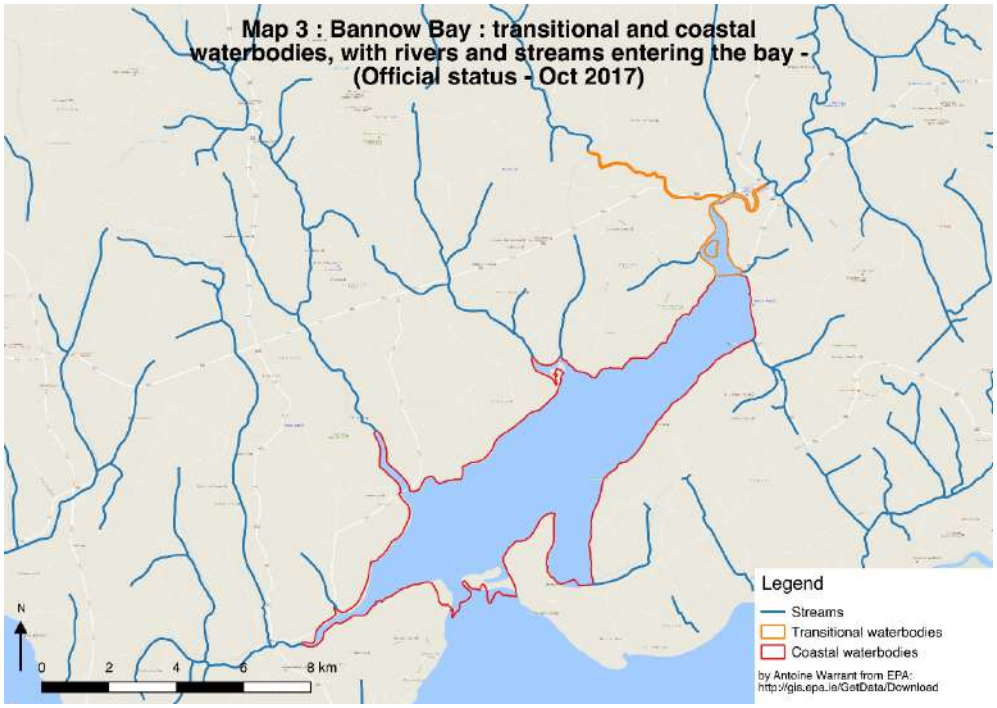

Figure 8: transitional and coastal waterbodies

When Bannow Bay was surveyed in Autumn 2017 as priority area, 44 inflows were recorded in the Bay and 29 were tested for nitrate. Table 1 and Figure 9 shows that there were a substantial number of inflows [5 streams and 22 drains] which were not previously marked on EPA or shellfish water maps.

Table1: Additional Fresh Water Inflows into Bannow Bay

Bannow Bay Feature	Rivers	Streams	Drains incl. piped drain	Comment
Number of inflows found by volunteers:	4	13	27	Additionally, there was water seepage, where the shore was wet and covered in green algae even in dry spells. These were not counted.
Project outcome:	Project made no difference to number of rivers observed	5 extra streams, which were not on official maps	22 drains more than on official maps	

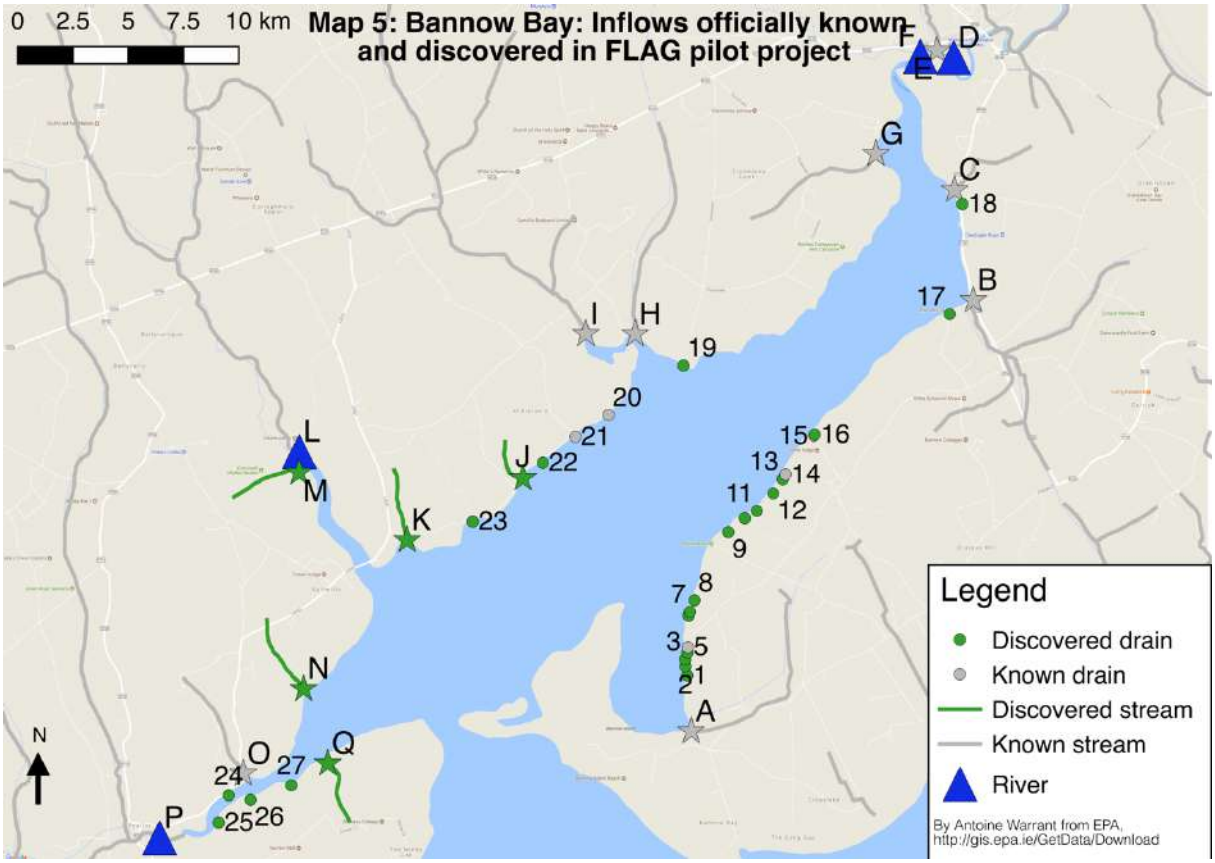

Figure 9 : Map: Inflows officially known and discovered in FLAG pilot project

The nitrate levels for the inflows tested were worrying (Figure 10). More than half of the inflows (55%) were considered as polluted to highly polluted. A quarter of the inflows tested were in breach of the nitrates directive's "50mg/L NO3".

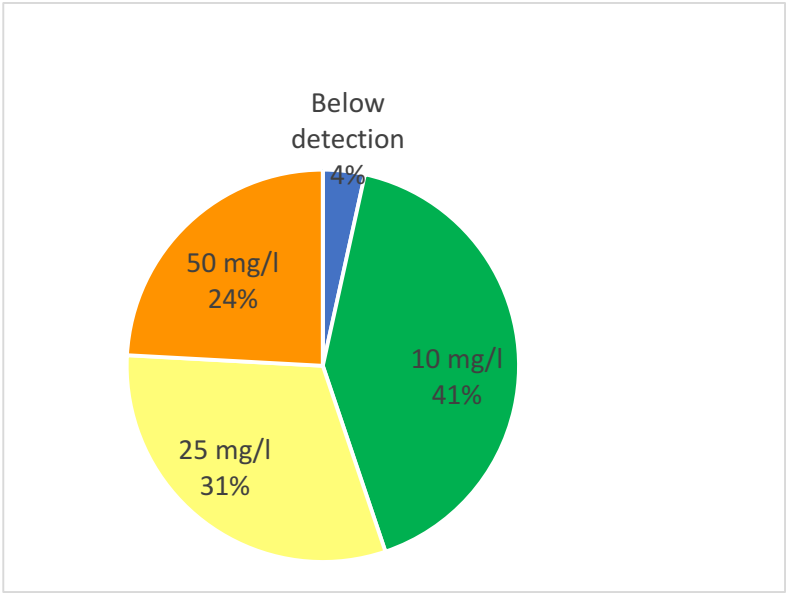

Figure10: Nitrate levels in average in Bannow bay's inflows(N=29 inflows)- Data was averaged where inflows were tested several times - Aug to Nov 2017

Comparison with Nitrate susceptibility maps

According to official data, the Sub Surface Nitrate Susceptibility (see Figure 11) is “Low to very Low” in the Bannow Bay area while the Near Surface Nitrate Susceptibility (see Figure 12) is mixed - mainly low with particular areas defined as having a high or very high susceptibility.
Coastwatch results showed high nitrate levels in high and low susceptibility areas. Some of the highest values found this year were where the range of near surface susceptibility was low.

Figure 11: Sub surface Nitrate Susceptibility map - Bannow Bay - EPA

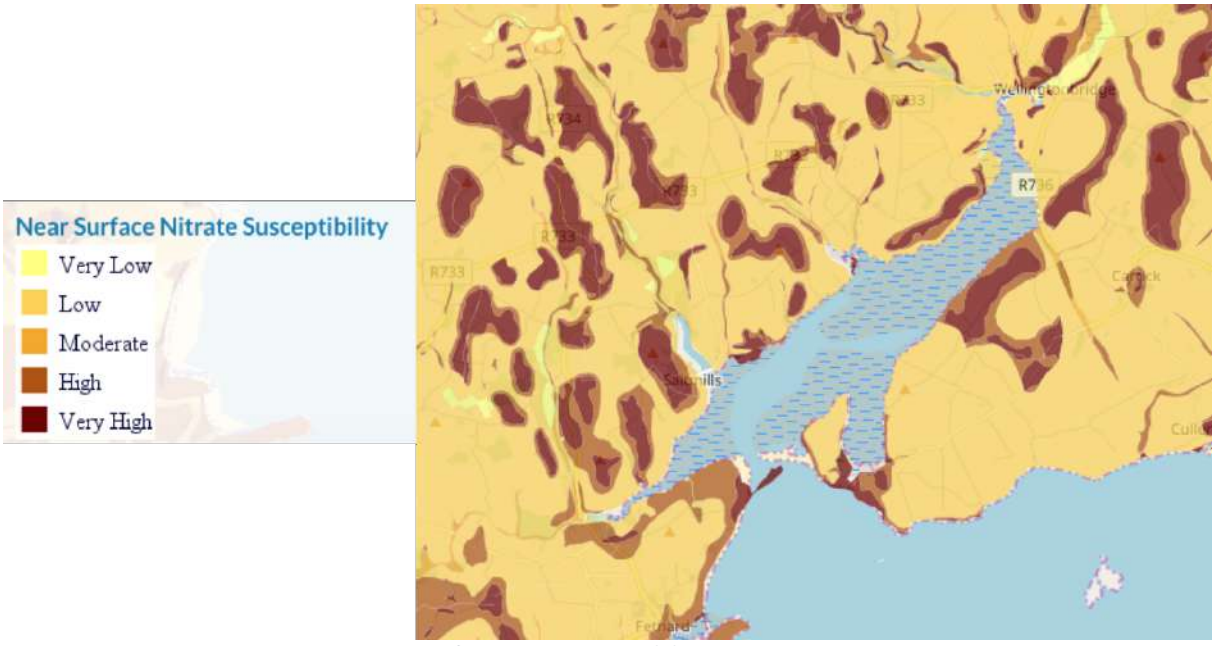

Figure12: Near surface Nitrate Susceptibility map - Bannow Bay - EPA

1.2. Risk of sewage pollution

This question of whether the area is experiencing sewage pollution is for volunteers who know their survey units well and was answered by 305 surveyors. The question is: "If you know the survey unit well, please estimate frequency of sewage pollution incidents (This is focussing on water of your survey unit. Think of advice if a visitor was to swim or eat shellfish)."

Picture 9: Water pollution; Breda Enright

The 2017 results saw 40% indicating their sites were reliably sewage pollution free, 31% thought it rarely happened and 29% thought it was either 'occasional', 'frequent' or 'usual'.
Looking back over recent years, the 2017 results appear to suggest a worsening - or at least a perception of worsening in water quality as the areas surveyed are roughly the same, with no shift towards urban areas which lack sewage treatment.
The survey included the same known sewage pollution core areas like Moville, Arklow, Duncannon and smaller raw sewage discharges like Doldrum bay, Howth head, where you expect some survey sites with sewage pollution described as 'usual' or 'frequent'. But comparing results with the previous year - Figure 13 (i) 2017 and (ii) 2016 - sewage pollution was described as 'rare' in 39% of survey sites in 2016, dropping to 31% of surveyed areas in 2017, while 'occasional' was up from 13% to 20%.

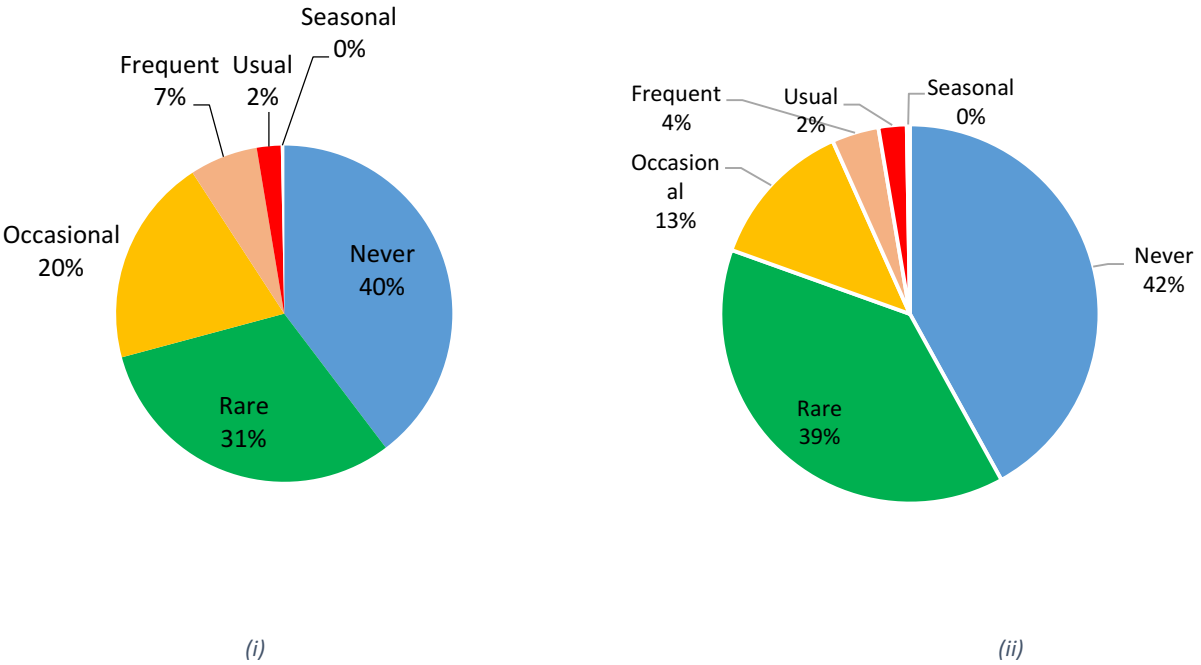

Figure 13 Surveyor view of sewage pollution in their survey unit (i) Coastwatch survey 2017 N= 305 and (ii) Survey 2016 N=374

Further data mapping and exploration is planned to see whether some of this is due to changes of areas surveyed, but we are also exploring three other factors which may be contributing:

1) Wetter summer weather on the west and north coast, causing more storm water overflows
2) wet wipe triggered sewage treatment plant breakdowns or pipe blockages. Both produce sewage pollution and visible signs of sewage pollution on bathing beaches.
3) Perception: anecdotal evidence from talking to some surveyors suggests that these pollution information pieces contribute to a change in perception about shore water quality. The first is the recently introduced well publicised beach closures to protect bathers from pollution blips on otherwise excellent bathing waters, then the stream pollution warning signage on both designated beaches and ones used for bathing and finally the EPA water report in late summer which received a lot of media coverage.

1.3. Threat (risk) of sea water pollution

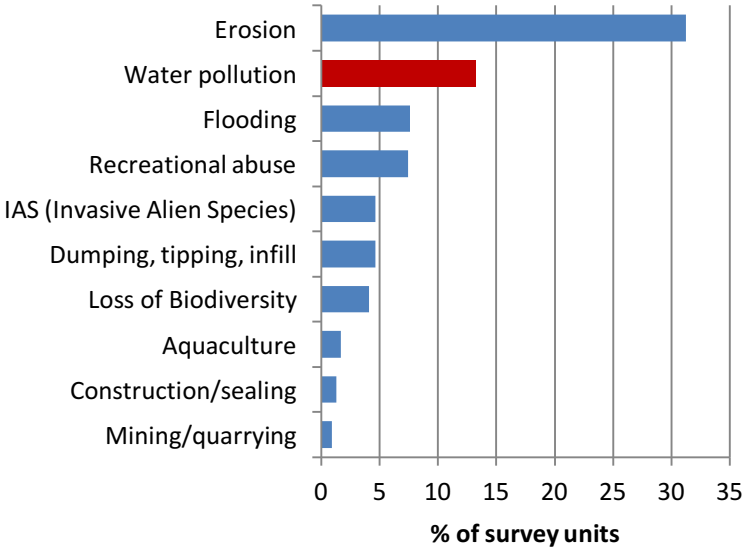

Figure 14: Threats to the shore perceive by surveyors

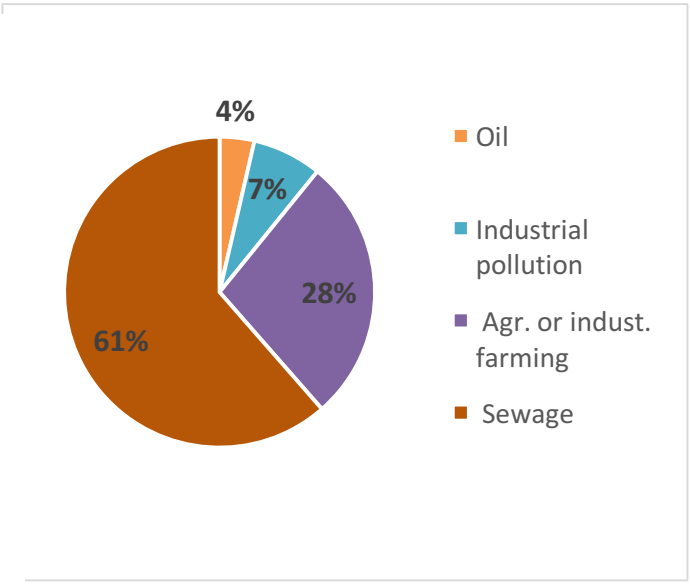

Figure 15 The threat of water pollution by types

In question F4 surveyors are asked to consider whether there is any serious risk or imminent planned change for the worse to their survey unit. A tick list of risks and threats are provided as well as an 'other' option. The list is based on the threats surveyors first noted when this question was phrased as an open invitation to write your own list. Water pollution can be ticked as general risk, or by type of pollution with 4 options: Sewage, Oil, Agricultural or industrial farming, and Industrial.
Figure 14 shows water pollution at the second most frequent threat mentioned. Thirteen percent of survey units were reported with this threat. Figure 15 shows that sewage is still the most frequently cited type of water pollution followed by agricultural or industrial farming pollution. Most of the 9% of survey units where citizens had reported sewage pollution incidents as being 'frequent' or 'usual' (Figure 15 above) also indicated that water pollution was a serious risk to their waters. Agricultural or industrial farming pollution made up 28% and 7% of the types of water pollution is threaten by industrial pollution. The 4% who mention oil as a threat would have considered the pollution source to come from the inflow or from the waste.