Sanitary Survey - Review

Three Rivers – 2024

Document No. – *J0591/23/11/01*

Carcinus Ltd, Wessex House, Upper Market Street, Eastleigh, Hampshire, SO50 9FD.
Tel. 023 8129 0095
https://www.carcinus.co.uk/

Carcinus Ltd – Document Control Sheet

Client	Food Standards Agency (FSA)
Project Title	Sanitary Survey Review
Document Title	Sanitary Survey Review - Three Rivers
Document Number	J0591/23/11/01
Revision	4.0
Date	03 August 2024

Revisions

Revision No.	Date	Comment
0.1	22 November 2023	Draft for internal review
1.0	23 November 2023	Draft for client review
2.0	30 January 2024	Draft for secondary consultation
3.0	29 February 2024	Final
3.1	27 March 2024	Sampling plan update
3.2	10 July 2024	July 2024 Update
4.0	03 August 2024	Document re-finalised

Document QA and Approval

	Name	Role	Date
Author	Antonia Davis	Consultant	10 July 2024
Checked	Joshua Baker	Senior Consultant	03 August 2024
Approved	Joshua Baker	Senior Consultant	03 August 2024

Initial Consultation

Consultee	Date of consultation
LA – Carmarthenshire Council	October 2023
Welsh Water (DCWW)	October 2023
Natural Resources Wales	October 2023

Consultation on draft report

Consultee	Date of consultation
LA – Carmarthenshire Council	February 2024
Welsh Water (DCWW)	February 2024
Natural Resources Wales	February 2024

A sanitary survey relevant to the bivalve mollusc beds in Three Rivers was undertaken in 2014 in accordance with Regulation (EC) 854/2004 (which was replaced by retained EU Law Regulation (EU) 2017/625, with sanitary survey requirements now specified in retained EU Law Regulation (EU) 2019/627). This provided appropriate hygiene classification zoning and monitoring plan based on the best available information with detailed supporting evidence. In line with regulatory and EU guidance the Food Standards Agency undertake targeted

sanitary survey reviews to ensure public health protection measures continue to be appropriate. This report provides a review of information and recommendations for a revised sampling plan if required. Carcinus Ltd. (Carcinus) undertook this work on behalf of the FSA. Carcinus Ltd accepts no liability for any costs, losses or liabilities arising from the reliance upon or use of the contents of this report other than by its client.

Dissemination

Food Standards Agency, Carmarthenshire County Council. The report is publicly available via the Carcinus Ltd. website.

Recommended Bibliographic Citation:

Carcinus Ltd., 2024. Review of the Three Rivers 2014 Sanitary Survey. Carcinus report on behalf of the Food Standards Agency, to demonstrate compliance with the requirements for classification of bivalve mollusc production areas in England and Wales under retained EU Law Regulation (EU) 2019/627.

Contents

List of figures

List of tables

1 Introduction

1.1 Background

The Food Standards Agency (FSA) is responsible for carrying out sanitary surveys in classified production and relay areas in accordance with Article 58 of retained (EU) Regulation 2019/627 and the EU Good Practice Guide (European Commission, 2021). In line with these requirements, sanitary surveys must be reviewed to ensure public health protection measures continue to be appropriate. Carcinus is contracted to undertake reviews on behalf of the FSA.

The report considers changes to bacterial contamination sources (primarily from faecal origin) and the associated loads of the faecal indicator organism *Escherichia coli* (*E. coli*) that may have taken place since the original sanitary survey was undertaken. It does not assess chemical contamination, or the risks associated with biotoxins. The assessment also determines the necessity and extent of a shoreline survey based on the outcome of the desktop report and identified risks. The desktop assessment is completed through analysis and interpretation of publicly available information, in addition to consultation with stakeholders.

1.2 Three Rivers Review

This report reviews information and makes recommendations for a revised sampling plan for existing cockle (*Cerastoderma edule*) classification zones in the Three Rivers BMPA (Figure 1.1). This review explores any changes to the main microbiological contamination sources that have taken place since the original sanitary survey was conducted. Data for this review was gathered through a desk-based study and consultation with stakeholders.

An **initial consultation** with Local Authorities (LAs), Welsh Government and Natural Resources Wales (NRW) responsible for the production area was undertaken in October 2023. This supporting local intelligence is valuable to assist with the review and was incorporated in the assessment process.

Following production of a draft report, a wider **external second round of consultation** with responsible Local Enforcement Authorities (LEAs), Industry and other Local Action Group (LAG) members was undertaken in February 2024. It is recognised that dissemination and inclusion of a wider stakeholder group, including local industry, is essential to sense-check findings and strengthen available evidence. The draft report is reviewed taking into account the feedback received.

The review updates the assessment originally conducted in 2014 (Cefas, 2014) and sampling plan as necessary and the report should read in conjunction with the previous survey.

Specifically, this review considers:
(a) Changes to the shellfishery (if any);
(b) Changes in microbiological monitoring results;
(c) Changes in sources of pollution impacting the production area or new evidence relating to the actual or potential impact of sources;

(d) Changes in land use of the area; and
(e) Change in environmental conditions.

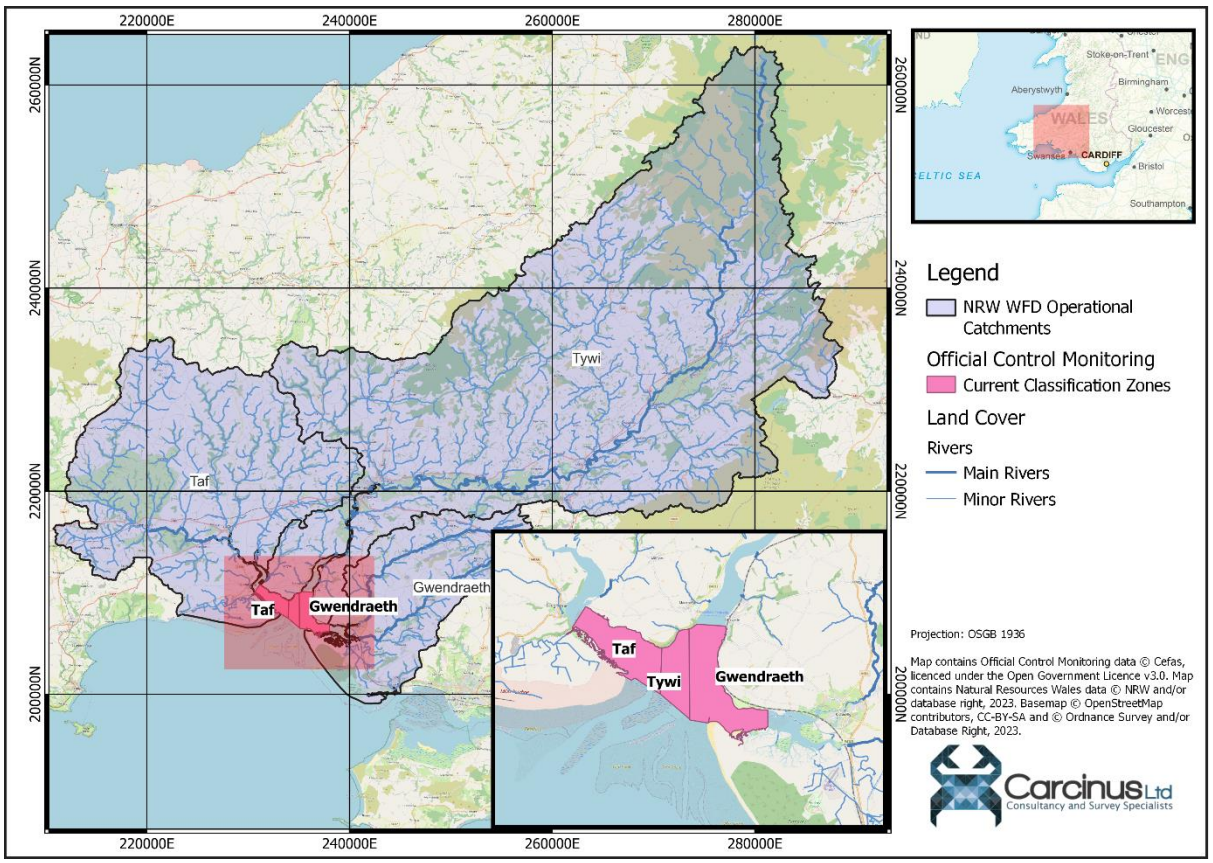


Figure 1.1 Location of the Three Rivers BMPA in south Wales. Inset map shows the locations of the Classification Zones with the BMPA.

Sections 2 - 6 detail the changes that have occurred to the shellfishery, environmental conditions and pollution sources within the catchment since the publication of the original sanitary survey. A summary of the changes is presented in section 7 and recommendations for an updated sampling plan are described in section 8.

1.3 Assumptions and limitations

This desktop assessment is subject to certain limitations and has been made based on several assumptions, namely:

- Accuracy of local intelligence provided by the Local Authorities and Natural Resources Wales (NRW), and Welsh Government;
- The findings of this report are based on information and data sources up to and including October 2023;
- Only information that may impact on the microbial contamination was considered for this review; and
- Official Control monitoring data have been provided through a request to Cefas, with no additional verification of the data undertaken. The data are also available on the

Cefas data hub[1]. Results up to and including October 2023 have been used within this study. Any subsequent samples have not been included.

2 Shellfisheries

2.1 Description of Shellfishery

The Three Rivers BMPA is coastally situated in southwest Wales and opens out into Carmarthen Bay (Figure 1.1). The closest BMPA is Burry Inlet, 14 km to the south east (Cefas Reference M038).

This review only provides a recommended sampling plan for the currently active Classification Zones (CZs) within the BMPA, but it draws upon data sources that consider the entire catchment. This is so that the findings of the report can be drawn on should reclassification of historic zones be required in the future.

The Local Authority (LA) for this fishery in terms of food hygiene Official Control purposes (including sampling) is Carmarthenshire County Council. The fishery is a public fishery, but is subject a series of byelaws. Byelaw 47 of the former South Wales Sea Fisheries Committee (SWSFC) regulates a permit scheme specific to the Three Rivers estuary for Cockle gathering[2]. There is a minimum size of cockle for catch (of 19 mm diameter), and a restriction to hand gathering only. The Three Rivers BMPA is also subject to Byelaw 48 which limits vehicle usage in the estuary, and Byelaw 29 which restricts fishing operations in the estuary from 1 May – 31 October, both from the former SWSFC. However, these do not directly affect the Shellfishery in this area. Whilst there is currently no formal season for closure, the fishery may be closed at any time to preserve stocks if deemed necessary.

Currently, three CZs are classified for Cockle harvesting but are closed all year round. Closure notices are imposed under the Fishery Regime[3] to protect future stocks, whereby the current harvestable quantities have been predetermined as insufficient (either in quantity of stock or size of specimens). By closing the fishery, stocks are given the chance to recover which should maintain future stocks.

During initial consultation, the LA stated there are currently no applications to begin harvesting an existing species in a new area, or a new species in an existing/new area for the Three Rivers BMPA.

2.2 Classification History

At the time of the original sanitary survey in 2014, there were three CZs within the Three Rivers BMPA for cockles. The CZs are unchanged since then. Cockle stocks were temporarily declassified as of 1 September 2014, with plans to reopen the beds the following year after monitoring (2015). All three CZs reopened in 2018, with a pilot reopening from 2018-2021.

[1] Cefas shellfish bacteriological monitoring data hub. Available at: https://www.cefas.co.uk/data-and-publications/shellfish-classification-and-microbiological-monitoring/england-and-wales/.
[2] https://www.gov.wales/sites/default/files/publications/2018-05/south-wales-inshore-fishery-legislation.pdf
[3] https://www.gov.wales/sites/default/files/pdf-versions/2022/2/1/1644831989/cockle-fishery-management-measures-2022.pdf

The current commercially active cockle bed CZs in the Three Rivers BMPA: *Tywi* CZ (Llansteffan, Ferryside up to Wharley Point – classified B), *Taf* CZ (Round from Wharley Point up to Laugharne – classified C), and *Gwendraeth* CZ (Pastoun Scar – classified long-term B). The location and classification status of all active CZs, along with RMPs sampled in the BMPA since 2014 are presented in Table 2.1 and Figure 2.1.

Table 2.1 Summary of all current active Classification Zones in the Three Rivers BMPA.

Classification Zone	Species	Current Classification (as of September 2023)	RMP Used
Tywi	Cockles	B	B071B – Wharley Point
Taf	Cockles	C	B071L – Laugharne
Gwendraeth	Cockles	LT-B	B071O – Pastoun Scar

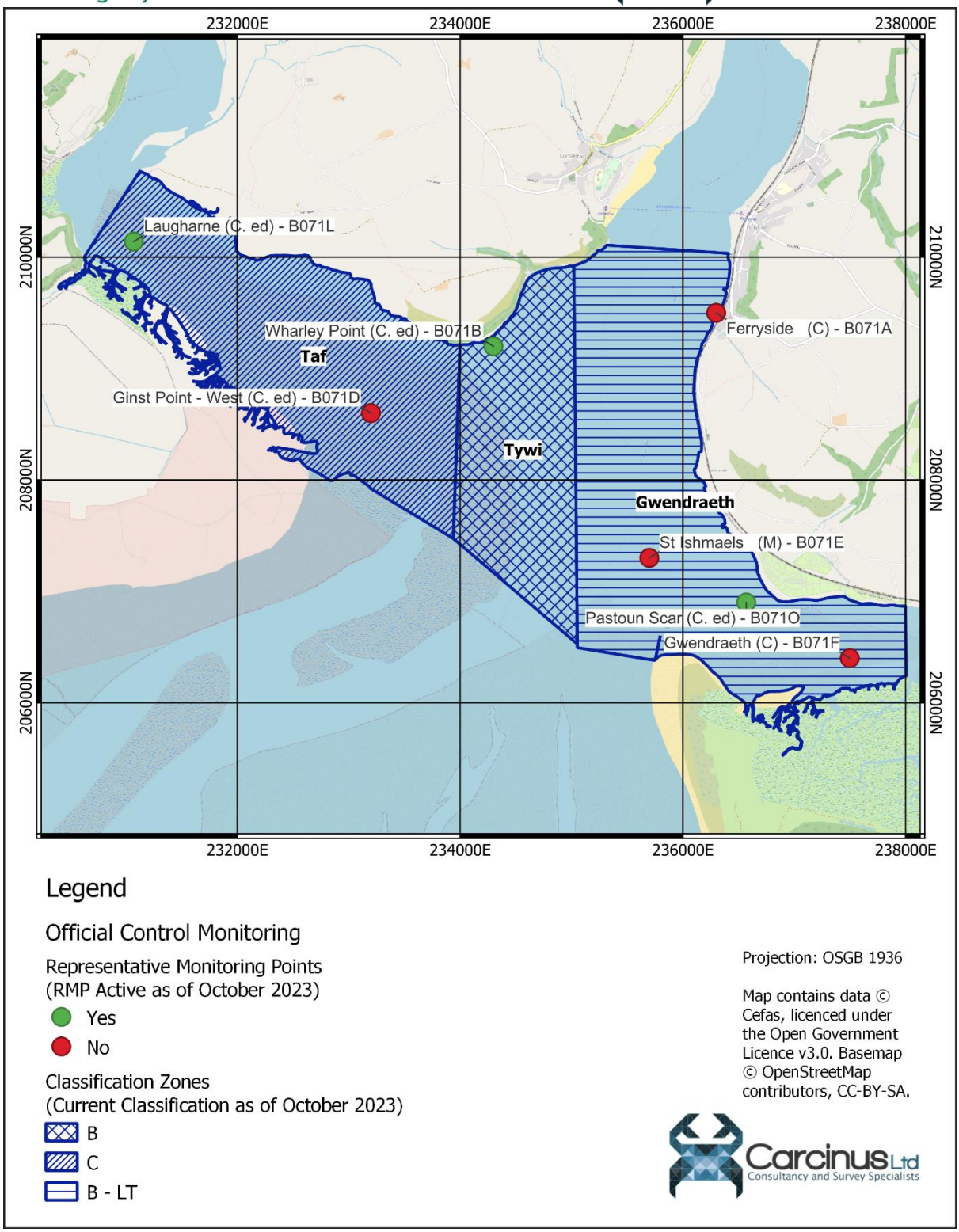


Figure 2.1 Current Classification Zones and Associated Representative Monitoring Points in the Three Rivers BMPA.

There were also two active CZs for mussels (*Mytilus edulis)* in 2014; *St Ishmaels Point* which was not commercially active at the time, and *Wharley Point* which held no commercially viable stocks. Recommendations were given in the sanitary survey to declassify *St Ishmaels*

Point due to lack of commercial activity. Both CZs were subsequently declassified, and no mussels are harvested from the Three Rivers BMPA.

3 Pollution sources

3.1 Human Population

The 2014 Sanitary survey cites population data for the catchment based on the 2011 Census of the United Kingdom. A subsequent Census was conducted in March 2021, and so the results of those two surveys have been compared to give an indication of the changes in the distribution of human population across the catchment between 2011 and 2021. Human population density per km^2 in the 2021 Census for areas wholly or partially contained within the Three Rivers catchment considered in this report are shown in Figure 3.1. Human population density changes between the 2011 and 2021 Censuses within Census Output Areas wholly or partially contained within the Three Rivers catchment considered in this report are presented in Figure 3.2.

The map presented in Figure 3.1 shows that the majority of land around the Three Rivers BMPA is rural. Population densities are generally lower than 500 persons per square kilometre (km^2), although the inlet map shows small areas of increased population density (<3,566 person per km^2) in the towns of Kidwelly to the east, Llansteffan to the North, Carmarthen to the far northwest, and Laugharne to the immediate northwest. At the time of the 2011 census, the total resident population in the catchment presented in Figure 3.1 was 102,847 with most of the population residing in the Carmarthen area and the *Gwendraeth* catchment. By 2021, the population had increased to 107,699 (an increase of 4.71 %). The towns mentioned previously provide the greatest risk of urban associated runoff, and therefore the greatest potential for urban contamination in the area. During initial consultation, no concerns were raised about the current wastewater treatment works being insufficient for the population size. The LA also confirmed no changes or additional potential sources of contamination in the wider area to the Three Rivers BMPA with regards to new developments (urban, tourism, agricultural). Whilst there has been development in the Carmarthenshire area, this is being carried out so as not to have any impact on the river and water quality. All large developments (over 100 m^2) are subject to Sustainable Urban Drainage Schemes which undergo Council approval. The schemes manage any potential run off from new developments.

During the 2014 sanitary survey, it was noted that Carmarthenshire attracts significant tourism with about three million visitors recorded in 2010. Most of the tourist visits to the area occur between April and October, peaking in July and August. In 2022, 3.46 million visitors came to Carmarthenshire, suggesting tourism to the area has risen since the previous sanitary survey[4]. The peak population remains likely to occur in the summer months (July and August), and will result in increased loading to the wastewater treatment network. During initial consultations, Dŵr Cymru Welsh Water (DCWW) stated that if an

[4] https://www.carmarthenshire.gov.wales/home/business/tourism/research-trends-development/

increase in population implies an issue with the current wastewater treatment works in the area, DCWW would act accordingly to remain compliant. Full details of the changes to the wastewater treatment network are discussed in the next section.

Analysis of Census data suggests that the population has seen an almost 5% increase in size, but that the majority of the catchment remains rural with low population densities and no additional developments providing additional loading to the wastewater treatment network. The main urban centres have not changed significantly since the 2014 sanitary survey was published, and the area continues to attract tourism which peaks in the summer months. Overall, the recommendations made in the 2014 sanitary survey to account for the impact of human populations remain valid.

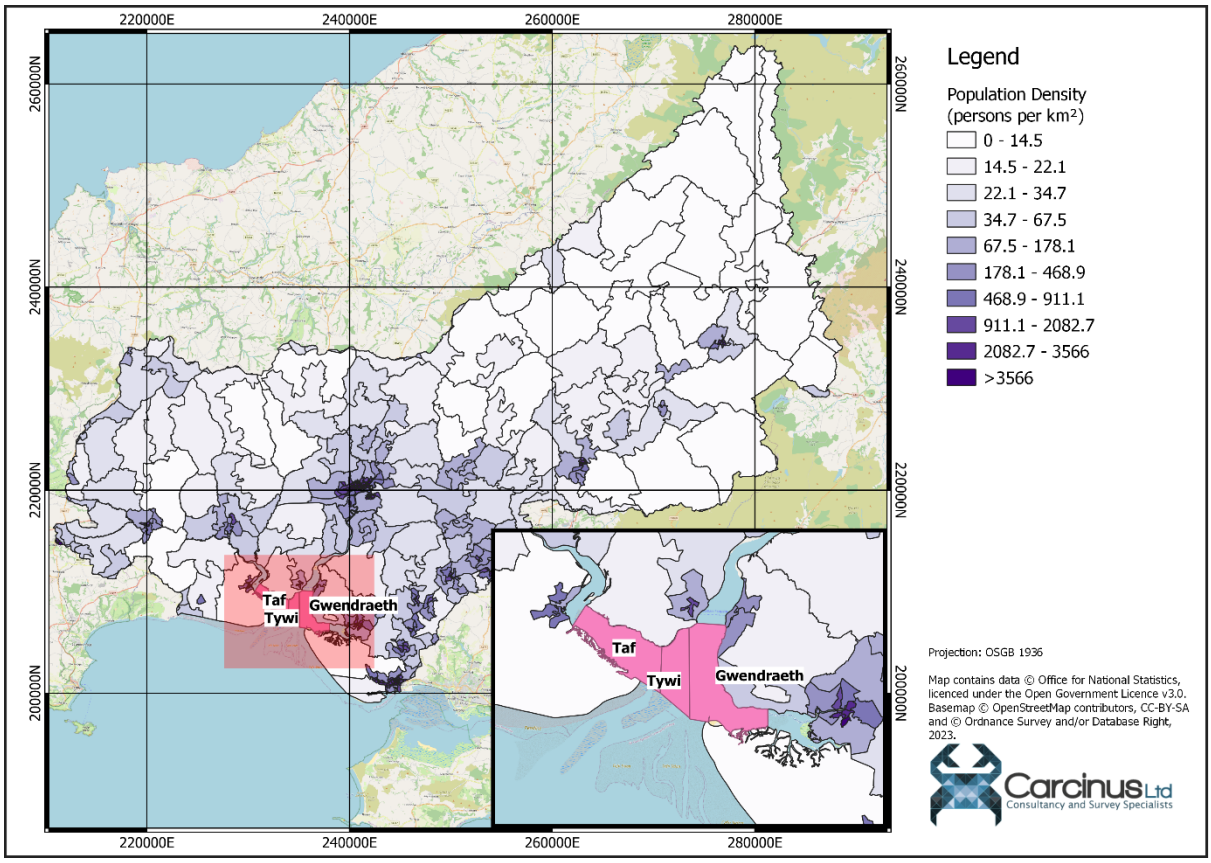


Figure 3.1 Human population density in Census Output Areas wholly or partially contained within the Three Rivers catchment for 2021 Census.

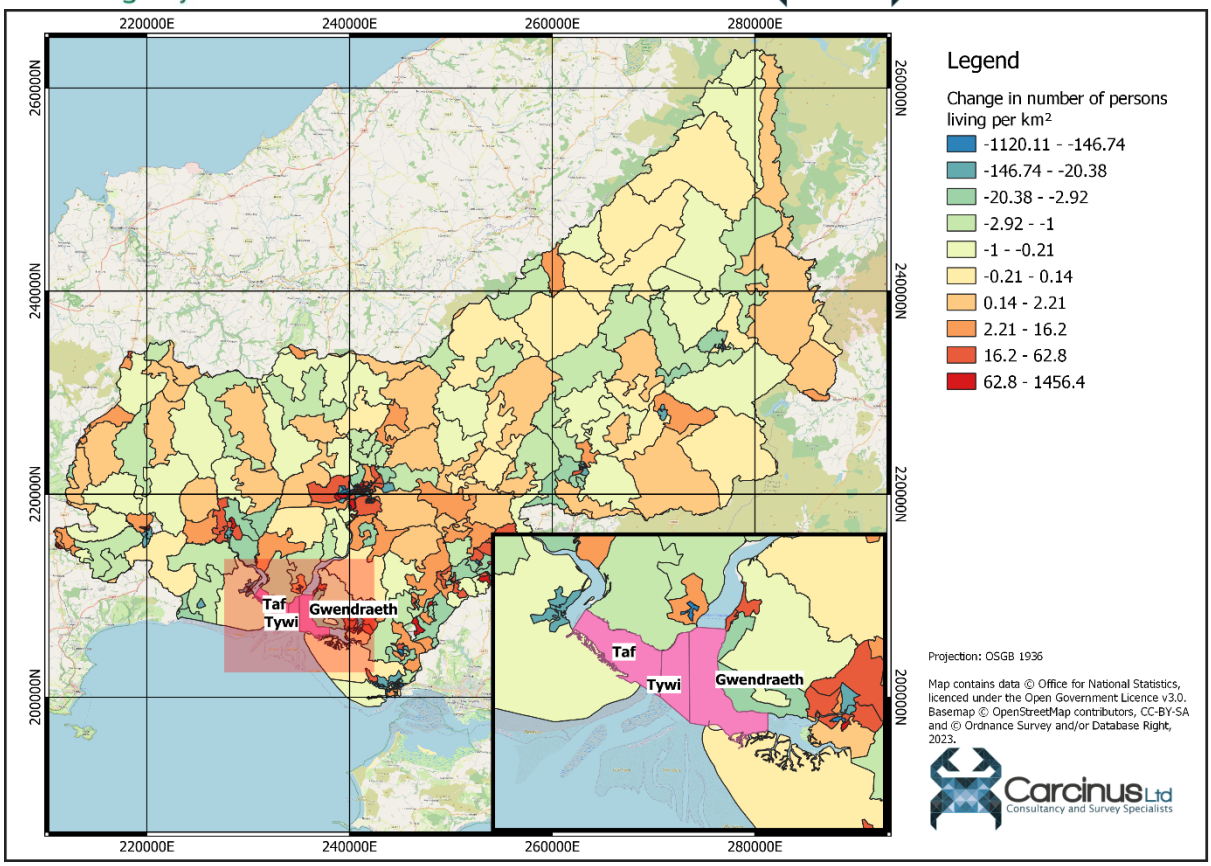


Figure 3.2 Human population density changes in Census Output Areas wholly or partially contained with the Three Rivers catchment. Changes considered between 2011 and 2021 data.

3.2 Sewage

Details of all consented discharges in the vicinity of the Three Rivers BMPA were taken from the most recent update to Natural Resources Wales' (NRW's) national permit database (Natural Resources Wales, 2023). The locations of these discharges within the catchment and near the Classification Zones are shown in Figure 3.3.

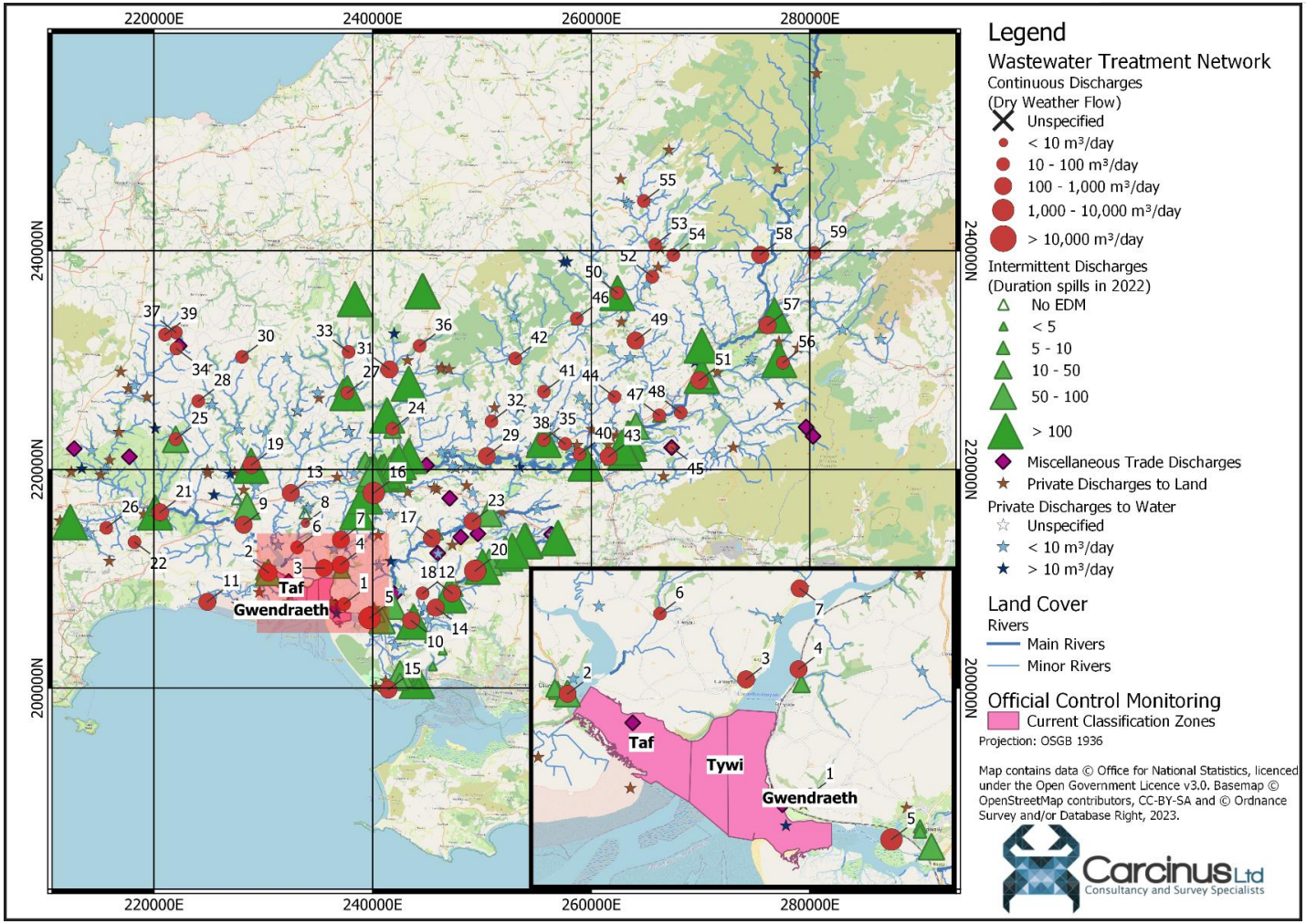


Figure 3.3 Locations of all consented discharges within the Three Rivers catchment. Numbers refer to continuous discharges, details of which can be found in Table 3.1.

Table 3.1 Details of 10 closest continuous discharges to the Three Rivers BMPA.

Discharge No.	Discharge Name	Permit Number	Receiving Water	Outlet NGR	Treatment Methodology	DWF (m^3/day)	Distance to centre of nearest CZ (km)
1	LLANSAINT WWTW LLANSAINT FERRYSIDE	BC0006101	LLANSAINT STREAM	SN 37395 07690	02: HIGH RATE BIOLOGICAL	96	0.89
2	LAUGHARNE WASTE WATER TREATMENT WKS	BH0060005	TAF ESTUARY	SN 30460 10567	22: UV DISINFECTION	320	2.26
3	LLANSTEPHAN STW	BK0111901	STREAM FORMIN TRIB OF AFON TOW	SN 35560 10980	01: BIOLOGICAL FILTRATION	158.4	3.30
4	FERRYSIDE STW FERRYSIDE CARMS	BJ0087001	THE FERRYSIDE STREAM	SN 37060 11270	01: BIOLOGICAL FILTRATION	317	3.50
5	KIDWELLY WASTEWATER TREATMENT WORKS	BF0147002	GWENDRAETH FACH ESTUARY	SN 39715 06405	01: BIOLOGICAL FILTRATION	1642	3.50
6	Llanybri WWTW	BN0269501	Nant Twlch Filiast	SN 33100 12860	01: BIOLOGICAL FILTRATION	31	3.84
7	PANTYRATHRO WWTW	BN0077102	FERNHILL BROOK	SN 37092 13580	01: BIOLOGICAL FILTRATION	114	5.79

	PANTYRATHRO CARMS						
8	Llangynog STW	BN0095701	LLANBRI STREAM	SN 33850 15080	01: BIOLOGICAL FILTRATION	9	6.18
9	ST CLEARS WWTW	BG0024501	AFON TAF	SN 28202 14939	01: BIOLOGICAL FILTRATION	987	7.05
10	TRIMSARAN WWTW SPUDDER BRIDGE RD	BC0019001	GWENDRAETH FAWR	SN 43522 06180	01: BIOLOGICAL FILTRATION	914	7.20

The 2014 sanitary survey identified 61 continuous water company sewage treatment works within the Three Rivers hydrological catchment. A small number of these discharged directly into the estuary. The majority were relatively small serving the rural areas and then discharging into watercourses subsequently draining into the estuary. At the time of this Sanitary Survey Review (November 2023), there are 59 continuous discharges within the Three Rivers hydrological catchment.

The previous sanitary survey identified two sewage works discharging directly into the *Taf* CZ. The first is the Laugharne STW (discharge no. 2) which discharges to the north of the CZ, and undergoes UV disinfection treatment (no change in treatment from 2014). This STW has a Dry Weather Flow (DWF) of 320 m^3/day and is 2.26 km from the nearest CZ. The original sanitary survey also identified the St Clears STW about 7 km upstream of Laugharne (Appendix I), which has a DWF of 987 m^3/day and undergoes Biological filtration (no change from 2014 Sanitary survey). A combination of distance from the BMPA and treatment type, means these discharges are unlikely to significantly increase contamination in the BMPA as bacteria will die off before reaching shellfish waters.

The closest discharge to any CZ in the catchment is Llansaint WWTW which is within 1 km of the *Gwendraeth* CZ, and discharges at 96 m^3/day with high rate biological treatment. Although this discharge is within close proximity to the BMPA, a combination of the treatment and low DWF mean it is likely to have minimal effect on contamination in the catchment. The Kidwelly WWTW has the highest DWF of 1,642 m^3/day and also discharges to the *Gwendraeth* CZ. This WWTW undergoes biological filtration and is 3.5 km to the nearest CZ, so any bacteriological contamination remaining after treatment is likely to experience die off before reaching the CZ, and overall contamination to the Shellfish waters from this WWTW is likely to be minimal.

The 2014 sanitary survey identified the Parc Y Splotts STW (Appendix I) as the only sewage works discharging directly into the Tywi estuary. This remains the largest sewage discharge in the catchment area and has a DWF of 7000 m^3/day (unchanged from 2014). Although this discharge is > 10 km from any CZ in the catchment, the 2014 sanitary survey identified its high discharge volume to have widespread impacts on the shellfish waters which remains the case today. Potential contamination from this STW should be considered in the placement of RMPs for this BMPA.

In addition to continuous discharges, the previous sanitary survey identified 34 permitted intermittent overflow discharges associated with the sewer networks within 2 km of the tidal limits of the estuary. According to Event Duration Monitoring (EDM) data for 2022, there are 3 discharges at Laugharne that spilled for between 5 and 100 hrs. EDM data is an indication of how often (and for how long) an intermittent discharge is active (it does not measure the volume of flow). A cluster was identified at Carmarthen in the 2014 sanitary survey and remains the case with the majority of these discharges currently spilling for more than 100 hrs in 2022. The five intermittent discharges previously identified at Kidwelly have EDM values between 5 – 100 hrs, and the two at the north end of Ferryside have EDM

values between 10 – 50 hrs. There are 4 previously identified intermittent discharges in the St Clears area of the catchment, one of which returned an EDM value of 50 – 100 hrs.

The storm overflow at Llansaint WWTW is the closest intermittent discharge to any CZ, and discharges to *Gwendraeth*. It spilled 26 times in 2022 for a duration of 485.75 hours. The next four closest intermittent discharges have a relatively low spill duration (< 60 hours) and so should have little impact on shellfish waters. However, the discharges at Llansteffan WwTW and the CSO at Ferryside WWTW are less than 3.4 km from *Gwendraeth* and spilled 83 and 91 times for a total of 528.75 and 766.5 hours respectively. Although the discharges discussed are >3 km away from the catchment, and some *E. coli* die off will likely occur before potential contamination reaches the Shellfish waters, however the high EDM values of these intermittent discharges means they should be considered in placement of RMPs for this BMPA.

Table 3.2 Details of Intermittent Discharges within 5 km of nearest CZ. Those likely to have an impact on contamination in the BMPA highlighted in yellow.

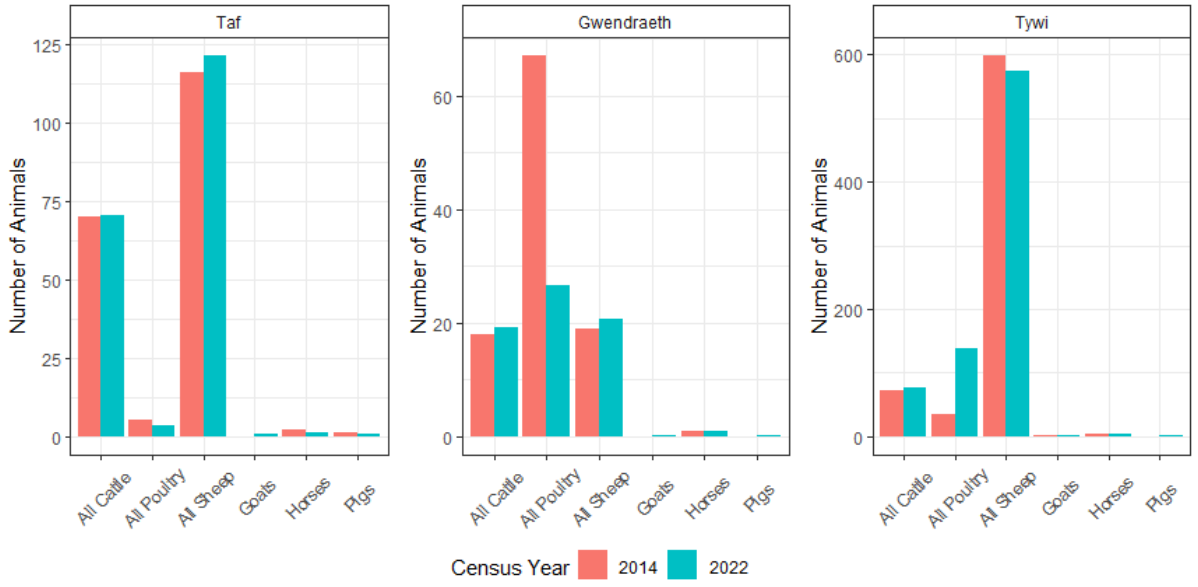
Discharge Name	Permit Ref.	Spill Duration (hours)	Spill count	Closest CZ	Distance to CZ
Settled Storm Overflow at Llansaint Wastewater Treatment Works	BC0006102	485.75	26	Gwendraeth	0.89
LAUGHARNE WWTW (STW) LAUGHARNE	BP0270701	58.25	48	Taf	2.27
LAUGHARNE SEWERAGE SYSTEM	BH0060003	24.25	41	Taf	2.55
Wogan Mews CSO	BP0209601	26	18	Taf	2.65
FERRYSIDE PS . .	BP0113101	29.5	31	Gwendraeth	3.11
Llansteffan WwTW	Unpermitted-73493	528.75	83	Gwendraeth	3.31
CSO at Ferryside Wastewater Treatment Works	BN0169301	766.5	91	Gwendraeth	3.40
SSO AT STATION ROAD P.S. KIDWELLY	BW2202901	6.5	14	Gwendraeth	4.15
SSO AT STATION ROAD P.S. KIDWELLY	BF0147004	6.5	14	Gwendraeth	4.19
TYCOCH SEWAGE PUMPING STATION KIDW	BW2203001	93.25	41	Gwendraeth	4.64

During initial consultations, no improvement works to the Wastewater Treatment Network were noted. However, it was briefly noted every intermittent asset will be subject to an impact assessment in future years.

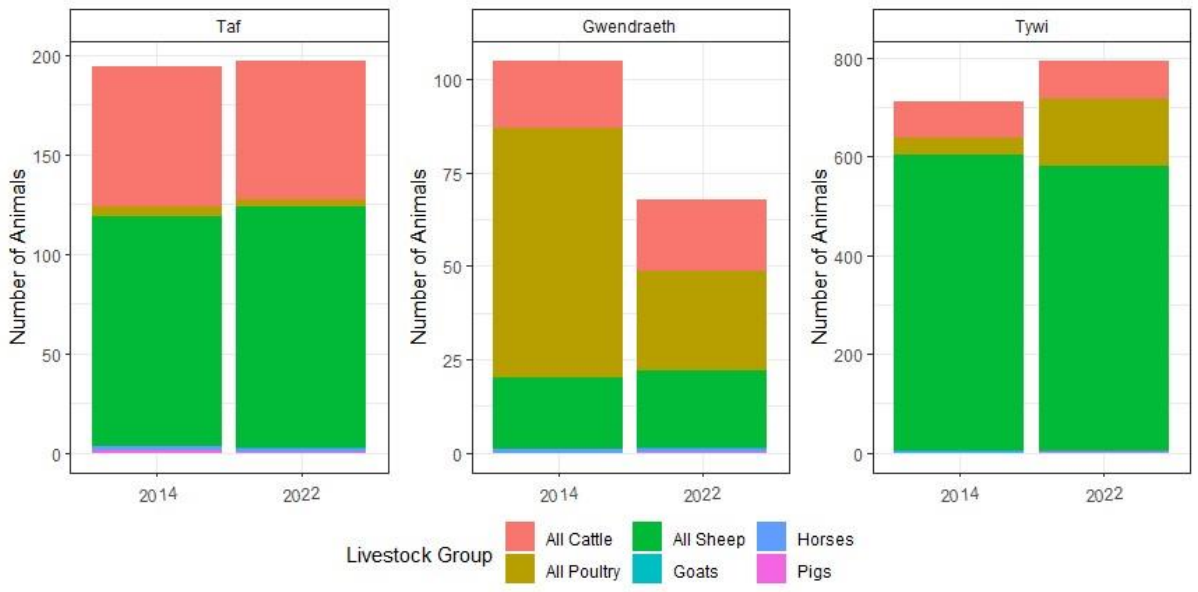
In addition to water company owned infrastructure, there continues to be privately owned discharges throughout the catchment. A number of these have consented discharge volumes of more than 10 m^3/day. Limited details of these can be provided due to data protection requirements. In the 2014 Sanitary Survey, a caravan park was identified to have a maximum consented flow of 320 m^3/day of effluent with an unspecified treatment level (although likely to be secondary treatment of some kind). The caravan park has the same maximum consented flow and treatment in 2023, and is approximately 1 km from the upper catchment of the nearest CZ (*Gwendraeth*). Given the nature of the site, there may also be increased faecal loading during the summer months when tourism to the area increases. The assessment of the impact from private discharges is considered to be small in comparison to the other sources of contamination discussed elsewhere in this report, including from the caravan park, and therefore does not require consideration in the placement of RMPs for the Three Rivers BMPA. Similarly, there are two miscellaneous Trade Discharges in the Taf and Gwendraeth CZs, however their predicted impact on contamination to the Shellfish waters is minimal.

3.3 Agricultural Sources

The 2014 Sanitary Survey identified that the majority of the land in the hydrological catchment of the Three rivers BMPA is used for agriculture, with almost all of this being pasture. In 2014, the upper areas of the catchment supported extensive sheep grazing, whilst the lower reaches supported a mixture of dairy and livestock farming. To provide an indication of changes to the livestock population in the catchment, a data request was made to the Agriculture and Rural Affairs department at Welsh Government. Figure 3.4shows a comparison the 2014 and 2022 livestock data, grouped by livestock type.



Livestock population data based on estimates from the Welsh Agricultural Survey, 2014 and 2022.
Data Â© Stats Wales, made available under the Open Government Licence v3.0



Livestock population data based on estimates from the Welsh Agricultural Survey, 2014 and 2022.
Data Â© Stats Wales, made available under the Open Government Licence v3.0

Figure 3.4 Changes in livestock populations in the Three Rivers BMPA catchment from the original Sanitary survey (2014) and current data (2022).

The data presented in Figure 3.4 shows that in the *Taf* CZ the number of cattle, sheep, and goats all increased slightly, whilst the numbers of poultry, horses, and pigs all decreased slightly. For the *Gwendraeth* CZ, the number of cattle, sheep, goats, and pigs increased. The number of poultry decreased by approximately 40, and the number of horses remained the same. In the *Tywi* CZ, the numbers of cattle, poultry and pigs increased. The number of sheep decreased. Across the *Taf* and *Tywi* CZs, sheep are the dominant livestock group in

both years. Poultry was the dominant livestock group in *Gwendraeth* in 2014, and remains so in 2022 despite the large decrease in numbers. Overall, the *Taf* total livestock increased by a marginal amount between 2014 and 2022, in the *Gwendraeth* total livestock decreased in this time period, and the *Tywi* livestock also increased. Livestock populations are subject to vary throughout the year. Highest numbers of animals will occur in spring, following the birthing season, and the lowest in autumn and winter when animals are sent to market.

The principal route of contamination of coastal waters by livestock is surface runoff carrying faecal matter. The land cover of the Three Rivers BMPA between 2012 and 2018 is shown in Figure 3.5. The maps show that the majority of the catchment is rural and dominated by pastures which also surround the 3 CZs in the BMPA. The maps show some areas of urban fabric directly to the north of the *Gwendraeth* catchment, and distributed to the north and north west of the CZs in general. The pasture areas noted adjacent to the shorelines present the greatest contamination risk to the classification zones. This is due to run-off from the land travelling less distance before reaching the CZs, resulting in less dilution and E. coli die off. Run-off from rivers further up the catchment will have a lower risk of contamination to the CZs, because the increased distance will result in further dilution and E. coli die off. These may however contribute to background levels of contamination in the CZs, particularly following significant rainfall events.

Some small areas within the catchment are also shown as arable farmland. This can represent a risk to the bacteriological health of the BMPA through the application of slurry used as fertiliser. The closed periods for the spreading of slurry in Wales are 1 September – 31 December for sandy/shallow soils, and 15 October – 15 January for other soil types[5]. The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021[6] specifies that silage cannot be stored within 10 m of a coastal or inland water. Given this regulation was introduced in 2021, we are unlikely to have seen large reductions, if any, in the overall bacteriological contamination caused by silage stored < 10 m from coastal or inland water before 2021. During initial consultations, NRW commented that the 2017 Coastal Report (Natural Resources Wales, 2017) suggested diffuse sources such as livestock and/or farming land uses play a significant role in the apportionment of bacteria in the Shellfish Water in the BMPA. It was also noted that there is a huge concentration of dairy farms specifically in the catchment, and many larger businesses are taking over smaller farms resulting in an increased intensity on land use in farming.

It was also noted in the original 2014 Sanitary Survey that some areas of the saltmarsh fringe are grazed, and that this could be of potential local significance to the shellfisheries. Smaller areas surrounding the *Taf* were lightly grazed, and areas around the *Gwendraeth* channel are grazed more intensely. During spring tides, there is likely to be a greater risk of

[5] https://ahdb.org.uk/knowledge-library/water-resources-control-of-agricultural-pollution-regulation-wales-faqs#:~:text=For%20grassland%20the%20closed%20periods,(2670%20gall%2Fac.)
[6] Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021. Available at: https://www.gov.wales/water-resources-control-agricultural-pollution-wales-regulations-2021-summary-measures-and-timeline

direct contamination to the estuary from faecal deposits. Water circulation around the estuary is clockwise and so will flow from the *Taf* down through the other two CZs.

This desktop assessment supports the findings of the original Sanitary Survey in that agricultural use of land surrounding the Three Rivers BMPA is likely to be of significant importance in deciding the locations of RMPs for the classification zones.

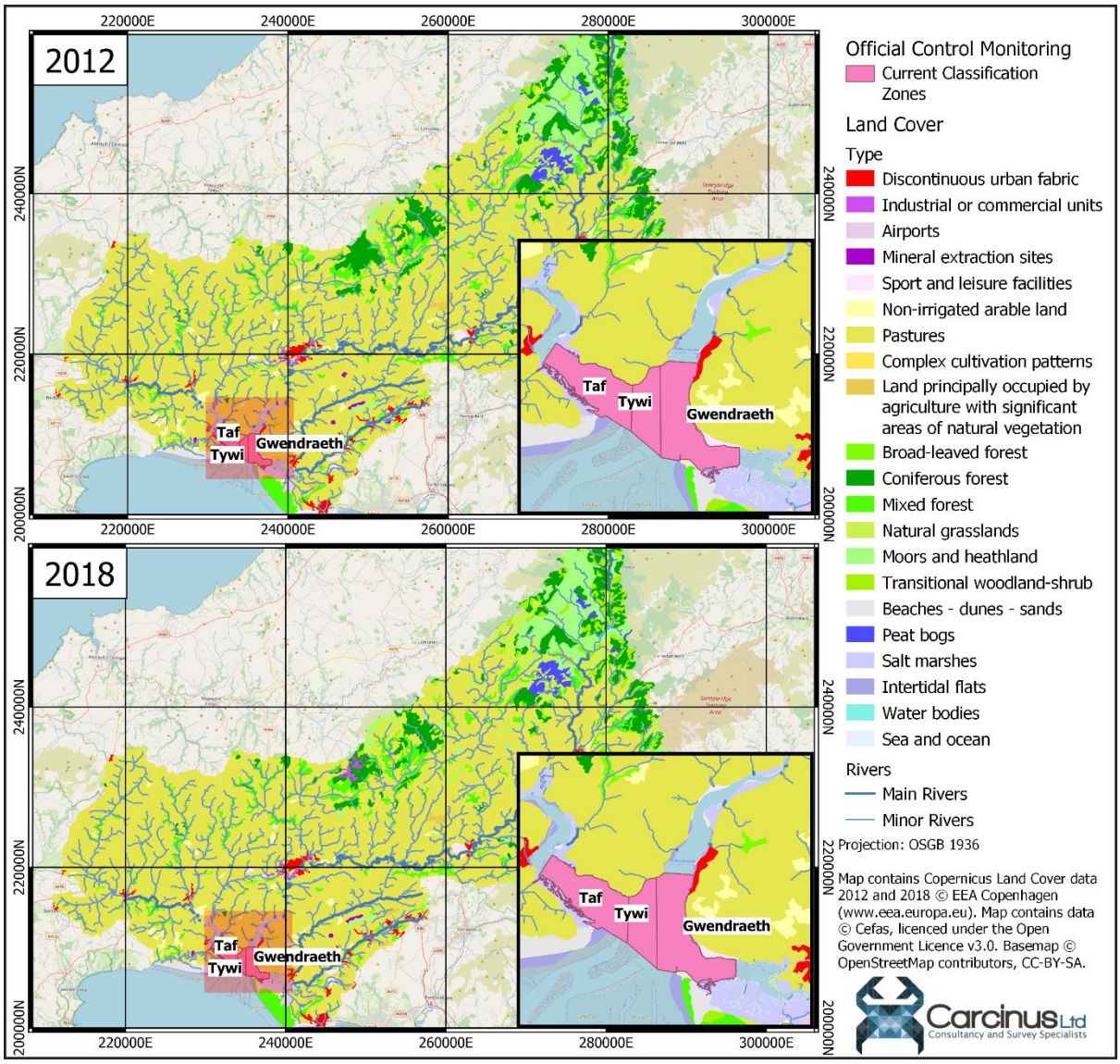


Figure 3.5 Land cover in the Three Rivers catchment in 2012 and 2018.

3.4 Wildlife

The survey area of the Three Rivers BMPA encompasses a range of estuarine habitats and these attract aggregations of wildlife, some of which may be an influence on shellfish hygiene through defecation in or nearby to the waters. The most significant of these is likely to be the waterbirds (wildfowl and waders) populations which overwinter in the area. The

Wetland Bird Survey (WeBS) provides waterbird counts for Carmarthen Bay, which includes the Three Rivers estuary.

Figure 3.6 shows the temporal trend in total overwintering waterbird counts from the winter of 2002/2003 – 2021/2022 (the most recent for which data are available). It shows that the dominant group in terms of population size is generally waders, but on one occasion in 2015 their population is slightly exceeded by Gulls (Austin *et al.*, 2014). The 2014 Sanitary survey noted over the five winters up until 2010/2011 an average total count of 37,923 overwintering birds were recorded within Carmarthen Bay. The current five year average total count (2017/18 - 2021/22) is 17,640 overwintering birds, a decrease of over 53% (Frost *et al.*, 2021). Between 2015 – 2020 the total number of birds counted decreased to c. 10,000, however this has increased drastically in 2021/2022. Carmarthen Bay also supports 6 nationally significant populations and 1 internationally significant population of birds.

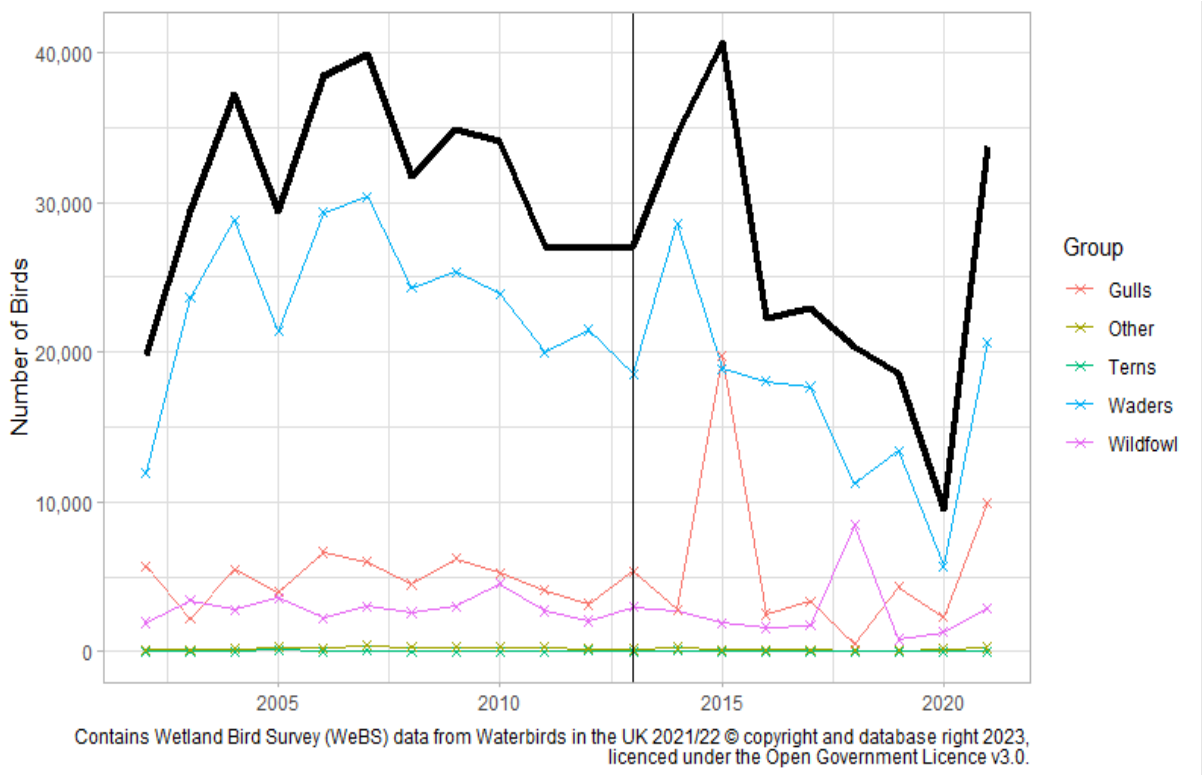


Figure 3.6 Temporal trend in waterbird counts from Carmarthen Bay. Data from the Wetland Bird Survey (Austin et al.*, 2023). Black line represents total number of birds.*

The largest aggregations of waterbirds, and therefore the highest risk of contamination due to defecation, will occur in winter months. The distribution of waterbirds within the estuary will be driven by the aggregations of their foraging resource, which will shift from year to year. The precise timing and locations of the contamination will however be variable, and it is challenging to define RMPs which reliably capture this source of pollution. Currently, the situation has not changed since the original sanitary survey was published and waterbird counts do not need consideration in placement of the RMP. However, should total bird

counts continue to rise as shown between 2020-2022, some consideration for them may need to be implemented.

The 2014 sanitary survey reported the closest seal colony to Three Rivers to be Caldey Island, about 20 km to the southwest. This area currently supports a population of approximately 100 grey seals[7] which are known to enter the estuary from time to time. Their patterns of movement align with foraging for salmon and sea trout, for which the peak period of upstream migration in these species is summer and autumn (Davidson, Vaughan and Hutchinson, 1943). Seals are likely to haul out in the estuary on sandbanks occasionally, although little information could be found confirming this. If seals are within the CZs and defecate, this has the potential to create localised hotspots of contamination. Given their small numbers and the large area they are known to forage over, their impacts are likely to be minimal and unpredictable spatially. Similarly the estuary has been known to support a small otter population as noted in the 2014 sanitary survey. Both animal groups are likely to cause minor impacts to bacteriological contamination in the estuary, and therefore do not need consideration in the placement of RMPs.

3.5 Boats and Marinas

The discharge of sewage from boats is unlikely to be a significant source of contamination to the shellfish beds of the Three Rivers BMPA. Boating activities in the area have been derived through analysis of satellite imagery and various internet sources and compared to that described in the 2010 Sanitary Survey. Their geographical positions are presented in Figure 3.7. Boats may make overboard sewage discharges, so require consideration in this assessment.

There are no ports or marinas within the survey area, but in 2014 it was noted there are areas of moorings for small yachts in the Tywi channel opposite Llanstefan, and about 2 km north of Llanstefan, and in the middle reaches of the Gwendraeth arm. The main uses of the estuary are likely to be the River Towy boating clubs, of which small pleasure craft are likely to be too small for onboard toilet facilities. If vessels of a larger nature with onboard facilities are to pass through the estuary, legislation states vessels are prohibited from making overboard discharges within 3 nautical miles of land[8]. In addition, boating activity of this kind is likely to follow seasonal patterns and be busier in the summer months.

Fishing vessels operate nearby in Burry Port and Saundersfoot, however the fishing patterns are likely to be limited to using the Three Rivers estuary for navigating in and out. Two fishing vessels < 10 m are noted to list their home port as ‘Three Rivers Area’ (gov.uk, 2024). Therefore, boating activities will have little impact on contamination in the Three Rivers BMPA and do not need consideration for the placement of RMPs.

[7] https://www.pembrokeshiremarinecode.org.uk/
[8] https://www.rya.org.uk/knowledge/environment/waste-management

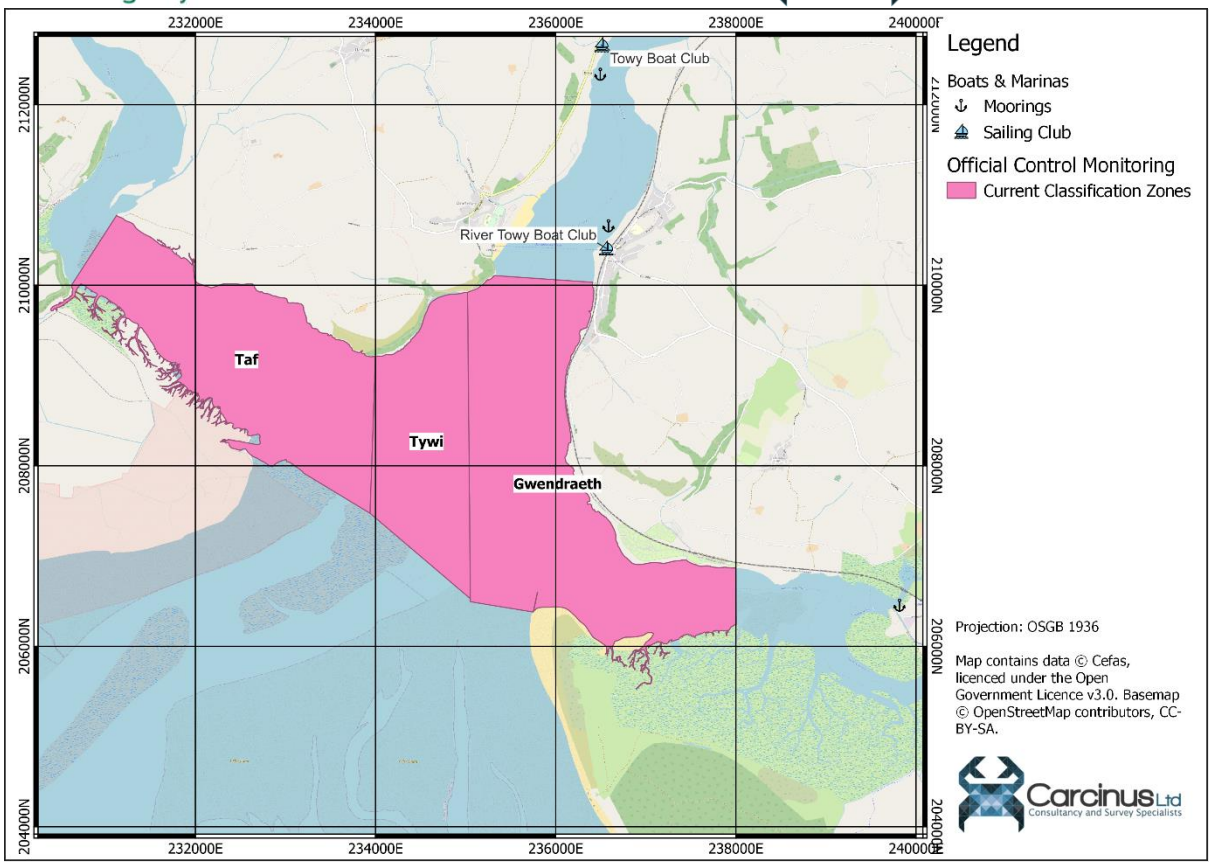


Figure 3.7 Locations of boats, marinas, and other boating activities in the vicinity of the Three Rivers BMPA.

3.6 Other Sources of Contamination

Utility misconnections are when foul water pipes are wrongly connected and enter surface waters without treatment, potentially putting raw sewage directly into watercourses via surface water drains. During initial consultations, no utility misconnections were noted.

Dog fouling was noted in the 2014 Sanitary Survey as a potential source of contamination. This is likely to be higher risk closer to the areas or urban fabric, and increase in the summer months with tourism. To the West of the catchment, the area is inaccessible Ministry of Defence land and therefore dog walking here is at minimal levels. Overall, dog fouling as a diffuse source of contamination to the shellfish waters will have little influence and does not need consideration in the placement of RMPs.

4 Hydrodynamics/Water Circulation

The original sanitary survey reported the Three Rivers estuary as a double split enclosed estuary facing south west, and draining into Carmarthen Bay. The area covered is approximately 37 km^2, the majority of which is intertidal with water circulating clockwise around the estuary. There are three separate arms extending inland from the estuary. These are all characterised by a central river channel through the intertidal areas and are the main freshwater inputs. The Tywi arm extends 20 km inland and becomes narrow towards the

upper end. The Taf arm has a similar profile to the Tywi, but is only 13 km to its tidal limit. Patches of saltmarsh have been noted in both channels, although more so in the Taf. The location of these channels in relation to discharges and urban fabric, along with their gradient may result increasing levels of runoff contamination in the upper areas. However, given the distance to the Classification Zones, bacteriological die off will occur before potentially contaminated water reaches the BMPA as mentioned in section 3.2 above. The Gwendraeth arm differs from the Tywi and Taf as it splits into two narrow tidal river channels after approximately 3.5 km. These two channels extend 2-3 km further with south shores possessing extensive saltmarsh.

Tidal range in the estuary is large at about 6.6 m on spring tides, which in turn drives extensive water movement through the CZs. The flooding tide will bring relatively clean water from Carmarthen Bay into the estuary, but the ebbing tide is more likely to carry contamination from the shoreline in. As previously mentioned, contamination decreases with distance travelled due to dilution and die-off of bacteria.

There is no evidence that the patterns of water movement within the Three Rivers BMPA will have changed significantly since the 2014 Sanitary Survey was published. No update to the sampling plan is necessary, as the recommendations made in the 2014 Sanitary Survey to account for the impact of water circulation within the estuary continue to be valid.

5 Rainfall

A complete record of the rainfall data for the Llangendeirne raingauge (ID: 499555) rainfall station at NGR SN 45472 13724 was downloaded from the rivers, rainfall and sea database NRW[9]. This station was chosen as it is the closest monitoring station to the BMPA, approximately 10 km from the Brancaster CZ. The data were subdivided into 2005 – 2014 (pre-sanitary survey) and 2014 – 2023 (post-sanitary survey) and processed in R (R Core Team, 2021). These data were used to determine whether any changes in rainfall patterns had occurred since the original sanitary surveys were published. The rainfall data are summarised in Figure 5.1Table 5.1 and the rainfall levels per month are shown in Figure 5.1.

Table 5.1 Summary statistics for the period preceding and following the 2014 Sanitary Survey.

Period	Mean Annual Rainfall (mm)	Percentage Dry Days	Percentage Days Exceeding 10 mm	Percentage Days Exceeding 20 mm
2005 - 2014	1337.3600	38.926	37.604	21.747
2014 - 2023	1388.32	34.597	39.493	24.119

[9] https://rivers-and-seas.naturalresources.wales/

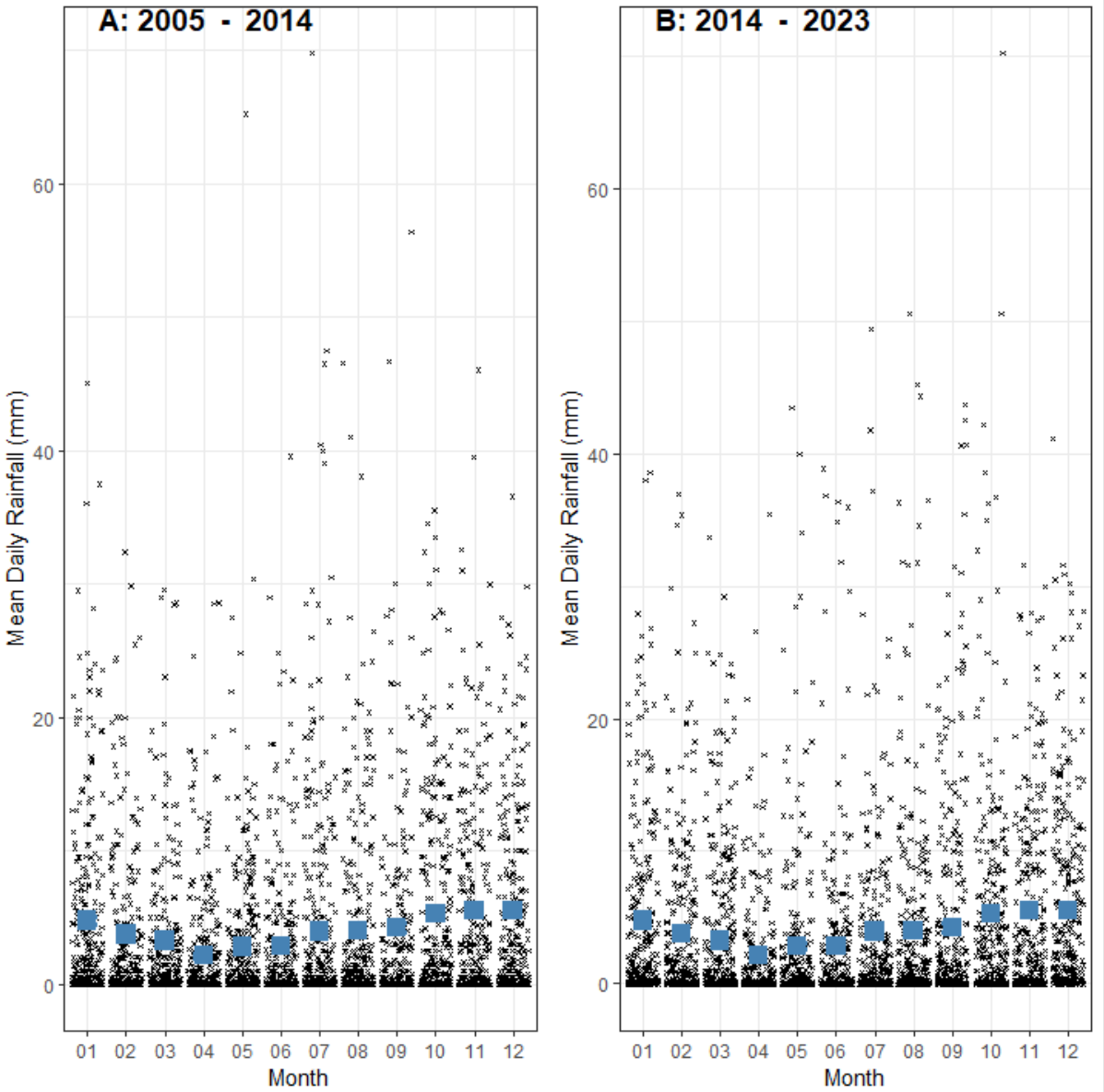


Figure 5.1 Mean daily rainfall per month at the Llangendeime raingauge (NGR: SN 45472 13724) for the period (A) 2005 - 2014 and (B) 2014 - 2023.

The data shows that the rainfall levels in the area have increased slightly, with the change in average annual rainfall only 50.96 mm. The percentage of dry days has decreased by > 4%, with the percentage of days with heavy rain (> 10 mm) and extremely heavy rain (> 20 mm) has increased slightly in both instances. Two sample t-tests indicated that there was no significant difference ($p > 0.05$) in the mean daily rainfall per month for the 2005 – 2014 and 2014 – 2023 periods (the mean daily rainfall between the two data sets is statistically the same).

Rainfall leads to increased faecal loading through two factors: elevated levels of surface runoff and increased spill events from intermittent discharges, particularly during periods of

heavy rain. Rainfall levels during both periods were greatest in winter months (November – February), and so levels of runoff etc. would be expected to be greatest during this time. However, as the rainfall patterns have remained (statistically) similar across the two time periods, significantly altered bacterial loading due to these factors is unlikely and as such sampling plan recommendations made in the original sanitary survey to capture the influence of runoff and spill events remain valid.

6 Microbial Monitoring Results

6.1 Official Control Monitoring

6.1.1 Summary Statistics and geographical variation

Mean Official Control Monitoring results for *E. coli* concentrations at RMPs sampled in the Three Rivers BMPA since 2010 are presented spatially in Figure 6.1 and summary statistics are presented in Table 6.1. This data was obtained through a request to Cefas, but are also available on the datahub[10].

[10] https://www.cefas.co.uk/data-and-publications/shellfish-classification-and-microbiological-monitoring/england-and-wales/shellfish-monitoring-results/

Table 6.1 Summary statistics from official control monitoring at bivalve RMPs in the Three Rivers BMPA. Highlighted rows are RMPs that are currently in use.

RMP (Species)	NGR	Species	No. Samples	First Sample	Last Sample	Mean	Min Value	Max Value	% > 230	% > 4,600	% > 46,000
Ferryside (C) - B071A	SN36300950	Cockle	15	25/10/2010	11/12/2012	1116	20	3500	80	0	0
Ginst Point - West (C. ed) - B071D	SN33200860	Cockle	40	15/03/2010	08/06/2017	1413.33	20	16000	52.5	10	0
Gwendraeth (C) - B071F	SN37500640	Cockle	64	18/01/2010	09/05/2017	5222.34	20	160000	71.88	15.63	3.13
Laugharne (C. ed) - B071L	SN31071014	Cockle	55	05/07/2017	11/10/2023	1799.89	45	11000	72.73	14.55	0
Pastoun Scar (C. ed) - B071O	SN36570690	Cockle	83	09/02/2016	11/10/2023	1607.60	18	24000	62.65	10.84	0
St Ishmaels (M) - B071E	SN35700730	Mussel	59	18/01/2010	18/09/2019	1213.48	20	9200	71.19	8.47	0
Wharley Point (C. ed) - B071B	SN34300920	Cockle	99	18/01/2010	11/10/2023	1156.33	18	18000	53.54	6.06	0

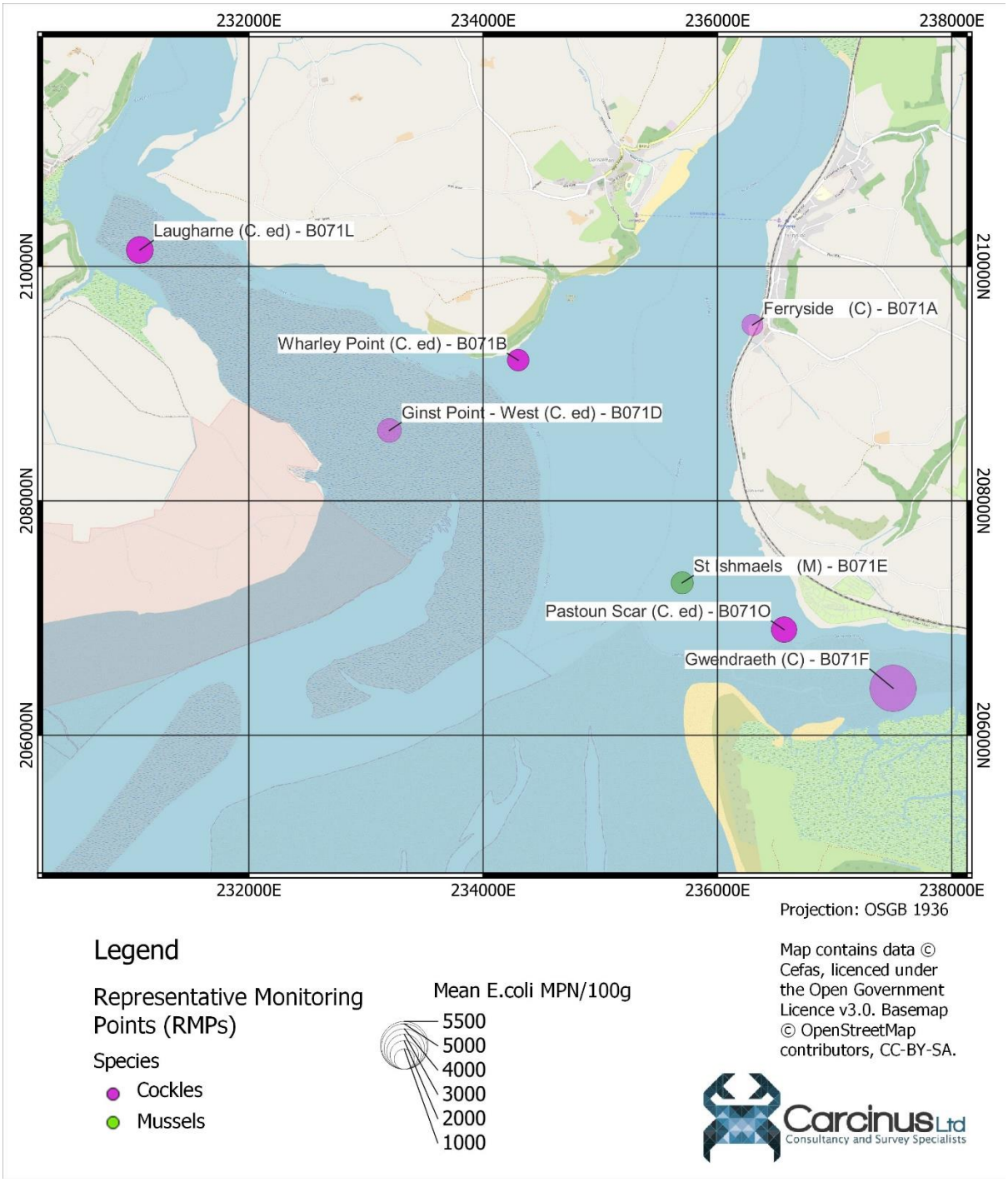


Figure 6.1 Mean E. coli results from Official Control Monitoring at bivalve RMPs in the Three Rivers BMPA. RMPs currently in use shown in full colour.

A total of seven RMPs have been sampled within the Three Rivers BMPA since 2010. Of these, five of seven were sampled prior to the publication of the 2014 Sanitary Survey. Sampling at Ferryside B071A ended in December of 2012, whilst sampling at Ginst Point - West B071D and Gwendraeth B071F finished in 2017. All 3 RMPs were for cockles. One RMP was sampled between 2010 – 2019 for Mussels (St Ishmaels B071E). Only three RMPs are

currently sampled, all for cockles; Laugharne B071L, Pastoun Scar B071O, and Wharley Point B071B.

All RMPs have returned results > 230 *E. coli* MPN/100 g, and only one RMP (Ferryside B071A) has never returned a result > 4,600 *E. coli* MPN/100 g. The Gwendraeth B071F RMP is the only RMP to have returned *E. coli* results of > 46,000 MPN/100 g. The maximum value recorded here is 160,000 MPN/100 g on 2nd June 2015. The Gwendraeth B071F RMP is no longer active. There is no clear geographical pattern in the monitoring results.

Figure 6.2and Figure 6.3 presents box and violin plots of *E. coli* monitoring at RMPs within the Three Rivers BMPA. One-way analyses of variance (ANOVA) tests were performed on the data to investigate the statistical significance of any differences between the monitoring results from the two RMPs. Significance was taken at the 0.05 level[11]. All statistical analysis described in this section was undertaken in R (R Core Team, 2021).
Within the cockle data, no significant differences in the monitoring results were found ($p > 0.05$). It is not appropriate to compare the results of RMPs for different species due to the differences in rates of *E. coli* uptake.

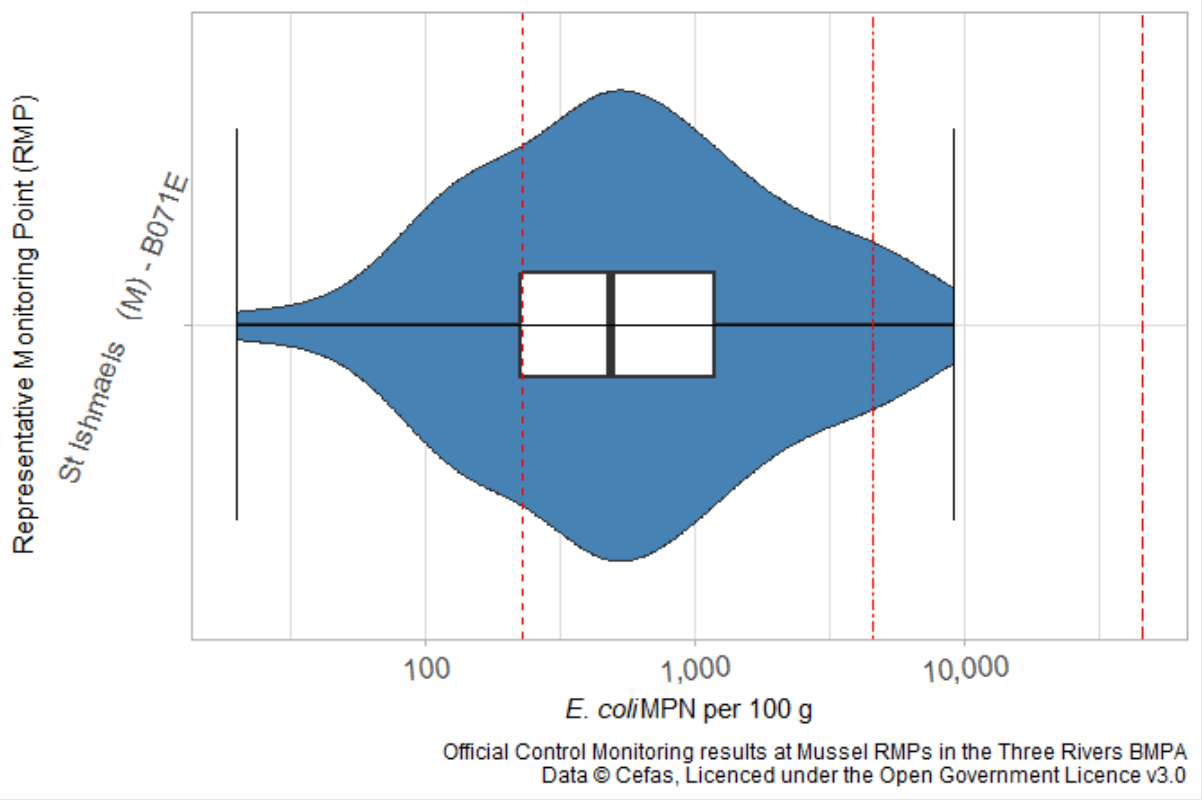


Figure 6.2 Box and violin plots of E. coli monitoring at mussel RMPs in the Three Rivers BMPA. Central line indicates median value, box indicates lower-upper quartile range and whisker indicates minimum/maximum values, excluding outliers. Boxplots are overlaid on

[11] A p-value of <0.05 means that there is a greater than 95% probability that the observed differences between the groups didn't occur by chance.

the distribution of the monitoring data. Horizontal dashed lines indicate classification thresholds at 230, 4,600 and 46,000 E. coli MPN/100 g.

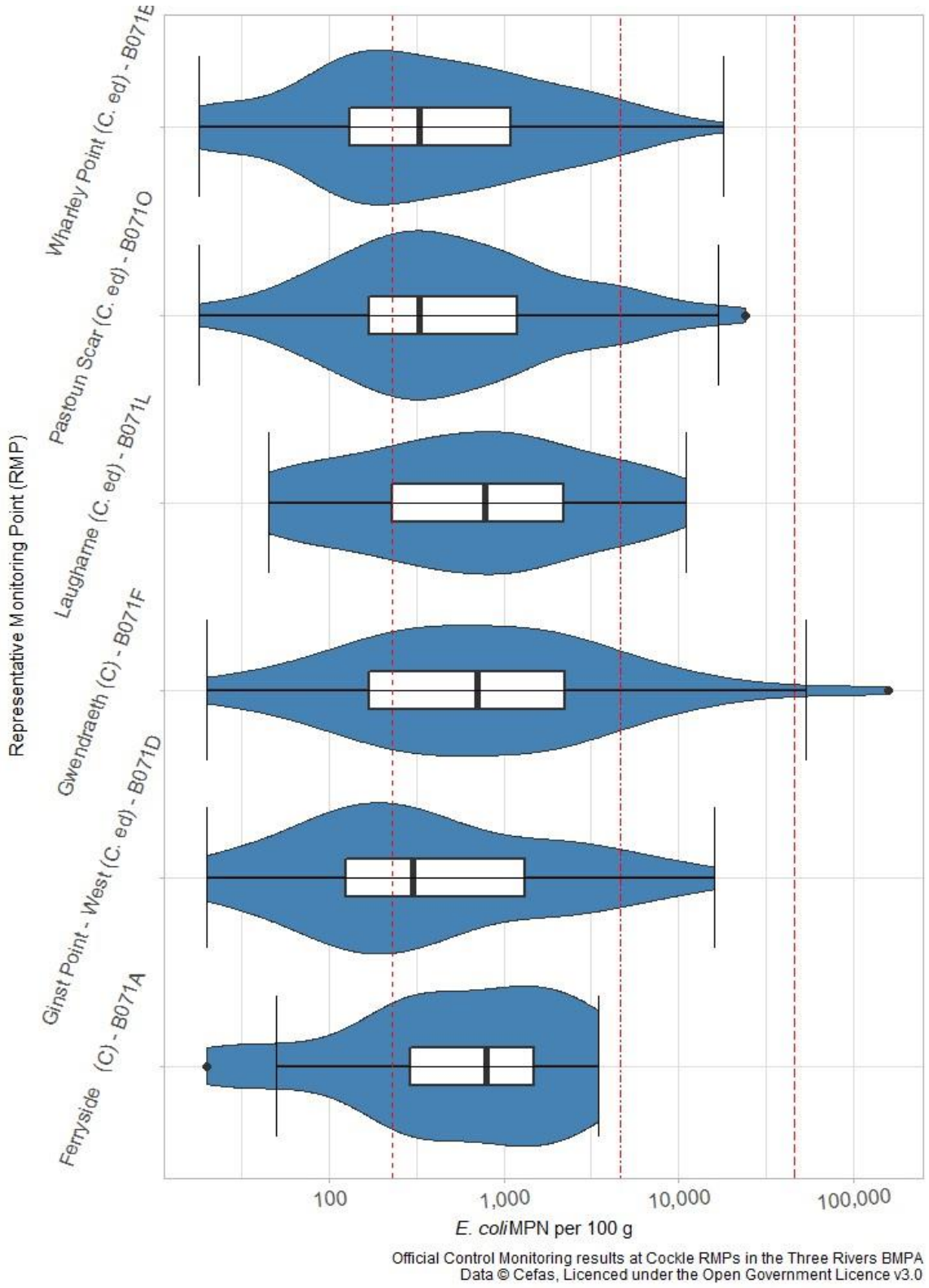


Figure 6.3 Box and violin plots of E. coli monitoring at cockle RMPs in the Three Rivers BMPA. Central line indicates median value, box indicates lower-upper quartile range and whisker

indicates minimum/maximum values, excluding outliers. Boxplots are overlaid on the distribution of the monitoring data. Horizontal dashed lines indicate classification thresholds at 230, 4,600 and 46,000 E. coli MPN/100 g.

6.1.2 Overall temporal pattern in results

The overall temporal pattern in shellfish flesh monitoring results within the Three Rivers BMPA are shown for mussels in Figure 6.4 and cockles in Figure 6.5.

The monitoring data from the mussel RMPs (Figure 6.4) indicates that concentrations of *E. coli* did not exceed >1,000 MPN/100g over the 10 years for which samples were taken. From January 2015 – January 2020 sampling was inconsistent, and so no patterns can be deduced.

No clear temporal pattern can be seen in the monitoring data at cockle RMPs. The loess models for all cockle RMPs fall below 4,600 MPN/100g. The frequency of extremely high results has fallen with only one result exceeding 100,000 MPN/100 g shortly after January 2015. Laugharne B071L is the only current RMP with results exceeding 1,000 MPN/100 g.

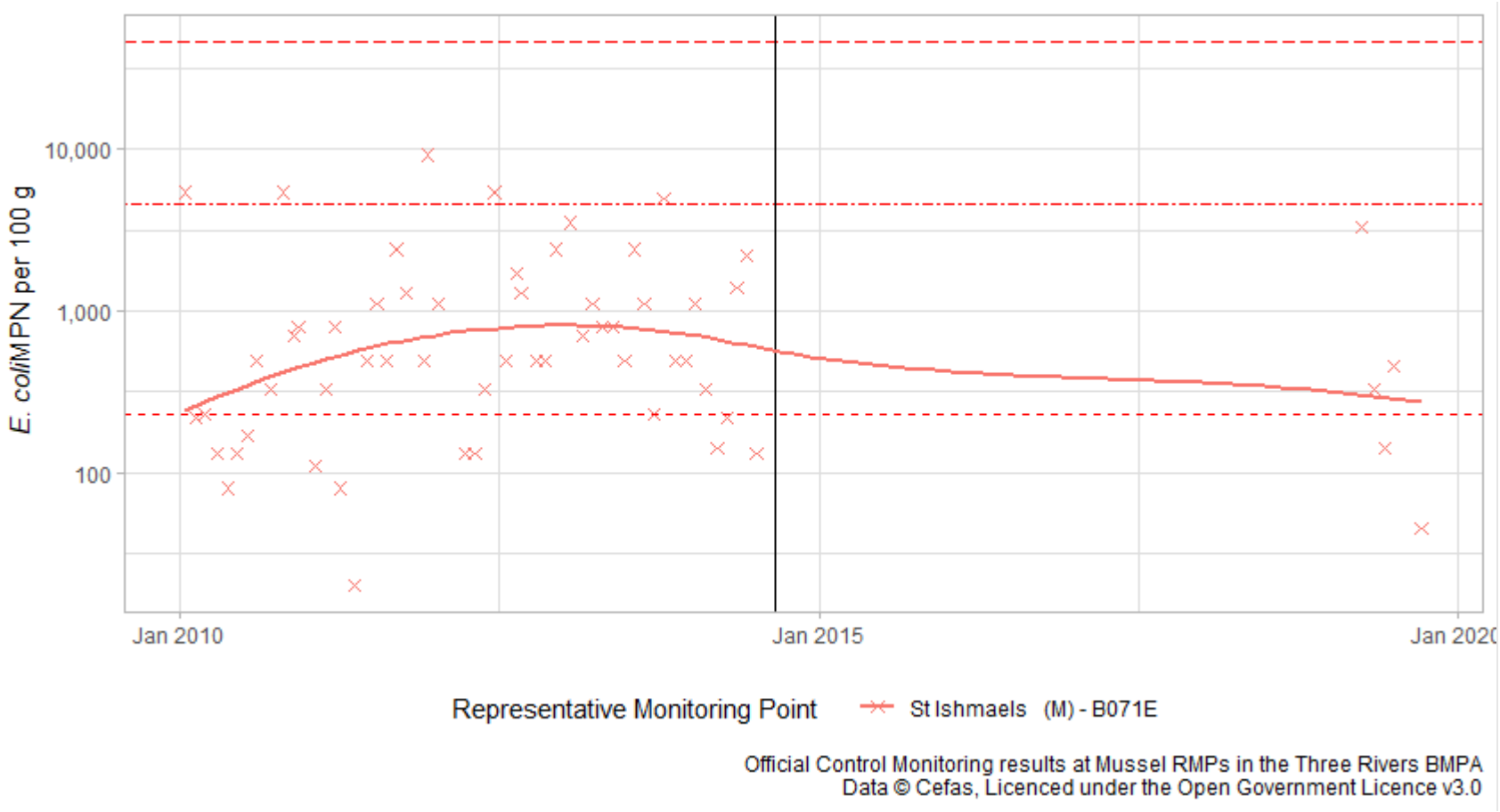


Figure 6.4 Timeseries of E. coli levels at mussel RMPs sampled in the Three Rivers BMPA since 2010. Scatter plots are overlaid with a loess model fitted to the data. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 E. coli MPN/100 g respectively.

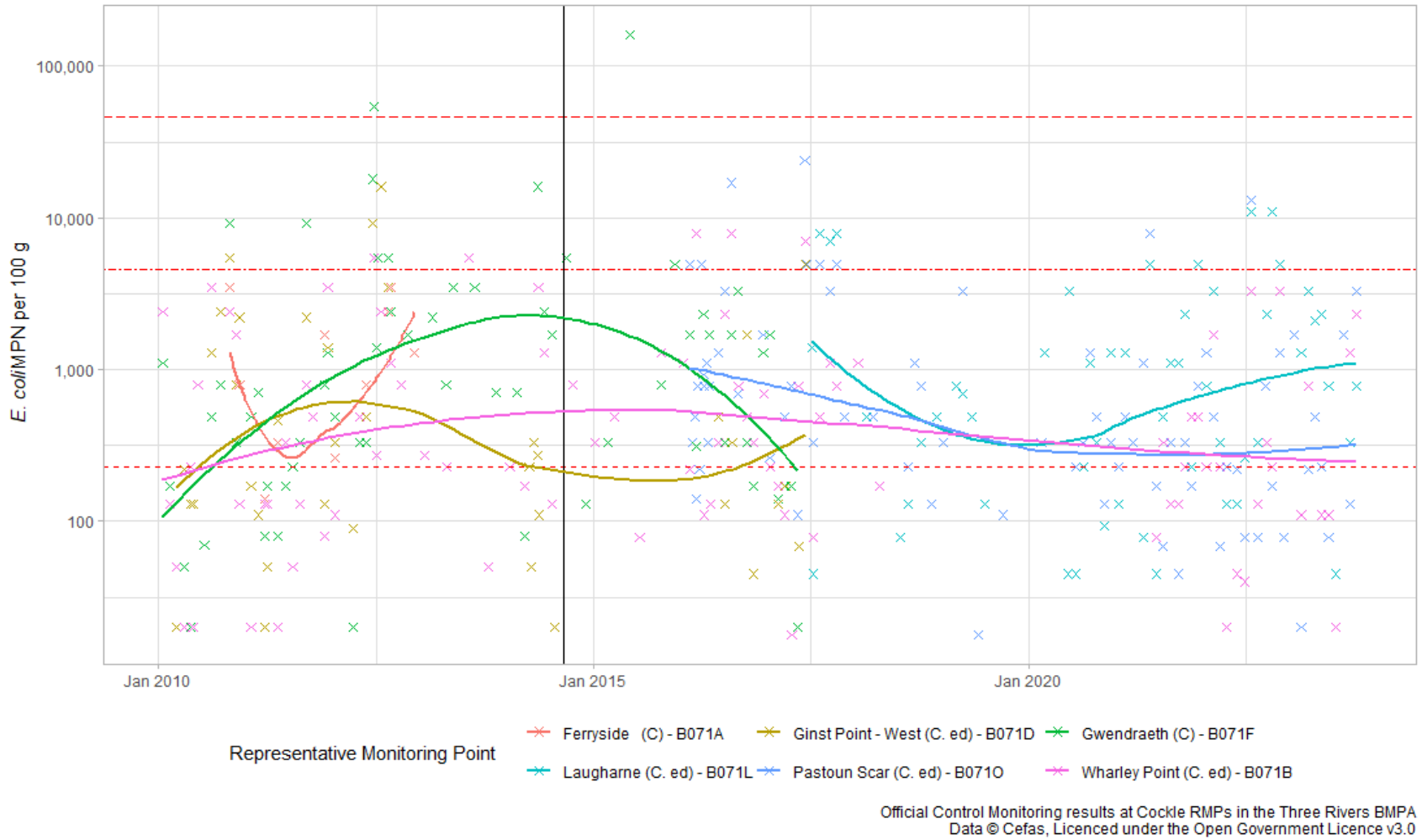


Figure 6.5 Timeseries of E. coli levels at cockle RMPs sampled in the Three Rivers BMPA since 2010. Scatter plots are overlaid with a loess model fitted to the data. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 E. coli MPN/100 g respectively.

6.1.3 Seasonal patterns of results

Seasonal patterns of *E. coli* concentrations at RMPs in the Three Rivers BMPA were investigated and are shown for mussels in Figure 6.6 and cockles in Figure 6.7. The data for each year were averaged into the four seasons, with spring from March – May, summer from June – August, autumn from September – November and winter comprising data from December – February the following year. Two-way ANOVA testing was used to look for significant differences in the data, using both season and RMP (if there is more than one RMP for a given species) as independent factors (i.e., pooling the data across season and RMP respectively), as well as the interaction between them (i.e., exploring seasonal differences within the results for a given RMP). Significance was taken at the 0.05 level.

For mussels (Figure 6.6), monitoring results from winter months was higher, but no significant differences in the monitoring data were found ($p > 0.05$). For cockles (Figure 6.7), the concentration of *E. coli* recorded in Spring at the Gwendraeth B071F RMP was significantly lower than all other seasons ($p < 0.05$). No significant differences were found for any other time of year per RMP, or when all the RMPs are pooled together. Winter months at cockle RMPs did not experience the highest monitoring results. At Ferryside and Laugharne, the highest monitoring results were seen in Autumn. At the remaining four cockle RMPs, the highest monitoring results were seen in summer. Given that high concentrations of dairy farms in the area, it is possible that high monitoring results coincide with animals being put out to pasture mid-late Spring[12] after winter months. This combined with the rainfall described in section 5, could lead to an accumulation of bacteriological contamination and therefore higher results in summer/autumn months. It was also noted in the 2014 sanitary survey that some livestock graze the saltmarsh fringing the estuary, which would produce direct contamination due to defecation and therefore higher results in the subsequent months.

[12] https://ahdb.org.uk/knowledge-library/planning-spring-rotational-grazing-for-cattle

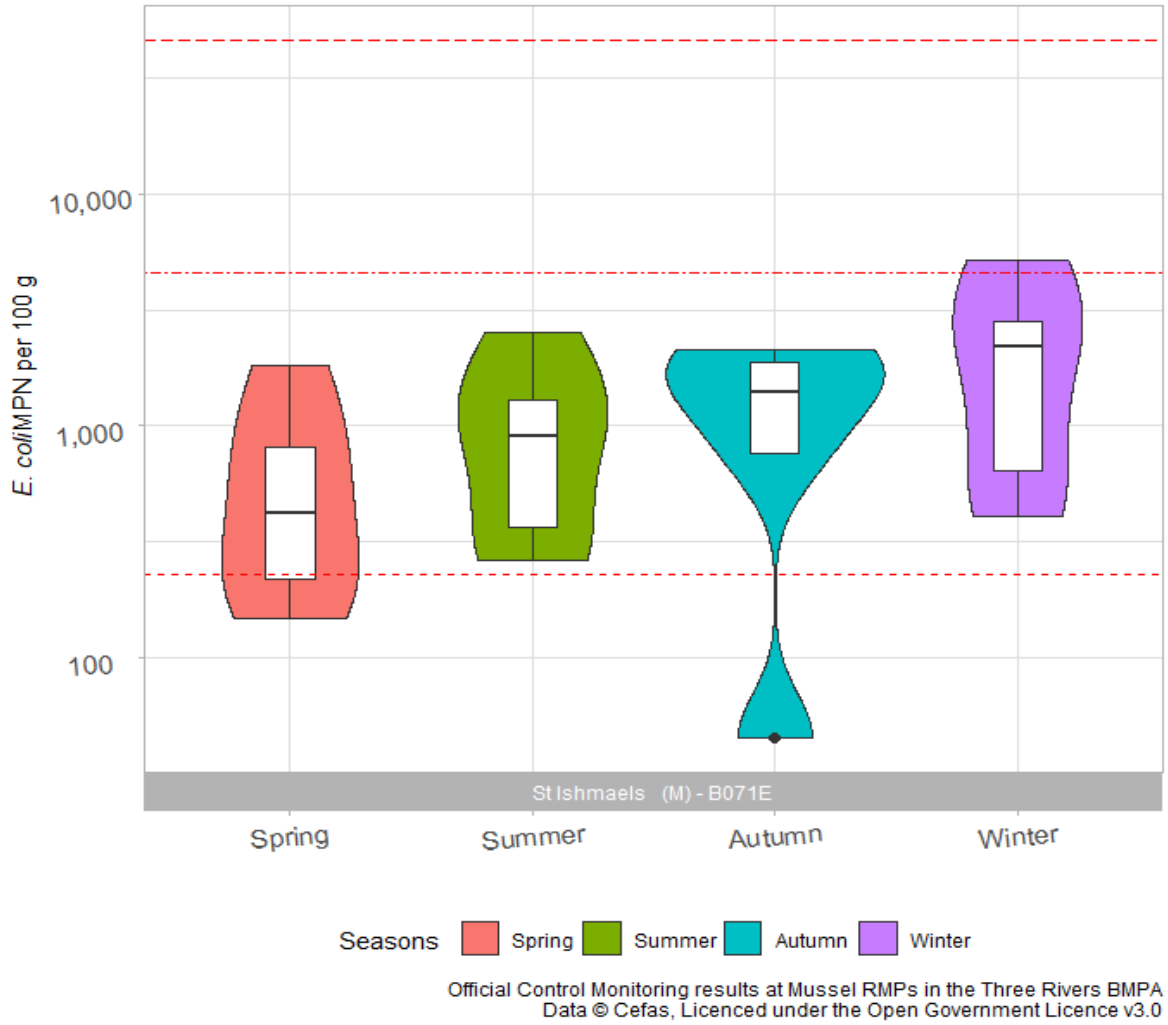


Figure 6.6 Box and violin plots of E. coli levels per season at mussel RMPs sampled within the Three Rivers BMPA since 2010. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 E. coli MPN/100 g.

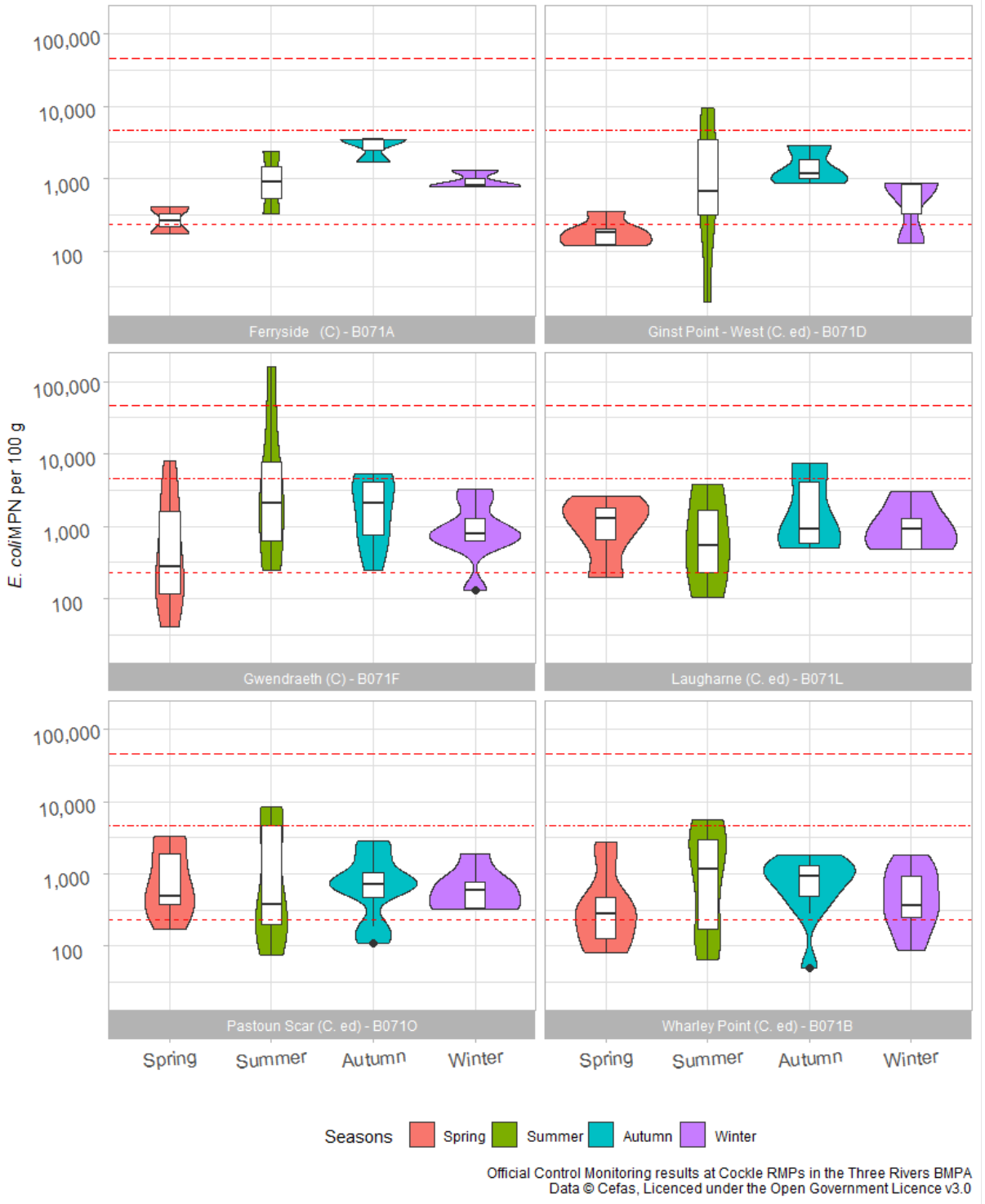


Figure 6.7 Box and violin plots of E. coli levels per season at cockle RMPs sampled within the Three Rivers BMPA since 2010. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 E. coli MPN/100 g.

6.2 Action States

Since the publication of the 2014 Sanitary Survey review, no action states have been triggered within this BMPA.

6.3 Bathing Water Quality Monitoring

The status of bathing waters near to and within the BMPA is also of relevance to this assessment. There are two designated bathing waters in the near vicinity of the Three Rivers BMPA, Pendine to the west and Pembrey to the south east. The location and 2023 bathing water classification status[13] of these points is shown in Figure 6.8 and Table 6.2 respectively. It should be noted that bathing water sampling only occurs during the bathing water season, which falls within the summer period (May to September inclusive) and therefore may not represent the potential for increased faecal loading during winter months. However, bathing water quality results do provide an indication of water quality in the area during the bathing water season, and suggest that generally water within the Three Rivers estuary is excellent, with low *E. coli* concentrations. It is important to note that Pendine is 8.48 km from the *Taf* CZ and Pembrey is 8.79 km away from the *Gwendraeth* CZ, and therefore potential bacteriological contamination reported at RMPs may experience dilution and die off before reaching the designated bathing waters.

[13] https://environment.data.gov.uk/wales/bathing-waters/profiles/

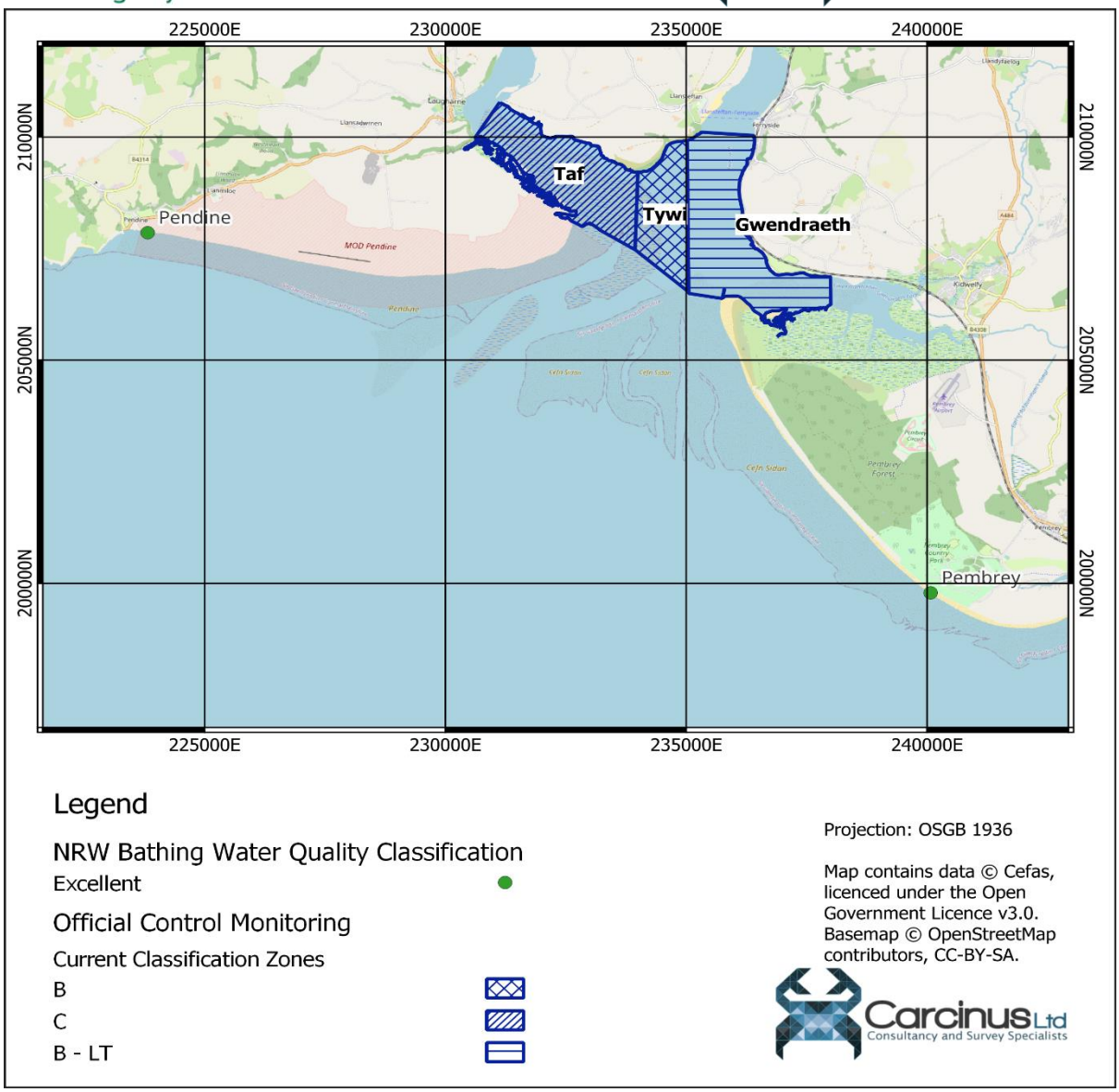


Figure 6.8 Status of EC Bathing Water Quality Designations at Monitoring Points in 2022.

Table 6.2 Summary of NRW bathing water quality designations at monitoring locations within Three Rivers BMPA (Carmarthenshire Bay).

Bathing Water Monitoring Point	2019	2020	2021	2022
Pendine	Excellent	Excellent	Excellent	Excellent
Pembrey	Excellent	Excellent	Excellent	Excellent

7 Conclusion and overall assessment

The Three Rivers BMPA covers an area of 37 km^2 in southwest Wales and is mostly (> 90%) intertidal. There are currently 3 active classification zones for wild cockles in the BMPA, which opens out into Carmarthen Bay. The CZs have been closed year round due to harvesting restrictions regarding size of specimens. When Cockles are deemed too small for harvesting, beds are subject to closure to ensure conservation of stocks and to allow a recovery period.

The results of the 2021 Census were compared to those reported in the 2011 Census to give an indication of changes in human population within the catchment since the publication of the original 2014 Sanitary Survey. These data suggest that the population of the catchment considered in this review increased by approximately 4.71 % between 2011 and 2021. The main population centres of the catchment remain the same; the town of Kidwelly to the east, Llansteffan to the North, Carmarthen to the far northwest, and Laugharne to the immediate northwest. Some smaller villages are dispersed around the catchment but unlikely to be of significance regarding potential contamination. The majority of the catchment is rural, and generally urban associated runoff is not considered to be a significant source of contamination within this area. The area does receive a significant increase in population each year with tourism, predominantly in summer months. DCWW stated that if an increase in population implies an issue with the current wastewater treatment works in the area, DCWW would act accordingly to remain compliant.

There are two sewage works discharging directly into the *Taf* CZ. Laugharne STW discharges 2.26 km to the north of the CZ and undergoes UV disinfection treatment (DWF of 320 m^3/day). The original sanitary survey identified the second sewage works as St Clears STW about 7 km upstream of Laugharne which has a DWF of 987 m^3/day and undergoes Biological filtration. A combination of distance from the BMPA and treatment type, means these discharges are unlikely to significantly increase contamination in the BMPA as bacteria will die off before reaching shellfish waters. Llansaint WWTW is within 1 km of the *Gwendraeth* CZ, and discharges at 96 m^3/day with high rate biological treatment. Although this discharge is within close proximity to the BMPA, a combination of the treatment and low DWF mean it is likely to have minimal effect on contamination in the catchment. The Kidwelly WWTW (3.5 km to *Gwendraeth* CZ) has the highest DWF of 1,642 m^3/day. This WWTW undergoes biological filtration and so any bacteriological contamination remaining after treatment is likely to experience die off before reaching the CZ. Overall contamination to the Shellfish waters from continuous discharges is likely to be remain low. Potential contamination from the Parc Y Splotts STW should be considered in the placement of RMPs for this BMPA as, although it is > 10 km away from the Tywi CZ, it has a high DWF and is likely to have widespread impacts on the shellfish waters as reported in the 2014 sanitary survey.

Regarding intermittent discharges, the storm overflow at Llansaint WWTW is the closest intermittent discharge to any CZ, and discharges to the *Gwendraeth* CZ (spilled 26 times in 2022 for a duration of 485.75 hours). The discharges at Llansteffan WwTW (spilled 83 times

for 528.75 hours) and the CSO at Ferryside WWTW (spilled 91 times for 766.5 hours) are less than 3.4 km from *Gwendraeth* CZ. Although the discharges discussed are >3 km away from the catchment, and some *E. coli* die off will likely occur before potential contamination reaches the Shellfish waters, the high EDM values of these intermittent discharges means they should be considered in placement of RMPs for this BMPA.

Data provided by Welsh Government show that the livestock population at the *Taf* and *Tywi* CZs increased, whilst a decreased was seen in *Gwendraeth* between 2014 and 2022. No single livestock dominated across all three CZs. Poultry dominated the *Gwendraeth* CZ in both 2014 and 2022, and sheep dominated the *Taf* and *Tywi* CZs in both years. The majority of land cover in the catchment area was previously identified as rural and mainly pasture in the 2014 sanitary survey, which remains the case today. The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021 restricts silage storage within 10 m of a coastal or inland water. We are unlikely to have seen large reductions, if any, in the overall bacteriological contamination caused by silage stored < 10 m from coastal or inland water before 2021. The 2015 Coastal Report suggested diffuse sources such as livestock and/or farming land uses play a significant role in the apportionment of bacteria in the Shellfish Water in the BMPA, and should be considered in placement of RMPs.

Waterbird counts suggest that the area does not support either internationally or internationally significant populations of waterbird species. Some minor impacts from either avian species or marine mammals may occur, but these are impossible to reliably predict and are therefore challenging to account for in any updated sampling plan.

Two fishing vessels < 10 m currently list Three Rivers area as their home port. The 2014 sanitary survey reported fishing fleets in the area to be passing through to nearby busy ports, and only using the estuary as a passageway. There are some small anchorages marked and boating stations in the catchment, and some occasional discharges from recreational vessels of a sufficient size to contain on board toilets may occur from time to time. The highest risk of this source of pollution will occur during summer months.

There are currently three RMPs that are sampled in the Three Rivers BMPA. *E. coli* results collected in Spring at Gwendraeth B071F were significantly lower than the other three seasons, however no other significant differences were found between seasons at any RMPs sampled since 2010 (mussel or cockle), or when all RMPs are pooled together. Samples collected in summer and autumn tended to be higher, which coincides with 'turnout' of livestock to pastures in late spring, increasing rainfall levels, and higher tourism creating additional urban run off.

Based on the information available, there do not appear to be any significant knowledge gaps that would justify a shoreline survey. There have been no notable changes to sources of pollution since the 2014 Sanitary Survey was published.

Having reviewed and compared the desk-based study with the findings of the original sanitary surveys in 2014, the FSA are also content that a shoreline assessment is not required.

8 Recommendations

Recommendations for the various classification zones within the Three Rivers BMPA are summarised below and a recommended sampling plan in provided Table 9.1. Tolerance around the RMPs should remain at 100 m as cockle beds are frequently subject to considerable shift.

During secondary consultation, the LEA stated that there were access issues with two of the RMPs, Laugharne (B071L) and Pastoun Scar (B071O). The RMP location and boundaries of the CZs these RMPs are used to represent have been re-aligned appropriately.

8.1 Cockles

Tywi

The current sampling plan for this CZ states that samples should be taken within 100 m of NGR SN 3430 0920. This was identified in the original sanitary survey to be representative of microbiological contamination entering the shellfish waters of the Three Rivers BMPA. The main source of contamination for this CZ identified in the 2014 sanitary survey was, and still is, agricultural land run off from the rural pastures surrounding the estuary. The sewage works at Parc Y Splotts STW should also be noted due to its high DWF despite being > 10 km from the CZ itself. The majority of the contamination into this CZ will continue to run in upstream of the cockle beds, and so the current RMP is best placed to capture the maximum potential *E. coli* and should be retained.

Taf

The current sampling plan for this CZ states that samples should be taken within a 100 m tolerance of NGR SN 3107 1014. The principle contamination source is agricultural land run off from the rural pasture surrounding the CZ, as identified in the original 2014 sanitary survey and reconfirmed in this review. During secondary consultation, the LEA stated that they had issues accessing the current RMP location and that there is no commercial gathering in the area. They advised that are more appropriate position in terms of access and commercial activity would be approximately 1 km south-east. The CZ boundaries should be adjusted to reflect the current activity (Figure 9.1). The RMP should be placed at SN 3200 0968

Gwendraeth

The current sampling plan for this Classification Zone states that samples should be taken within 100 m of NGR SN 3657 0690. The main contamination to this CZ was identified in 2014 as agricultural and land run off, alongside potential contamination from urban areas including a caravan park close-by, and intermittent discharges at Llansaint WWTW, Llansteffan WwTW, and Ferryside WWTW. Two rivers enter at the head of the estuary arm and so any RMP for this CZ was recommended to be as close to the main channel as

possible. This remains the case in 2023. Access via one shoreline to the Gwendraeth classification zone traverses an RAF firing range, and so limited access should also be considered in the placement of the RMP. During secondary consultation the LEA advised that there is no stock in the current RMP area and recommended moving the RMP to a position off Llanismel (SN 3611 0764). The CZ boundaries should also be updated to reflect this change in RMP (Figure 9.1), ensuring that the RMP remains representative.

9 General Information

9.1 Location Reference

Production Area	**Three Rivers**
Cefas Main Site Reference	M071
Ordnance survey 1:25,000	Explorer 177
Admiralty Chart	1076

9.2 Shellfishery

Species	Culture Method	Seasonality of Harvest
Cockles *(Cerastoderma edule)*	*Wild*	*Year round*

9.3 Local Enforcement Authority(s)

Name	Carmarthenshire County Council **3 Spilman Street** **Carmarthen** **Carmarthenshire** SA31 1LE
Website	Council services (gov.wales)
Telephone number	01267 234567
E-mail address	PublicProtection@carmarthenshire.gov.uk

9.4 Sampling Plan

*Table 9.1 Proposed sampling plan for the Three Rivers BMPA. Suggested changes, if any, are given in **bold red** type.*

Classification Zone	RMP	RMP Name	NGR (OSGB 1936)	Lat / Lon (WGS 1984)	Species Represented	Harvesting Technique	Sampling Method	Sampling Species	Tolerance	Frequency
Taf	**TBC**	**Taf Channel**	**SN 3200 0968**	**51°45.63'N 4° 26.15'W**	*C. edule*	Wild	Hand/Dredged	Hand	100 m	Monthly
Tywi	B071B	Wharley Point	SN 3430 0920	51°45.415N 4° 24.131W	*C. edule*	Wild	Hand/Dredged	Hand	100 m	Monthly
Gwendraeth	**TBC**	**Llanismel**	**SN 3611 0764**	**51°44.60'N 4°22.52'W**	*C. edule*	Wild	Hand/Dredged	Hand	100 m	Monthly

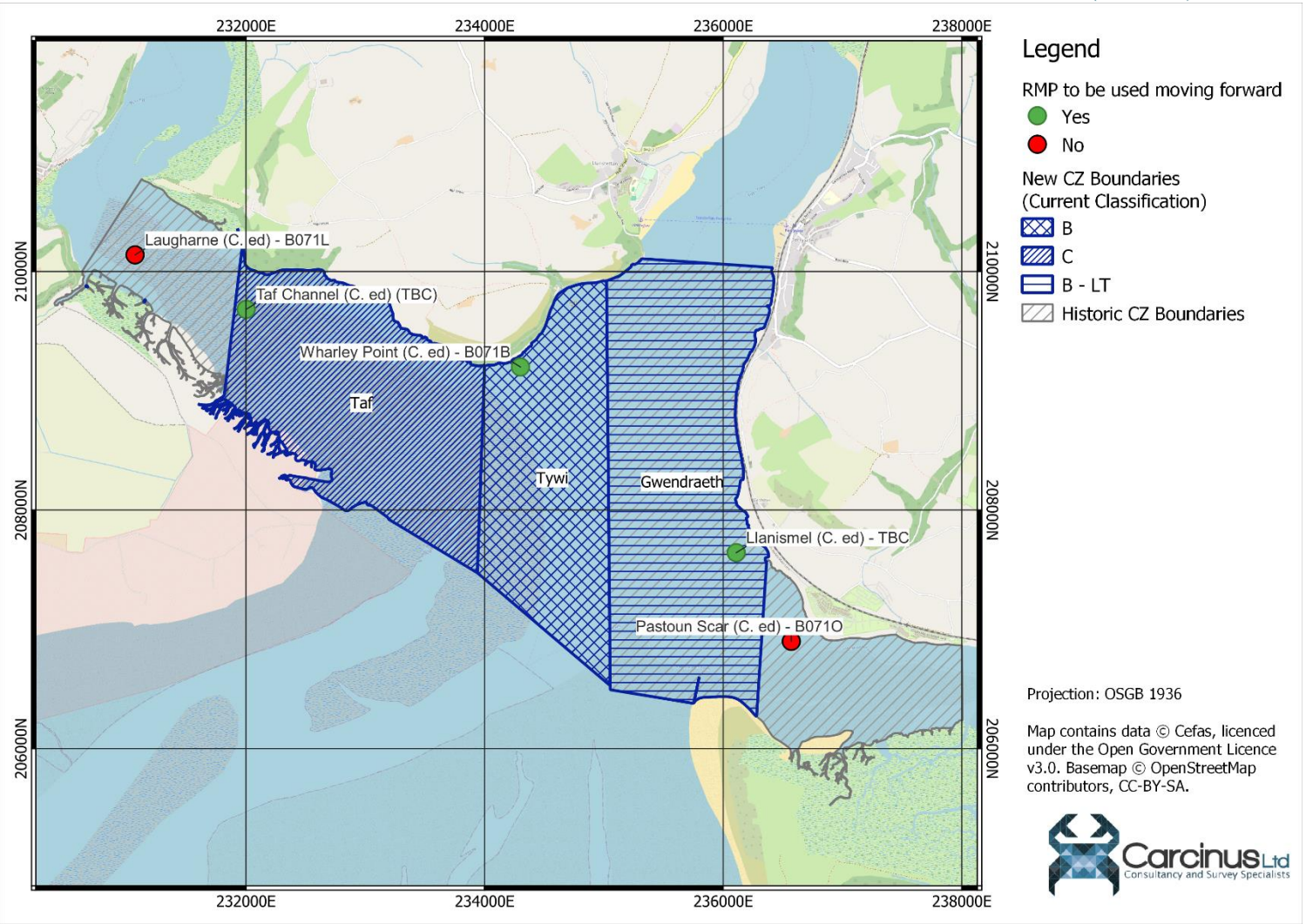


Figure 9.1 Proposed new CZ Boundaries and RMPs for the Three Rivers BMPA.

10 References

Austin, G.E. *et al.* (2014) *Waterbirds in the UK 2011/12: The Wetland Bird Survey.* Thetford: BTO/RSPB/JNCC.

Austin, G.E. *et al.* (2023) *Waterbirds in the UK 2021/22: The Wetland Bird Survey.* Thetford: BTO/RSPB/JNCC.

Cefas (2014) *Sanitary Survey of Three Rivers Estuary (Wales)*. Weymouth: Cefas.

Davidson, F.A., Vaughan, E. and Hutchinson, S.J. (1943) 'Factors Influencing the Upstream Migration of the Pink Salmon (Oncorhynchus Gorbuscha)', *Ecology*, 24(2), pp. 149–168. Available at: https://doi.org/10.2307/1929698.

European Commission (2021) *Community Guide to the Principles of Good Practice for the Microbiological Classification and Monitoring of Bivialve Mollusc Production and Relaying Areas with regard to Implementing Regulation 2019/627*. Issue 4. Available at: https://www.aesan.gob.es/en/CRLMB/docs/docs/procedimientos/Micro_Control_Guide_DEC_2021.pdf (Accessed: 24 October 2022).

Frost, T.M. *et al.* (2021) *Waterbirds in the UK 2019/20: The Wetland Bird Survey.* Thetford: BTO/RSPB/JNCC.

gov.uk (2024) *UK fishing vessel lists*. Available at: https://www.gov.uk/government/collections/uk-vessel-lists (Accessed: 11 January 2024).

Natural Resources Wales (2017) *Compliance Assessment - Three Rivers*. Compliance Assessment 3499_E_200-INT-00-XX-RP-RP-N-C–10339.

Natural Resources Wales (2023) *Consented Discharges to Controlled Waters with Conditions*. Available at: https://datamap.gov.wales/layers/geonode:nrw_water_quality_permits (Accessed: 11 September 2023).

R Core Team (2021) 'R: A language and environment for statistical computing'. Vienna, Austria: R Foundation for Statistical Computing. Available at: https://www.R-project.org/ (Accessed: 8 June 2022).

Appendices

Site Name	Permit Reference	NGR	Count of Spills in 2022	Total duration (hours) of spills in 2022
Carmarthen - Sticle Path	AB3596ZT	SN4161419515	78	186.25
Porthyrhyd PS	AB3598CN	SN5163616217	77	958.5
Llanddarog	AB3691FU	SN5051516249	8	63.5
Cynwyl Village Bridge	AB3691HG	SN3729927487	9	20.5
Carmarthen Pentremeurig Road CSO	AB3794HE	SN3932020550	23	20.5
Park Hinds CSO	AB3794ZT	SN4199220466	15	184.25
St Clears Sewage Pumping Station	AB3795ZF	SN2818215365	88	867.5
Pentremeurig Road CSO	AB3796CN	SN3936620545	0	0
Pencader Bridge CSO	AB3796FW	SN4462236310	30	121.5
Cwmdwyfran SPS	AB3796ZZ	SN4125324892	23	117.5
Carmarthen Market CSO	AB3797CV	SN4106820199	5	1.25
Llangynog STW	AB3798CA	SN3380016000		-1
CSO at Llangynderyn PS into R Gwendraeth Fach	BB3391CY	SN4596514085	0	0
Settled Storm Overflow at Llansaint Wastewater Treatment Works	BC0006102	SN3810108593	26	485.75
CSO and EO at Mynydd Cerrig SPS	BD0025101	SN5162513692	92	1245.25
Settled Storm Overflow at Llangyndeyrn Wastewater Treatment Works	BE0039502	SN4545813751	1	0.25
Pencader SPS	BG0007802	SN4456036290	30	117.5
PENCADER STW STORM TANKS	BG0007805	SN4446536485	101	2015.5
Settled Storm Overflow at Llangadog Wastewater Treatment Works	BG0040002	SN7004328005	122	1519.5
CRAIGWEN PS TENBY ROAD ST CLEARS	BH0053403	SN2680215513	64	742.75
Settled Storm Overflow at Brickyard Lane Pumping Station	BH0053404	SN4046019641	116	821.75
Old Priory Row CSO Parc Hinds PS C	BH0053405	SN4193920437	196	234.25

Site Name	Permit Reference	NGR	Count of Spills in 2022	Total duration (hours) of spills in 2022
Morfa Lane CSO, Carmarthen	BH0053406	SN4072619855	131	387.25
CSO Pothouse Wharf PS	BH0053407	SN4106519842	64	151.75
SPS at Castle Hill Drainage Area	BH0053408	SN4136519884	61	43.5
CARMARTHEN - STATION ROAD PUMP	BH0053409	SN4153419974	82	55
TAVERNSPITE STW	BH0056202	SN1824913117	108	2078.5
LAUGHARNE SEWERAGE SYSTEM	BH0060003	SN3013210675	41	24.25
Myddfai Village Sewerage Scheme CSO	BH0074901	SN7720029989	127	301.75
PENDINE SEWAGE TREATMENT WORKS	BJ0084202	SN2500007900	66	1015.25
Carmarthen Near Fire Station CSO	BJ0096401	SN4030420833	4	1
Pencoed Farm SPS, Llangain	BK0114501	SN3857316099	35	214.25
WHITLAND WWTW	BL0138501	SN2046215872	114	1789
LLANFYNYDD STW	BN0077601	SN5568827143	173	1738.25
CSO at Ferryside Wastewater Treatment Works	BN0169301	SN3720411456	91	766.5
CSO at FFAIRFACH STW	BN0194103	SN6179321109	120	1722.5
Sawmills Y'd CSO Llandeilo Carmarthen	BN0194104	SN6332322812	41	304
LLANDOVERY WASTEWATER TREATMENT	BN0202702	SN7616633142	136	2244
Settled Storm Tank at Bancyfelin STW	BN0269702	SN32511784	1	0.25
Llandeilo Yscubor Abad CSOs	BP0018401	SN63462235	81	148.75
CSO at Llanboidy WwTW	BP0044502	SN2200022700	13	62.75
Abergwili SPS	BP0072101	SN4333021230	80	295.5
Llanfrynach SPS	BP0110801	SN2210031200	68	1202.5

Site Name	Permit Reference	NGR	Count of Spills in 2022	Total duration (hours) of spills in 2022
Whitland Terminal Pumping Station CSO and EO	BP0113001	SN2007916012	68	232
FERRYSIDE PS . .	BP0113101	SN3714310843	31	29.5
Rhosmaen PS	BP0113301	SN6409223974	40	72.5
Albion SPS	BP0113501	SN7010028560	80	383
PWNTAN SPS LLANGAIN CARMARTHENSHIRE	BP0113601	SN3929117540	20	198.75
Primary School CSO Ffairfach	BP0115401	SN6291121502	43	156
Llangadog Common CSO	BP0115501	SN7060027900	19	6.5
LLANDEILO CSO	BP0115701	SN6278522042	100	160
Llansawel Village CSO No2	BP0115801	SN6201736373	3	1
LLANSAWEL . .	BP0115901	SN6194836230		-1
Llandovery No1 SPS	BP0116001	SN7660134186	86	237.5
Wogan Mews CSO	BP0209601	SN3010110766	18	26
Jewsons CSO Tanerdy Carmarthen	BP0209801	SN4229420758	68	378
Carmarthen Old Llansteffan Rd CSO	BP0209901	SN4002919432	64	165
Hermon STW Storm Overflow Hermon	BP0210101	SN2093332307	150	2398.5
Llansadwrn SPS	BP0218201	SN6981031372	27	227
SALEM STW Settled Storm	BP0219001	SN6213526624	124	1691.75
Settled Storm Overflow at Llanfyrnach Wastewater Treatment Works	BP0219201	SN2202931038	139	2921.25
CSO at Trelech Wastewater Treatment Works	BP0219401	SN2806330314	62	540
CSO at Narberth East SPS	BP0219701	SN1230015200	20	114.25

Site Name	Permit Reference	NGR	Count of Spills in 2022	Total duration (hours) of spills in 2022
Settled Storm Overflow at Llanddarog Wastewater Treatment Works	BP0220701	SN4927516307	132	2700
CSO at Cwm Ifor STW Storm Tanks Manordei	BP0239802	SN6602825096	6	5.5
15 Meters D/S Whitland Bridge CSO	BP0246101	SN2025716590	37	38.5
Ashfield Road P.S. Ashfield Llangado	BP0263301	SN6943528424	70	1020.5
LAUGHARNE WWTW (STW) LAUGHARNE	BP0270701	SN3038010386	48	58.25
Heol Ddu SPS	BP0274101	SN4639103415	2	3.75
Brynmeillion SPS Llanpumsaint	BP0292601	SN4325527876	42	219.75
Parc Y Dai No1 CSO Drefach	BP0301001	SN5399613475	57	175
Settled Storm Overflow at Pontyberem Wastewater Treatment Works	BP0304601	SN4941010950	139	2417.5
27 RHOSNEWYDD MAESYGWERN CSO TUMBLE	BP0307301	SN5350612171	28	22.75
Golden Grove WwTW Inlet CSO Llandie	BP0312601	SN5926520464	92	338.25
Trimsaran Waste Water Treatement Works Settled Storm	BP0315501	SN4380906042	104	1634.5
CSO at Trimsaran WWTW Spudder Bridge Road	BP0315601	SN4352206180	132	148.25
CWRT HENRI WWTW INLET STORM OVERFLW	BP0316701	SN5540022828	55	102.75
Cynwyl Elfed WwTW Cynwyl Elfed Carm Settled Storm	BP0317301	SN3767026980	42	352.75
Ty Hen Rhos PS	BP0323501	SN3838135589	61	399.75
CYNGHORDY WWTW INLET STORM OVERFLOW	BP0328201	SN8029339931	113	516
CSO at Felingwm Wastewater Treatment Works	BP0328301	SN5087824409	108	458.75
PEMBREY WWTW CSO	BP0328501	SS4142799941	49	427.75

Site Name	Permit Reference	NGR	Count of Spills in 2022	Total duration (hours) of spills in 2022
Pont-ar-Gothi & Nantgaredig Wastewater Treatment Works	BP0340501	SN5033821411	0	0
Llansawel WWTW Settled Storm	BP0340601	SN6232236179	24	134.25
CSO at Glogue STW	BP0348601	SN2201032516	101	1157
Storm Overflow at Cilycwm Wastewater Treatment Works	BP0349901	SN7543739612	270	1776.75
CARWAY WWTW CARWAY CARMS	BP0361501	SN4601506910	27	9.75
Parc y Dai CSO	BW0800101	SN5388213452	64	364.75
BLAENHIRWAUN CSO CEFNEITHIN	BW0800201	SN5511813447	98	544.25
HEOL NAZARETH 2 CSO	BW0800601	SN4678008540	6	1.75
Heol y Meinciau CSO	BW0800701	SN4694008556	12	27.75
Tom Jones Nursery CSO	BW0800901	SN5693913759	65	253.25
Clos Isaf CSO, Drefach	BW0801001	SN5218012337	59	207.75
New Lodge Inn CSO Pontyberem Carm	BW0801101	SN5070411613	25	92.5
Pontyberem No2 SPS	BW0801201	SN5003011110	49	342.25
CSO at Cwm Mawr Rb No1 Gwendreath Catchmen	BW2201801	SN5283312608	29	104.25
HEOL WAUN Y CLUN CSO TRIMSARAN	BW2201901	SN4527904658	0	0
CSO at Access Road To Pontyberem STW	BW2202401	SN4954211046	1	0.25
PONT HENRI INCLINE INN CSO	BW2202501	SN4747209191	9	21
Pontyates Area CSO	BW2202601	SN4699408479	42	195
GARREG SPS LLANGADOG KIDWELLY	BW2202801	SN4196007493	26	91
SSO AT STATION ROAD P.S. KIDWELLY	BW2202901	SN4052706770	14	6.5
TYCOCH SEWAGE PUMPING STATION KIDW	BW2203001	SN4085006218	41	93.25

Site Name	Permit Reference	NGR	Count of Spills in 2022	Total duration (hours) of spills in 2022
Ahshburnham SPS CSO	BW2203101	SN4395000630	19	230.75
Ashburnham Road CSO	BW2203301	SN4324000890	2	0.5
SWO. BURRY PORT AREA - INTO O	BW2203601	SN4257601241	46	73.25
Storm Overflow at Llanpumsaint Wastewater Treatment Works	FB3690HH	SN4160829125	118	605
Storm Overflow at Bronwydd Wastewater Treatment Works	QB3690HY	SN4180823714	10	19.75
CSO at Jobswell Road	UB3893HF	SN3987219855	64	84.25
SPS at Cwmduad STW	WQD009506	SN3779330757	96	1571
LINKS PEMBREY PS EMERG , ,	BO5099701	SN4263500726	10	28.25
SSO AT STATION ROAD P.S. KIDWELLY	BF0147004	SN4052706770	14	6.5
CWM CAPEL PS BURRY PORT	BF0177707	SN4550402087	1	0.25
SHORELINE PS BURRY PORT	BF0177708	SN4427700465	0	0
ABERGORLECH SPS	BN0007001	SN5858833636	1	0.5
Meidrim WwTW	Unpermitted-50704	SN2896120430	45	202
Carmarthen Decorators CSO	Unpermitted-70930	SN4199419720	101	468.25
St Clears Car Park SPS Overflow	Unpermitted-73047	SN2800416354	15	4.5
Caio WwTW	Unpermitted-73438	SN6748939682	32	607.75
Llansteffan WwTW	Unpermitted-73493	SN3558311194	83	528.75
Ysgol Griffith Jones CSO	Unpermitted-73799	SN2849316755	48	94.75

Centre for Environment Fisheries & Aquaculture Science

www.cefas.defra.gov.uk

EC Regulation 854/2004

CLASSIFICATION OF BIVALVE MOLLUSC PRODUCTION AREAS IN ENGLAND AND WALES

SANITARY SURVEY REPORT

Three Rivers Estuary

January 2014

About Carcinus Ltd

Carcinus Ltd is a leading provider of aquatic environmental consultancy and survey services in the UK.

Carcinus was established in 2016 by its directors after over 30 years combined experience of working within the marine and freshwater environment sector. From our base in Southampton, we provide environmental consultancy advice and support as well as ecological, topographic and hydrographic survey services to clients throughout the UK and overseas.

Our clients operate in a range of industry sectors including civil engineering and construction, ports and harbours, new and existing nuclear power, renewable energy (including offshore wind, tidal energy and wave energy), public sector, government, NGOs, transport and water.

Our aim is to offer professional, high quality and robust solutions to our clients, using the latest techniques, innovation and recognised best practice.

Contact Us

Carcinus Ltd

Wessex House

Upper Market Street

Eastleigh

Hampshire

SO50 9FD

Tel. 023 8129 0095

Email. enquiries@carcinus.co.uk

Web. https://www.carcinus.co.uk

Environmental Consultancy

Carcinus provides environmental consultancy services for both freshwater and marine environments. Our freshwater and marine environmental consultants provide services that include scoping studies, Environmental Impact Assessment (EIA) for ecological and human receptors, Habitats Regulations Appraisal (HRA), Water Framework Directive (WFD) assessments, project management, licensing and consent support, pre-dredge sediment assessments and options appraisal, stakeholder and regulator engagement, survey design and management and site selection and feasibility studies.

Ecological and Geophysical Surveys

Carcinus delivers ecology surveys in both marine and freshwater environments. Our staff are experienced in the design and implementation of ecological surveys, including marine subtidal and intertidal fish ecology and benthic ecology, freshwater fisheries, macro invertebrate sampling, macrophytes, marine mammals, birds, habitat mapping, River Habitat Surveys (RHS), phase 1 habitat surveys, catchment studies, water quality and sediment sampling and analysis, ichthyoplankton, zooplankton and phytoplankton.

In addition, we provide aerial, topographic, bathymetric and laser scan surveys for nearshore, coastal and riverine environments.

Our Vision

"*To be a dependable partner to our clients, providing robust and reliable environmental advice, services and support, enabling them to achieve project aims whilst taking due care of the sensitivity of the environment*"