Sanitary Survey - Review

River Crouch – 2022

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Document QA and Approval

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Initial Consultation

Consultee	**Date of consultation**
Maldon District Council	28 July 2021
Environment Agency	28 July 2021

Consultation on draft report

Consultee	Date of consultation
Environment Agency	22 October 2021
Maldon District Council	October 2021 & February 2022

A sanitary survey relevant to the bivalve mollusc beds in River Crouch was undertaken in 2012 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, Maldon District Council. The report is publicly available via the Carcinus Ltd. website.

Recommended Bibliographic Citation:

Carcinus Ltd., 2021. Review of the River Crouch 2012 Sanitary Survey. Carcinus report on behalf of the Food Standards Agency, to demonstrate compliance with the requirements for classification of bivalve mollusc production areas (BMPA) in England and Wales under retained EU Law Regulation (EU) 2019/627.

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1 Introduction

1.1 Background

The Food Standards Agency 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, 2017). 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 Food Standards Agency.

The report considers changes to bacterial contamination sources (primarily from faecal origin) and the associated loads of the faecal indicator organism (FIO) *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 River Crouch Review

This report reviews information and makes recommendations for a appropriate sampling plan for existing native oyster (*Ostrea edulis*), Pacific oyster (*Crassostrea gigas*), mussel (*Mytilus spp.*) and American hard clam (*Mercenaria mercenaria*) classification zones in the River Crouch (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. The original sanitary survey considered the shellfisheries of both the Rivers Crouch and Roach, and therefore the contamination sources affecting both waterbodies. Whilst this review only considers the shellfisheries of the Crouch, it discusses contamination sources affecting both rivers, as the mouth of the Roach joins the Crouch, and so contamination from the former will affect the latter to a degree.

An **initial consultation** with Local Authorities (LAs) and the Environment Agency (EA) responsible for the production area was undertaken in August and September 2021. 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 LAs and Local Action Group (LAG) members was undertaken in November 2021 and February 2022. 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 sanitary survey assessment originally conducted in 2012 and sampling plan as necessary and the report should be 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;

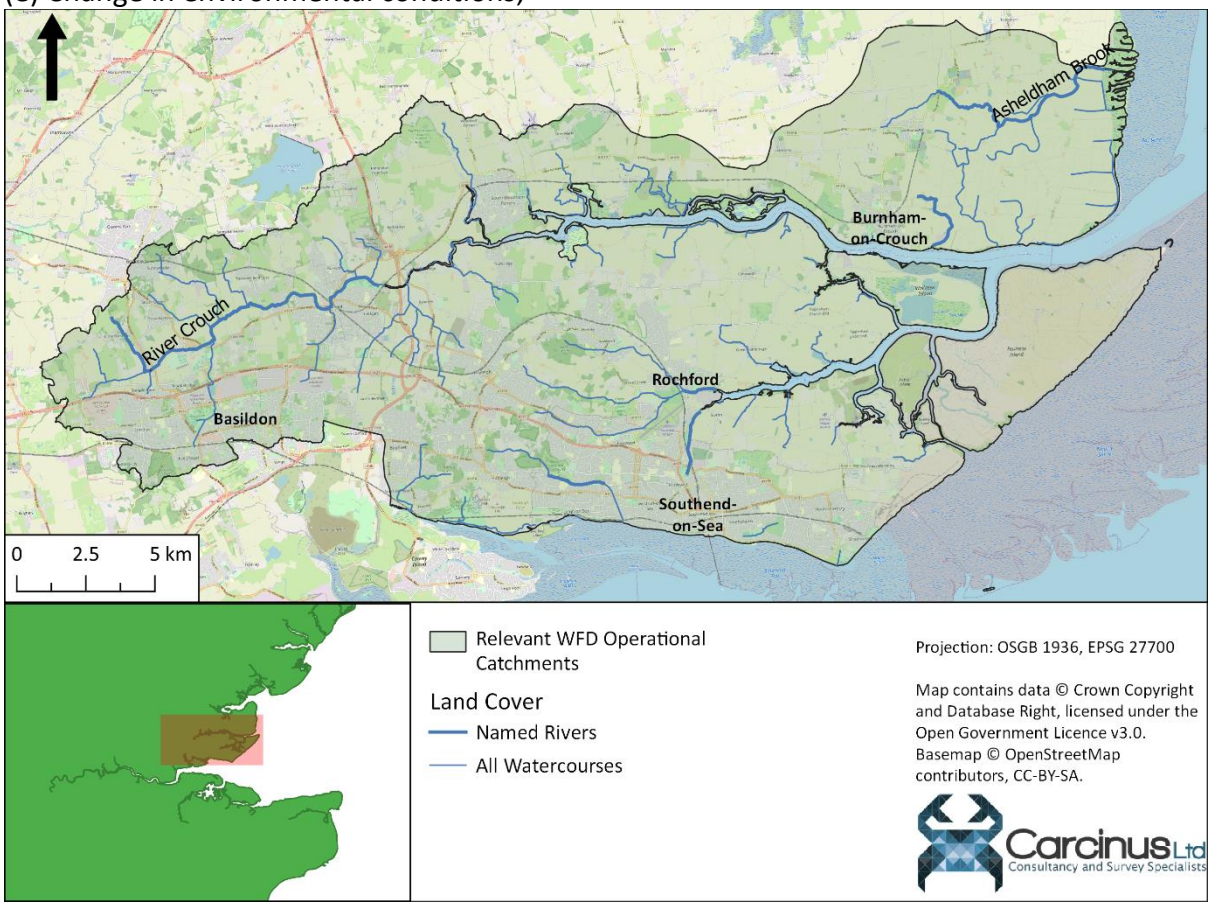

Figure 1.1 Location of the River Crouch.

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 Environment Agency;
- The findings of this report are based on information and data sources up to and including September 2021;
- Only information that may impact on the microbial contamination was considered for this review; and
- Official Control monitoring data have been taken directly from the Cefas data hub[1], with no additional verification of the data undertaken. Results up to and including August 2021 have been used within this study. Any subsequent samples have not been included.

2 Shellfisheries

2.1 Description of Shellfishery

The estuary of the River Crouch is approximately 24 km long and is situated on the East Anglian coast. The original sanitary survey, conducted in 2012, investigated the sources of contamination affecting shellfish in both the River Crouch and the River Roach, given the proximity of the two estuaries. However, for the purposes of this review, only those Classification Zones (CZs) identified as falling within the Crouch Bivalve Mollusc Production Area (BMPA) in the October 2021 update to the designated BMPAs in England and Wales (FSA, 2021) have been considered. In addition to the Roach BMPA, CZs in the Thames Estuary and Blackwater BMPAs are nearby, situated at the mouth of the estuary.

The shellfish beds within the Crouch BMPA are under the jurisdiction of the Kent and Essex Inshore Fisheries and Conservation Authority (KEIFCA), and its 'Area A' byelaws apply to the area. These byelaws impose several restrictions on the harvesting of the various species, details of which are summarised in Sections 2.1.1 - 2.1.4. Under the terms of the Shellfish Bed Byelaw[2] KEIFCA reserve the right to impose temporary closures on any part of, or bed of shellfish if it is significantly depleted, and makes it an offence to take shellfish from these areas during such a closure. The BMPA is under the jurisdiction of the Local Enforcement Authority (LEA), Maldon District Council, for food hygiene purposes.

The original sanitary survey gave recommendations for a total of eight Classification Zones within the Crouch BMPA, reflecting the broad areas of differing water quality and hydrology in the area. It presented two tables of proposed Recommended Monitoring Points (RMPs), one for the RMPs that required sampling for ongoing operation of the fishery (Table 3.1, p15 – 16) and another of RMPs that should be used following a formal classification request from industry (Table 3.2, p17-18). The following paragraphs detail the current CZs for each

[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] KEIFA Area A Shellfish Beds Byelaw. Available at: https://www.kentandessex-ifca.gov.uk/#acc_shellfish-beds-byelaw.

of the harvested species within the BMPA. The LEA stated during initial consultation that the shellfishery involves wild harvest of all currently classified species.

2.1.1 Native oyster

The Crouch estuary has historically supported significant populations of native oyster, although various factors have led to a significant decline in the middle of the 20th Century. From 31 May 2015 to 31 May 2018, KEIFCA implemented a closure of all native oyster beds within the area of the Blackwater, Crouch, Roach and Colne Marine Conservation Zone (MCZ)[3] to prevent further stock decline and promote recovery. The Essex Native Oyster Restoration Initiative (ENORI) have put in place a restoration plan and conservation strategy designed to promote the recovery of this species in this MCZ (ENORI, 2019). Various restrictions apply to the harvest of native oyster within the BMPA:

- A closed season is in place from 1st May to 31st August;
- No dredge with an aggregate width of blade or front edge that exceeds 4 m may be used;
- No oysters that will pass through a circular ring of 7 cm internal diameter may be removed from a public fishery; and
- A maximum of 250 kg of oyster may be removed per harvesting trip.

The original sanitary survey noted that the native oyster stock within the Crouch/Roach complex was located in the subtidal areas of the estuaries, and that the pattern of tidal circulation tended to trap spat within the estuary. There are currently two classification zones for this species; *Bridgemarsh* and *Outer Crouch*, which have held classifications since 2013.

The harvesters in the area, consulted as part of the LAG, stated during secondary consultation that the usual output of this species is 1,000 – 1,500 Kg *per annum*.

2.1.2 Pacific oyster

The only byelaws that apply to the harvest of Pacific oyster from within the Crouch BMPA is the dredge blade size limit of 4 m; there is no minimum landing size or closed season for this species of oyster. The original sanitary survey reported that the main commercial interest on this species was focussed on the upper Crouch, but that it was likely that the species was present throughout the estuary where there are suitable substrates for settlement. There are currently four classification zones for this species: *Brandy Hole*, *Bridgemarsh*, *Easter Reach* and *Fambridge*. The *Easter Reach* zone has been classified since 2015, whereas the others have been classified since 2013.

No estimate of the output of the fishery for this species was available to the authors of this review following initial and secondary consultations.

[3] Blackwater, Crouch, Roach & Colne Marine Conservation Zone Factsheet. Available at: http://publications.naturalengland.org.uk/file/5779144885403648.

2.1.3 Mussel

The original sanitary survey describes that the wild stocks of mussels within the Crouch/Roach estuary complex were quite low, and not of specific commercial interest. In addition to the wild stocks, on-growing of mussels took place in three areas of the Crouch but the status was uncertain at the time. Through the Area A Byelaws, KEIFCA impose various restrictions on the harvesting of mussels within the BMPA:

- No dredge with an aggregate width of blade or front edge that exceeds 2 m may be used;
- No more than 13.6 m^3 of mussels may be removed in a 24 hr period; and
- Without written consent of KEIFCA, no person may remove from the fishery mussels of which more than 10%, of a representative sample, will pass through a space 18 mm in width.

There is only one classification zone for this species, *Bridgemarsh,* which has been classified since 2013. The *Easter Reach* zone was classified for this species until recently but was declassified due to a lack of samples being collected (FSA, 2021).

No estimate of the output of the fishery for this species was available to the authors of this review following initial and secondary consultations.

2.1.4 American Hard Clam

The original sanitary survey describes that hard clams were introduced to the estuary complex through the relocation of specimens from Southampton Water, which then proliferated throughout the BMPAs to the point that they were present throughout the estuary. The only conservation control imposed on the harvest of this species is that no more than 10% of the shellfish (other than cockles, oysters, mussels or scallops) landed has visible damage to their shells.

There are currently three classification zones for this species, *Bridgemarsh*, *Easter Reach*, *Fambridge*, all of which have been classified since 2013.

No estimate of the output of the fishery for this species was available to the authors of this review following initial and secondary consultations.

2.2 Classification History

The original sanitary survey recommended the designation of eight classification zones within the Crouch estuary, with each of the four species being classified in two zones. There are currently 10 zones within the estuary, four for Pacific oyster, two for native oyster, one for mussel and three for hard clams. Every zone in the Crouch BMPA has a ‘Long-Term B’ classification, indicating stable classifications over at least the last 5 years. The location of all active classification zones and associated RMPs within the Crouch BMPA is shown in Figure 2.1.

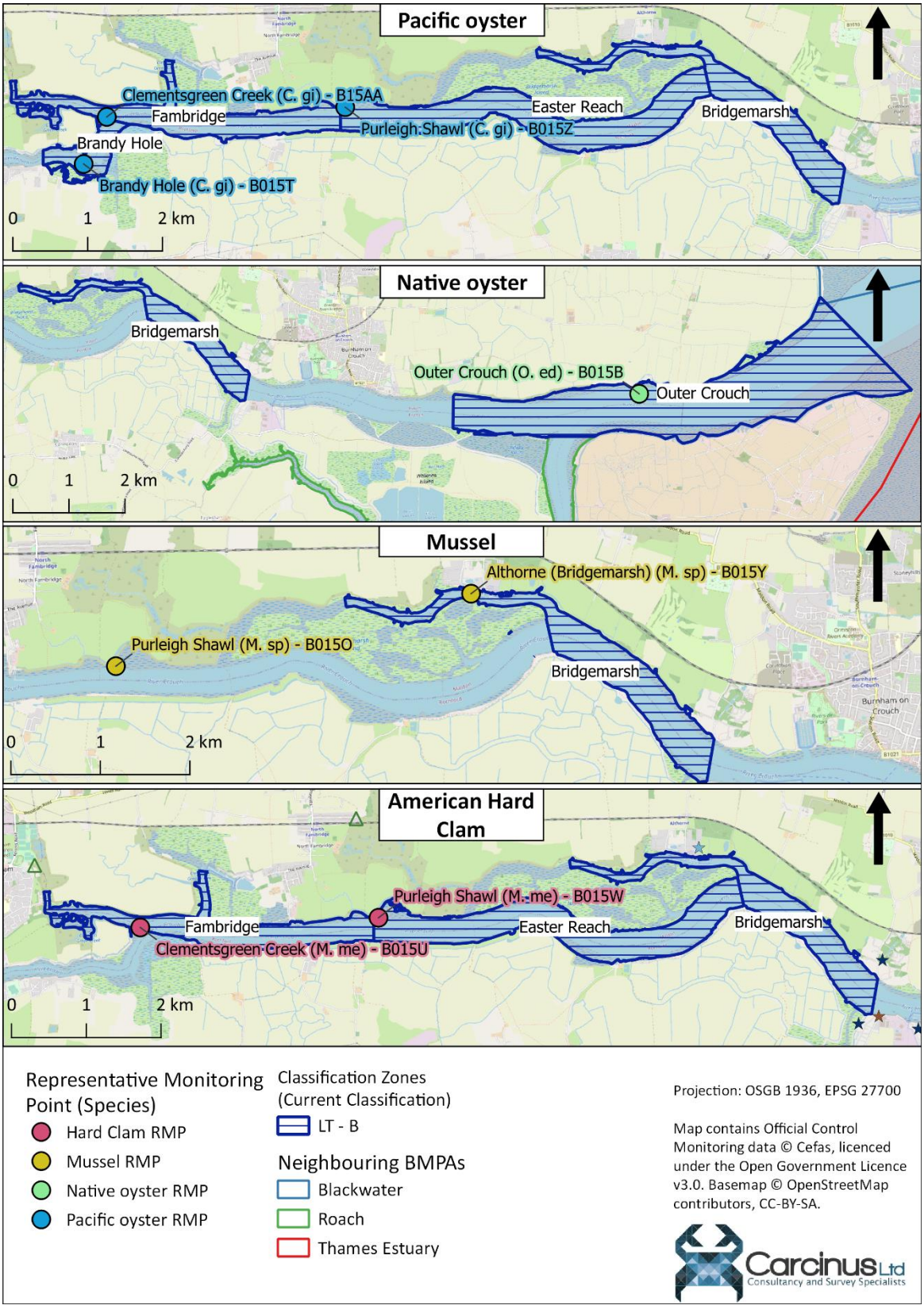

Figure 2.1 Current Classification Zones and associated Representative Monitoring Points in the Crouch BMPA.

3 Pollution sources

3.1 Human Population

The original sanitary survey cites population data from the 2001 census of the United Kingdom. Since the publication of that document, the data from the subsequent full census of 2011 has been made available, and so this data has been compared to that of the 2001 census to give an indication of the changes in human population within the catchment. These data have been used as no further population data are freely available (the results of the March 2021 census are not yet available). Changes in total population within Electoral Wards and changes in human population density in census Super Output Areas (lower layer) and wholly or partially contained within the Crouch catchment between the 2001 and 2011 censuses are shown in Figure 3.1 and Figure 3.2 respectively.

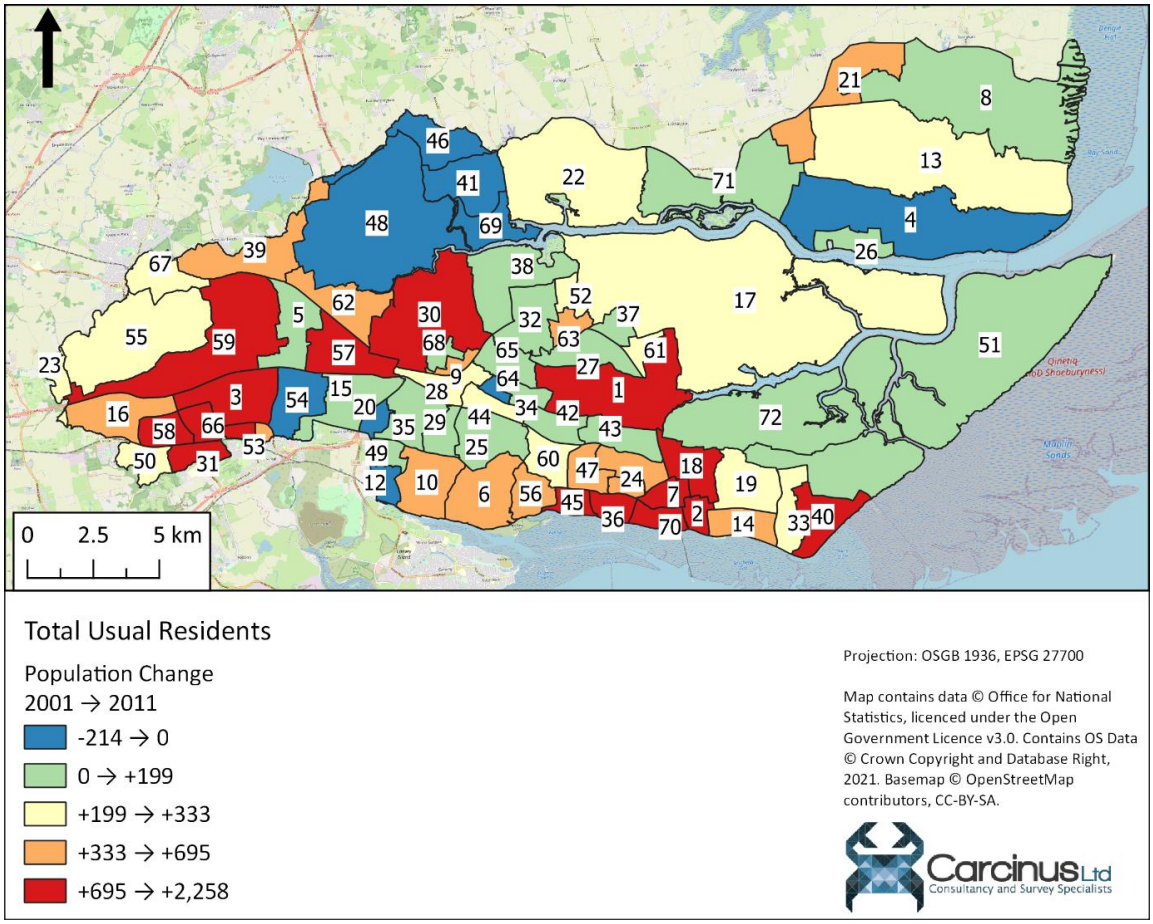

Figure 3.1 Population changes between the 2001 and 2011 censuses in Wards and Electoral Divisions (based on 2011 boundaries) that are within the Crouch catchment[4]. Numbers within wards are identifiers that can be used in combination with Appendix I to provide more detail.

[4] 2001 Census data have been transposed to 2011 wards using the UK Data Service's GeoConvert tool (http://geoconvert.mimas.ac.uk/) to facilitate comparison.

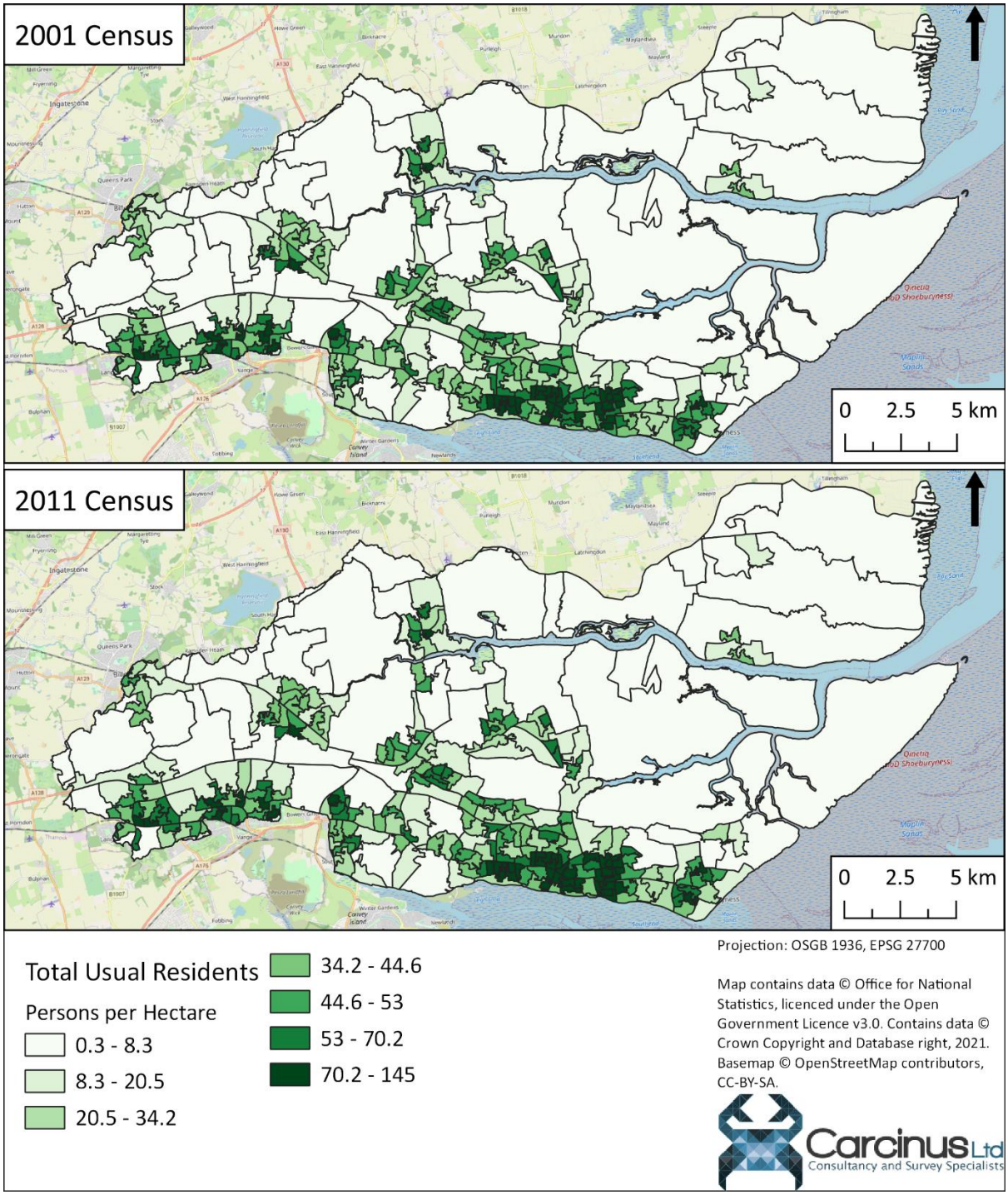

Figure 3.2 Human population density in 2001 and 2011 Census Super Output Areas (lower layer) that intersect the Crouch catchment.

In general, population has increased across the catchment, with all but 9 wards in the region showing an increase in total population size. The average population density is relatively high, at >26 people per hectare (an increase of 1.64 p/ha between 2001 and 2011), although nearly 30% of wards have a population density of <10 people per hectare. The original

sanitary survey describes that the main population centres within the catchment consist of the towns of South Woodham Ferrers and Rochford at the head of the Crouch and Roach estuaries respectively, as well as the town of Burnham on the north shore of the Crouch, approximately 8 km from the mouth of the estuary. Southend-on-Sea is located in the far south of the catchment, along the shoreline of the Thames estuary. This is a major source of population density within the catchment, and whilst most of the runoff from this settlement will drain to the Thames Estuary and is therefore of little consequence to the bacteriological health of the Crouch BMPA, some contamination enters the Crouch via Prittle Brook, Eastwood Brook and the Roach. The urban centres of the catchment have generally shown the greatest increase in population size.

At the 2001 census, the total resident population within wards wholly or partially contained within the Crouch catchment was 501,944 people. By the time of the 2011 census, this had increased to 531,148, an increase of 5.82%. The population data for the 2011 census was collected one year prior to the publication of the original sanitary survey and so could be considered more relevant to that document. Whilst the full results of the March 2021 census have not yet been published, the UK Government estimates that the national population will have increased 6.6% between 2011 and 2021 (ons.gov.uk, 2021). An increase of this proportion would see the approximate population within the catchment rise to 566,204 (though it is likely that the real increase may not have been as large). The greatest potential for runoff remains at the head of the estuaries, due to the settlements in these locations. Impacts from sewage discharges will depend on the specific nature and locations of such discharges, changes to which are discussed in the next section. Consultation with the LEA did not indicate that any significant housing developments had been built since the original sanitary survey was published, though the EA stated that new developments have been built at Rawreth, Hullbridge, North Fambridge, Burnham and the Runwell hospital site. Essex County Council require that Sustainable Drainage Systems (SuDS) be put in place (essexdesignguide.co.uk, 2021), which should minimise the additional impact of these developments. As such, the overall risk from urban runoff and loading to the wastewater treatment network (WWTN) will have remained similar.

The original sanitary survey describes that the main visitor town in the area is Burnham, on the northern shore of the Crouch, and Southend-on-Sea in the south of the catchment. That report does not present any tourism statistics but states that an increase in population size will occur during summer months. No tourism statistics or trends were available to the authors of this review, though it is likely that the level of tourism that the area receives has increased slightly in recent years, particularly in the last 18 months given that foreign travel has been restricted due to the Covid-19 pandemic. Peak tourism numbers, and therefore maximal loading to the WWTN will occur during summer months. It is assumed that the WWTN capacity is sufficient to accommodate this increase, though increases from tourism in summer months may impact the seasonality of contamination.

Comparison of the two most recently available census data indicates that the population in the catchment has increased slightly. The area still likely receives a high volume of tourism and given that the main population centres have remained the same, the recommendations for RMP location based on this source of contamination remain the same as is described in the original sanitary survey.

3.2 Sewage

Details of all consented discharges within the Crouch catchment were taken from the most recent update to the Environment Agency (EA)'s national permit database at the time of this report (August 2021). The locations of these discharges are shown in Figure 3.3.

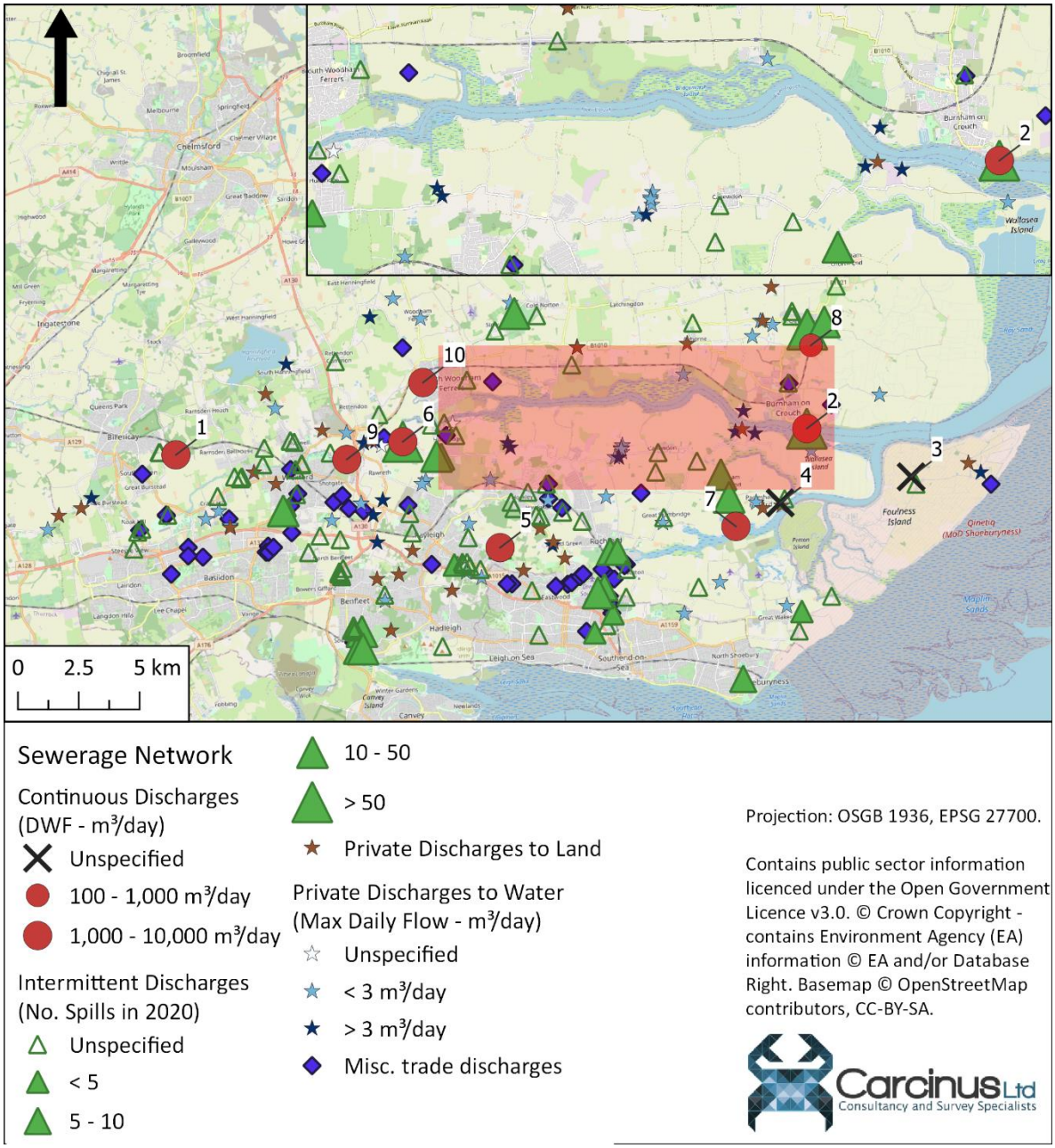

Figure 3.3 Locations of all consented discharges in the Crouch catchment. Labels refer to continuous discharges, details of which can be found in Table 3.1.

The original sanitary survey identified a total of nine continuous discharges within the Crouch/Roach catchment (Figure VII.1, p 61; Table VII.1, p 62). It identified that the most acute impacts were likely to arise in the upper reaches of the Crouch estuary, and around the Burnham STW outfall. Consultation with the LEA did not indicate any significant upgrades to the continuous discharges in the catchment. The EA indicated that UV disinfection had been installed at Burnham-on-Crouch WRC and Wickford WRC prior to the original sanitary survey, although this is not detailed in the data presented in the 2012 report. During secondary consultation, the EA stated that these discharges had UV

disinfection installed around March 2013, with permits requiring UV treatment by 31 March 2013, though it was likely operational before then. Based on the EA database queried for this review, UV disinfection has been successfully installed at both these discharges, as well as at Rayleigh East STW. The addition of this treatment methodology should reduce the bacteriological contamination caused by these outfalls. The Wickford STW has also seen a reduction in its consented Dry Weather Flow (DWF), from 8,214 m^3/day to 7,500 m^3/day. The other consented discharge rates have remained the same.

Table 3.1 Details of all continuous discharges within the Crouch catchment. Those discharges that have received upgrades since the original sanitary survey are shaded green.

ID	Sewage Works	Permit Number	NGR	Treatment	DWF (m^3/day)
1	BILLERICAY WATER RECYCLING CENTRE	AW2NFE05358	TQ6989094200	LAGOON SETTLEMENT	1417
2	BURNHAM ON CROUCH WRC	ASETS10533	TQ9581095280	UV DISINFECTION	2200
3	FOULNESS (CHURCH END) STW	AW2NFE02262	TR0010093300	UNSPECIFIED	27
4	PAGLESHAM (EAST END) STW	ASENF144	TQ9472092230	UNSPECIFIED	Unspecified
5	RAYLEIGH EAST STW	ASENF1172	TQ8321090390	UV DISINFECTION	4600
6	RAYLEIGH WEST STW	AW2TSE12870	TQ7921094740	LAGOON SETTLEMENT	5827
7	ROCHFORD (STAMBRIDGE) STW	AW2TS975	TQ9290091260	ACTIVATED SLUDGE	8630
8	SOUTHMINSTER WATER RECYCLING CENTRE	AW2NF490	TQ9598098700	OXIDATION DITCH	900
9	WICKFORD WATER RECYCLING CENTRE	ASETS1322	TQ7691094010	UV DISINFECTION	7500
10	WOODHAM FERRERS STW	ASENF1251	TQ8004097170	LAGOON SETTLEMENT	3900

In addition to the continuous discharges, the original sanitary survey identified a total of 45 intermittent discharges with the potential to impact the BMPA. Intermittent discharges comprise Combined Storm Overflows (CSOs), Storm Tank Overflows (STOs) and Pumping Station Emergency Overflows (PSs). During Asset Management Plans (AMP) 6 and 7, (five-year periods that water companies use to plan performance upgrades etc.) Event Duration Monitoring (EDM) was installed at several of the discharges within the catchment, and summary data for 2020 was published by the Environment Agency in March 2021

(Environment Agency, 2021). Details of these data for those discharges in the vicinity of the BMPA are presented in Appendix II. The details for each discharge was joined to the main discharge database using the permit number. Beyond the data processing described above, the data have been taken at face value, and some locations in the consented discharge database may be erroneous, meaning that the point appears in the wrong location. Some EDM returns had multiple meters on a single discharge activity, in this case we have presented all reported spill counts as individual values, unless the comment indicated that the meters were not working properly in which case the values were nulled. The EDM returns 'Activity Reference' field did not reliably distinguish between emergency overflows and storm overflows, therefore we have included all of these in the intermittent discharge category.

The 2012 report presents EDM data for 10 of the intermittent discharges within the catchment. Based on the summary data provided by Anglian Water, those discharges where EDM data is available for 2011 (presented in the original report) and 2020 have spilled a similar amount of time. The 2020 data indicates that the intermittent discharge most likely to significantly affect the shellfishery is the Burnham-on-Crouch storm discharge, which only employs primary screening and spilled 81 times for a total 1274 hours in 2020. Consultation with the Environment Agency indicated that by 2024, the screening filter will be replaced with a storm tank, which should reduce the frequency of spills. Until this is completed (and EDM data confirms that the reduction in spill frequency has occurred), consideration should be given to this discharge in any updated sampling plan.

In addition to the water company owned discharges, there remain many privately owned discharges in the vicinity of the Crouch/Roach complex. These are likely to be of little significance compared to the water company owned discharges, due to the small consented discharge volumes.

There have been some upgrades to the treatment methodologies employed at the continuous discharges within the catchment, which should have reduced the FIOs discharged to the estuary. However, EDM data suggests that a significant number of spills, that have only undergone primary treatment, are discharged to the head of the Crouch estuary and around Burnham-on-Crouch. Consideration should be given to these outfalls in any updated sampling plan.

3.3 Agricultural Sources

Livestock census data have been obtained for 2013 and 2016 (Defra, 2018) for Local Authority Districts that fall within or partially within the Crouch catchment. No more recent data are available, but these data have been used to give an indication of livestock population trends in the period since the original sanitary survey was published. As only a proportion of each district falls within the catchment, the livestock data have been adjusted to reflect the percentage of each district that falls within the catchment. This assumes that

the livestock are uniformly distributed throughout the district and therefore some inaccuracies may be present. The percentage change in total livestock population for each district is shown in Figure 3.4. Changes in livestock population data for each District, broken down by livestock group, are shown in Table 3.2.

The total (adjusted) livestock population within the Crouch catchment was estimated to have increased by 21.32% between 2013 and 2016. The dominant livestock group remains poultry, with more animals than the other three groups combined. Only cattle showed a decrease in population size across the catchment. Two out of the seven Local Authority Districts (LADs) showed an increase in population size. Across all groups of animals and LADs, the livestock population will vary throughout the year, with the highest numbers occurring during spring and the lowest numbers when animals are sent to market in Autumn and Winter.

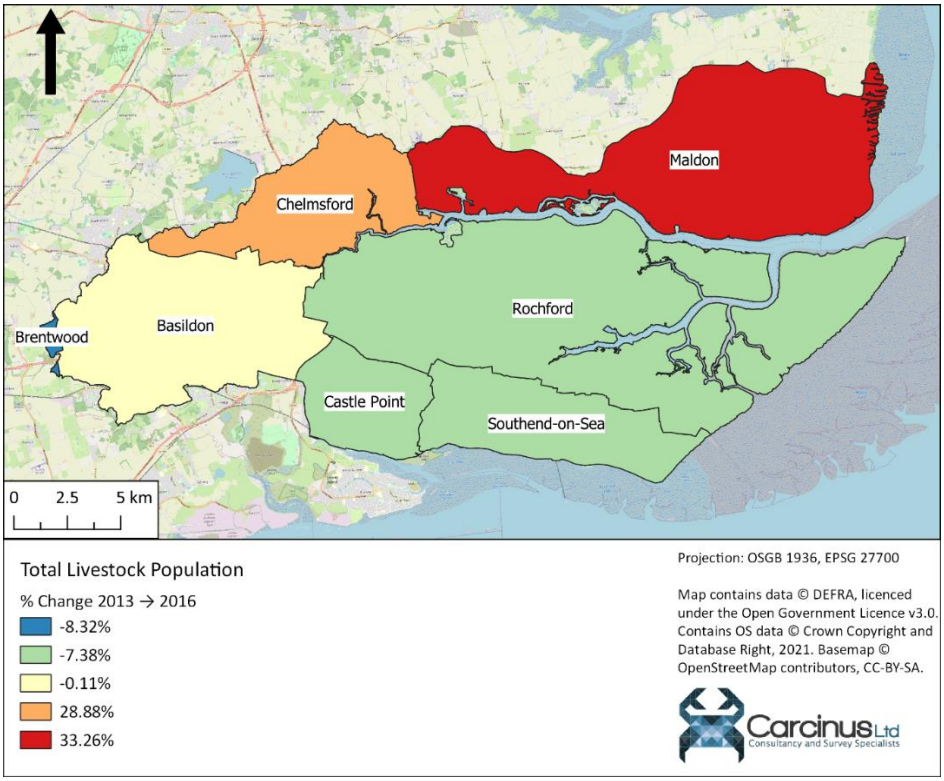

Figure 3.4 Livestock population change between 2013 and 2016 for Local Authority Districts wholly or partially contained within the Crouch catchment.

Table 3.2 Livestock population data for Local Authority Districts wholly or partially contained within the Crouch catchment.

LAD Name	Area (Ha)	Area within catchment	% LAD in Catchment	% of Catchment	Adjusted Cattle Population			Adjusted Sheep Population			Adjusted Pig Population			Adjusted Poultry Population		
					2013	2016	% Change	2013	2016	% Change	2013	2016	% Change	2013	2016	% Change
Basildon	11,002	7,370	66.99%	16.06%	696	691	-0.81%	668	0	-100.00%	20	0	-100.00%	2,052	2,741	33.60%
Brentwood	15,317	128	0.84%	0.28%	2	1	-58.96%	3	3	5.08%	30	30	-0.43%	341	311	-8.91%
Chelmsford	34,230	4,258	12.44%	9.28%	230	310	34.91%	271	228	-15.86%	393	529	34.54%	27,913	36,061	29.19%
Maldon	35,855	10,745	29.97%	23.42%	1,291	1,201	-6.98%	2,158	2,012	-6.77%	959	2,608	171.90%	200,529	267,278	33.29%

LAD Name	Area (Ha)	Area within catchment	% LAD in Catchment	% of Catchment	Adjusted Cattle Population			Adjusted Sheep Population			Adjusted Pig Population			Adjusted Poultry Population		
					2013	2016	% Change	2013	2016	% Change	2013	2016	% Change	2013	2016	% Change
Rochford*	16,933	16,792	65.56%	36.60%	737	614	-16.63%	31	858	2687.84%	552	502	-9.18%	63,247	57,827	-8.57%
Southend-on-Sea*	4,175	4,102	16.02%	8.94%	180	150	-16.63%	8	210	2687.84%	135	123	-9.18%	15,450	14,126	-8.57%
Castle Point*	4,504	2,483	9.69%	5.41%	109	91	-16.63%	5	127	2687.84%	82	74	-9.18%	9,352	8,551	-8.57%
TOTAL	**122,016**	**45,878**	**37.60%**	**100.00%**	**3,244**	**3,057**	**-5.76%**	**3,143**	**3,438**	**9.39%**	**2,171**	**3,865**	**78.01%**	**318,885**	**386,895**	**21.33%**

*Calculated as Rochford, Castle Point and Southend-On-Sea.

The principal route of contamination of coastal waters by livestock is surface run-off carrying faecal matter. Figure 3.5 shows how land cover has changed throughout the catchment between 2012 and 2018. It shows that the south-west regions of the catchment are dominated by urban fabric and associated land cover types, whereas the land in the north-east is mostly arable farmland. There are however several areas of pasture immediately adjacent to the shoreline, particularly around North Fambridge. These areas may contribute some faecal contamination to the shellfish beds, particularly during heavy rainfall that follows an extended dry period. Application of slurry as fertiliser to areas of arable farmland may also result in contamination to coastal waters and freshwater sources via runoff. Whilst there are some areas of arable land immediately adjacent to the river, the authors of this review are not aware of any specific concerns, and as such this does not need to be given any additional consideration in any updated sampling plan.

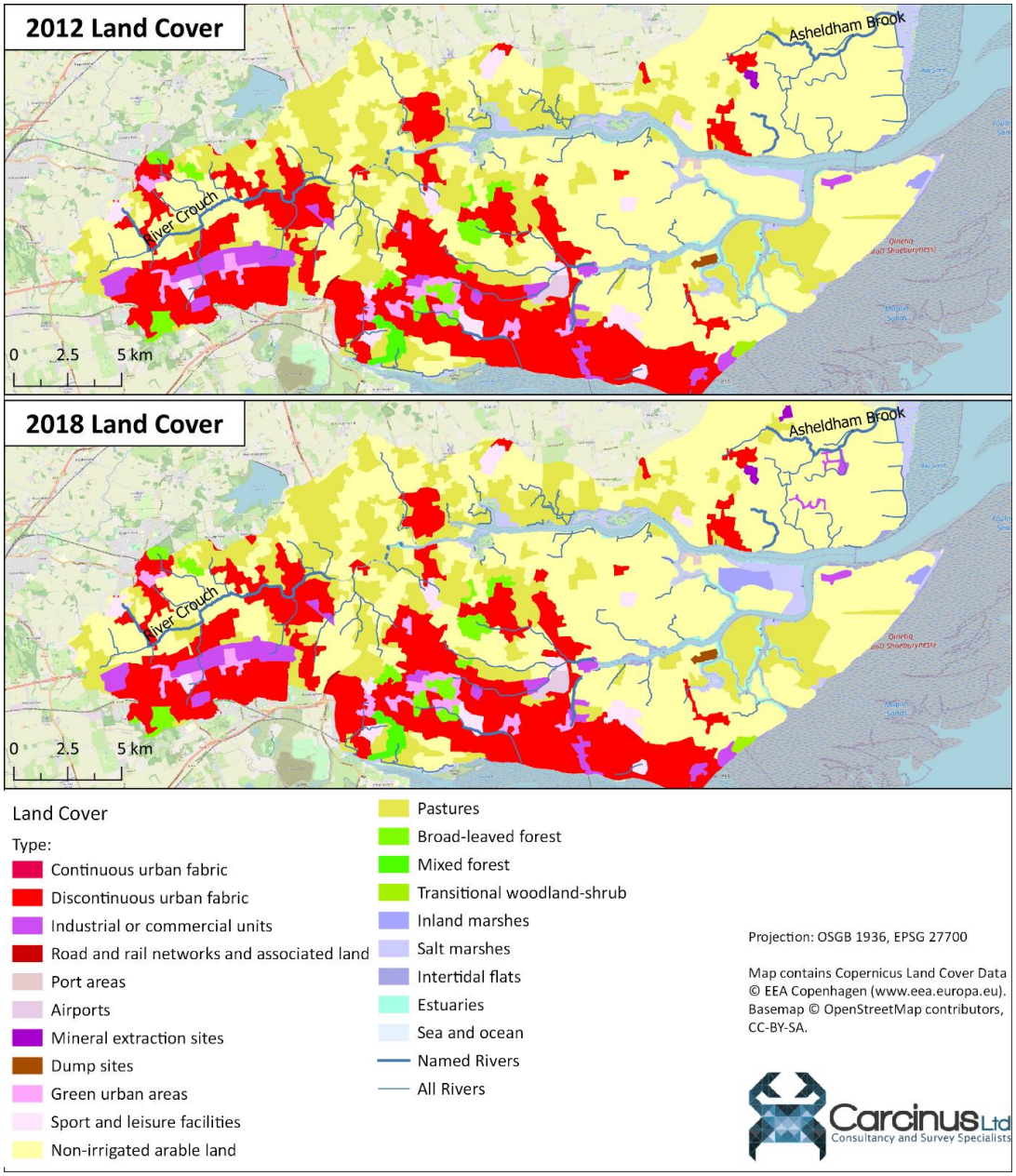

Figure 3.5 Changes in the land cover across the Crouch catchment between 2012 and 2018.

Livestock populations have risen across the catchment, although most of this increase is associated with a rise in the dominant group, poultry. Livestock density remains generally low, at 8.66 animals per hectare. There are some areas of pasture immediately adjacent to the shoreline, near the shellfish beds. However, as the geographical extent of these pasture areas has not changed significantly (<10% total area change), the overall risk to the shellfishery remains similar to that at the time of the original sanitary survey. As such, the recommendations made in the original survey to capture this form of pollution remain valid.

3.4 Wildlife

The waters of the Crouch/Roach estuary complex contain a variety of natural habitats, including sand banks and saltmarsh, that support a significant diversity of wildlife species. As a result of this, the area is conferred protection under a variety of statutory and non-statutory designations, including as a Site of Special Scientific Interest (SSSI), Ramsar Site, Special Protection Area (SPA), Special Area of Conservation (SAC) and Marine Conservation Zone (MCZ) (ENORI, 2019). There have also been efforts to 'rewild' sections of the catchment. Land cover on Wallasea Island, where the Rivers Roach and Crouch join has changed between 2012 and 2018 (Figure 3.5), with large arable fields being converted to saltmarsh, creek, lagoon and mudflat habitats. These works were part of an RPSB project designed to return the island to its natural state through a process of managed realignment, which will increase the available habitat for wildlife in the area.

The statutory and non-statutory designations afforded to the Crouch/Roach complex are due, in part, to the significant populations of overwintering waterbirds. These species represent a potentially significant source of faecal contamination to BMPAs as they typically forage for food and defecate directly on shellfish beds. In the five winters to 2011/2012, an average total count of 30,131 waterbirds were spotted in the Crouch/Roach estuary complex (Austin *et al.*, 2014). In the five winters to 2019/2020, the average total count had increased to 33,514 waterbirds, an increase of 11.23% (Frost *et al.*, 2021). Within this count is an internationally significant population of Brent Goose as well as nationally significant populations of Shelduck, Avocet and Dunlin, amongst others. The precise distribution of these birds, and therefore the contamination they cause, is hard to accurately quantify as it will change from year-to-year with the shifting distributions of their prey. This makes it hard to define RMP positions that will reliably capture this source of pollution.

The estuary complex also supports a small population of seals, mostly located in the Roach and the sand banks. Animals from this population will almost certainly forage around the shellfish beds from time-to-time, though these animals have large foraging ranges and therefore the pollution they cause will show a large degree of spatial and temporal variability. This makes it impossible to account for in any updated sampling plan.

Waterbird populations are the main group likely to contribute significant amounts of bacteriological contamination to the BMPA, although it remains challenging to account for the pollution from wildlife in any updated sampling plan, due to the spatial and temporal variability of the pollution source.

3.5 Boats and Marinas

The discharge of sewage from boats is a potentially significant source of bacteriological contamination of the shellfish beds within the Crouch BMPA. Boating activities in the Crouch/Roach estuary complex have been derived through analysis of satellite imagery and

various internet sources and compared to that described in the original sanitary survey. Their geographical positions are presented in Figure 3.6.

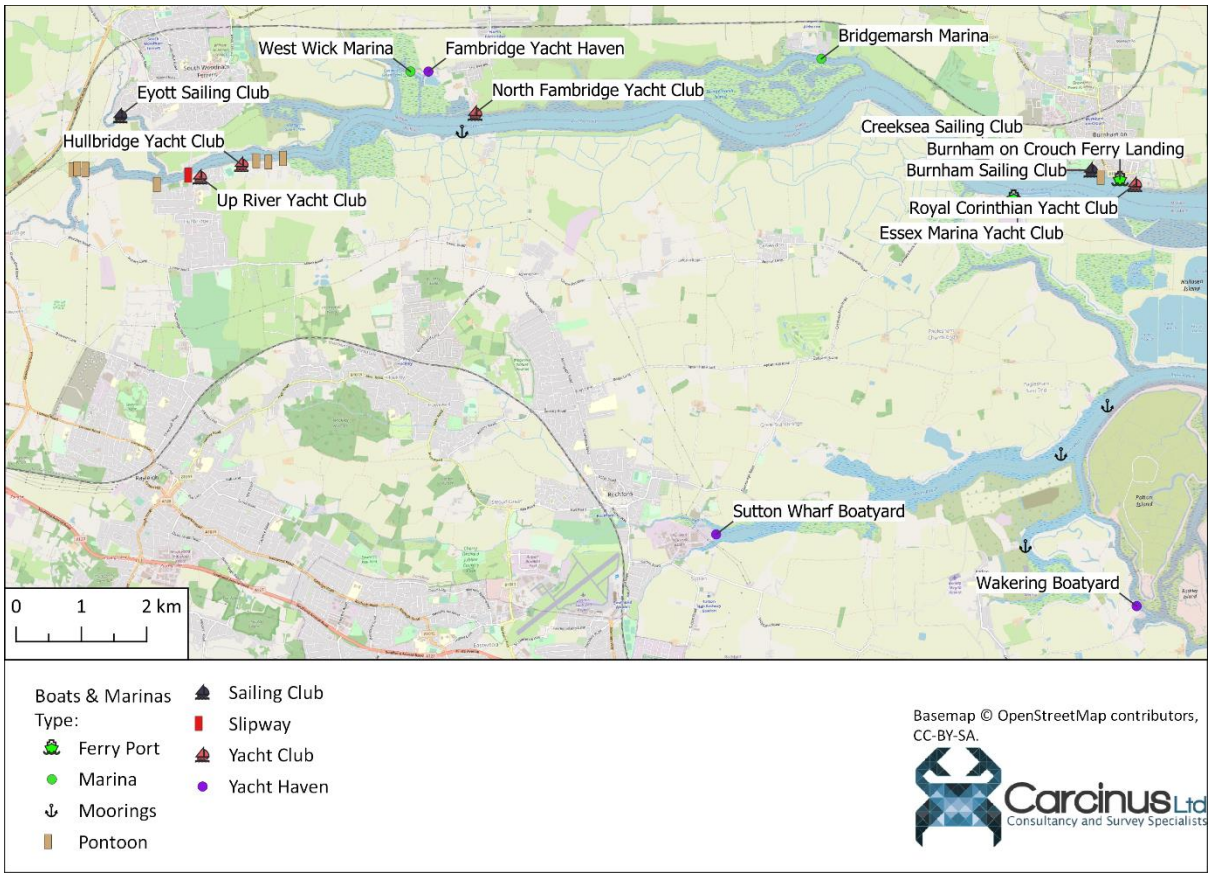

Figure 3.6 Locations of moorings, marinas and other boating activities within the Crouch/Roach estuary complex.

The original sanitary survey identifies that most of the marinas and moorings are located in the Crouch. All the marinas etc. identified in the 2012 report are still in use, based on recent satellite imagery. None of the marinas present contain pump-out facilities, and therefore private vessels of a sufficient size are likely to make overboard discharges from time to time. This is most likely to occur around the areas of moorings and main navigational channels rather than around the pontoons/marinas, as it is considered antisocial in the marina setting where on-shore toilets are readily available. The level of recreational boating activity within the estuary complex will be highest during the summer months, and therefore the greatest impact on the bacteriological health of the shellfishery will also be during this period.

In addition to the private vessels, there is a small amount of commercial shipping traffic, including two fishing vessels <10 m (gov.uk, 2021). Merchant shipping vessels are not

permitted to make overboard discharges within 3 nautical miles of land[5], and so are not considered to be of relevance in any updated sampling plan.

The level of boating activity, especially from recreational pleasure craft, remains very high within the Crouch/Roach complex. The seasonality and areas of high-risk from this source of pollution remain very similar however, and so the recommendations made in the original sanitary survey to capture this source of pollution remain valid.

3.6 Other Sources of Contamination

Urban fabric within the catchment remains centred at the heads of the two estuaries, as well as the town of Burnham on the northern shore of the Crouch. These settlements near to waterbodies remain a risk of diffuse microbiological contamination through utility misconnections and dog fouling to a lesser extent. The geographical extent of these settlements has increased slightly since the original sanitary survey was published (Figure 3.5), and so the risk of this source of contamination may have increased slightly, but not significantly as the settlement increase has occurred at least 5 km from the shellfish beds.

There are a number of advertised walks that follow the coastline of the two estuaries, and so there may be some impact from dog fouling in the nearshore zone. The extent of this source of pollution is not assessed to have changed significantly since the original sanitary survey was published.

No evidence of significant changes to these sources of contamination exists. Therefore, it can be assumed that the RMP location recommendations made in the original sanitary survey will still capture the influence of these sources.

4 Hydrodynamics/Water Circulation

The original sanitary survey identifies that the Crouch/Roach estuary complex is surrounded by reclaimed land and flanked by flood walls. The Crouch has a more linear structure, with the Roach having many branching creeks that surround small islands. The dilution potential will be greatest in the main navigational channels where water depth is maximal. Similarly, dilution potential will be lowest in the small creeks that branch off the main river.

The main driver of water movement in the Crouch/Roach complex is tidal circulation, which will carry contamination up-estuary in a westerly direction in the Crouch and a south-westerly direction in the Roach during flooding tides, and in the opposite direction on an ebbing tide. Farther down the estuary, there lies the potential for contamination to be carried some distance depending on the state of the tide it is released.

[5] The Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008.

It is considered unlikely that the hydrodynamic conditions will have changed in the BMPA since the original sanitary survey was published. As such, the recommendations made in that document to account for it in the recommended sampling plan remain valid.

5 Rainfall

Rainfall data for the Crouch at Wickford monitoring station (NGR: TQ748933) from 2008 – 2012 (pre sanitary survey) and 2013 – 2017 (post sanitary survey) were taken from the National River Flow Archives (NRFA)[6] (NRFA, 2021) and processed in R (R Core Team, 2021) using the 'rnrfa' package (Vitolo, 2016). These data were used to determine whether any changes in rainfall patterns had occurred since the original sanitary survey. The mean daily rainfall per month between the 2008 – 2012 and 2013 – 2017 periods are presented in Figure 5.1 and the results are summarised in Figure 5.1.

[6] Note – Catchment Daily Rainfall data is only available up to 2017 for monitoring stations on the NRFA.

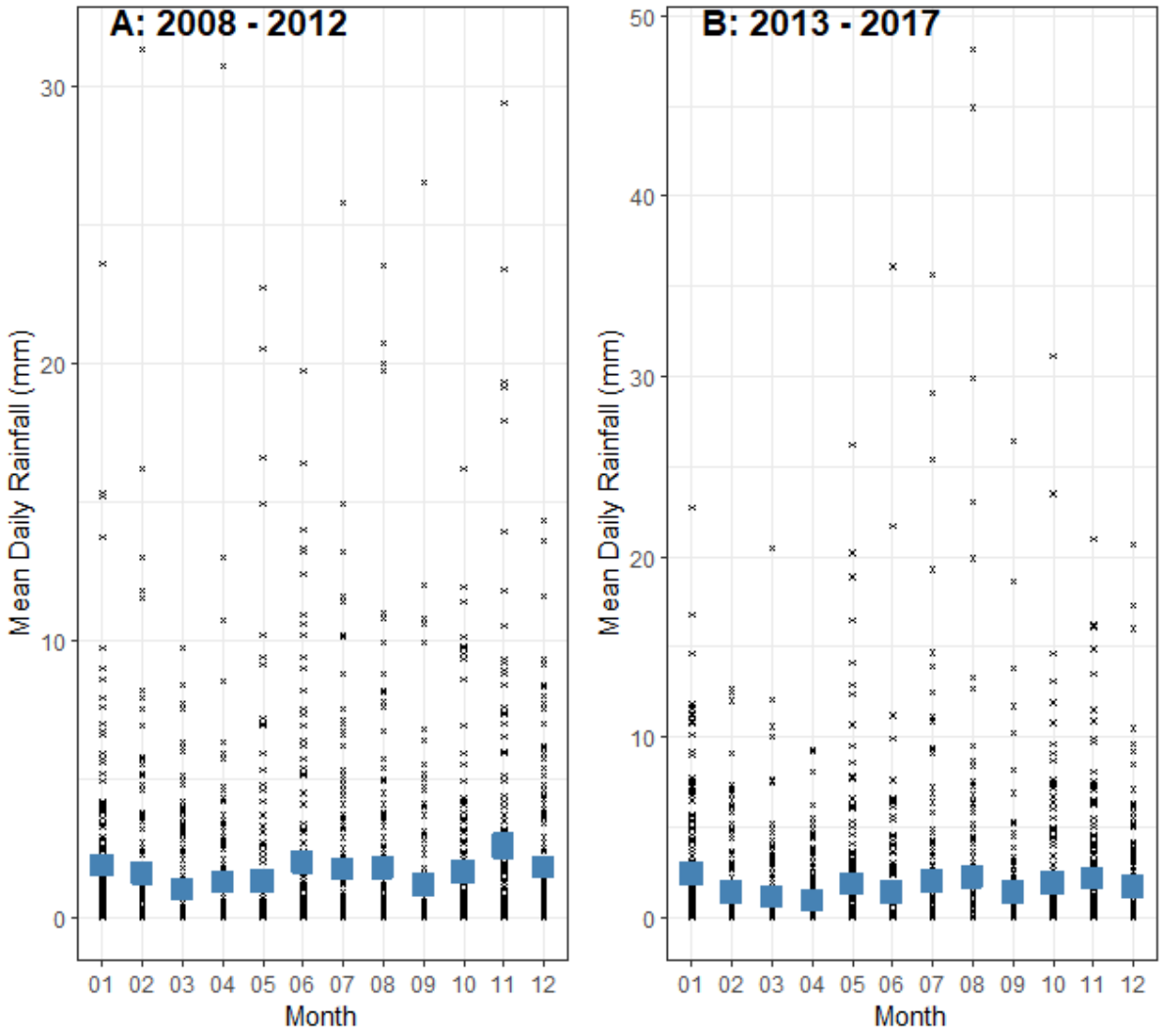

Figure 5.1 Mean daily rainfall (mm) per month for the Crouch at Wickford monitoring station (NGR: TQ748933) monitoring station for the period (A) 2008 – 2012 and (B) 2013 – 2017.

Table 5.1 Summary statistics for rainfall before and after the original sanitary survey.

Period	Mean Annual Rainfall (mm)	% Dry Days	% Days > 10 mm	% Days > 20 mm
2008 - 2012	596.18	44.88	23.37	14.94
2013 - 2017	616.66	43.26	23.00	14.62

Whilst annual rainfall has increased slightly, the number of days with heavy rainfall (> 10 mm rain) has decreased. Two sample t-tests indicated that there was no significant

difference (p = 0.981) in the mean daily rainfall per month between the 2008 – 2012 and 2013 – 2017 periods.

Rainfall leads to increased faecal loading through two factors; elevated levels of surface runoff and spill events from intermittent discharges. However, as the rainfall patterns have remained consistent across the two time periods, significantly increased bacterial loading due to these factors is unlikely and as such RMP recommendations made in the original sanitary survey to capture the influence of runoff and spill events remain valid.

6 Microbial Monitoring Results

6.1 Summary Statistics and geographical variation

A total of eight RMPs have been sampled within the Crouch BMPA since the original sanitary was published, three of which involved sampling of Pacific oysters (*Crassostrea gigas*), two each of mussels (*Mytilus spp.*) and American hard clams (*Mercenaria mercenaria*) and one of native oyster (*Ostrea edulis*). Of these, only one (Outer Crouch – B015B) was sampled prior to the original sanitary survey. Sampling at four of the remaining RMPs began in late 2012 / early 2013, and at the remaining two in January 2012 and 2014. All eight RMPs are still in use. Summary statistics from Official Control Monitoring at these RMPs are presented in Table 6.1. Figure 6.1 shows the geometric mean results of this monitoring. All data have been taken directly from the Cefas datahub[1] and have been taken at face value. The datahub only presents the data of RMPs where a sample has been collected in the last five years so it is possible that monitoring data for the other locations exists, but it is not considered in this report.

Table 6.1 Summary statistics of E. coli (MPN/100 g) from RMPs sampled since the original sanitary survey. Data cut off at August 2021.

				E. coli (MPN/100 g)							
RMP (Species)	**NGR**	**Species**	**No.**	**First Sample**	**Last Sample**	**Geometric Mean**	**Min Value**	**Max Value**	**% > 230**	**% > 4,600**	**% > 46,000**
Outer Crouch (O. ed) - B015B	TR00109540	Native Oyster	207	15/01/2003	04/08/2021	412.24	18	7900	30.92	1.45	0.00
Purleigh Shawl (M. sp) - B015O	TQ86459657	Mussel	60	29/03/2012	27/04/2021	1243.02	18	17000	43.33	8.33	0.00
Brandy Hole (C. gi) - B015T	TQ82959581	Pacific Oyster	99	22/10/2012	27/04/2021	1182.64	18	16000	61.62	8.08	0.00
Clementsgreen Creek (M. me) - B015U	TQ83269644	American Hard Clams	95	11/12/2012	27/04/2021	405.19	18	13000	25.26	2.11	0.00
Purleigh Shawl (M. me) - B015W	TQ86459657	American Hard Clams	96	11/12/2012	27/04/2021	244.68	18	9200	12.50	1.04	0.00
Althorne (Bridgmarsh) (M. sp) - B015Y	TQ90429738	Mussel	98	10/01/2013	04/08/2021	1182.01	18	35000	46.94	5.10	0.00
Purleigh Shawl (C. gi) - B015Z	TQ86459657	Pacific Oyster	84	28/01/2014	27/04/2021	481.89	18	13000	25.00	2.38	0.00

						E. coli (MPN/100 g)					
RMP (Species)	**NGR**	**Species**	**No.**	**First Sample**	**Last Sample**	**Geometric Mean**	**Min Value**	**Max Value**	**% > 230**	**% > 4,600**	**% > 46,000**
Clementsgreen Creek (C. gi) - B15AA	TQ83269644	Pacific Oyster	85	28/01/2014	27/04/2021	825.42	18	7900	54.12	5.88	0.00

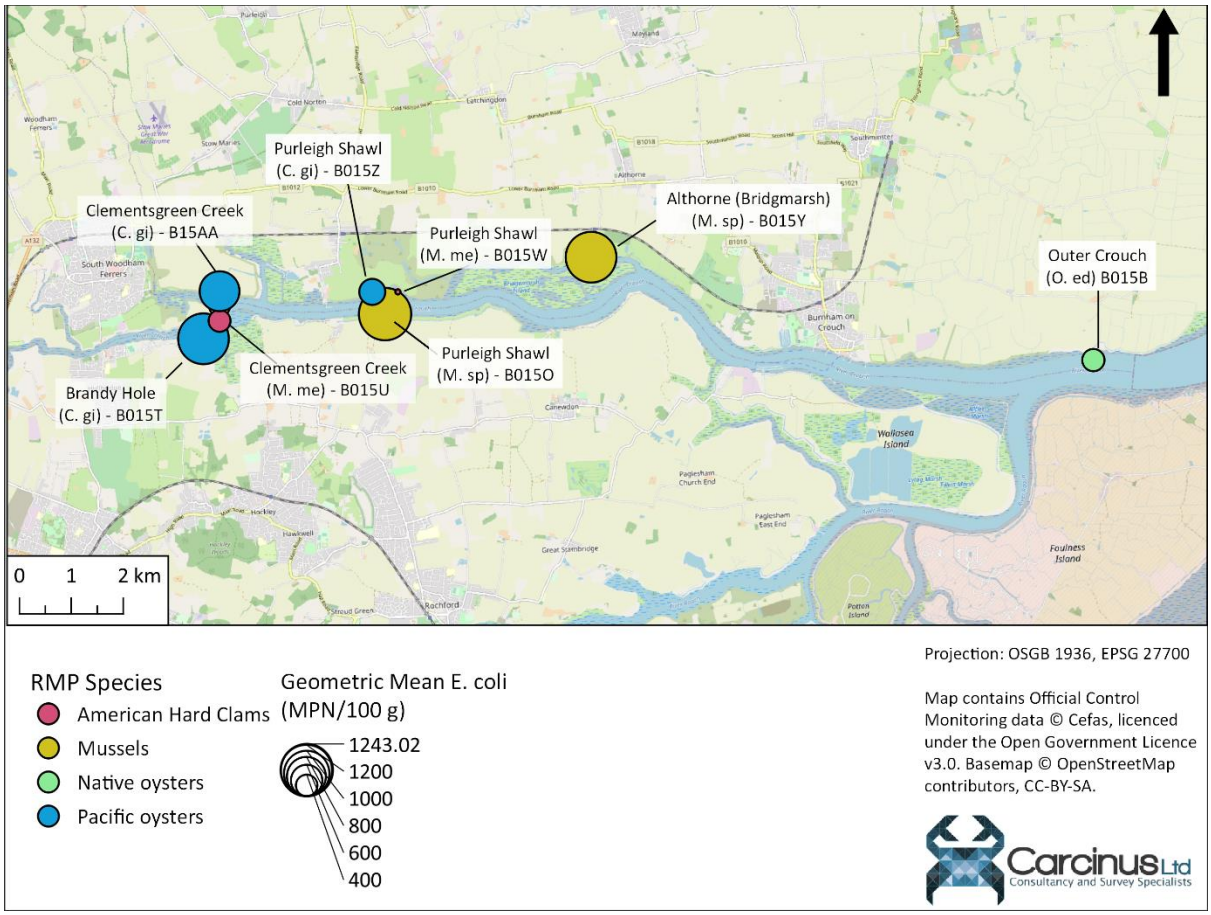

Figure 6.1 Geometric mean E. coli monitoring results from Official Control monitoring at bivalve RMPs within the Crouch BMPA.

Relative to other BMPAs around the country, the mean results from samples collected from RMPs in the Crouch are low, with only two RMPs (Purleigh Shawl – B015Z & Brandy Hole – B015T) having a mean result of >1,000 MPN/100 g, and no RMP ever returning a result >46,000 MPN/100 g. There are two instances of an RMP being co-located for more than one species. In this case, the hard clam RMP has returned a much lower result than the RMPs of other species. This pattern is to be expected, as a Cefas report, commissioned by the FSA (Cefas, 2014) into the use of indicator species in UK BMPAs found that hard clams tend to accumulate *E. coli* less readily than other species (Cefas, 2014). There does also appear to be some geographic pattern, with those RMPs situated nearer to the head of the estuary returning higher results, likely due to the concentration of consented discharges in and around Woodham Ferrers. As such, a general recommendation of locating RMPs at the upstream end of classification zones is given, unless point sources warrant a different location.

Figure 6.2 - Figure 6.5 present boxplots of *E. coli* monitoring results from RMPs for the various species harvested within the Crouch BMPA. One-way analyses of variance (ANOVA) tests were used to investigate the statistical significance of any differences between

monitoring results from RMPs for a given species. It is not appropriate to compare between different species due to the differences in the rate of *E. coli* uptake and retention. All statistical analysis in this section was undertaken in R (R Core Team, 2021). Significance has been taken at the 0.05 level.

The ANOVA tests revealed that results from Brandy Hole (B015T) were significantly greater than those from Purleigh Shawl (B015Z) ($p = 0.025$). No other significant differences were found in the data for Pacific oyster or any of the other monitored species.

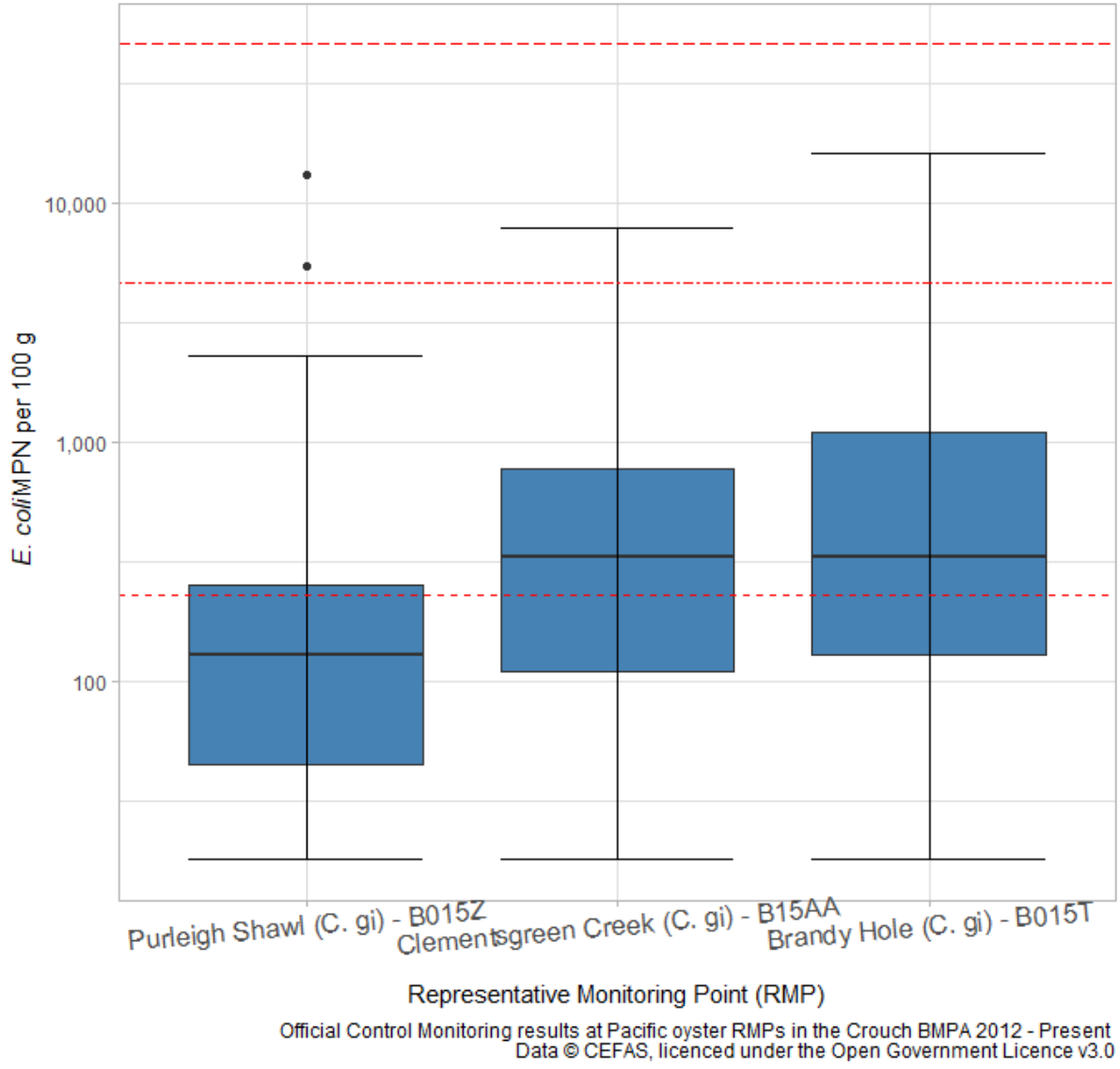

Figure 6.2 Boxplots of E. coli levels at Pacific oyster RMPs sampled within the Crouch BMPA 2012 – Present. Central line indicates median value, box indicates lower-upper quartile range and whisker indicates minimum/maximum values excluding outliers (points >1.5 x the

interquartile range). Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

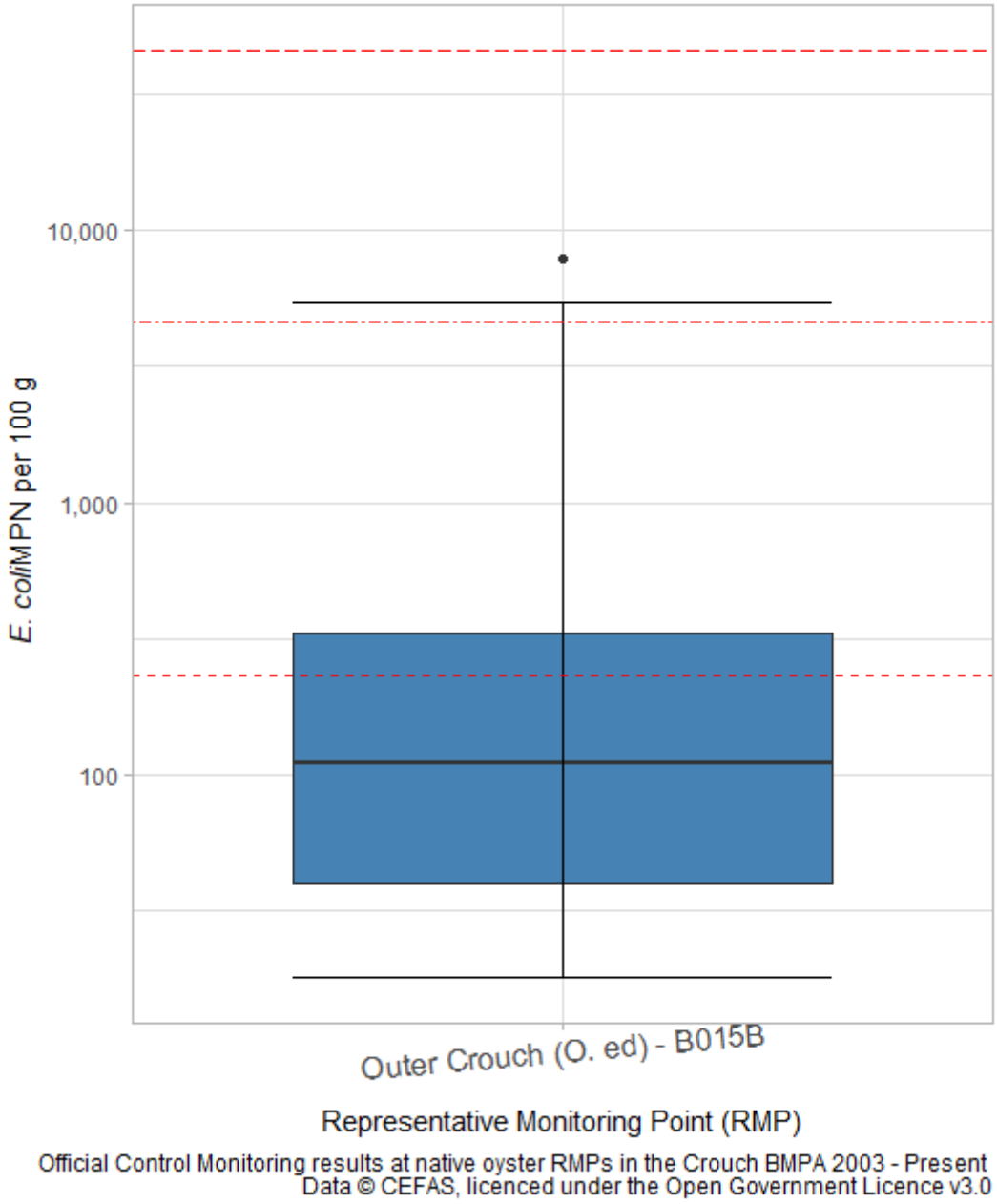

Figure 6.3 Boxplots of E. coli levels at native oyster RMPs sampled within the Crouch BMPA 2003 – Present. Central line indicates median value, box indicates lower-upper quartile range and whisker indicates minimum/maximum values excluding outliers (points >1.5 x the interquartile range). Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

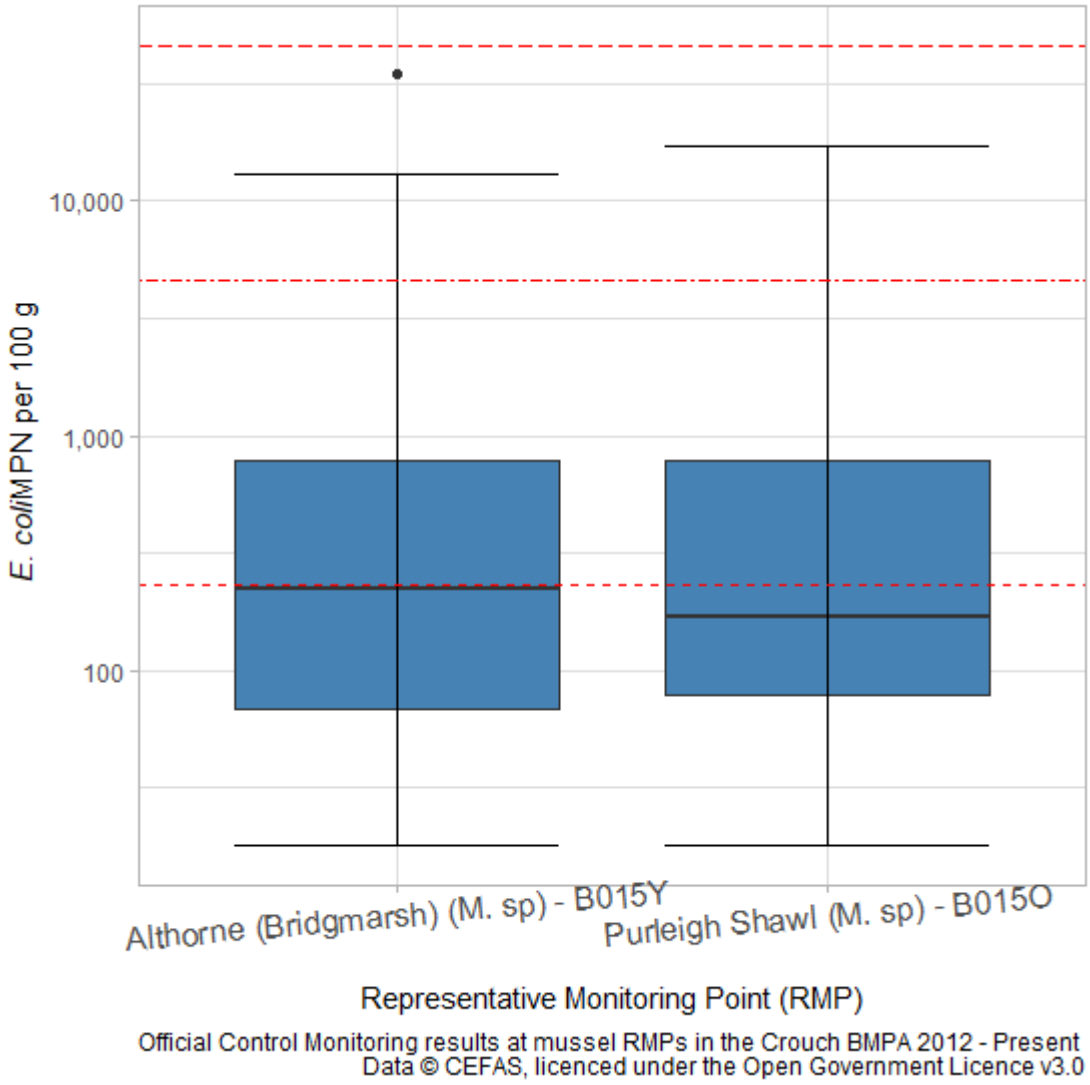

Figure 6.4 Boxplots of E. coli levels at mussel RMPs sampled within the Crouch BMPA 2012 – Present. Central line indicates median value, box indicates lower-upper quartile range and whisker indicates minimum/maximum values excluding outliers (points >1.5 x the interquartile range). Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

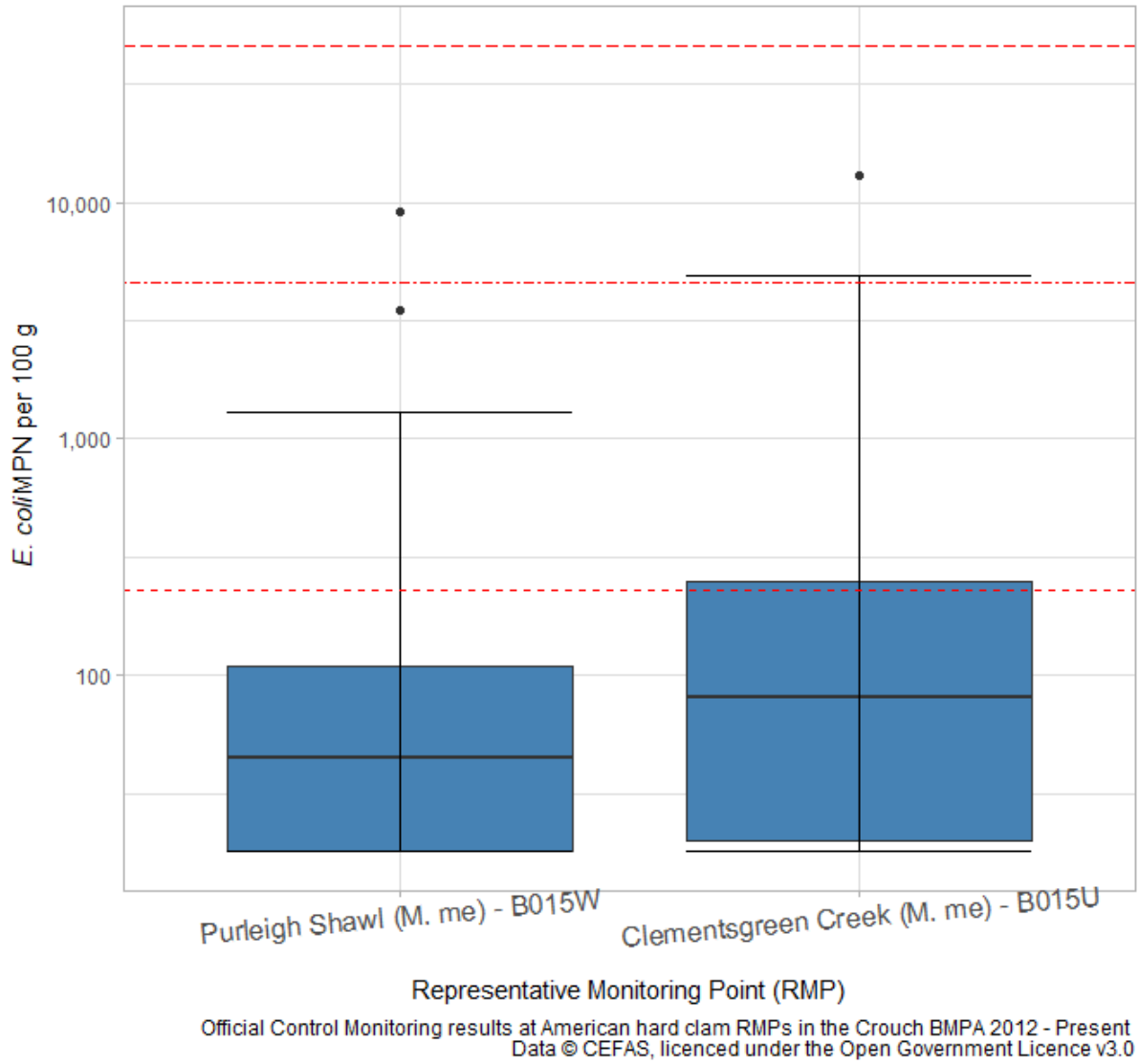

Figure 6.5 Boxplots of E. coli levels at hard clam RMPs sampled within the Crouch BMPA 2012 – Present. Central line indicates median value, box indicates lower-upper quartile range and whisker indicates minimum/maximum values excluding outliers (points >1.5 x the interquartile range). Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

6.2 Overall temporal pattern in results

The overall temporal pattern in shellfish flesh monitoring results from the various RMP species within the Crouch BMPA is shown in Figure 6.6 - Figure 6.9.

The loess model fitted to the Pacific oyster data indicates that generally results have been stable since 2012 (Figure 6.6). It is clear to see that the water quality at Purleigh Shawl (B015Z) is better than at the other two RMP locations with the trend line consistently falling below the low threshold of 230 MPN/100 g between 2014 and 2020 .

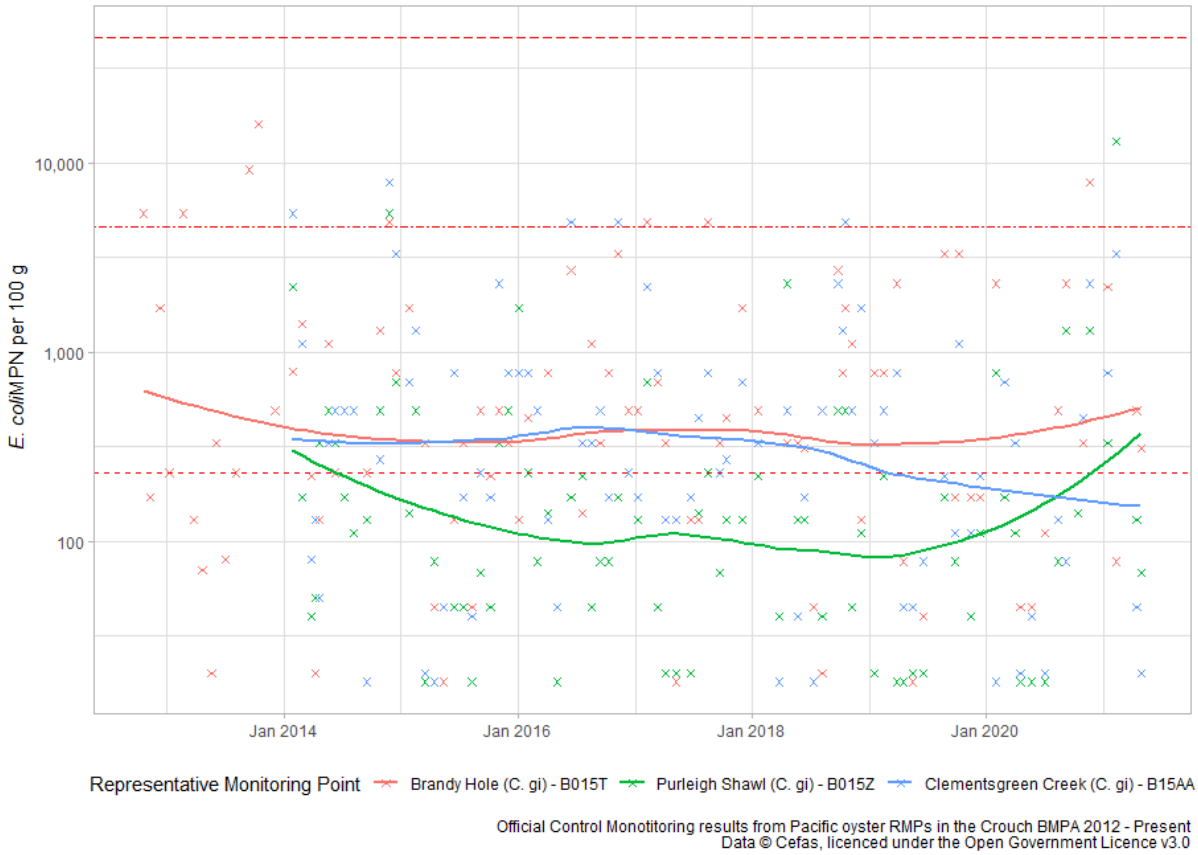

Figure 6.6 Timeseries of E. coli levels at Pacific oyster RMPs sampled in the Crouch BMPA 2012 – Present. Scatter plots are overlaid with a loess model fitted to the data. Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

Water quality at the Outer Crouch (B015B) RMP has been generally good, with the trend line always falling below the low threshold of 230 MPN/100 g and only three results exceeding 4,600 MPN/100 g (Figure 6.7). Water quality gradually improved between 2003 and ~2017, as evidenced by declining monitoring results.

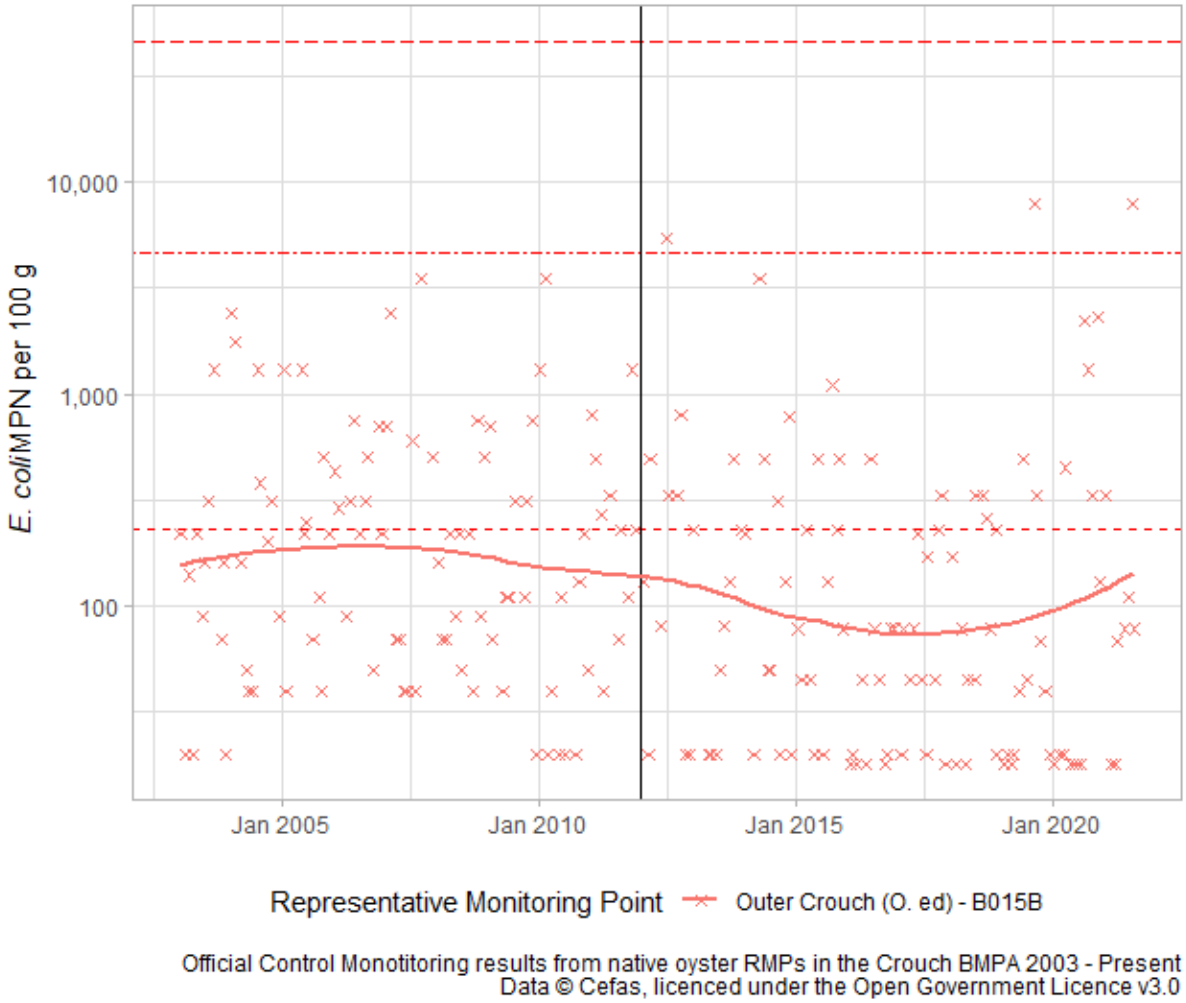

Figure 6.7 Timeseries of E. coli levels at native oyster RMPs sampled in the Crouch BMPA 2003 – Present. Scatter plots are overlaid with a loess model fitted to the data. Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

The monitoring results from the Purleigh Shawl mussel RMP (B015O) indicate that whilst water quality is generally good, it has been declining since ~2015 (Figure 6.8), with the trend line falling above 230 MPN/100 g consistently since mid-2018. Between 2013 and 2018, the trend line from Althorne (Bridgmarsh) (B015Y) was above that for Purleigh Shawl (B015O). However since then water quality at the B015Y RMP has been better than at the B015O RMP.

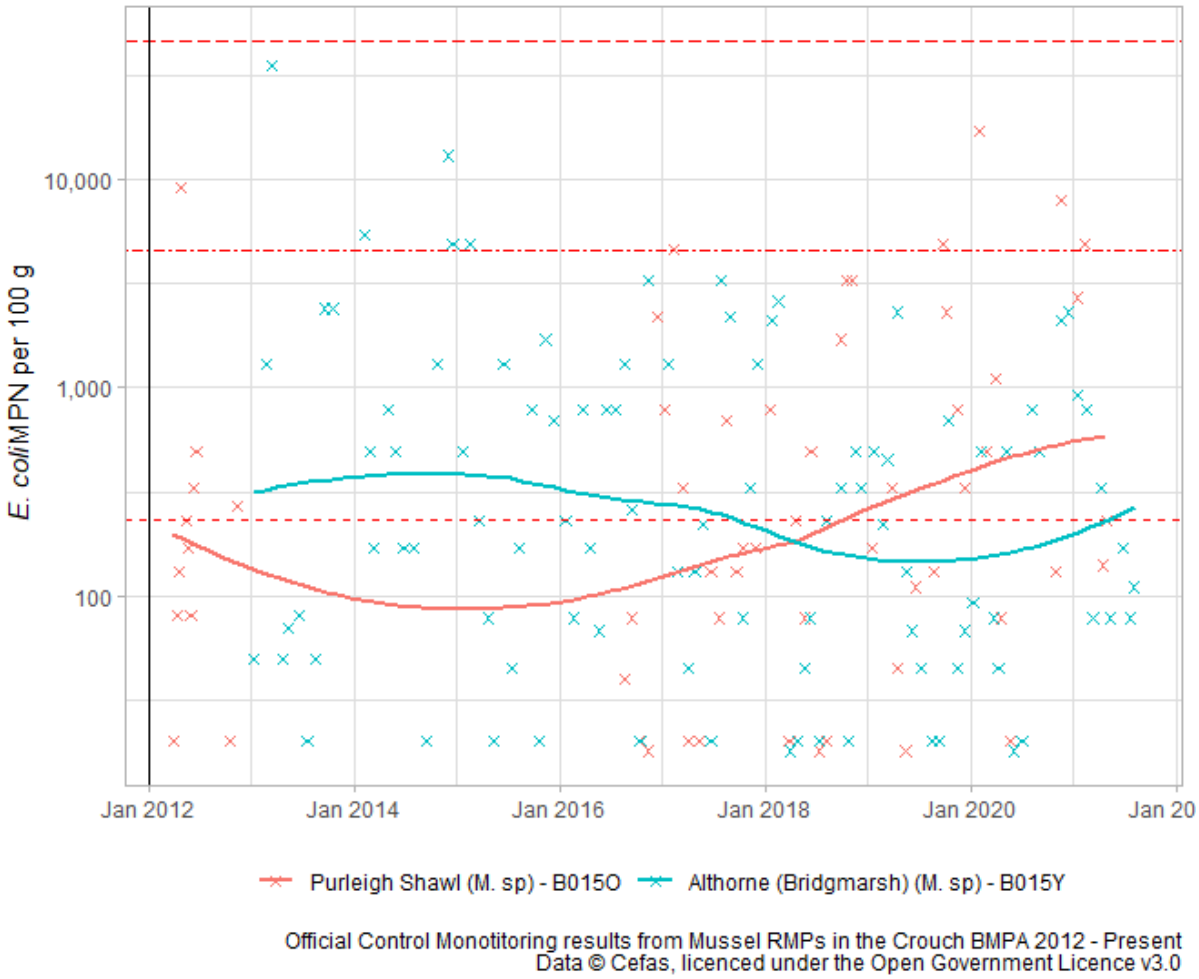

Figure 6.8 Timeseries of E. coli levels at mussel RMPs sampled in the Crouch BMPA 2012 – Present. Scatter plots are overlaid with a loess model fitted to the data. Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

Monitoring results from the two hard clam RMPs show indicate that results from this species have been consistently the lowest of any sampled species in the Crouch BMPA, with both trend lines consistently falling below the low threshold of 230 MPN/100 g (Figure 6.9). However, as with the trend at many other RMPs, water quality does appear to have been declining slightly since 2019, indicated by a trend of increasing *E. coli* levels in samples.

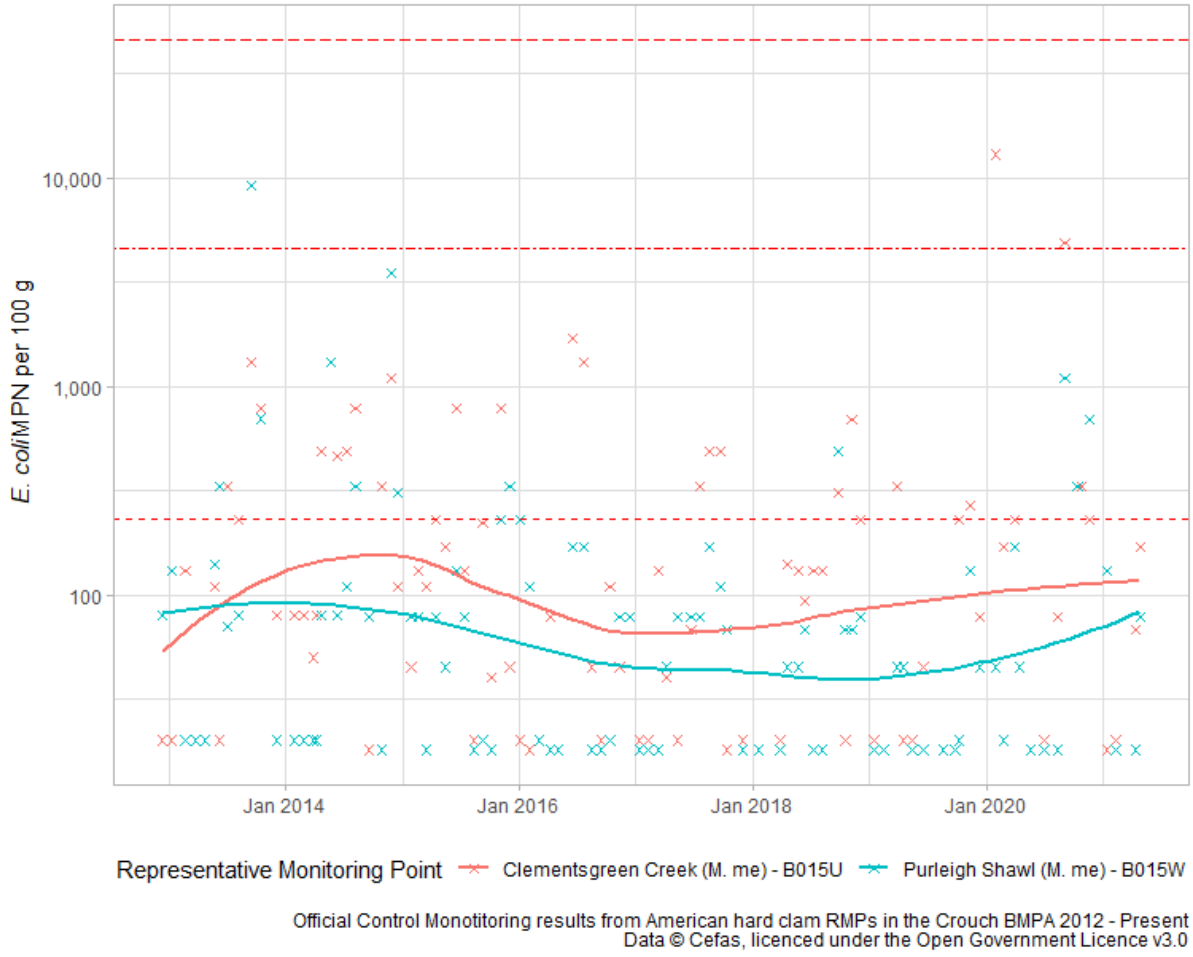

Figure 6.9 Timeseries of E. coli levels at hard clam RMPs sampled in the Crouch BMPA 2012 – Present. Scatter plots are overlaid with a loess model fitted to the data. Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

6.3 Seasonal patterns of results

The seasonal pattern in *E. coli* levels at the various RMPs within the Crouch BMPA were investigated and are presented in Figure 6.10 - Figure 6.13. The data for each year were averaged into the four seasons, with Winter comprising data from January – March, Spring from April – June, Summer from July – September and Autumn from October – December. Two-way ANOVA testing was used to look for significant differences in the data, using both season and RMP as independent factors (i.e. pooling the database across RMP and season respectively), as well as the interaction between them (i.e. exploring seasonal differences within a given RMP. Significance was taken at the 0.05 level).

Two-way ANOVA tests revealed that when pooled across RMP, results from autumn were significantly greater than those collected in spring ($p = 0.0007$) and summer ($p = 0.029$) (Figure 6.10). When RMPs were considered individually, only Brandy Hole (B015T) showed

any significant seasonal differences, where results from autumn were significantly greater than at other times (p = 0.0084).

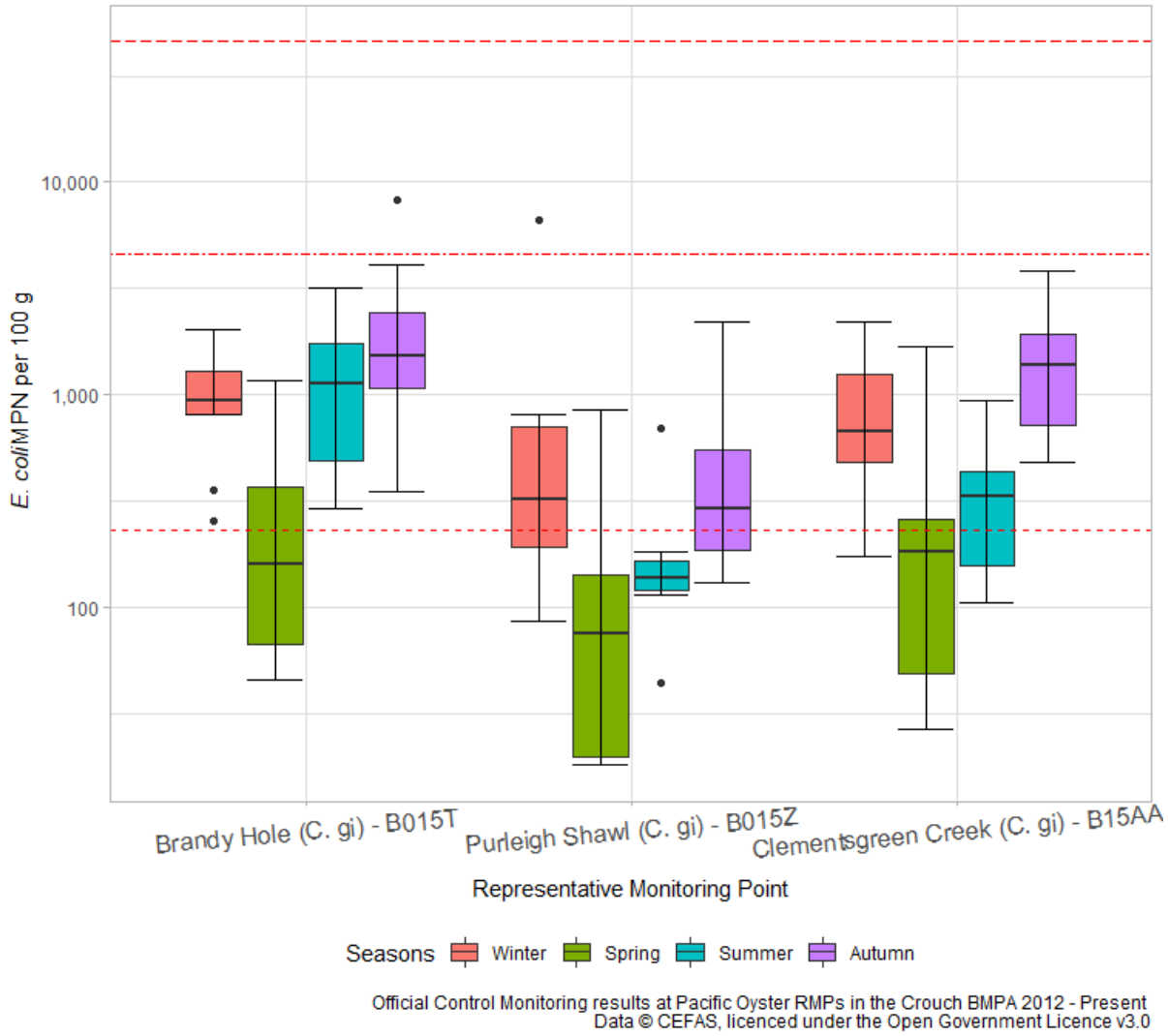

Figure 6.10 Boxplots of E. coli levels per season at Pacific oyster RMPs sampled in the Crouch BMPA 2012 – Present. Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

No significant differences between seasons were found in the data from native oysters (Figure 6.11), mussels (Figure 6.12) or hard clams (Figure 6.13), either when data was pooled across RMP or considered for an individual RMP.

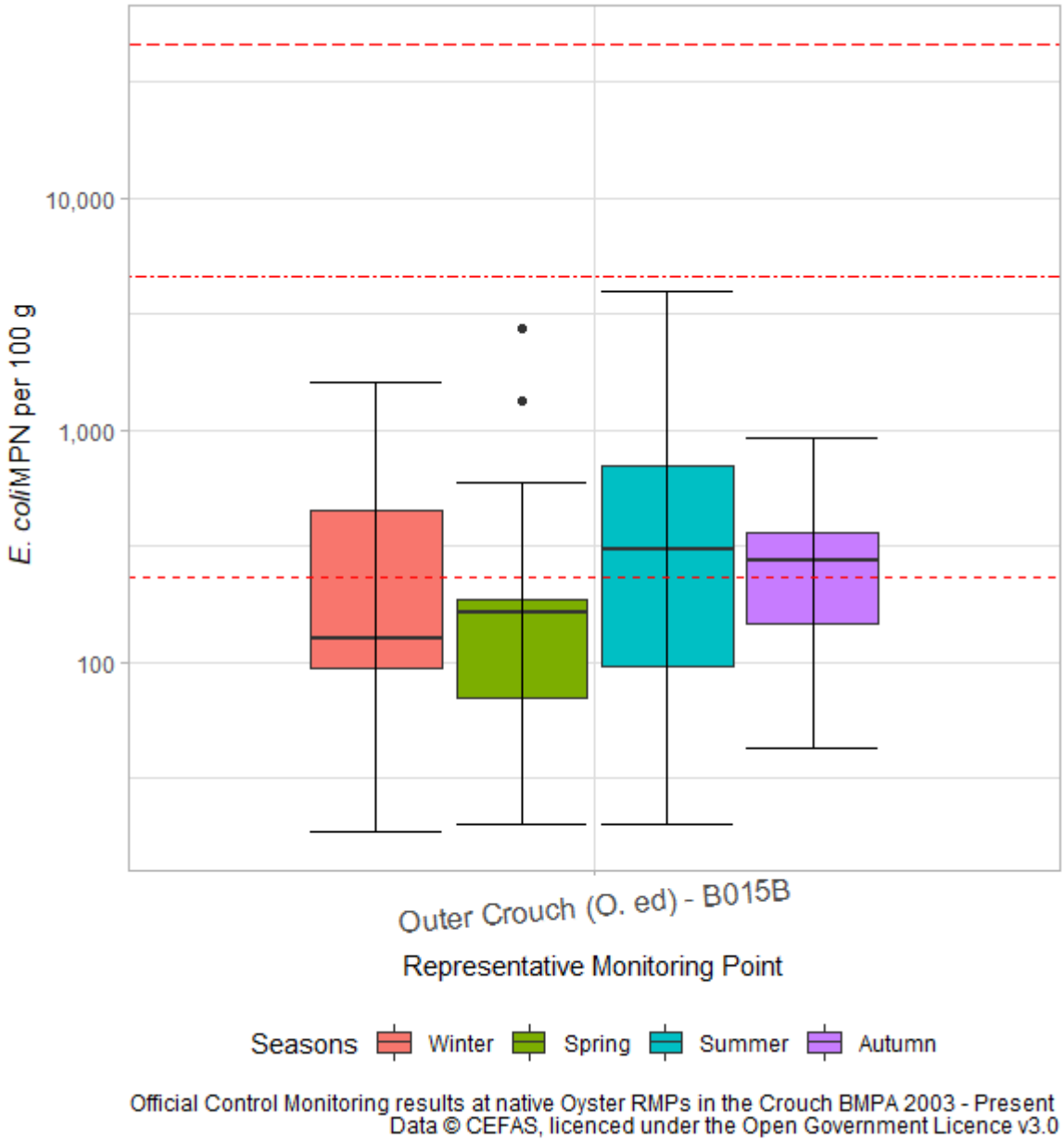

Figure 6.11 Boxplots of E. coli levels per season at native oyster RMPs sampled in the Crouch BMPA 2003 – Present. Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

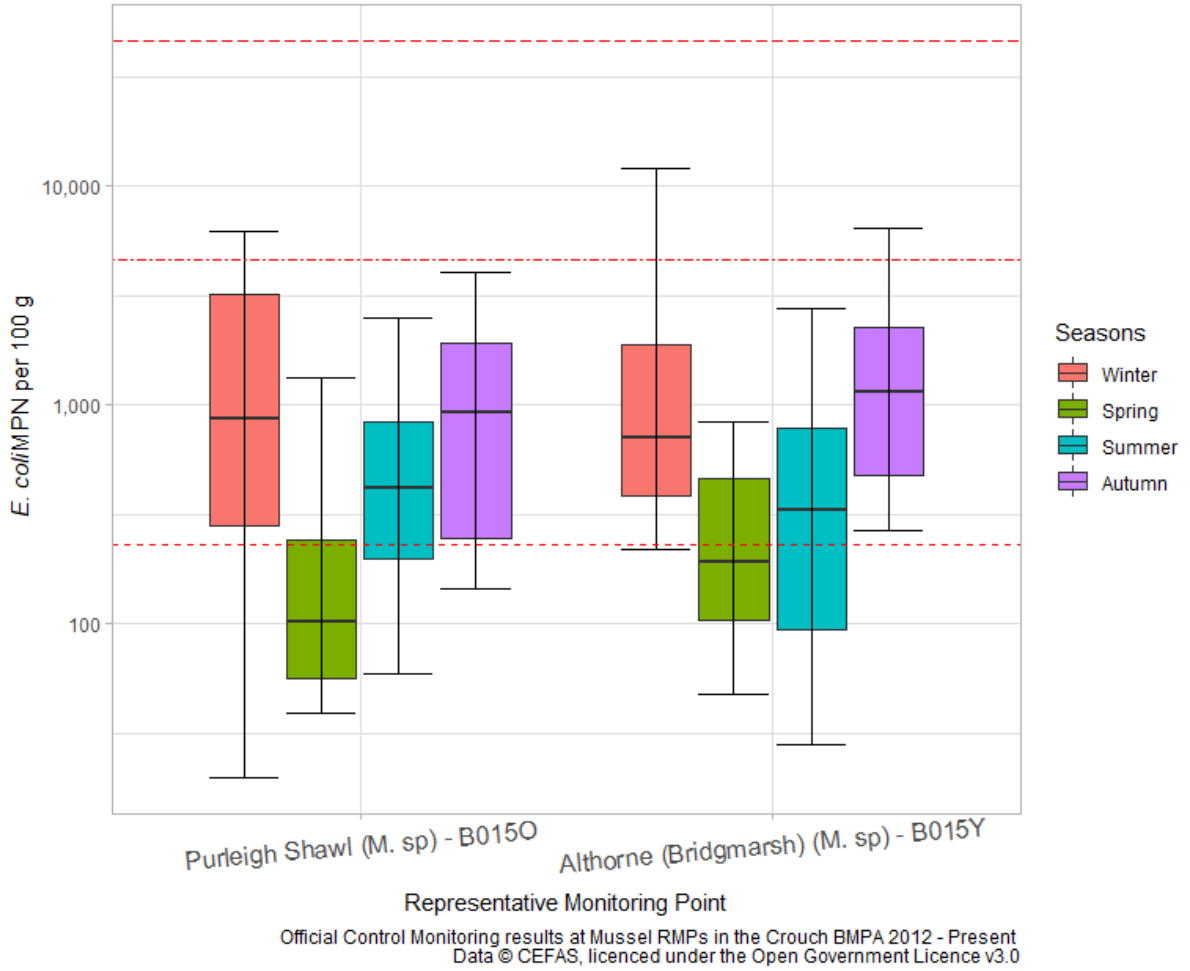

Figure 6.12 Boxplots of E. coli levels per season at mussel RMPs sampled in the Crouch BMPA 2012 – Present. Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

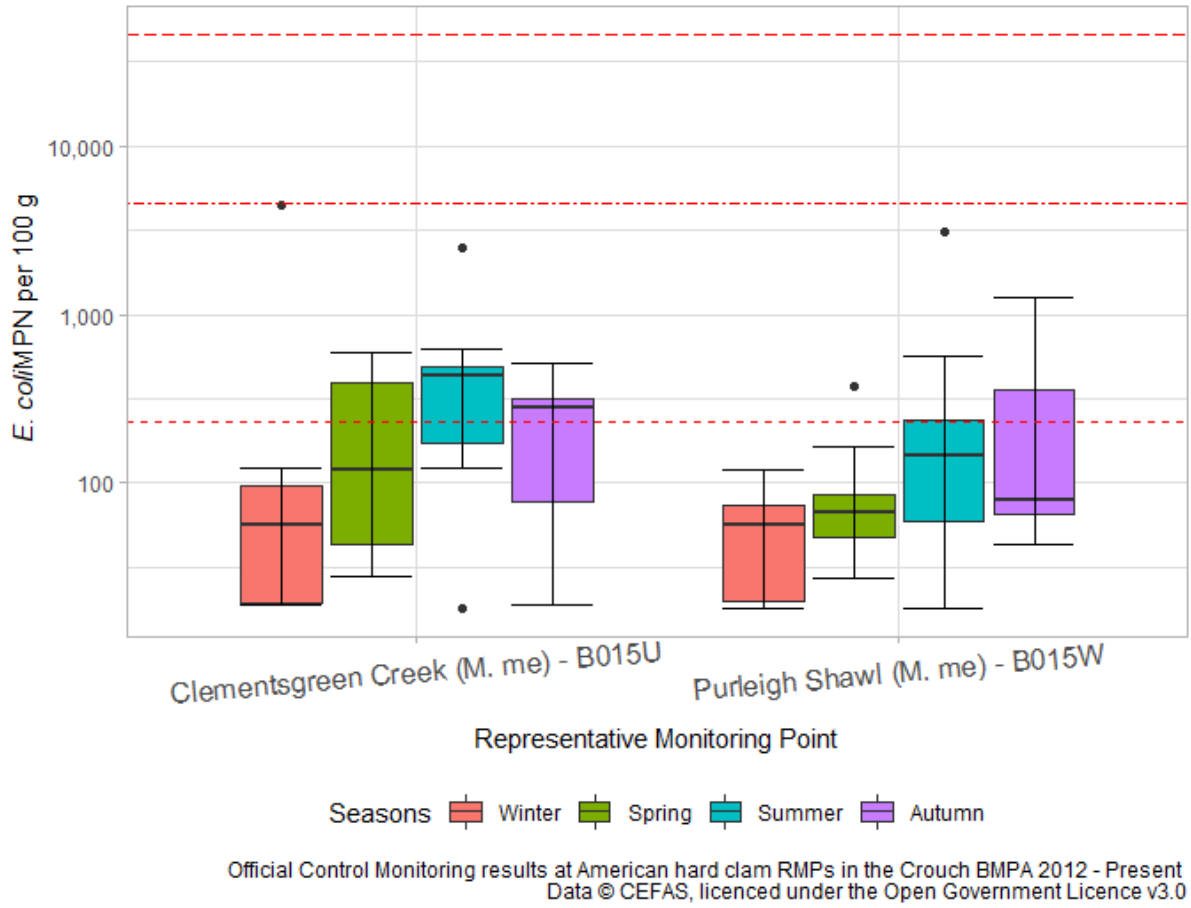

Figure 6.13 Boxplots of E. coli levels per season at hard clam RMPs sampled in the Crouch BMPA 2012 – Present. Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

7 Conclusion and overall assessment

The Crouch estuary is situated on the east coast of the United Kingdom, and forms an estuary complex together with the Roach estuary, which drains into the Crouch near the mouth. Historically, the estuary has supported large populations of native oyster, although populations are currently much lower than historic levels. In addition to native oysters, the BMPA sees harvesting of Pacific oyster, mussel and American hard clams, although the output of each fishery is unknown. All Classification Zones in the BMPA have Long Term B classifications.

The results of the 2001 and 2011 censuses were compared to give an estimate of human population trends within the catchment, as no more recent census data were available. Between 2001 and 2011, the total usual residents increased by 5.82% to 531,148 people. The UK government estimate that the population will have increased by a further 6.6% by 2021. The main population centres are at the heads of the Roach and Crouch estuaries, as well as Burnham-on-Crouch on the northern shore. Southend-on-Sea is also located in the

south of the catchment, although most of the runoff from this conurbation will drain to the Thames estuary and so is of little consequence to the bacteriological health of the estuary. The area still receives a large volume of tourism, particularly during summer months, and although it is assumed that the current capacity within the wastewater treatment network is sufficient to handle this increase, there may be some seasonal fluctuations in water quality.

Some upgrades to continuous discharges within the catchment have occurred since the original sanitary survey was published. UV disinfection has been installed at three discharges, which should reduce the bacterial loading these outfalls contribute. However, Event Duration Monitoring data indicate that several intermittent discharges in the vicinity of the BMPA spill frequently. Consultation with the Environment Agency indicated that the most significant of these, Burnham-on-Crouch STW, will have a storm tank fitted by 2024, although at present this does represent a potentially significant source of pollution to the estuary.

The total livestock population within the catchment was estimated to have increased by 21.32% between 2013 and 2016 (no more recently collected livestock population data are available). There are some areas of pasture immediately adjacent to the Crouch, which represent the highest risk of faecal contamination to the estuary. However, the risk of contamination is not considered to have increased particularly as land cover maps indicate that the area of pasture has not changed significantly, and there is no evidence of significant issues associated with the application of slurry to arable areas. Consideration should still be given to these areas in any updated sampling plan.

The Crouch/Roach estuary complex is home to a variety of habitats and wildlife and as a consequence is conferred protection under a variety of statutory and non-statutory designations. The average count of overwintering waterbirds in the five winters to 2019/2020 (the most recent for which data are available) increased by 11.23% on the five winters to 2011/2012. Within this number are nationally significant populations of various species. A small population of seals also utilise the waters of the estuary complex for foraging/hauling out. The spatial and temporal variation of the pollution from both these groups makes it challenging to account for it in any updated sampling plan.

The Crouch and Roach estuaries remain very popular with recreational boaters, with a large number of moorings, pontoons and marinas throughout the estuary. There are no pump-out facilities at any of the marinas, and so vessels of a sufficient size to contain onboard toilets are liable to make overboard discharges from time to time, particularly when moored overnight or moving through the main navigational channels. There is a small fishing fleet within the area, although discharges from commercial vessels are considered very unlikely to be of significance to the sampling plan as these vessels are still prohibited from making overboard discharges near to land.

A total of eight RMPs have been sampled within the Crouch BMPA since the original sanitary survey, of which only one was sampled prior. There is a general trend of monitoring results from RMPs nearer to the head of the estuary being higher, although monitoring results are fairly low – with only two RMPs having a geometric mean result of >1,000 MPN/100 g and no RMP ever returning a result of >46,000 MPN/100 g . Some significant differences in monitoring results were found, and samples collected in Autumn from Pacific oyster RMPs had generally higher results than at other times of year. Across several RMPs, there is a trend of declining water quality (higher monitoring results) in recent years, although the cause of this pattern is not clear. That being said, no downgrade to Class C has occurred for any Classification Zone.

Based on the information available, there do not appear to have been any significant changes to the main sources of contamination to this BMPA since the original sanitary survey was published. There are knowledge gaps (as highlighted in Sections 3.6, 6.2 and 6.3) and the review identifies that there has been some deterioration in water quality. However, classifications have remained stable and with no downgrades to Class C since the initial sanitary survey, therefore an updated shoreline survey is not required. –

Having reviewed and compared the desk-based study with the findings of the initial sanitary survey in 2012, the FSA are also content that an updated shoreline assessment is not required.

8 Recommendations

The original sanitary survey recommended the designation of eight classification zones within the Crouch estuary, with each of the four species being classified in two zones. There are currently ten CZs with active classifications. Recommendations for the CZs for each of the classified species are described below, and summarised in Table 8.1.

8.1 Pacific Oyster

Brandy Hole

This is the CZ located farthest up-river in the Crouch BMPA, covering an area of 0.37 km². The original sanitary survey identified that significant sources of contamination existed up-river of this zone, all of which are still present. The 2012 survey recommended placing an RMP as close to the upstream boundary as possible, but were advised by the LEA at the time that they could only access an RMP placed at TQ 8295 9581, ~600 m from the upstream boundary. This RMP (Brandy Hole – B015T) has been used since then. During secondary consultation, the authors of this review requested confirmation from the LEA that it is still impossible to access an RMP placed farther up the channel, as this would be more representative of contamination sources to this zone. Two options for this zone were presented to the LEA: either moving the RMP upstream to the CZ boundary, or moving the CZ boundary downstream to the position of RMP B015T. At the time of finalising this review,

no response had been received. The sampling plan should be updated with whichever option the LEA expresses a preference for.

Bridgemarsh

This zone covers an area of 1.31 km² and is the furthest Pacific oyster CZ down the estuary. At the time of the original sanitary survey, this zone was referred to as 'Althorne', and it was identified that there were few contaminating influences inside the zone, but that contamination from the Burnham STW and boat traffic would be a significant influence. It was recommended in the 2012 survey that an RMP should be set within the Bridgemarsh creek to capture contamination from the marina and private sewage discharges in the adjacent fields. It is currently classified using samples from bagged mussels in this location (Althorne (Bridgemarsh) – B015Y). An FSA funded investigation into the suitability of using indicator species in the classification of UK shellfish beds (Cefas, 2014) found that mussels are representative of Pacific oysters and so it is recommended that this RMP be retained.

Easter Reach

This zone covers an area of 2.06 km² and is situated just up-river of the *Bridgemarsh* zone. Like that zone, the original sanitary survey identified that there were limited direct influences on this zone and that contamination will come from both up river and down river sources. It recommended that an RMP be placed at a location on the up-estuary end as this returned the highest individual result from the 2012 bacteriological survey. This RMP (Purleigh Shawl – B015Z) has been sampled since 2014. It is co-located with additional RMPs for both mussels (B015O) and hard clams (B015W). During secondary consultation, the LEA expressed an interest in discontinuing the Pacific oyster and hard clam RMPs, as the mussel RMP has returned higher results and so it therefore would represent a worst-case scenario for the zone. The sampling plan summarised in Table 8.1 includes all the RMPs at this location. Samples from the mussel RMP (B015O) should be used moving forward to classify this zone.

Fambridge

This zone is bounded at its down-river limit by the *Easter Reach* zone and at its up-river limit by the *Brandy Hole* zone, covering an area of 1.32 km². The original sanitary survey identified that the main contaminating influences would originate from up-estuary sources, and recommended the placement of an RMP at the south shore of the mouth of Clementsgreen Creek. An RMP for Pacific oysters (Clementsgreen Creek – B15AA) has been in use since January 2014, two years after the co-located RMP for hard clams (B015U). It is recommended that both current RMPs be retained, although as with the Purleigh Shawl RMPs, sampling at the hard clam RMP could be discontinued as samples from Pacific oysters could be used to represent that species. As above, the LEA indicated during secondary consultation that they would be keen on the use of indicator species.

8.2 Native oyster

Bridgmarsh

The boundaries for this zone are the same as the Pacific oyster zone described above. It is recommended that the RMP at Althorne (B015Y) using bagged mussels be retained.

Outer Crouch

This zone is located farthest down river of any zone in the Crouch BMPA, covering an area of 7.63 km². The original sanitary survey identified that the main contaminating influence on this zone was the Burnham STW outfall, along with boat moorings throughout the zone. The authors of the original sanitary survey recommended placing an RMP at the up-estuary boundary, due east of the STW outfall. The LEA advised at the time that an RMP at TR 0010 9540 was the preferred location for sampling. An RMP at this point (Outer Crouch – B015B) has been in use since then, although we request confirmation from the LEA that no oyster stock exists farther up as ideally the RMP should be closer to the STW discharge point. Two options for this zone were presented to the LEA: either moving the RMP upstream to the CZ boundary, or moving the CZ boundary downstream to the RMP position. At the time of finalising this review, no response had been received. The sampling plan should be updated with whichever option the LEA express a preference for.

8.3 Mussel

Bridgemarsh

The boundaries of this zone are the same as the Pacific and native oyster zones described above. It is recommended that the RMP at Althorne (B015Y), using bagged mussels, be retained.

Easter Reach

There is a mussel RMP within this CZ (Purleigh Shawl – B015O), although as there is no active classification zone it would normally be recommended that sampling at this RMP be discontinued. However, this RMP is to be used as a suitable substitute for the hard clam and Pacific oyster zones.

8.4 American hard clam

Bridgemarsh

The boundaries of this zone are the same as the mussel, Pacific and native oyster zones described above. It is recommended that the RMP at Althorne (B015Y), using bagged mussels, be retained.

Easter Reach

The boundaries of this zone are the same as for the Pacific oyster zone described above. It is recommended that the current RMP at Purleigh Shawl (B015W) be retained, although as discussed above, sampling at this RMP could be suspended if the LEA desire, with Pacific oyster samples used to classify the entire zone. The LEA indicated that the use of indicator species where possible would be preferable, and as such this RMP should be discontinued with samples from the mussel (B015O) RMP used moving forward.

Fambridge

The boundaries of this zone are the same as for the Pacific oyster zone described above. It is recommended that the current RMP at Clementsgreen Creek (B015U) be retained, although as discussed above, sampling at this RMP could be suspended if the LEA desire, with Pacific oyster samples used to classify the entire zone. The LEA indicated that the use of indicator species where possible would be preferable, and as such this RMP should be discontinued with samples from the Pacific oyster (B15AA) used moving forward.

8.5 General Information

8.5.1 Location Reference

Production Area	**River Crouch**
Cefas Main Site Reference	M015
Ordnance survey 1:25,000	Explorer 176
Admiralty Chart	3750

8.5.2 Shellfishery

Species	Culture Method	Seasonality of Harvest
Pacific oyster (*Crassostrea gigas*)	Wild	Year round
Native oyster (*Ostrea edulis*)	Wild	Closed season from 01/05 to 31/08
Mussel (*Mytilus spp*)	Wild	Year round
American hard clam (*Mercenaria mercenaria*)	Wild	Year round

8.5.3 Local Enforcement Authority(s)

Name	**Maldon District Council,** Princes Road, Maldon, Essex CM9 5DL
Website	https://www.maldon.gov.uk/info/20091/environmental_health
Telephone number	n/a
E-mail address	n/a

8.6 Sampling Plan

*Table 8.1 Proposed sampling plan for the River Crouch BMPA. Suggested changes are given in **bold red** type. RMPs where it is recommended that sampling is suspended are shown in ~~strikethrough text~~.*

Classification Zone	RMP	RMP Name	NGR (OSGB 1936)	Lat / Lon (WGS 1984)	Species Represented	Harvesting Technique	Sampling Method	Sampling Species	Tolerance	Frequency
Brandy Hole (P oyster)	**TBC**	**TBC**	**TBC**	**TBC**	**TBC**	**TBC**	**TBC**	**TBC**	**TBC**	**TBC**
Bridgmarsh (P oyster, N oyster, Mussel & Hard Clam)	B015Y	Althorne	TQ 9042 9738	51° 38.578' N 00° 45.041' E	Pacific oyster; Native oyster; Mussel; American Hard Clam	Dredge	Hand (bagged)	*Mytilus spp.*	10 m	Monthly
Easter Reach (P oyster; Hard Clam)	**B015O**	Purleigh Shawl	TQ 8645 9657	51° 38.222' N 00° 41.577' E	Pacific oyster; Hard Clam	Dredge	Dredge	***Mytilus spp.***	100 m	Monthly
~~**Easter Reach (Mussel)**~~	~~B015O~~	~~Purleigh Shawl~~	~~TQ 8645 9657~~	~~51° 38.222' N~~	~~Mussel~~	~~Dredge~~	~~Dredge~~	~~*Mytilus edulis*~~	~~100 m~~	~~Monthly~~

Classification Zone	RMP	RMP Name	NGR (OSGB 1936)	Lat / Lon (WGS 1984)	Species Represented	Harvesting Technique	Sampling Method	Sampling Species	Tolerance	Frequency
				~~00° 41.577' E~~						
Fambridge (P oyster, hard clam)	B15AA	Clementsgreen Creek	TQ 8326 9644	51° 38.214' N 00° 38.810' E	Pacific oyster; **Hard clam**	Dredge	Dredge	*Crassostrea gigas*	100 m	Monthly
Outer Crouch (N oyster)	**TBC**	**TBC**	**TBC**	**TBC**	**TBC**	**TBC**	**TBC**	**TBC**	**TBC**	**TBC**

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Appendices

Appendix I. Breakdown of population change within Electoral Wards

ID	Electoral Ward	Total Usual Residents				Population Density (p/Ha)		
		2001 Census	2011 Census	Population Change	% Population Change	2001 Census	2011 Census	Density Change
1	Rochford	6,870	7,695	825	12.01%	5.99	6.7	0.71
2	Kursaal	8,872	11,130	2258	25.45%	71.18	89.3	18.12
3	Fryerns	12,178	13,118	940	7.72%	21.36	23	1.64
4	Burnham-on-Crouch North	3,805	3,713	-92	-2.42%	1.97	1.9	-0.07
5	Wickford Castledon	7,555	7,602	47	0.62%	17.34	17.5	0.16
6	St James	6,199	6,553	354	5.71%	9.99	10.6	0.61
7	Victoria	9,346	11,004	1658	17.74%	58.11	68.4	10.29
8	Tillingham	2,181	2,182	1	0.05%	0.37	0.4	0.03
9	Grange	3,366	3,739	373	11.08%	41.36	46	4.64
10	Boyce	6,118	6,752	634	10.36%	12.59	13.9	1.31
11	Westborough	10,196	10,847	651	6.38%	111.18	118.3	7.12
12	St Mary's	6,287	6,120	-167	-2.66%	26.91	26.2	-0.71
13	Southminster	4,021	4,272	251	6.24%	1.52	1.6	0.08
14	Thorpe	8,715	9,215	500	5.74%	31.75	33.6	1.85
15	Pitsea South East	11,650	11,736	86	0.74%	6.62	6.7	0.08
16	Laindon Park	11,026	11,367	341	3.09%	18.79	19.4	0.61
17	Ashingdon and Canewdon	4,208	4,514	306	7.27%	0.78	0.8	0.02
18	St. Luke's	10,453	11,213	760	7.27%	29.75	31.9	2.15
19	Southchurch	9,467	9,710	243	2.57%	20.35	20.9	0.55
20	St George's	6,072	5,858	-214	-3.52%	54.15	52.2	-1.95
21	Mayland	3,795	4,360	565	14.89%	1.43	1.6	0.17
22	Purleigh	3,201	3,419	218	6.81%	0.78	0.8	0.02
23	Herongate, Ingrave and West Horndon	3,490	3,712	222	6.36%	1.76	1.9	0.14
24	Prittlewell	9,478	9,971	493	5.20%	38.15	40.1	1.95
25	Victoria	5,740	5,747	7	0.12%	12.13	12.1	-0.03

ID	Electoral Ward	Total Usual Residents				Population Density (p/Ha)		
		2001 Census	2011 Census	Population Change	% Population Change	2001 Census	2011 Census	Density Change
26	Burnham-on-Crouch South	3,954	3,958	4	0.10%	16.98	17	0.02
27	Hawkwell West	3,938	4,134	196	4.98%	10.78	11.3	0.52
28	Wheatley	3,885	4,191	306	7.88%	15.47	16.7	1.23
29	Cedar Hall	5,641	5,708	67	1.19%	32.37	32.8	0.43
30	Downhall and Rawreth	4,057	4,843	786	19.37%	3.22	3.8	0.58
31	Nethermayne	11,160	11,866	706	6.33%	16.52	17.6	1.08
32	Hockley West	2,008	2,096	88	4.38%	4.42	4.6	0.18
33	West Shoebury	10,017	10,280	263	2.63%	34.93	35.9	0.97
34	Lodge	3,974	4,088	114	2.87%	28.12	28.9	0.78
35	St Peter's	6,391	6,409	18	0.28%	15.37	15.4	0.03
36	Chalkwell	9,207	10,045	838	9.10%	56.82	62	5.18
37	Hawkwell North	4,369	4,536	167	3.82%	29.99	31.1	1.11
38	Hullbridge	6,445	6,527	82	1.27%	8.22	8.3	0.08
39	South Hanningfield, Stock and Margaretting	5,179	5,576	397	7.67%	1.19	1.3	0.11
40	Shoeburyness	9,974	11,159	1185	11.88%	26.2	29.3	3.10
41	South Woodham-Elmwood and Woodville	8,133	8,087	-46	-0.57%	15.61	15.5	-0.11
42	Eastwood Park	9,332	9,364	32	0.34%	41.69	41.8	0.11
43	St Laurence	9,673	9,726	53	0.55%	32.89	33.1	0.21
44	Whitehouse	3,728	4,048	320	8.58%	23.08	25.1	2.02
45	Leigh	9,015	10,083	1068	11.85%	59.59	66.6	7.01
46	Bicknacre and East	5,039	5,035	-4	-0.08%	1.5	1.5	0.00

ID	Electoral Ward	Total Usual Residents 2001 Census	Total Usual Residents 2011 Census	Population Change	% Population Change	Population Density (p/Ha) 2001 Census	Population Density (p/Ha) 2011 Census	Density Change
	and West Hanningfield							
47	Blenheim Park	9,908	10,475	567	5.72%	43.75	46.3	2.55
48	Rettendon and Runwell	5,039	5,021	-18	-0.36%	2.17	2.2	0.03
49	Appleton	6,681	6,694	13	0.19%	40.86	40.9	0.04
50	Langdon Hills	8,762	9,064	302	3.45%	14.99	15.5	0.51
51	Foulness and Great Wakering	5,724	5,738	14	0.24%	1.45	1.5	0.05
52	Hockley North	1,872	2,120	248	13.25%	14.92	16.9	1.98
53	Vange	9,571	10,048	477	4.98%	58.22	61.1	2.88
54	Pitsea North West	12,901	12,722	-179	-1.39%	31.37	30.9	-0.47
55	Burstead	10,417	10,620	203	1.95%	5.42	5.5	0.08
56	West Leigh	8,670	9,154	484	5.58%	28.35	29.9	1.55
57	Wickford Park	7,965	9,537	1572	19.74%	16.49	19.7	3.21
58	Lee Chapel North	12,102	13,488	1386	11.45%	57.1	63.6	6.50
59	Crouch	7,491	8,943	1452	19.38%	5.25	6.3	1.05
60	Belfairs	8,944	9,219	275	3.07%	33.92	35	1.08
61	Hawkwell South	3,961	4,249	288	7.27%	29.24	31.4	2.16
62	Wickford North	11,843	12,235	392	3.31%	25.44	26.3	0.86
63	Hockley Central	6,111	6,526	415	6.79%	43.5	46.5	3.00
64	Rayleigh Central	4,284	4,255	-29	-0.68%	59.3	58.9	-0.40
65	Trinity	3,580	3,697	117	3.27%	14.29	14.8	0.51
66	St Martin's	7,641	8,410	769	10.06%	31.67	34.9	3.23
67	Billericay East	11,472	11,777	305	2.66%	21.55	22.1	0.55
68	Sweyne Park	4,325	4,415	90	2.08%	46.95	47.9	0.95

ID	Electoral Ward	Total Usual Residents 2001 Census	Total Usual Residents 2011 Census	Population Change	% Population Change	Population Density (p/Ha) 2001 Census	Population Density (p/Ha) 2011 Census	Density Change
69	South Woodham-Chetwood and Collingwood	8,496	8,366	-130	-1.53%	25.63	25.2	-0.43
70	Milton	8,990	11,063	2073	23.06%	54.8	67.4	12.60
71	Althorne	4,002	4,128	126	3.15%	1.07	1.1	0.03
72	Barling and Sutton	1,784	1,876	92	5.16%	0.88	0.9	0.02
Total / *Average*		**501,944**	**531,148**	**29,204**	**5.82%**	***24.72***	***26.36***	***1.64***

Appendix II. Event Duration Monitoring Data Summary for 2020

Discharge Name	Permit number	Receiving Environment	NGR	Treatment (if applicable)	Total Duration (hours) of all spills prior to processing through 12-24 hour counting method	Counted spills using 12-24hr counting method	% of reporting period EDM operational	Comments
242 EASTWOOD ROAD	AW2NFE06163	Eastwood Brook	TQ8185189786	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
ASHELDHAM PS	AW2NFE02779	Trib Asheldham Brook	TL9701901134	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
BARLING - STONEBRIDGE TPS	ASENF2634	THE MUCKING HALL DITCH	TQ9137088770	NONE	Unspecified	Unspecified	Unspecified	No EDM
BENFLEET CREEK	AW2NFE08862	Common Water Course No.7.	TQ7753386942	SCREENING	243	34	1	
BENFLEET MARSH PUMPING STATION	AW2NFE08669	TRIB BENFLEET CREEK	TQ7742086250	SCREENING	56.5	11	1	

Discharge Name	Permit number	Receiving Environment	NGR	Treatment (if applicable)	Total Duration (hours) of all spills prior to processing through 12-24 hour counting method	Counted spills using 12-24hr counting method	% of reporting period EDM operational	Comments
BILLERICAY P.S. ST AGNES ROAD	AW2NFE00754	RIVER CROUCH	TQ6832091030	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
BILLERICAY WATER RECYCLING CENTRE	AW2NFE05358	Tributary of R.Crouch NT	TQ6989094200	PRIMARY SETTLEMENT	Unspecified	Unspecified	Unspecified	No EDM
BURNHAM ON CROUCH WRC	ASETS10533	THE RIVER CROUCH (TIDAL)	TQ9581095280	SCREENING	1274	81	1	Possible SOAF investigation (Storm Overflow Assesment Framework) with EA agreement
CASTLE PT HI ROAD/SOUTHVIEW RD CSO	EPRNB3199AR	COMMON WATERCOURSE NO7	TQ7719087090	NONE	0.5	1	1	

Discharge Name	Permit number	Receiving Environment	NGR	Treatment (if applicable)	Total Duration (hours) of all spills prior to processing through 12-24 hour counting method	Counted spills using 12-24hr counting method	% of reporting period EDM operational	Comments
CHEAPSIDE	AW2NFE02858	Trib River Crouch	TQ7950091800	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
CHURCH END LANE SO	ASENF12106	tributary River Crouch	TQ7475094720	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
CHURCH END-FOULNESS PS	AW2TSE07062	Trib River Roach	TR0030093000	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
CHURCH ROAD FOUL SEWER	AW2NFE05676	River Crouch	TQ7229893299	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
COLD NORTON - STOW ROAD PS	ASENF2637	TRIBUTARY OF THE RIVER CROUCH	TL8379000010	NONE	185.5	27	1	
COLD NORTON SPS	ASENF10354	Trib Fambridge Wood Brook	TQ8471099920	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
CRAYS HILL PS	AW2NFE08263	Trib River Crouch	TQ7160092500	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
CUMMINGS ROAD PS	AW2NFE04084	Trib River Crouch	TQ7352094480	SCREENING	Unspecified	Unspecified	Unspecified	No EDM

Discharge Name	Permit number	Receiving Environment	NGR	Treatment (if applicable)	Total Duration (hours) of all spills prior to processing through 12-24 hour counting method	Counted spills using 12-24hr counting method	% of reporting period EDM operational	Comments
DEVONSHIRE ROAD	ASENF2251	Asheldham Brook	TQ9520099900	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
DEVONSHIRE ROAD PS	AW2NFE05069	Trib Asheldham Brook	TL9520000100	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
EASTWOOD PARK	AW2NFE03958	Eastwood Brook	TQ8452088630	NONE	Unspecified	Unspecified	Unspecified	No EDM
ELM ROAD SPS	AW2NF585	North Benfleet Brook	TQ7534090190	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
EVERSLEY RD/RUSHBOT.LN	ASENF15694	TRIB OF THE RIVER CROUCH	TQ7659089320	NONE	Unspecified	Unspecified	Unspecified	No EDM
EVERSLEY RD/RUSHBOT.LN	AW2NFE08469	Trib River Crouch	TQ7670089200	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
FERRERS ROAD PS	AW2TSE02080	Fenn Creek	TQ8024997321	SCREENING	Unspecified	Unspecified	Unspecified	No EDM

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FERRY RD SPS HULLBRIDGE	AW2TS670	TIDAL RIVER CROUCH	TQ8091095510	SCREENING	44.5	7	100	
FRANKLIN ROAD PS	AW2NFE10484	Trib Fambridge Wood Brook	TQ8615197898	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
GREAT WAKERING SPS	AW2NFE12284	Trib Havengore Creek	TQ9561187767	SCREENING	1.033333333	2	1	
HADLEIGH - CASTLE LANE SP	ASENF2192	THE MILL FLEET	TQ8085086330	NONE	Unspecified	Unspecified	Unspecified	No EDM
HARROWS PS EO	ASENF12195	North Benfleet Brook	TQ7581090870	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
HAWKWELL - RECTORY ROAD CSO	AW2NFE10166	Hawkwell Brook	TQ8578091850	NONE	0	0	1	

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HAWKWELL & HOCKLEY PS	ASENF10263	unnamed tributary Hawkwell Bro	TQ8366092260	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
HAWKWELL ROAD	AW2NFE18568	Trib River Roach	TQ8435292670	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
HAWKWELL ROAD	AW2NFE18568	Trib River Roach	TQ8488891662	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
HAWKWELL ROAD	AW2NFE18568	Trib River Roach	TQ8511193009	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
HULLBRIDGE - KESWICK AVENUE CSO	AW2NFE04179	TRIBUTARY OF THE RIVER CROUCH	TQ8139095000	NONE	0	0	1	
HULLBRIDGE- FERRY ROAD 2 CSO	AW2NFE15768	TRIBURATY OF THE RIVER CROUCH	TQ8079094130	NONE	44.5	7	1	
HULLBRIDGE- WHITE POST CORNER TPS	AW2NFE18369	TRIB OF THE RIVER CROUCH	TQ8060094140	NONE	120.5	15	1	

Discharge Name	Permit number	Receiving Environment	NGR	Treatment (if applicable)	Total Duration (hours) of all spills prior to processing through 12-24 hour counting method	Counted spills using 12-24hr counting method	% of reporting period EDM operational	Comments
JOTMANS LANE/HIGH ROAD CSO	ASENF15691	TRIB OF THE RIVER CROUCH	TQ7718087080	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
LATIMER DRIVE SPS	AW2NF536	River Crouch	TQ6816090330	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
LONG MEADOW DRIVE PS	AW2NFE08968	River Crouch	TQ7506293802	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
LOWER CHURCH ROAD	ASENF15692	TRIB OF THE RIVER CROUCH	TQ7659089320	NONE	Unspecified	Unspecified	Unspecified	No EDM
LOWER PARK RD WICKFORD	ASENF12114	Nevendon Brook	TQ7447092020	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
MAIN ROAD PS RETTENDON COMMON	AW2NFE03474	Trib Fenn Creek	TQ7643998035	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
MOUNT ROAD CSO	AW2NFE09561	River Crouch	TQ7480093600	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM

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OUTWOOD COMMON CSO	ASENF16480	OUTWOOD COMMON TRIB R CROUCH	TQ6920094310	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
OVERFLOW OUTLET AT THE CIVIC CENTRE	AW2NFE01558	Prittle Brook	TQ8760087200	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
PAGLESHAM CHURCHEND SPS	ASENF10351	Trib Paglesham Creek	TQ9228093390	NONE	82.75	16	1	
PAGLESHAM EAST	ASENF2520	Trib River Roach	TQ9490092400	SCREENING				NPS have not yet issued a CSO condition under TDC project
PAGLESHAM WEST TERMINAL PS	ASENF10352	Stannets Creek Brook	TQ9262092460	NONE	107.75	12	1	

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PARK DRIVE PS	AW2NFE11660	Trib River Crouch	TQ7484692571	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
PAVILION DRIVE CSO	AW2NFE16669	Prittle Brook	TQ8480086800	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
PS AT CANEWDON VILLAGE	AW2NFE09265	Trib River Roach	TQ8970094300	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
PS AT CASTLEDON ROAD	AW2NFE00781	Trib River Crouch	TQ7346093800	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
PS AT LOFTMANS CORNER	AW2NFE18468	Trib River Roach	TQ9129793946	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
PS AT THE WOODLANDS	AW2NFE07664	Trib Eastwood Brook	TQ8130089700	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
PS AT WOODHAM ROAD	AW2NFE03374	Trib River Crouch	TQ7822895854	SCREENING	Unspecified	Unspecified	Unspecified	No EDM

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PS CLEMENTS GREEN LANE	AW2NFE06175	Trib River Crouch	TQ8184497273	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
RAYLEIGH	AW2NFE04255	Trib River Crouch	TQ7960091000	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
RAYLEIGH - WYBURNS AVENUE PS	AW2NFE10060	Rayleigh Brook	TQ8133089680	NONE	3	2	1	
RAYLEIGH EAST STW	ASENF1172	RAYLEIGH EAST BROOK	TQ8321090390	PRIMARY SETTLEMENT	32.5	4	1	
RAYLEIGH WEST STW	AW2TSE12870	River Crouch T	TQ7921094740	SCREENING	1996.25	99	0.995681818	Proposed SOAF investigation (Storm Overflow Assesment Framework) with EA agreement

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RES. DEVLPT	ASENF2130	Eastwood Brook	TQ8240089500	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
RICHMON AVE CSO	ASENF15693	A TRIB OF BENFLEET CREEK	TQ7722086930	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
ROCHFORD - DORIC AV & ASHINGT R CSO	AW2NFE03369	Hockley Brook	TQ8658091480	NONE	0	0	0.880719697	Under investigation
ROCHFORD DEPOT PUMPING STATION	AW2NFE15272	THE RIVER ROACH	TQ8773090230	NONE	7.9	9	0.997305707	
ROCHFORD DEPOT PUMPING STATION	AW2NFE15272	THE RIVER ROACH	TQ8803090220	SCREENING	39.7	8	1	

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ROMANS FARM SPS	AW2NFE09584	Brook Farm Ditch	TQ9504997158	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
RUNWELL - BROCK HILL CSO	ASENF12108	tributary River Crouch	TQ7459094770	SCREENING	0	0	0.999659091	
RUNWELL TPS	AW2NFE03883	Trib River Crouch	TQ7623094280	NONE	0	0	1	
RUNWELL-DOWNHAM ROAD CSO	ASENF12107	tributary River Crouch	TQ7459094780	SCREENING	0	0	1	
RUSH BOTTOM LANE & STANSFIELD RD	AW2NFE27266	Trib River Crouch	TQ7660089400	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
RUSHBOTTOM LANE PS	AW2NFE01277	TRIB OF RIVER CROUCH	TQ7658089320	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
RUSHBOTTOM SPS ESSEX	AW2NFC05B	.	TQ7668089290	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM

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S BENFLEET- HALL FARM ROAD PS	EPRNB3199DJ	COMMON WATERCOURSE NO 7	TQ7758086230	NONE	42	38	0.999971539	
SCOTTS HALL ROAD	ASENF2585	Trib River Roach	TQ8960093500	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
SEAVIEW ESTATE PS	AW2NFE07169	THE RIVER THAMES	TQ9550086970	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
SEWER OUTLET TO EASTWOOD BROOK	AW2NFE02356	Eastwood Brook	TQ8170089700	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
SOUTHEND - ROCHFORD ROAD CSO	AW2NFE05483	TRIB PRITTLE BROOK	TQ8750088760	SCREENING	14.75	6	0.999829235	
SOUTHEND 21-27 SHAKESPEARE AVE CSO	AW2NFE18768	Prittle Brook	TQ8710086900	NONE	0.25	1	0.999772727	

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SOUTHEND- RIORY CRESCENT CSO	AW2NFE05183	PRITTLE BROOK	TQ8785087680	SCREENING	1	1	0.998121585	
SOUTHEND TOWERFIELD PS	AW2NFE12684	Trib River Thames	TQ9320085000	NONE	13.4	6	1	
SOUTHEND-PRINCE AVE (BELL PUB) CSO	AW2NFE17964	TRIB OF PRITTLE BROOK	TQ8723088530	SCREENING	31	12	0.988558743	
SOUTHMINSTER - BURNHAM ROAD CSO	ASENF10329	Trib River Crouch	TQ9583099350	NONE	30.5	64	0.998106061	Under investigation
SOUTHMINSTER - HALL RD CSO	ASENF10414	Raywick Ditch	TQ9653099660	NONE	263.25	41	0.998295455	

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SOUTHMINSTER ROAD	ASENF10224	unnamed tributary Mayland Broo	TQ9112099620	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
SOUTHVIEW CLOSE PS	ASENF12274	TRIBUTARY OF RIVER CROUCH	TQ8197089620	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
SPS AT NEVERN ROAD	AW2NFE06072	Eastwood Brook	TQ8165989796	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
SPS AT RUSHBOTTOM LANE	AW2NFE16771	Trib River Crouch	TQ7676089538	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
SSO BARLEYLAND BASILDON	AW2NFC024	.	TQ6849091150	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
SSO BARLEYLAND BASILDON	AW2NFC025	.	TQ6923094300	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM

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SSO BARLEYLAND BASILDON	AW2NFC023	.	TQ6955691727	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
SSO BARLEYLAND BASILDON	AW2NFC037	.	TQ7506093840	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
SSO BARLEYLAND BASILDON	AW2NFC049	.	TQ7664090720	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
STAMBRIDGE SPS	AW2NF854	Stambridge Brook	TQ8993091630	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
STOW MARIES SPS	AW2NFE10684	Trib River Crouch	TQ8300099300	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
SUTTON ROAD PS	AW2NFE20665	Trib River Roach	TQ8840089500	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
TEMPLE FARM SPS	AW2NFE12584	Trib Prittle Brook	TQ8839088361	SCREENING	Unspecified	Unspecified	Unspecified	No EDM

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THE CHASE (NORTH)	AW2NFE10160	Rayleigh Brook	TQ8190090800	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
THE ESPLANADE PS	AW2NFE00680	Trib River Crouch	TQ8039095430	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
THUNDERSLEY - COOMBEWOOD DRIVE PS	ASENF12272	TRIBUTARY OF RIVER CROUCH	TQ7847088450		Unspecified	Unspecified	Unspecified	No EDM
TUDOR WAY	ASENF12022	Hawkwell Brook	TQ8469091720	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM
WAKERING COMMON TPS VIA HAVENGORE	ASETF12389	HAVENGORE CREEK, R ROACH	TQ9683088400	PRIMARY SETTLEMENT	Unspecified	Unspecified	Unspecified	No EDM
WICKFORD CSO	AW2NFE10661	Trib River Crouch	TQ7430091900	UNSPECIFIED	220.75	16	1	
WICKFORD PS	AW2NFE2254	River Crouch	TQ7254493224	UNSPECIFIED	Unspecified	Unspecified	Unspecified	No EDM

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WICKFORD WATER RECYCLING CENTRE	ASETS1322	River Crouch T	TQ7691094010	PRIMARY SETTLEMENT	Unspecified	Unspecified	Unspecified	No EDM
WOODLANDS ROAD PS	AW2NFE08473	Hawkwell Brook	TQ8377892000	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
WOOLSHOTS CSO	AW2NFE02353	.	TQ7260093300	SCREENING	Unspecified	Unspecified	Unspecified	No EDM
WOOLSHOTS RD PS	AW2NFE03768	River Crouch	TQ7254593225	SCREENING	Unspecified	Unspecified	Unspecified	No EDM

Cefas

EC Regulation 854/2004

CLASSIFICATION OF BIVALVE MOLLUSC PRODUCTION AREAS IN ENGLAND AND WALES

SANITARY SURVEY REPORT

Roach and Crouch

2012

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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.

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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*"