# SWEPT

## Surveying the Welsh Environment for Pollution Threats

## Pembrokeshire Open Coast Project 2020

**Sue Burton, SAC Officer, Pembrokeshire Marine Special Area of Conservation Relevant Authorities Group.**

Final project report. December 2021

Pembrokeshire Marine Special Area of Conservation
Sir Benfro Forol
Ardal Cadwaeth Arbennig

PEMBROKESHIRE NATURE PARTNERSHIP
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Pembrokeshire Coast National Park

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Cover image: Freshwater input at Penpistyll, North Pembrokeshire (Carol Owen)

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# Summary

There have been concerns from recreational users about human illnesses after winter sea bathing. Natural Resources Wales (NRW) monitor bathing waters from May to September, but widespread sampling outside of this period does not take place. Winter swimming and water sports do not therefore have the assurance of adequate water quality. Nutrient run-off is known to be an issue for the marine environment in Pembrokeshire and can be at its highest in the autumn/winter. Additional survey data from the open coast was seen to be useful from a general water quality point of view and in raising awareness about how what we do on the land can affect our use of the sea.

This work followed on from the SWEPT (Surveying the Waterway Environment for Pollution Threats) volunteer project 2018-19 which won the Park Protector Award 2019 for its contribution to national parks and its use of citizen science and successful awareness raising to link land and sea use.

Survey results showed that polluting levels of nitrate were found at 51 (63%) of the 81 locations visited and tested, and polluting levels of phosphate were found at 8 locations (10%). From local knowledge and observations, agricultural run-off was considered to be the likely primary cause of the pollution recorded during the survey.

Impacts to marine life from high levels of nutrients are well known in areas of restricted water flow like inlets and small embayments where elevated levels of green algal growth on the shore can provide visual signs that the system is out of balance. This can result in low oxygen levels in the water as the algal ‘mats’ break down which can kill marine life. However, on the open coast wave action and tidal movements tend to quickly dilute any inputs from freshwater sources, carrying them away along the coast or offshore. But pollution is still entering the sea and the local impacts (if any) are not known. The cumulative impact of all of the small streams, flood run-off, seeps and rivers are not being studied. Could it be that in years to come, the existence of nutrient pollution in the sea (and any resultant impacts either direct or indirect from associated bacteria or chemical pollution such as pesticides) is as common to us as marine plastics have become in the last decade? You don’t know what is there, and whether it is causing any harm, until you look.

Recommendations from the survey are that the widespread nutrient pollution (particularly of nitrates) around the Pembrokeshire coast needs to be reduced and that wider awareness raising of the insidious nature of nutrient pollution around the open coast and the potential impact on human health of recreational users of the near-shore marine environment (especially outside of the main bathing season) is needed.

# Crynodeb Gweithredol

Cafwyd pryderon gan y rheiny sy'n defnyddio'r dyfroedd at ddibenion hamdden, ynghylch salwch ar ôl bod yn nofio yn y môr dros y gaeaf. Mae Cyfoeth Naturiol Cymru yn monitro dyfroedd ymdrochi o fis Mai hyd fis Medi, ond ni chymerir samplau'n eang y tu allan i'r cyfnod hwn. Felly, ar gyfer nofio a chwaraeon dŵr yn ystod y gaeaf, nid oes sicrwydd bod ansawdd y dŵr yn ddigonol. Rydyn ni'n gwybod bod maetholion mewn dŵr ffo yn bryder yn yr amgylchedd morol yn Sir Benfro a bod hyn yn gallu bod ar ei uchaf yn ystod yr hydref/gaeaf. Gwelwyd bod data ychwanegol o arolygon o'r arfordir agored yn ddefnyddiol o safbwynt ansawdd cyffredinol y dŵr, ac wrth godi ymwybyddiaeth am y ffordd y mae'r hyn yr ydym yn ei wneud ar y tir yn gallu effeithio ar ein defnydd o'r môr.

Roedd y gwaith hwn yn dilyn prosiect gwirfoddol SWEPT (*Surveying the Waterway Environment for Pollution Threats*) 2018-19 a enillodd Wobr 'Park Protector' 2019 am ei gyfraniad at barciau cenedlaethol, a'i ddefnydd o wyddoniaeth dinasyddion a'i lwyddiant wrth godi ymwybyddiaeth i gysylltu'r defnydd o'r tir a'r môr.

Yn ôl canlyniadau'r arolwg, daethpwyd o hyd i lefelau nitrad sy'n llygru mewn 51 (63%) o'r 81 lleoliad yr ymwelwyd â hwy ac a brofwyd, a daethpwyd o hyd i lefelau ffosffad sy'n llygru mewn 8 lleoliad (10%). Yn ôl gwybodaeth leol ac arsylwadau, credwyd mai dŵr ffo amaethyddol oedd y prif achos tebygol dros y llygredd a gofnodwyd yn ystod yr arolwg.

Mae effeithiau lefelau uchel o faetholion ar fywyd morol yn gyffredin mewn ardaloedd ble mae llif y dŵr yn gyfyngedig, er enghraifft cilfachau ac amfaeau. Yn y mannau hyn, mae lefelau uwch o dwf algaidd gwyrdd ar y lan yn gallu dangos arwyddion gweledol fod rhywbeth o'i le ar gydbwysedd y system. Gall hyn arwain at lefelau ocsigen isel yn y dŵr wrth i'r 'matiau' algaidd dorri i lawr, ac mae hyn yn gallu lladd bywyd morol. Ond, ar yr arfordir agored mae symudiadau'r tonnau a'r llanw yn dueddol o wanedu unrhyw fewnlif o ffynonellau dŵr croyw, gan eu cario ar hyd yr arfordir neu oddi ar y lan. Ond, mae llygredd yn dal i ddod i mewn i'r môr ac nid ydym yn gwybod beth yw'r effeithiau lleol (os oes effeithiau). Nid yw effeithiau cronnus yr holl nentydd bach, dŵr ffo yn dilyn llifogydd, gollyngiadau ac afonydd yn cael eu hastudio. A allen ni wynebu sefyllfa ymhen rhai blynyddoedd, lle bydd presenoldeb llygredd o faetholion yn y môr (ac unrhyw effeithiau sy'n ganlyniad, boed yn uniongyrchol neu'n anuniongyrchol, o facteria cysylltiedig neu lygredd cemegol fe plaladdwyr) mor gyffredin i ni â phlastigion yn y môr dros y ddegawd ddiwethaf? Dydych chi ddim yn gwybod beth sydd yno, a ph'un ai ei fod yn gwneud niwed ai peidio, nes i chi edrych.

Argymhelliad yr arolwg yw bod angen lleihau'r llygredd helaeth o faetholion (yn enwedig nitradau) o amgylch arfordir Penfro. Mae angen codi ymwybyddiaeth yn ehangach am natur lechwraidd llygredd o faetholion o amgylch yr arfordir agored a'r effaith bosibl ar iechyd pobl sy'n defnyddio'r amgylchedd morol yn agos at y lan at ddibenion hamdden (yn enwedig y tu allan i'r prif dymor nofio).

# 1. Background

This work followed on from the SWEPT (Surveying the Waterway Environment for Pollution Threats) volunteer project 2018-19 which won the Park Protector Award 2019 for its contribution to national parks and its use of citizen science and successful awareness raising to link land and sea use. Information can be found under projects at http://www.pembrokeshiremarinesac.org.uk

The wide prevalence of nitrates from agricultural run-off found in the original SWEPT survey raised the question of whether levels were also high along the coast? The aim of the open coast surveys was to test a selection of freshwater inputs along the Pembrokeshire open coast for levels of nitrate and phosphate. Whilst there is quicker dispersion and less localised accumulation of pollutants off the open coast (compared to the Milford Haven Waterway) and therefore no obvious widespread impacts upon marine life, the presence of nitrate and phosphate can be an indicator that other contaminants such as bacteria and pesticides may also be present. Elevated levels of these substances can result in bathing water failures.

There have been concerns about human illnesses due to winter bathing (outside of the main bathing water testing season). Natural Resources Wales (NRW) monitor bathing waters from May-Sept, but widespread sampling outside of this period does not take place. Winter swimming and water sports do not therefore have the assurance of adequate water quality. Nutrient run-off can be at its highest in the autumn/winter. Additional survey data was seen to be useful from a general water quality point of view and in raising awareness about how what we do on the land can affect our use of the sea.

## 1.1 The importance of good water quality.

Our rivers, lakes, groundwater, estuaries, coasts and seas provide us with important natural benefits, many of which contribute to the well-being of local communities and the wider population. These benefits include (Pembrokeshire Public Services Board, 2021):

- Providing clean fresh water for people to drink, for industry and for agriculture.
- Clean rivers and seas for recreation, relaxation, and enjoyment.
- Income generation from business and industry, tourism, energy production, angling and commercial sea and shell fisheries.
- Supporting resilient terrestrial and marine ecosystems and habitats.
- Providing seafood (fish and shellfish) and for crop growth.

By working together to improve and maintain the management and quality of our water resources we can deliver benefits for the environment, the local economy, health, and quality of life.

## 1.2 Impacts upon water quality.

There are a number of significant factors having an impact upon our waterways in Pembrokeshire (Pembrokeshire Public Services Board, 2021). Water quality is being affected by pollution from nitrates, phosphorus and sediments from agriculture and sewage. Artificial structures and changes to river channels and banks pose barriers to fish and disruption of natural habitats. Invasive species are widespread, including Japanese knotweed and *Himalayan balsam* and there is an increasing demand for water. Nutrient concentrations in Welsh rivers and globally are a widespread problem and Pembrokeshire is no exception. Pollutants, in particular nitrate, phosphorus, and sediments, are having a detrimental impact on water quality. In this predominantly rural county diffuse pollution from agricultural sources is contributing to water quality failures, both in terms of water chemistry, but also dependent ecological indicators. The problem is exacerbated by continuous sewage and storm sewage overflow discharges from water industry sources.

Natural Resources Wales give the top five sources of bathing water pollution in Wales as follows:

1. Pollution from sewage – bacteria from sewage can enter our waters as a result of system failures or overflows or directly from sewage works.

2. Water draining from farms and farmland – manure from livestock or poorly stored slurry can wash into rivers and streams resulting in faecal material entering the sea.
3. Animals and birds on or near beaches – dog, bird and other animal faeces can affect bathing water as they often contain high levels of bacteria (much higher than treated human waste).
4. Water draining from populated areas – water draining from urban areas following heavy rain can contain pollution from a variety of sources, including animal and bird faeces.
5. Domestic sewage – misconnected drains and poorly located and maintained septic tanks can pollute surface water systems.

Climate change in Wales, evident now, such as an increase in mean daily temperatures, reduction in air frosts, and increase in storm events is predicted to have a range of impacts on our habitats and species and human health and well-being. The potential for more frequent flooding and increased coastal erosion, affecting beaches, could also have a significant impact along the coastline.

## 1.3 Bathing waters in Pembrokeshire.

The beaches in Wales are designated by the Welsh Government depending on their popularity and usage. Beaches which are designated as bathing waters are sampled and monitored by Natural Resources Wales. The non-designated beaches are sampled and monitored by Pembrokeshire County Council. During the survey (Oct 2020) there were 29 designated (see Figure 1) and 7 non-designated bathing waters in Pembrokeshire (Caldey, Gelliswick, West Dale, Martin's Haven, St Brides, Goodwick, Cwm Yr Eglwys).


*Figure 1: Bathing waters in Pembrokeshire taken from [Find a bathing water (data.gov.uk)](Find a bathing water (data.gov.uk)) OS Data @Crown copyright and database rights.*

The designated bathing waters are monitored and assessed for compliance under the Bathing Water Directive (2006/EEC). The Bathing Water Directive came into force in 1976. It was revised and 2015 was the first year it was fully implemented in the UK with new tighter microbiological standards brought in alongside changes to management and surveillance methods. Since leaving the EU the Bathing Water Directive is now devolved and comes under the Bathing Water Regulations of Welsh Government.

Bathing waters are classified as "Excellent", "Good", "Sufficient" and "Poor" as per Figure 2. Each is tested at least 8 times; immediately before and throughout the season from 15 May to 30 September. During the bathing season, Natural Resources Wales monitors bathing water quality and provides information about

possible health risks arising from issues such as short-term pollution episodes. The results are used to assess compliance with the Bathing Water Directive's standards. Samples are analysed for two types of bacteria, which indicate pollution from sewage or livestock. Polluted water can have impacts on human health, causing stomach upsets and diarrhoea if swallowed.

| | E. coli 95th percentile | Intestinal Enterococci 95th percentile | E. coli 90th percentile | Intestinal Enterococci 90th percentile |
|---|---|---|---|---|
| Excellent | 250 | 100 | | |
| Good | 500 | 200 | | |
| Sufficient | | | 500 | 185 |
| Poor | Fails to meet any of the above standards | | | |
| Not classified | Does not have enough samples in the four-year calculation window | | | |

*Figure 2: Bathing water standards that must not be exceeded for coastal and transitional (i.e. estuarine) waters*

Pembrokeshire had 302 confirmed pollution incidents between 2016 and 2020, 89% were low impact and 11% high impact (Pembrokeshire Public Services Board, 2021). In 107 of the total number of confirmed incidents agricultural materials and waste was the main type of pollutant followed by 52 incidents caused by sewage. Approximately 15% of incidents from agricultural sources and 3 % from water industry sources had a high impact.

The sampling and analysis that Pembrokeshire County Council have done alongside Natural Resources Wales statutory Bathing Water Directive monitoring and the work that continues with Welsh Water has ensured continued improvements to bathing water quality in Pembrokeshire. Despite the concerns raised in this report, the Pembrokeshire County Council note (supported by the data) that Pembrokeshire's water quality is amongst the best in the UK, with 27 of the 29 bathing waters in Pembrokeshire having achieved the highest 'excellent' status, the other two were awarded 'good' status in 2020.

### 1.4 Water Quality and marine wildlife.

Whilst some studies have identified that nutrient fluxes to coastal areas have risen in recent decades, leading to widespread hypoxia and other ecological damage (such as Howarth *et al.,* 2011), most of these focus on estuarine or enclosed or semi-enclosed systems. Occasional toxic algal blooms may occur, but generally, knowledge about impacts (if any) on marine life on open coasts as a result of nutrient inputs is limited. Any localised impacts from nutrient enrichment are likely minimised by natural physical processes on the coast diluting and flushing away inputs. The same is likely to be said for any bacterial or chemical contamination. The cumulative impact of all of the small streams, flood run-off, seeps and rivers are not being studied. Statutory monitoring of sites on the open coast fall within NRW's open coast water body sampling regime which is limited to a few sites only.

It should be noted that phytoplankton (microscopic algae) naturally increase in number at certain times of the year. This process is known as a phytoplankton bloom. These algal blooms are usually noticeable by a surface scum (especially after turbulent weather) and froth on the strandline. It is a completely natural process and is not a sign of a pollution event.

## 2. Methodology

Surveys (and water sample testing) were conducted in October 2020 by Pembrokeshire Coast National Park Authority Rangers, the Pembrokeshire Marine SAC Officer, and some volunteers.

The same methodology was used as for the original SWEPT (Surveying the Waterway Environment for Pollution Threats) project in 2018-19 (Burton 2020). Freshwater inputs to the marine environment were

tested for nitrate ($NO^3$) and phosphate ($PO^4$) using Kyoritsu PackTest kits (Kyoritsu 2000), manufactured in Japan. These are seen to be a simple, rapid and cost-effective way to identify nutrient pollution (Burton, 2020; Biggs *et al.,* 2016). The instant results are particularly useful and an excellent aid to raising awareness of nutrient pollution.

Kyoritsu low range PackTest kits WAK-N03 and WAK-PO4(D) respectively measure nitrate-nitrogen with a minimum detection limit of 0.5 mg/L and phosphate-phosphorus with a minimum detection limit of 0.02 mg/L. Tests are based on colourimetry and judged by eye against a colour chart following the introduction of the test water sample and reaction with a chemical reagent within the testing tube. Each test takes either 3 minutes (nitrate) or 5 minutes (phosphate). The small testing tubes are easy to transport and use (see Figure 3).

SWEPT methodology noted results within the following seven ranges:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Nitrate ppm | <0.2 | 0.2-0.5 | 0.5-1 | 1-2 | 2-5 | 5-10 | 10+ |
| Phosphate ppm | <0.02 | 0.02-0.05 | 0.05-0.1 | 0.1-0.2 | 0.2-0.5 | 0.5-1 | 1+ |

Photos were taken at survey sites, generally with views 'upstream' and 'downstream'. Results were collated by the SAC Officer.


*Figure 3: Nitrate analysis card used for identifying nitrate levels in water samples (Richard Vaughan)*

# 3. Results

In addition to the water testing results from this survey, statutory monitoring results are also provided.

## 3.1 SWEPT open coast results.

In total 81 sites were visited, and water samples were tested for both nitrate and phosphate levels at each.

The thresholds when observing whether water samples were nutrient 'polluted' or not were as follows (Biggs *et al*. 2016):

| **Phosphate (mg /L)** | **Nitrate (mg /L)** |
|---|---|
| **Clean water** | **<0.05** | **<0.5** |
| **Some evidence of pollution:** | **0.05-0.1** | **0.5-1** |
| **High or very high levels of nutrient pollution** | **>0.1** | **>1** |

This definition of clean water is equivalent to the EU Water Framework Directive (WFD) 'High' status.

Figure 4 illustrates that in the PackTest kits, the two lowest categories (<0.02 and 0.02-0.05 for phosphate; <0.2 and 0.2-0.5 for nitrate) are broadly equivalent to clean, or minimally impaired, values i.e. values less than 0.05

ppm[1] for phosphate, and less than 0.5 ppm for nitrate. Categories above these values are polluted. Therefore, nitrate samples above 1 mg/l and phosphate samples above 0.1 mg/l are considered polluted. Test results were recorded in range categories, with seven different options available for each. For nitrate, four of those recorded 'polluted' samples; 1-2, 2-5, 5-10 and 10+. For phosphate 'polluted' samples were in the range 0.1-0.2, 0.2-0.5, 0.5-1 and 1+.

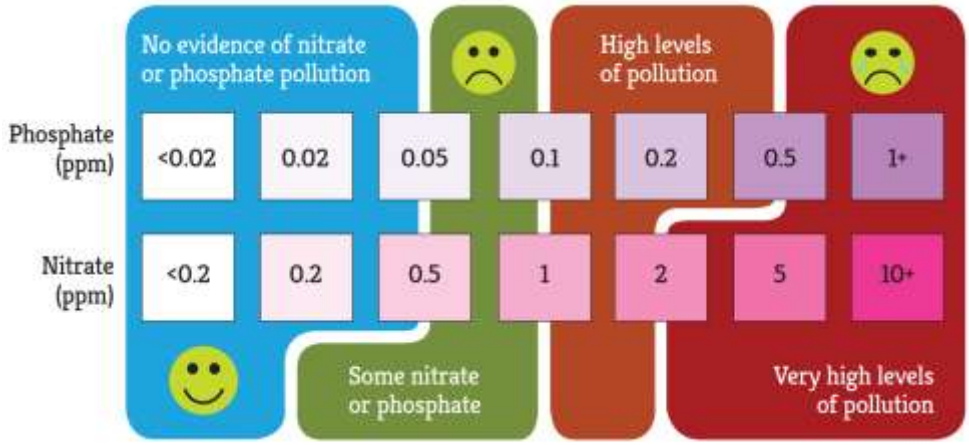


*Figure 4. PackTest kit ranges and Clean Water for Wildlife thresholds for nitrate and phosphate, Biggs et al. (2016).*

Mapped results for water quality data collected from the individual survey stretches can be seen in Figures 5 (nitrate) and 6 (phosphate). The data spreadsheet can be seen in Appendix 3.

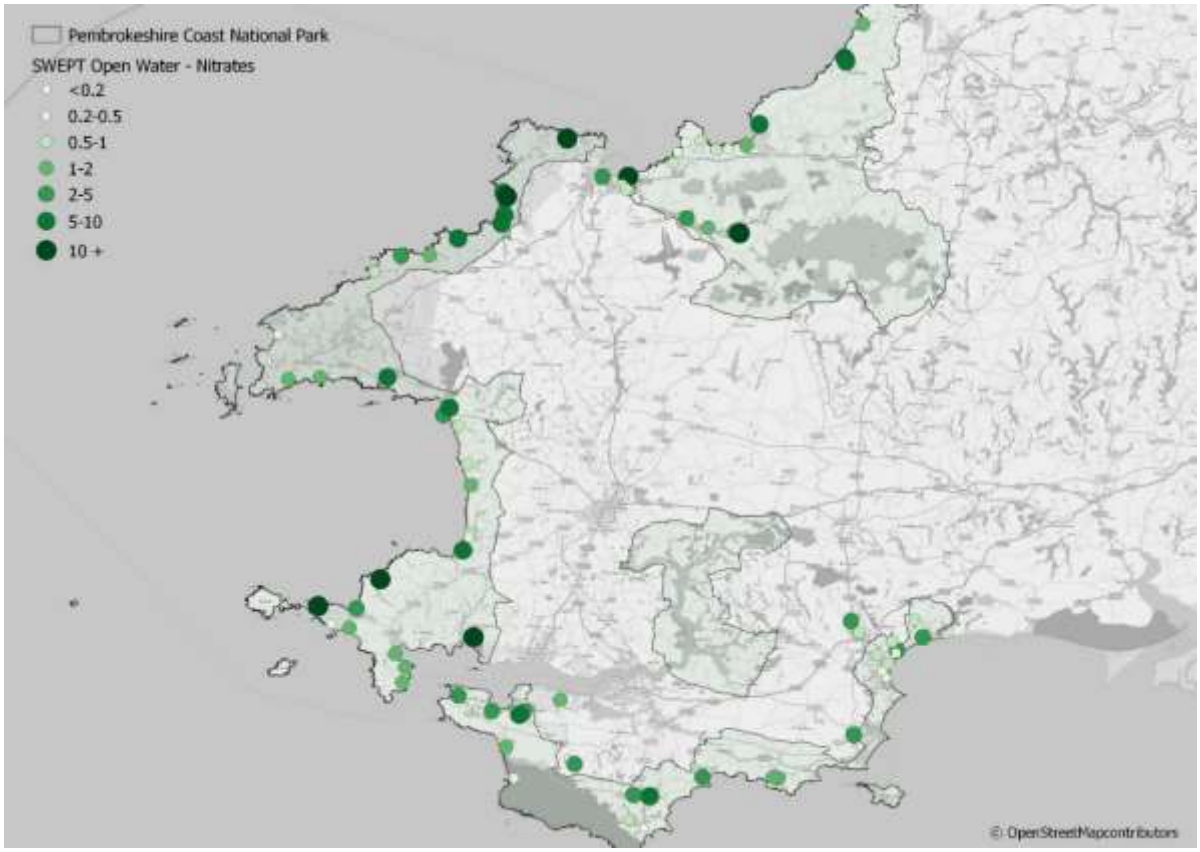


*Figure 5: Map of SWEPT nitrate water sample results at sites on or adjacent to the Pembrokeshire coast, October 2020.*

[1] Note: ppm (parts per million) and mg/ L (milligrams per litre) are equivalent in this context. It is not always exactly true that the measure mg/L is the same as ppm. For many purposes if the fluid is water, its density is close enough to 1 at normal conditions for this to be true. Pure water at standard temperature and pressure has a density of 1 kg/L, therefore: mg/L = mg/kg = ppm. But that is only true when using pure water at standard temperature and pressure. Any other substance will have a different density and will not be a direct conversion between mg/L and ppm.

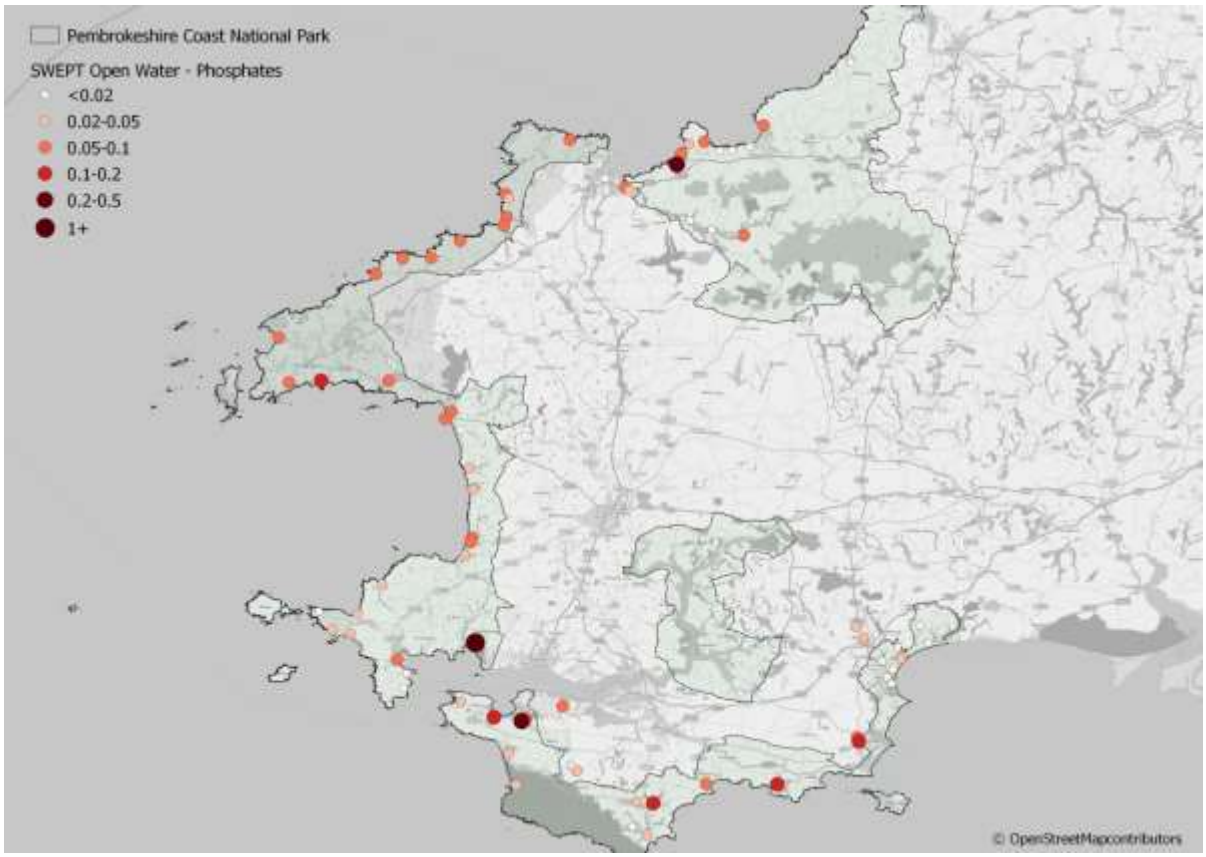


*Figure 6: Map of SWEPT phosphate water sample results at sites on or adjacent to the Pembrokeshire coast, October 2020.*

## 3.2 Designated bathing water results.

Official annual results, based on monitoring by Natural Resources Wales, for bathing water designated beaches in Pembrokeshire for 2019 and 2020 are given in Figure 7 (and Appendix 1). Annual ratings classify each site as excellent, good, sufficient or poor based on measurements taken over a four-year period. All information is communicated to the public via the Bathing Water Data Explorer Find a bathing water (data.gov.uk) which links to beach-specific profile data at Natural Resources Wales / Bathing water quality.

| Location | 2020 Classification | 2019 Classification |
|---|---|---|
| **Abereiddy** | Excellent | Excellent |
| **Abermawr** | Excellent | Excellent |
| **Amroth Central** | Excellent | Excellent |
| **Barafundle** | Excellent | Excellent |
| **Broad Haven (Central)** | Excellent | Excellent |
| **Broad Haven (South)** | Excellent | Excellent |
| **Caerfai** | Excellent | Excellent |
| **Castle Beach, Tenby** | Excellent | Excellent |
| **Coppet Hall** | Excellent | Excellent |
| **Dale** | Excellent | Excellent |
| **Druidston Haven** | Excellent | Excellent |
| **Freshwater East** | Excellent | Excellent |
| **Freshwater West** | Excellent | Excellent |
| **Little Haven** | Excellent | Excellent |
| **Lydstep** | Excellent | Excellent |
| **Manorbier** | Excellent | Excellent |

| | | |
|---|---|---|
| **Marloes Sands** | Excellent | Excellent |
| **Newgale** | Excellent | Excellent |
| **Newport North** | Good | Good |
| **Nolton Haven** | Good | Good |
| **Penally** | Excellent | Excellent |
| **Poppit West** | Excellent | Excellent |
| **Sandy Haven** | Excellent | Good |
| **Saundersfoot** | Excellent | Excellent |
| **Tenby North** | Excellent | Excellent |
| **Tenby South** | Excellent | Excellent |
| **West Angle** | Excellent | Excellent |
| **Whitesands** | Excellent | Excellent |
| **Wiseman's Bridge** | Excellent | Excellent |

*Figure 7: Classifications for Bathing Water beaches in Pembrokeshire for 2019 and 2020 (NRW).*

## 3.3 Non-designated bathing water results.

Annual results, based on monitoring by Pembrokeshire County Council, for non- designated beaches in Pembrokeshire for 2019 are given in Figure 8 (see also Appendix 2). Covid-19 meant that sampling was not conducted in 2020.

| Bathing Water | Unofficial BWD classification 2019 | 2018 for comparison |
|---|---|---|
| Cwm yr Eglwys | GOOD | GOOD |
| Gelliswick, Milford Haven | GOOD | GOOD |
| Martin's Haven | EXCELLENT | EXCELLENT |
| St. Brides Haven | GOOD | POOR |
| Westdale | EXCELLENT | EXCELLENT |
| Priory Bay, Caldy Island | EXCELLENT | EXCELLENT |
| Goodwick Sands | EXCELLENT | EXCELLENT |

*Figure 8: Classifications for non-EC bathing water beaches in Pembrokeshire for 2019 and 2018 (PCC)*

## 3.4 Other statutory monitoring.

NRW also undertake monitoring for other Directives apart from the Bathing Waters Directive. Data of relevance to this report includes monthly monitoring for the Water Framework Directive for dissolved inorganic nitrogen (DIN) at sites within the outer Milford Haven Waterway transitional water body. One site that overlaps with the current study is Sandy Haven Pill. NRW regularly find highly polluting levels of nitrate at this site. It is interesting to note that pollution levels are considerably higher in the winter months than during the summer. Dissolved inorganic nitrogen samples are also taken as part of the open coast water body sampling. Sites include Solva and Lower Town Fishguard. Statistical comparisons are outside the scope of the present study, but it can be noted that, in common with the Milford Haven Waterway transitional water body, polluting levels of nitrate are frequently recorded and vary throughout the year with the highest levels being identified in the winter months.

## 4. Discussion and Conclusions

Of the 81 water samples tested, 51 locations were considered polluted in terms of nitrate (>1 ppm N), comprising 63% of the sites visited, and 8 locations were considered polluted in terms of phosphate (>0.1 ppm P), comprising 10% of the sites visited.

Nitrate therefore seemed to be the dominant nutrient pollution found. Of the 81 sites, 7 exceeded 10 ppm (the highest test category) equating to 9% sites visited, 20 were above 5ppm equating to 25% sites visited, and 36 were above 2ppm equating to 44% sites visited.

Phosphate levels reached the highest test category available at 1 site, with the second highest category being identified at 2 other locations.

From local knowledge, agricultural run-off was considered to be the likely primary cause of the pollution recorded during the survey.

The survey provided proof that pollution is present and widespread around the coast of Pembrokeshire. This is not a huge surprise to those who know the area well, whether from knowledge of the land or from knowledge as a user of the shore and sea.

*Figure 9: The North Pembrokeshire Bluetits – Porthsele Beach 2019 (Ella Richardson Photography).*

Regular sea swimmers, The Bluetits, swim all year round and members have noted slurry in the sea on occasion and raised concerns.

Tools such as the Safer Seas & Rivers Service (available as an App) by Surfers Against Sewage help to raise awareness of reduced water quality as a result of untreated sewage and wastewater discharging from thousands of sewer overflows around the UK. When these events occur, Surfers Against Sewage is automatically notified by the water company (Dŵr Cymru Welsh Water in Wales) and issues a real-time sewage alert through the Safer Seas & Rivers Service so surfers, swimmers and other water users can avoid potentially harmful pollution incidents. Whilst this service is useful it does not cover pollution from agricultural run-off which in Pembrokeshire seems to be more a chronic rather than acute pollution event (although accidental spills do occur on occasion).

Wild swimmer Ms Own Sanderson was forced to halt her high-profile microplastics pollution campaign through the UK national parks for a week to recover after contracting gastroenteritis following a swim through what she believed was agricultural slurry in the upper reaches of the Daugleddau estuary near Slebech. She said “I can’t believe that as a national park that’s allowed to go on. This has been an eye opener because I knew that our urban rivers, some of those are gross. But national parks, I didn’t realise it was exactly the same picture.”

# Wild swimmer falls ill after testing water for microplastic pollution in national parks

Laura Owen Sanderson is collecting water from all 15 national parks to raise awareness of microplastic pollution

By Emma Gatten, ENVIRONMENT EDITOR
21 September 2020 • 7:42am

Laura Owen Sanderson is swimming all of the UK's 15 national parks to collect samples to be test for microplastics. [ CREDIT: David Sievers

A project to test water from all of the UK's national parks for microplastic contamination had to be halted at the first step after the wild swimmer collecting the samples fell ill from pollution.

*Figure 10: Article from The Daily Telegraph, September 2020*

Poor water quality can have a seriously negative impact on human health. Bathing waters are monitored for two types of bacteria; *Escherichia coli* (E.coli) and intestinal enterococci. These species are targeted as they indicate faecal matter is present, which is what can make water users ill. Statutory monitoring by Natural Resources Wales and local councils is designed to pick up pollution and emergency notices can alert users if a beach is impacted. However, bathing water monitoring only routinely takes place during the summer season (May-September). Water users who use the sea outside of the summer months, including increasing numbers of winter swimmers as the activity has gained popularity, are at risk of becoming ill due to water pollution from both sewage and land run-off and the lack of regular monitoring to provide safety reassurance.

Impacts to marine life from high levels of nutrients are well known in areas of restricted water flow like inlets and small embayments where elevated levels of green algal growth on the shore can provide visual signs that the system is out of balance. This can result in low oxygen levels in the water as the algal 'mats' break down which can kill marine life. However, on the open coast wave action and tidal movements tend to quickly dilute any inputs from freshwater sources, carrying them away along the coast or offshore. But pollution is still entering the sea and the local impacts (if any) are not known. The cumulative impact of all of the small streams, flood run-off, seeps and rivers are not being studied. Could it be that in years to come, the existence of nutrient pollution in the sea (and any resultant impacts either direct or indirect from associated chemical pollution such as pesticides) is as common to us as marine plastics have become in the last decade? You don't know what is there, and whether it is causing any harm, until you look.

**Recommendations:**

- **The widespread nutrient pollution (particularly of nitrates) around the Pembrokeshire coast highlighted in this report needs to be reduced. Investigation and implementation of methods of reducing nutrient inputs is urgently required.**
- **Wider awareness raising of the insidious nature of nutrient pollution around the open coast and the potential impact on human health of recreational users of the near-shore marine environment (especially outside of the main bathing season) is needed.**
- **Any concerns about pollution should be noted and reported immediately to the NRW incident line 0300 065 3000. Photos can be sent to icc@naturalresourceswales.gov.uk**

## 5. References


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## Appendix 1: Bathing water results for Pembrokeshire 2019 and 2020 monitored by Natural Resources Wales

2019

| Location | IE - Intestinal enterococci (colonies per 100ml) | | | | | EC - Escherichia coli (colonies per 100ml) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | May-19 | Jun-19 | Jul-19 | Aug-19 | Sep-19 | May-19 | Jun-19 | Jul-19 | Aug-19 | Sep-19 |
| Abereiddy | < 10 | | 18 | < 10 | < 10 | < 10 | | 18 | < 10 | < 10 |
| Abermawr | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 |
| Amroth Central | < 10 | | 18 | < 10 | < 10 | < 10 | | 18 | < 10 | < 10 |
| Barafundle | < 10 | | 27 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 |
| Broad Haven (Central) | < 10 | < 10 | < 10 | < 10 | < 10 | | 191 | 36 | < 10 | < 10 |
| Broad Haven (South) | < 10 | | 18 | < 10 | < 10 | | 18 | < 10 | < 10 | < 10 |
| Caerfai | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | | 55 | < 10 |
| Castle Beach, Tenby | < 10 | | 200 | < 10 | < 10 | | 18 | < 10 | 118 | 27 |
| Coppet Hall | < 10 | | 27 | < 10 | < 10 | | 18 | < 10 | 64 | < 10 |
| Dale | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | 27 |
| Druidston Haven | < 10 | < 10 | | 18 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 |
| Freshwater East | | 73 | 18 | < 10 | < 10 | | 36 | < 10 | | 91 |
| Freshwater West | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 |
| Little Haven | < 10 | | 109 | < 10 | 250 | 27 | < 10 | | 36 | < 10 |
| | | | | | | | | | 780 | 18 |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lydstep** | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | | 36 | < 10 | < 10 | < 10 | < 10 | | | | | | | | |
| **Manorbier** | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | | | | | | | | | |
| **Marloes Sands** | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | | | | | | | | | |
| **Newgale** | < 10 | < 10 | < 10 | | 18 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | | | | | | | | | |
| **Newport North** | | 18 | | 45 | | 36 | | 45 | | 45 | | 27 | | 18 | | 155 | < 10 | | | 45 |
| **Nolton Haven** | | 460 | | 100 | < 10 | | | 45 | < 10 | | | 200 | | 118 | < 10 | | | 100 | < 10 | |
| **Penally** | | 118 | | 18 | < 10 | < 10 | | | 18 | | | 127 | < 10 | | < 10 | < 10 | | | | 27 |
| **Poppit West** | < 10 | < 10 | < 10 | < 10 | | 73 | | 27 | | 118 | | 27 | < 10 | | | 73 | | | | |
| **Sandy Haven** | < 10 | | 36 | | 55 | | 82 | | 64 | | 64 | | 18 | | 55 | | 36 | | 82 | |
| **Saundersfoot** | < 10 | | 55 | < 10 | < 10 | < 10 | | | 18 | | | 109 | < 10 | | < 10 | | | | 55 | |
| **Tenby North** | < 10 | | 700 | | 18 | < 10 | < 10 | | | < 10 | | 330 | | | 18 | < 10 | | | 27 | |
| **Tenby South** | | 27 | | 2100 | | 27 | | 27 | | 55 | < 10 | | 882 | | | 27 | < 10 | | | 27 |
| **West Angle** | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | | | | | | | | | |
| **Whitesands** | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | | | | | | | | | |
| **Wiseman's Bridge** | | 36 | | 280 | | 27 | | 27 | < 10 | | | 36 | | 480 | | 82 | | 45 | < 10 | |

| Colour Key |
|---|
| EC: ≤250 cfu/100ml IE: ≤100 cfu/100ml |
| EC: ≤500 cfu/100ml ; IE: ≤200 cfu/100ml |
| Anything worse than above |

2020

| Location | IE - Intestinal enterococci (colonies per 100ml) | | | | | EC - Escherichia coli (colonies per 100ml) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | May-20 | Jun-20 | Jul-20 | Aug-20 | Sep-20 | May-202 | Jun-202 | Jul-202 | Aug-202 | Sep-202 |
| Abereiddy | n/a | < 10 | 18 | < 10 | < 10 | n/a | < 10 | < 10 | 45 | < 10 |
| Abermawr | n/a | < 10 | < 10 | < 10 | < 10 | n/a | < 10 | < 10 | 18 | < 10 |
| Amroth Central | n/a | < 10 | 18 | < 10 | < 10 | n/a | < 10 | < 10 | 45 | < 10 |
| Barafundle | n/a | < 10 | < 10 | < 10 | < 10 | n/a | < 10 | < 10 | < 10 | < 10 |
| Broad Haven (Central) | n/a | < 10 | 73 | | 55 | < 10 | n/a | < 10 | < 10 | 100 | < 10 |
| Broad Haven (South) | n/a | < 10 | < 10 | < 10 | < 10 | n/a | < 10 | < 10 | 18 | < 10 |
| Caerfai | n/a | < 10 | < 10 | < 10 | < 10 | n/a | < 10 | < 10 | <10 | < 10 |
| Castle Beach, Tenby | n/a | < 10 | < 10 | < 10 | < 10 | n/a | < 10 | < 10 | 18 | < 10 |
| Coppet Hall | n/a | < 10 | < 10 | < 10 | < 10 | n/a | < 10 | < 10 | < 10 | < 10 |
| Dale | n/a | < 10 | < 10 | < 10 | < 10 | n/a | | 27 | < 10 | < 10 | < 10 |
| Druidston Haven | n/a | < 10 | < 10 | < 10 | < 10 | n/a | < 10 | < 10 | < 10 | | 18 |
| Freshwater East | n/a | < 10 | < 10 | < 10 | < 10 | n/a | < 10 | < 10 | < 10 | < 10 | |
| Freshwater West | n/a | < 10 | < 10 | < 10 | < 10 | n/a | < 10 | < 10 | < 10 | < 10 | |
| Little Haven | n/a | | 18 | < 10 | 109 | < 10 | n/a | < 10 | < 10 | 91 | 270 |
| Lydstep | n/a | < 10 | < 10 | < 10 | < 10 | n/a | < 10 | < 10 | < 10 | < 10 | |
| Manorbier | n/a | | 18 | < 10 | < 10 | < 10 | n/a | | 82 | < 10 | < 10 | < 10 | |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Marloes Sands** | n/a | < 10 | | | 18 | | 18 | < 10 | | n/a | | < 10 | | < 10 | | < 10 | | < 10 | | |
| **Newgale** | n/a | < 10 | | < 10 | | < 10 | | < 10 | | n/a | | < 10 | | < 10 | | < 10 | | < 10 | | |
| **Newport North** | n/a | | 18 | | 27 | | 18 | < 10 | | n/a | | < 10 | | < 10 | | < 10 | | < 10 | | |
| **Nolton Haven** | n/a | | 36 | | 182 | | 27 | | 18 | n/a | | | 27 | | 320 | | 18 | | 27 | |
| **Penally** | n/a | | 45 | < 10 | | < 10 | | < 10 | | n/a | | < 10 | | < 10 | | < 10 | | < 10 | | |
| **Poppit West** | n/a | < 10 | | < 10 | | < 10 | | < 10 | | n/a | | < 10 | | < 10 | | < 10 | | < 10 | | |
| **Sandy Haven** | n/a | < 10 | | < 10 | | < 10 | | < 10 | | n/a | | < 10 | | < 10 | | < 10 | | | 36 | |
| **Saundersfoot** | n/a | < 10 | | < 10 | | | 36 | < 10 | | n/a | | < 10 | | < 10 | | | 18 | < 10 | | |
| **Tenby North** | n/a | < 10 | | < 10 | | < 10 | | < 10 | | n/a | | < 10 | | | 18 | | 18 | < 10 | | |
| **Tenby South** | n/a | < 10 | | < 10 | | | 18 | < 10 | | n/a | | < 10 | | < 10 | | | 136 | < 10 | | |
| **West Angle** | n/a | < 10 | | < 10 | | < 10 | | < 10 | | n/a | | < 10 | | | 64 | < 10 | | < 10 | | |
| **Whitesands** | n/a | < 10 | | < 10 | | < 10 | | < 10 | | n/a | | < 10 | | < 10 | | < 10 | | < 10 | | |
| **Wiseman's Bridge** | n/a | < 10 | | < 10 | | | 37 | | 55 | n/a | | < 10 | | | 18 | | 127 | | 100 | |

## Appendix 2: Non-EC designated bathing water results for Pembrokeshire 2019 monitored by Pembrokeshire County Council

| Bathing Water | NumberEColi | 95_percentile_EColi | 95_percentile_IE | 90_percentile_EColi | 90_percentile_IE | Unofficial BWD classification 2019 | 2018 for comparison |
|---|---|---|---|---|---|---|---|
| Cwm yr Eglwys | 48 | 154.3482512 | 110.469789 | 97.33962222 | 73.08826253 | GOOD | GOOD |
| Gelliswick, Milford Haven | 48 | 149.8932782 | 155.373418 | 98.18302545 | 101.4351329 | GOOD | GOOD |
| Martin's Haven | 48 | 31.57044323 | 20.6965836 | 25.81513316 | 17.97355397 | EXCELLENT | EXCELLENT |
| St. Brides Haven | 48 | 219.3019528 | 174.873585 | 132.5163653 | 108.0126276 | GOOD | POOR |
| Westdale | 48 | 87.88776848 | 50.3128194 | 60.15088302 | 37.15538902 | EXCELLENT | EXCELLENT |
| Priory Bay, Caldy Island | 48 | 93.42377447 | 91.7600575 | 64.96722573 | 63.1250276 | EXCELLENT | EXCELLENT |
| Goodwick Sands | 48 | 181.1893627 | 75.1153937 | 116.4217204 | 53.06052034 | EXCELLENT | EXCELLENT |

Pembrokeshire County Council were not able to sample beaches in 2020 due to the work-impact of Covid-19.

# Appendix 3 – SWEPT Pembrokeshire open coast results spreadsheet

| Sample site (Blue Flag) | surveyor | date | description | clarity | smell | flow | depth | width | nitrates | phosphates | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South Pembrokeshire | | | | | | | | | | | | |
| Begelly, opposite Shell garage | H&DC | 21/10/2020 | Stream - flows eventually into Eastern Cleddau | Clear | No | medium | 30 | 120 | 0.5-1 | 0.02-0.05 | 51.732256 | -4.723769 |
| Begelly, at bridge on New Rd | H&DC | 24/10/2020 | same stream | Cloudy | No | fast | 30 | 300 | 0.5-1 | 0.02-0.05 | 51.73375 | -4.724116 |
| Stepaside | H&DC | 25/10/2020 | stream at head of Pleasant Valley | Cloudy | No | medium | 50 | 350 | 2-5 | 0.02-0.05 | 51.73987 | -4.731996 |
| Wiseman's Bridge | H&DC | 25/10/2020 | stream at bottom of Pleasant Valley | Cloudy | No | slow | 75 | 400 | 2-5 | 0.02-0.05 | 51.723502 | -4.686562 |
| Wiseman's Bridge sea shore | H&DC | 25/10/2020 | outflow pipe below Tramway | Clear | No | fast | 0 | 30 | 0.2-0.5 | 0.02-0.05 | 51.721933 | -4.68765 |
| Back Lane, Wisemans Bridge | H&DC | 25/10/2020 | stream flowing down from Sardis | Clear | No | medium | 5 | 75 | 0.5-1 | <0.02 | 51.728675 | -4.691752 |
| St Issells church cemetry, Churchton | H&DC | 26/10/2020 | stream | Clear | No | fast | 15 | 80 | 0.5-1 | <0.02 | 51.720231 | -4.705448 |
| Coppett Hall | H&DC | 26/10/2020 | pipe onto beach | Clear | No | fast | 20 | 80 | 0.5-1 | <0.02 | 51.71544 | -4.694895 |
| The Glen, Saundersfoot | H&DC | 27/10/2020 | waterfall | a little cloudy | No | fast | 25 | 75 | 0.2-0.5 | <0.02 | 51.706904 | -4.695934 |
| Rusheylake | H&DC | 27/10/2020 | stream below Rusheylake | a little cloudy | No | fast | 15 | 100 | 0.2-0.5 | <0.02 | 51.706976 | -4.69599 |
| Regency Hall, Saundersfoot | H&DC | 27/10/2020 | same stream at carpark road bridge | a little cloudy | No | fast | 35 | 120 | 0.2-0.5 | <0.02 | 51.710811 | -4.700553 |
| Amroth | H&DC | 28/10/2020 | stream at main carpark footbridge to shops | clear | No | fast | 50 | 400 | 2-5 | <0.02 | 51.73186 | -4.66235 |
| Colby Lodge | H&DC | 28/10/2020 | stream 100m north of Colby Lodge on footpath | clear | No | fast | 30 | 250 | 0.5-1 | <0.02 | 51.741849 | -4.670503 |
| Frainslake Beach, Castlemartin Range | LH | 24/10/2020 | stream | Clear | No | fast | 5 | 200 | 0.2-0.5 | 0.02-0.05 | 51.638285 | -5.0497368 |
| Ritec (North feed) | CT | 21/10/2020 | stream | Mod sediment | No | slow | 60 | 400 | 0.5-1 | 0.05-0.1 | 51.674671 | -4.7267208 |
| Ritec | CT | 21/10/2020 | stream | Clear | No | slow | 100 | 300 | 2-5 | 0.1-0.2 | 51.672045 | -4.7252158 |
| Manorbier (East) | CT | 21/10/2020 | stream | Clear | No | medium | 40 | 100 | 1-2 | 0.02-0.05 | 51.644525 | -4.7964277 |

| Sample site (Blue Flag) | surveyor | date | description | clarity | smell | flow | depth | width | nitrates | phosphates | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Manorbier (West) | CT | 21/10/2020 | stream | Clear | No | fast | 60 | 150 | 1-2 | 0.1-0.2 | 51.644919 | -4.801295 |
| Freshwater East | CT | 21/10/2020 | stream | Low sediment | No | medium | 100 | 300 | 2-5 | 0.05-0.1 | 51.643454 | -4.8689607 |
| Stackpole | CT | 22/10/2020 | Stream (Just below a dam/pond) | Clear | No | medium | 40 | 100 | 5-10 | 0.1-0.2 | 51.630775 | -4.9186812 |
| Stackpole (Sampson Cross) | CT | 23/10/2020 | Stream | Clear | No | slow | 20 | 150 | 2-5 | 0.02-0.05 | 51.631254 | -4.9345112 |
| Bosherston Lily Pond (nr NT Car Park at Bosh) | CT | 24/10/2020 | Lake edge - but probably not far enough out for a reliable sample | Clear | No | none | | | 0.5-1 | <0.02 | 51.616337 | -4.9376172 |
| Bosherston Lily Pond (Broadhaven End) | CT | 25/10/2020 | Lake edge - but probably not far enough out for a reliable sample. No sample from outflow, not enough flow | Clear | No | none | | | <0.2 | 0.02-0.05 | 51.611876 | -4.9231883 |
| Stem Bridge | CT | 26/10/2020 | Channelled stream (next to old pumping station) | Clear | No | fast | 50 | 300 | 2-5 | 0.02-0.05 | 51.648197 | -4.992173 |
| Freshwater West | CT | 27/10/2020 | Stream | Clear | No | fast | 70 | 400 | 1-2 | 0.02-0.05 | 51.65654 | -5.0584481 |
| West Angle | CT | 22/10/2020 | Stream - Outflow from culvert under car park) | Clear | No | fast | 10 | 20 | 2-5 | 0.02-0.05 | 51.686122 | -5.1061615 |
| Angle Bay (Tom B Road) | CT | 22/10/2020 | Stream | Clear | No | medium | 5 | 10 | 2-5 | 0.1-0.2 | 51.67781 | -5.0737185 |
| Angle Bay (Rhoscrowther End East) | CT | 22/10/2020 | Stream | Clear | No | fast | 15 | 80 | 2-5 | 0.05-0.1 | 51.678099 | -5.0430042 |
| Angle Bay (Rhoscrowther End West) | CT | 22/10/2020 | Stream (algal growth evident) | Clear | No | fast | 15 | 70 | 5-10 | 0.2-0.5 | 51.676215 | -5.047197 |
| Pwllcrochan | CT | 22/10/2020 | Stream | Clear | No | medium | 40 | 100 | 1-2 | 0.05-0.1 | 51.686114 | -5.0085419 |
| South west Pembrokeshire | | | | | | | | | | | | |
| Nolton Haven | CT | 22/10/2020 | Stream | Clear | No | medium | 45 | 500 | 0.5-1 | 0.02-0.05 | 51.824525 | -5.1074218 |
| Druidstone (N) | CT | 22/10/2020 | Stream | Clear | No | medium | 50 | 150 | 0.2-0.5 | 0.02-0.05 | 51.813256 | -5.1010362 |
| Druidstone (S) | CT | 22/10/2020 | Stream | Clear | No | medium | 20 | 150 | 1-2 | 0.02-0.05 | 51.81201 | -5.1028215 |
| Broad Haven North (North) | CT | 22/10/2020 | Stream | Clear | No | fast | 10 | 200 | 0.5-1 | 0.05-0.1 | 51.783481 | -5.1020718 |

| Sample site (Blue Flag) | surveyor | date | description | clarity | smell | flow | depth | width | nitrates | phosphates | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Broad Haven North (South) | CT | 22/10/2020 | Stream | Clear | No | fast | 10 | 200 | 0.2-0.5 | 0.05-0.1 | 51.780814 | -5.1029741 |
| Little Haven | CT | 22/10/2020 | Stream | Clear | No | medium | 60 | 100 | 5-10 | 0.02-0.05 | 51.772998 | -5.1079693 |
| St Brides Haven | SB | 22/10/2020 | Stream | Clear | No | fast | 5 | 100 | 10 + | 0.02-0.05 | 51.75353 | -5.1862681 |
| Watwick Beach | SB | 22/10/2020 | Stream over cliff / waterfall | Clear | No | fast | | | 1-2 | <0.02 | 51.692709 | -5.1610382 |
| Castle Beach | SB | 22/10/2020 | Stream | Clear | No | medium | 8 | 160 | 1-2 | <0.02 | 51.701641 | -5.1586892 |
| Dale | SB | 23/10/2020 | Stream | Clear | No | very fast | 5 | 60 | 1-2 | 0.05-0.1 | 51.709519 | -5.1686322 |
| Sandy Haven beach (east) | SB | 23/10/2020 | Stream | Clear | No | fast | 10 | 40 | 10 + | 1 + | 51.721397 | -5.094417 |
| Musselwick | SB | 26/10/2020 | Stream | clear | No | fast | 1 | 20 | 2-5 | 0.02-0.05 | 51.735514 | -5.208092 |
| Martin's Haven | SB | 26/10/2020 | Stream | clear | No | medium | 2 | 50 | 10 + | <0.02 | 51.735864 | -5.244929 |
| Watery Bay | SB | 26/10/2020 | Stream | clear, very scummy | No | medium | 5 | 40 | 0.2-0.5 | 0.02-0.05 | 51.72559 | -5.231339 |
| Marloes Sands | SB | 26/10/2020 | Stream | clear | No | fast | 10 | 50 | 1-2 | 0.02-0.05 | 51.723787 | -5.2139615 |
| North west Pembrokeshire | | | | | | | | | | | | |
| Goodwick | RV | 22/10/2020 | River | Clear | No | fast | 15 | 500 | 2-5 | <0.02 | 51.99938 | -4.988344 |
| Aberfelin | RV | 27/10/2020 | Stream | Clear | No | fast | 20 | 300 | 10 + | 0.05-0.1 | 52.021361 | -5.024229 |
| Pwll Crochan 2 (nearer Pwll Deri) | RV | 01/11/2020 | Stream | Clear | No | fast | 10 | 30 | 5-10 | 0.05-0.1 | 51.9875 | -5.0837 |
| Pwll Crochan | RV | 01/11/2020 | stream | Clear | No | fast | 10 | 40 | 10 + | 0.02-0.05 | 51.9851 | -5.0803 |
| Aberbach | RV | 01/11/2020 | small river | Clear | No | fast | 30 | 400 | 5-10 | 0.05-0.1 | 51.9741 | -5.0818 |
| Abermawr | RV | 01/11/2020 | stream - seeping out from wetland through pebbles | Clear | No | medium | 2 | 300 | 5-10 | 0.05-0.1 | 51.9689 | -5.0842 |
| Abercastell | RV | 22/10/2020 | Stream | Clear | No | fast | 20 | 300 | 5-10 | 0.05-0.1 | 51.958905 | -5.1256112 |
| Trefin | RV | 22/10/2020 | Small river | Clear | No | fast | 30 | 200 | 1-2 | 0.05-0.1 | 51.948076 | -5.1523656 |
| Porthgain | RV | 22/10/2020 | Stream | Clear | No | fast | 30 | 100 | 2-5 | 0.05-0.1 | 51.947057 | -5.179751 |
| Abereiddy | RV | 22/10/2020 | Stream | Clear | No | fast | 20 | 200 | 0.5-1 | 0.05-0.1 | 51.937136 | -5.204867 |
| Whitesands | RV | 22/10/2020 | Ditch | Clear | No | slow | 20 | 150 | 0.2-0.5 | 0.05-0.1 | 51.897038 | -5.295105 |
| Porthclais | RV | 22/10/2020 | Small river | Clear | No | fast | 25 | 300 | 1-2 | 0.05-0.1 | 51.870552 | -5.28346 |
| Caerfai | RV | 22/10/2020 | Ditch | Clear | No | slow | 5 | 20 | 1-2 | 0.1-0.2 | 51.872551 | -5.2527107 |
| Solva | RV | 22/10/2020 | River | Clear | No | fast | 100 | 800 | 5-10 | 0.05-0.1 | 51.874228 | -5.1879518 |

| Sample site (Blue Flag) | surveyor | date | description | clarity | smell | flow | depth | width | nitrates | phosphates | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Penycwm | RV | 22/10/2020 | Stream | Clear | No | fast | 5 | 30 | 2-5 | 0.05-0.1 | 51.853224 | -5.1325618 |
| Newgale Brandy Brook | RV | 22/10/2020 | Small river | Clear | No | slow | 100 | 500 | 5-10 | 0.05-0.1 | 51.857726 | -5.1268782 |
| Newgale Pebbles | RV | 22/10/2020 | Stream | Clear | No | slow | 15 | 50 | 0.5-1 | <0.02 | 51.847043 | -5.1174202 |
| North Pembrokeshire | | | | | | | | | | | | |
| Cwm yr Eglwys | RV | 20/10/2020 | Stream in concrete channel | Clear | No | Medium | 10 | 60 | 0.5-1 | 0.05-0.1 | 52.023339 | -4.894979 |
| Pwll Gwaelod | RV | 20/10/2020 | Stream | Frothy | Yes - sewage | Medium | 10 | 80 | 0.2-0.5 | 0.02-0.05 | 52.021728 | -4.909528 |
| Pwll Gwylog | RV | 21/10/2020 | Stream | Clear | No | fast | 10 | 80 | 0.2-0.5 | 0.05-0.1 | 52.015918 | -4.916458 |
| Aber Bach (Hescwm) | RV | 21/10/2020 | Small river | Clear | No | fast | 20 | 300 | 0.5-1 | 0.2-0.5 | 52.009314 | -4.920492 |
| Pwll Landdu | RV | 21/10/2020 | small stream - very little water running | Clear | | slow | 0.5 | 40 | 10 + | | 51.999922 | -4.963558 |
| Lower Town bridge | RV | 27/10/2020 | River | Clear | No | fast | 50 | 1400 | 0.5-1 | 0.05-0.1 | 51.9947 | -4.9693 |
| Lower Town weir | RV | 27/10/2020 | River | Clear | No | fast | 100 | 900 | 0.5-1 | 0.02-0.05 | 51.9926 | -4.965 |
| Cilrhedyn Bridge, Gwaun | RV | 21/10/2020 | River | Clear | No | fast | 50 | 800 | 2-5 | <0.02 | 51.976531 | -4.90549 |
| Gwaun downstream of Ty Gwyn | RV | 21/10/2020 | River | Clear | No | fast | 30 | 500 | 1-2 | <0.02 | 51.971519 | -4.884525 |
| Afon Cwmau at Dan Coed (trib) | RV | 21/10/2020 | Stream | Clear | No | fast | 20 | 300 | 2-5 | <0.02 | 51.969609 | -4.858038 |
| Ditch into Afon Cwmau | RV | 21/10/2020 | Ditch | Clear | No | slow | 10 | 80 | 10 + | 0.05-0.1 | 51.96895 | -4.853714 |
| Pwll Grannant | CO | 21/10/2020 | Stream | Clear | No | fast | 10 | 100 | 1-2 | <0.02 | 52.096616 | -4.7420906 |
| Ceibwr | CO | 21/10/2020 | Small river | Clear | No | medium | 40 | 1500 | 5-10 | <0.02 | 52.076181 | -4.7587605 |
| Cwm Tawel tributary | CO | 21/10/2020 | Small stream | Clear | No | medium | 10 | 200 | 5-10 | <0.02 | 52.07474 | -4.757233 |
| Nant Ceibwr | CO | 21/10/2020 | Small river | Clear | No | medium | 30 | 1200 | 5-10 | <0.02 | 52.07381 | -4.757056 |
| Pen Pistyll | CO | 21/10/2020 | Small stream | Clear | No | fast | 15 | 100 | 5-10 | 0.05-0.1 | 52.034459 | -4.8386742 |
| Cwm Newport | CO | 21/10/2020 | Small stream in culvert just above sample point | Clear | No | medium | 5 | 50 | 1-2 | <0.02 | 52.02171 | -4.850672 |
| Aber Rhigian | CO | 21/10/2020 | Small river | Clear | No | fast | 30 | 1000 | 0.2-0.5 | <0.02 | 52.01878 | -4.868067 |
| Aber Fforest | CO | 21/10/2020 | Small river | Clear | No | medium | 15 | 500 | 0.5-1 | <0.02 | 52.01825 | -4.879539 |