Report on Water Quality in the River Deben February 2024

This report from **The Deben Climate Centre** describes E.coli and phosphate pollution in the River Deben. It involved over 12 months of sampling and testing results from over 25 locations, with a particular focus on the impact that Waste Water Treatment Works (WWTW) have on pollution levels. These treatment works are owned and operated by Anglian Water but governed by standards set by the Environment Agency.

Report written by Bill Brammar PhD and David Findley PhD
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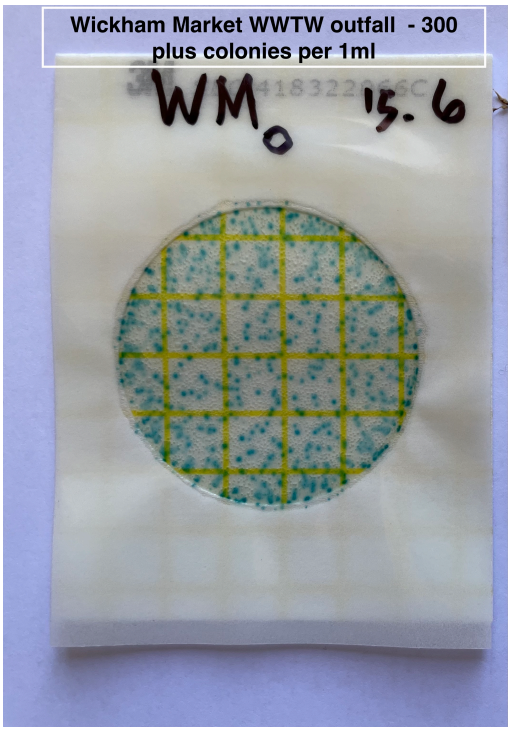
Overview

Whilst the E.coli levels in the tidal River Deben had been monitored by the Deben Climate Centre for over two years, less had been known about the non-tidal section or about phosphate pollution. WWTW sites at Melton and Martlesham Creek had consistently displayed high E.coli pollution levels.

It is now clear that the WWTWs at Rendlesham, Wickham Market, Easton and Debenham, all sited on or close to the River Deben, are also shown to be major sources of pollution.



Results summary

This report details results for the non-tidal areas of the River Deben from the source waters at Debenham down to the tidal junction just below Ufford. The analysis demonstrates that there are high levels of E.coli and phosphates coming from the WWTW's at Debenham, Easton, Wickham Market and Rendlesham. Weekly water samples from Rendlesham WWTW outfall and sampling points up and down stream were tested for E.coli and phosphates and show a picture typical of the other WWTW's.

E.coli levels in the Deben, in particular during the summer of 2023 and during Storm Babet, were high not just at the WWTW outfalls but also in the middle to upper stretches of the river. E.coli levels were 5 to 500 times the Environment Agency "safe bathing" maximum level of 9 colonies for 1ml. These levels can pose a danger to human health and in some cases led to signs being placed at locations such as campsites and popular swimming spots, advising people not to enter the water. Initial studies with the University of Suffolk have identified bacterial isolates from several E.coli samples to be carrying genes encoding toxins which can be injurious to human health.

Phosphate levels in the River Deben in summer 2023 were 80 to 250 times the Natural England healthy river guideline at the WWTW outfalls, with downstream levels often up to twice those of upstream levels. These high phosphate levels led to significant weed and algal growth and hence to eutrophication, involving oxygen depletion and reduced river flow. This excess weed growth is suspected to have been a contributory factor to recent flooding. Although phosphate pollution levels have reduced over the winter months with greater river flow and hence dilution, those from the WWTW are still often 60 to 80 times that of a healthy river.

Sampling and testing expertise

Water samples are taken at around 25 locations on the River Deben usually on a fortnightly schedule by volunteer citizen scientists. This group has about 25 volunteers and works under the auspices of the Woodbridge-based Deben Climate Centre. All E.coli and phosphate testing activities are coordinated by David Findley and Bill Brammar, who live in Ufford. David has a Ph.D in Chemistry whilst Bill has a Ph.D. in Microbial Physiology and thirty years of professorial research experience in Biochemistry and Molecular Biology.

The group uses well established methods for E.coli incubation as recommended by the Environment Agency, and a Hanna mid-range phosphate testing device.

E.coli in the non-tidal River Deben

Sampling of the non-tidal River Deben started in Summer 2021 and has continued since. The number of sampling locations has been extended to cover the river from the tidal junction at Wilford Bridge in Melton right up to the source streams in Debenham.

E.coli levels spike when river flow is low in the summer allowing the accumulation of harmful bacteria in many locations. Samples from the Ufford "swimming hole" during 2002/23 showed peaks of 3,000 to 10,000 colonies per 100ml which is dangerously above the Environment Agency safe bathing maximum guideline of 900 colonies per 100ml. ***Chart*** 1 shows the E.coli levels over a 7 month period. At least one of the winter peaks have been traced to a storm overflow at the Wickham Market WWTW and verified with Anglian Water.

Samples taken across 16 locations in August 2023 and at 26 locations in January 2024 show dangerous levels of E.coli coming from all the River Deben WWTW's. The August map - ***Chart 2*** - shows high levels of downstream E.coli within 500 to 1500 metres of the WWTW outfalls at Easton, Wickham Market and Rendlesham. Two of the sampling points are in fields where there are permanent or temporary camping sites, endangering anyone who bathes, paddles or fishes here.

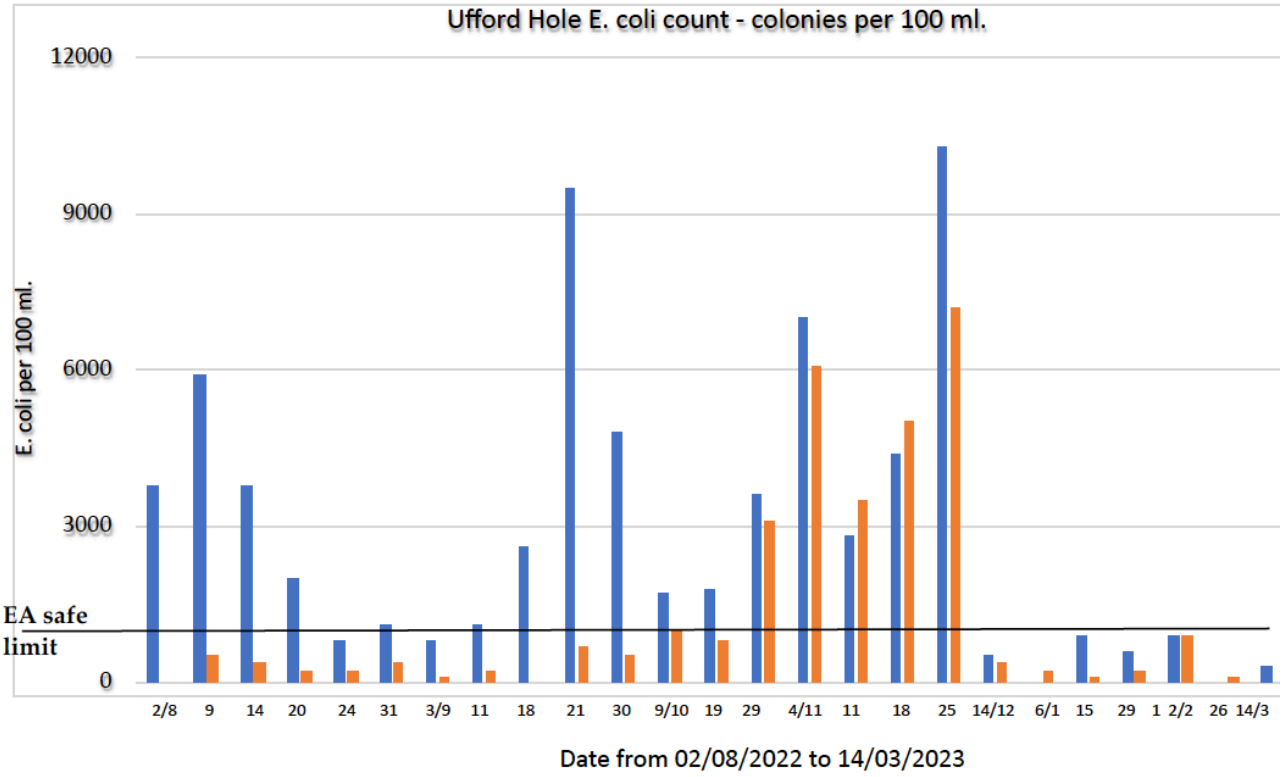
In the immediate aftermath of Storm Babet on 20th and 21st October, samples were taken from a number of nearby locations as most WWTW's were not accessible. Even with the volume of floodwater coming down the Deben, E.coli levels ranged from 26 colonies per 1ml (2600 per 100ml) in Debenham to 126 colonies per 1 ml (12600 per 100ml) in the floodwater in Wickham Market close to flooded properties - **see Chart 3.** Perhaps these levels are not surprising given that many of the WWTW's had significant damage or storm overflow spills but led to warning being issued to some communities.

The most recent results from 8th January 2024 were taken a few days after Storm Henk when the river was still very fast flowing but when floods had subsided. **Chart 4** shows the E.coli levels in the immediate vicinity of the WWTW's were high but were quickly diluted by the volume of river flow.

Overall, the E.coli picture on the non-tidal Deben is as bad if not worse than the tidal section. Low river flows in summer combined with significant abstraction for public water supply and for farming irrigation make many stretches of the water dangerous to enter. Warning notices have been placed regularly at swimming holes and campsites; one campsite owner estimates to have lost £20,000 in revenue from cancelled bookings. There have been many anecdotal reports of bacterial infections affecting both human and domestic animals in both Summer 2023 and 2024.

Chart 1

Results from regular Summer 2022 to early 2023 sampling at the Ufford "swimming holes" at Hawkeswade Bridge from two branches of the River Deben;



900 colonies per ml. is the recommended upper limit for safe bathing in inland waters

Upper Hole Lower Hole

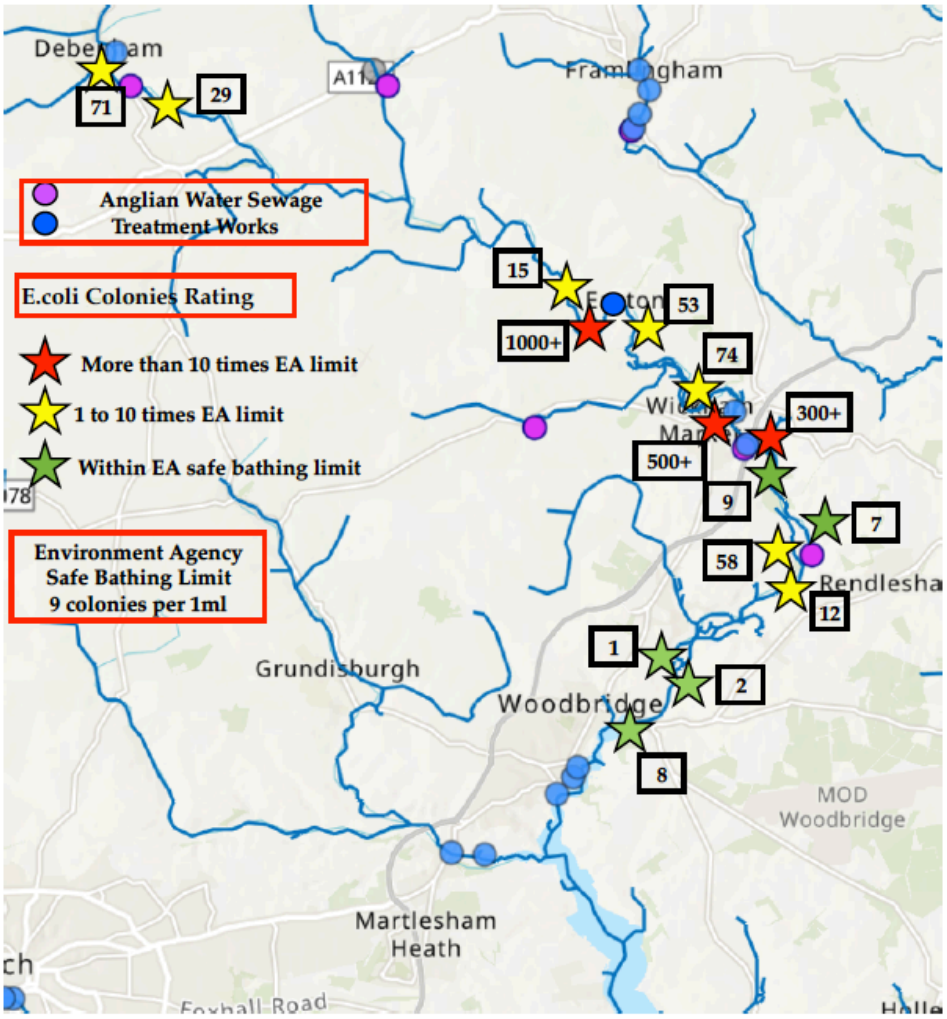
Note the variation between the upper millstream hole and the lower overspill channel. The summer and early autumn spikes in the lower pool result from low river flow and the accumulation of E.coli bacteria in near stagnant conditions.

The autumn and early winter peaks in both pools are likely linked to heavy rain and possible WWTW storm overflows; one November spike verified with Anglian Water as coinciding with a Wickham Market WWTW spill.

Chart 2

Deben River Safari Results - 24th August 2023

E.coli Results - actual results noted at sampling points

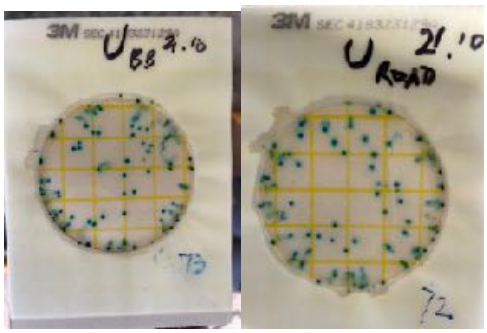


This map shows the E.coli results at 16 sampling points on the non-tidal River Deben. There are WWTW's at Debenham, Easton, Wickham Market and Rendlesham; most are red rated locations with significant raised levels of E.coli bacteria downstream.

River Deben - Floodwater samples taken during Storm Babet

Samples of floodwater were taken on Saturday 21st October in the immediate aftermath of Storm Babet. A number of WWTCs and pumping stations had been inundated and in some places sewage outflow and other pollutants had added to floodwater dangers. These sample results show the extent of E.coli presence; the sample in Wickham Market was from the roadside close to flooded properties.

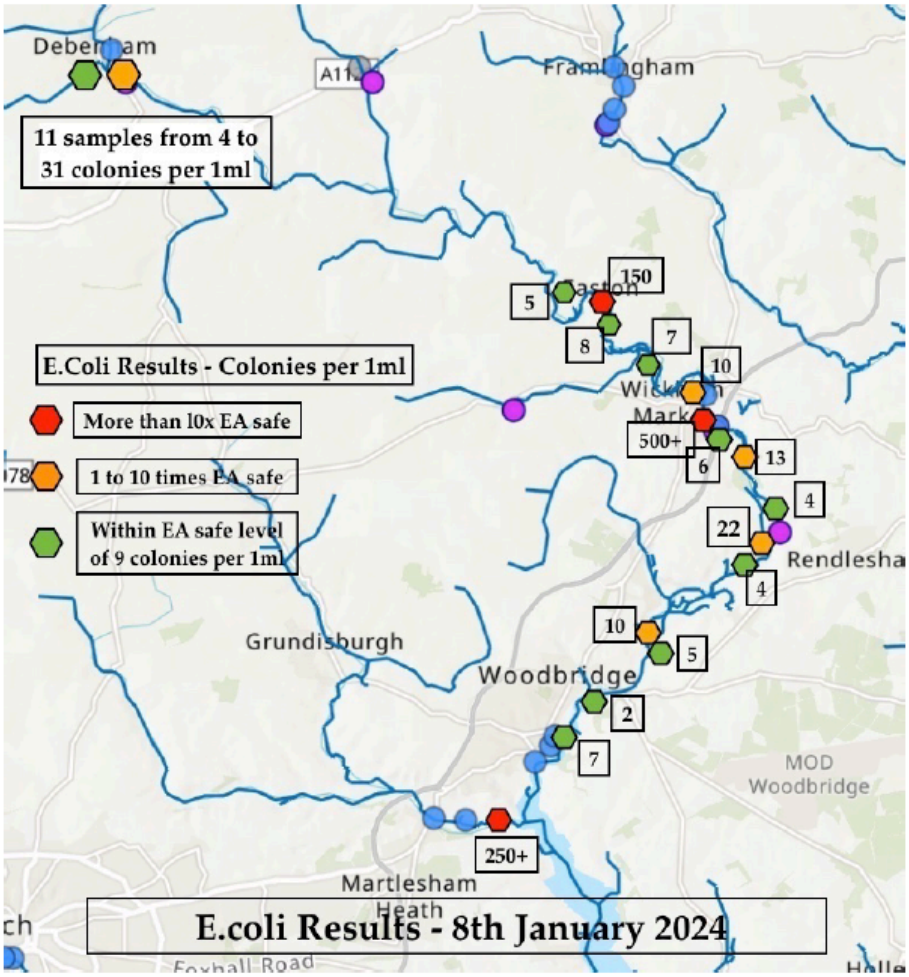
Location	Date/ Time	E.Coli Colonies per 1ml	Phosphate ppm	Comment on location/ State of River
Ufford Road. - Lower Street (UR)	21st October morning	72	0.74	50 metres from Bridge; highest flood level
Byng Brook - Ufford	21st October morning	73	0.66	Tributary of Deben; flood level max on 20/10
Rendlesham Weir (RW)	21st October morning	115	1.17	Downstream of Rendlesham CSO
Rendlesham Ford RF)	21st October morning	78	0.75	Upstream of Rendlesham CSO
Wickham Market High Street (WM)	21st October morning	126	1.18	In town centre close to flooded properties; upstream of WM CSO
Debenham 1 Brook Lane Bridge	22nd October morning	43	0.75	
Debenham 4 Water Lane	22nd October morning	29	0.41	
Debenham 5 Priory Lane Bridge	22nd October morning	39	0.39	
Debenam 8 Thorpe Lane	22nd October morning	26	0.35	Upstream of Debenham STW CSO
Debenham 9 Thorpe Lane	22nd October morning	60	0.56	Downstream of Debenham STW CSO



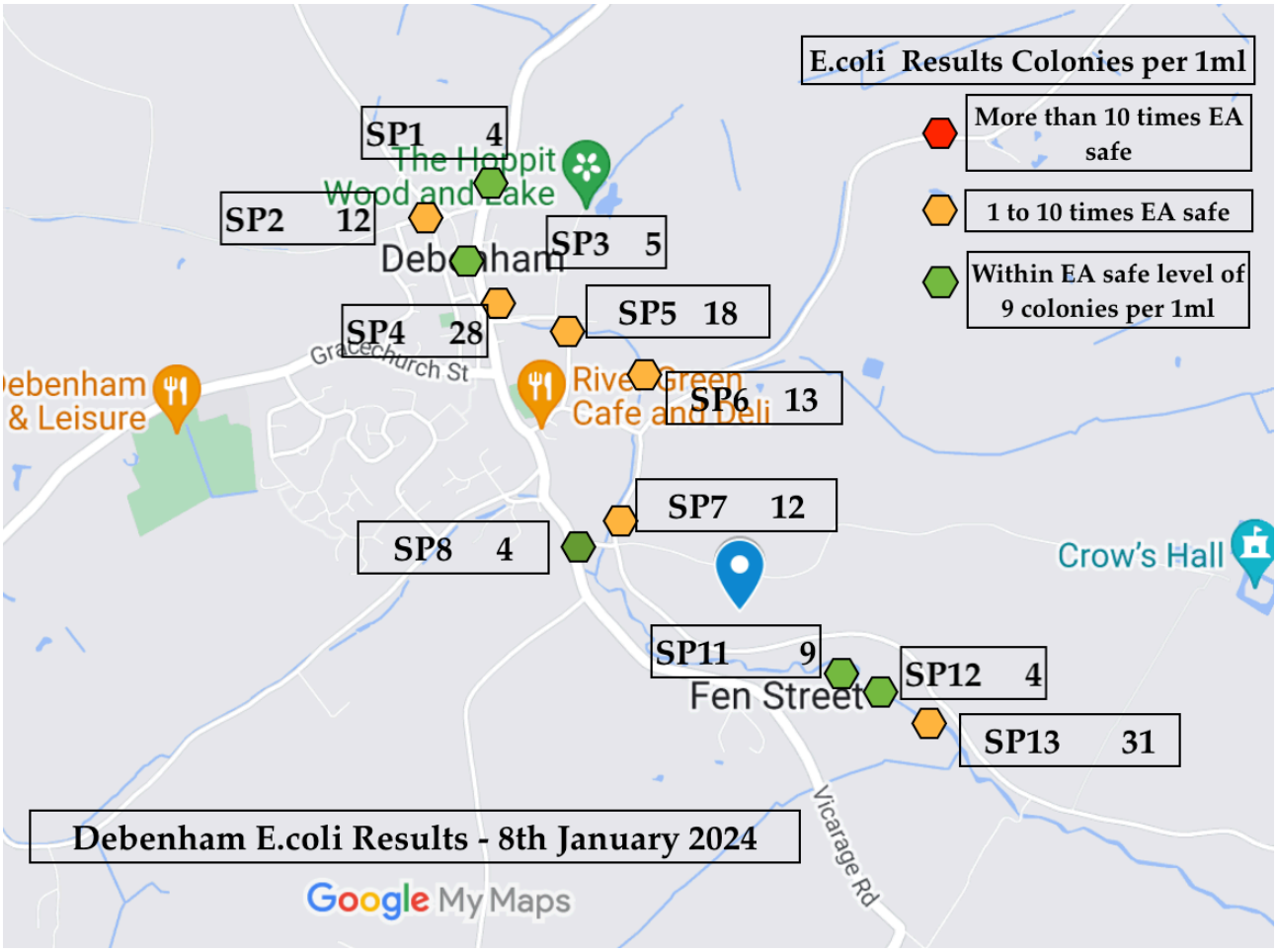
E.coli colonies from floodwater samples in Ufford

Chart 4

This map shows the E.coli results at 26 sampling points on the non-tidal River Deben. Samples were taken about 5 days after Storm Henk when the river was still swollen. The WWTW outfalls at Easton, Wickham Market and Martlesham Creek show a high E.coli presence but river flow led to fast dilution.



Debenham Map Detail ref Chart 4



Phosphate pollution on the River Deben

Phosphates in our rivers come from a number of sources; from waste water treatment works (WWTW's), from farming activities - mainly field run-off - and from faecal pollution from animals. Along with nitrates and ammonia, phosphates are a damaging nutrient in rivers as their presence accelerates algal and weed growth leading to eutrophication and to the mass of weeds reducing oxygen levels and river flow.

Environment Agency data (2019 Report on Phosphorus and Freshwater) suggest that 60 to 80% of the phosphate pollution load in rivers derives from sewage treatment whereas only 20 - 30% comes from agriculture.

Deben Climate Centre volunteers started testing for phosphates in Summer 2023 using the Hanna phosphate test kit, approved by the Environment Agency. Two non-tidal samplings at all 26 locations took place in August 2023 and January 2024. Rendlesham sampling where the local WWTW outfall enters the Deben, was conducted every 1 to 2 weeks during this period .

Overall, the phosphate levels in the River Deben in summer 2023 were 80 to 250 times the Natural England healthy river guideline (0.1 ppm) at the WWTW outfalls with downstream samples levels often up to twice those of those sampled upstream - ***see Chart 5***. The resulting excess weed growth is suspected to have been a contributory factor to flooding in October and December 2023 and in January 2024.

Although phosphate pollution levels in the river have reduced over the winter months with greater river flow and hence dilution, the results for 26 locations sampled on 8th January 2024 show that phosphate levels at most WWTW's were still 60 to 80 times those for a healthy river - **Chart 6.**

At Rendlesham, the reported phosphate levels fluctuate due to samples being taken from the actual outfall or from the river adjacent to it. Nonetheless there is pattern of very high phosphate emission from the WWTW here, with a downstream impact at the Weir, some 300 metres below the outfall pipe. **Charts 7 and 8** show the pattern of pollution from the CSO outfall and from the upstream Ford and downstream Weir. In most cases the downstream Weir phosphate levels were significantly above those at the upstream Ford.

From discussions with Anglian Water, we understand that plans have been brought forward to install phosphate removal equipment at several WWTW's on the River Deben during 2024 - **See note in Appendix 1.** The target phosphate Environment Agency levels are between 0.4 and 1.0 ppm at the WWTW outfalls. Achieving these target levels at the outfalls should bring the rest of the river within the parameters set by the Environment Agency for "Good" status for the River Deben.

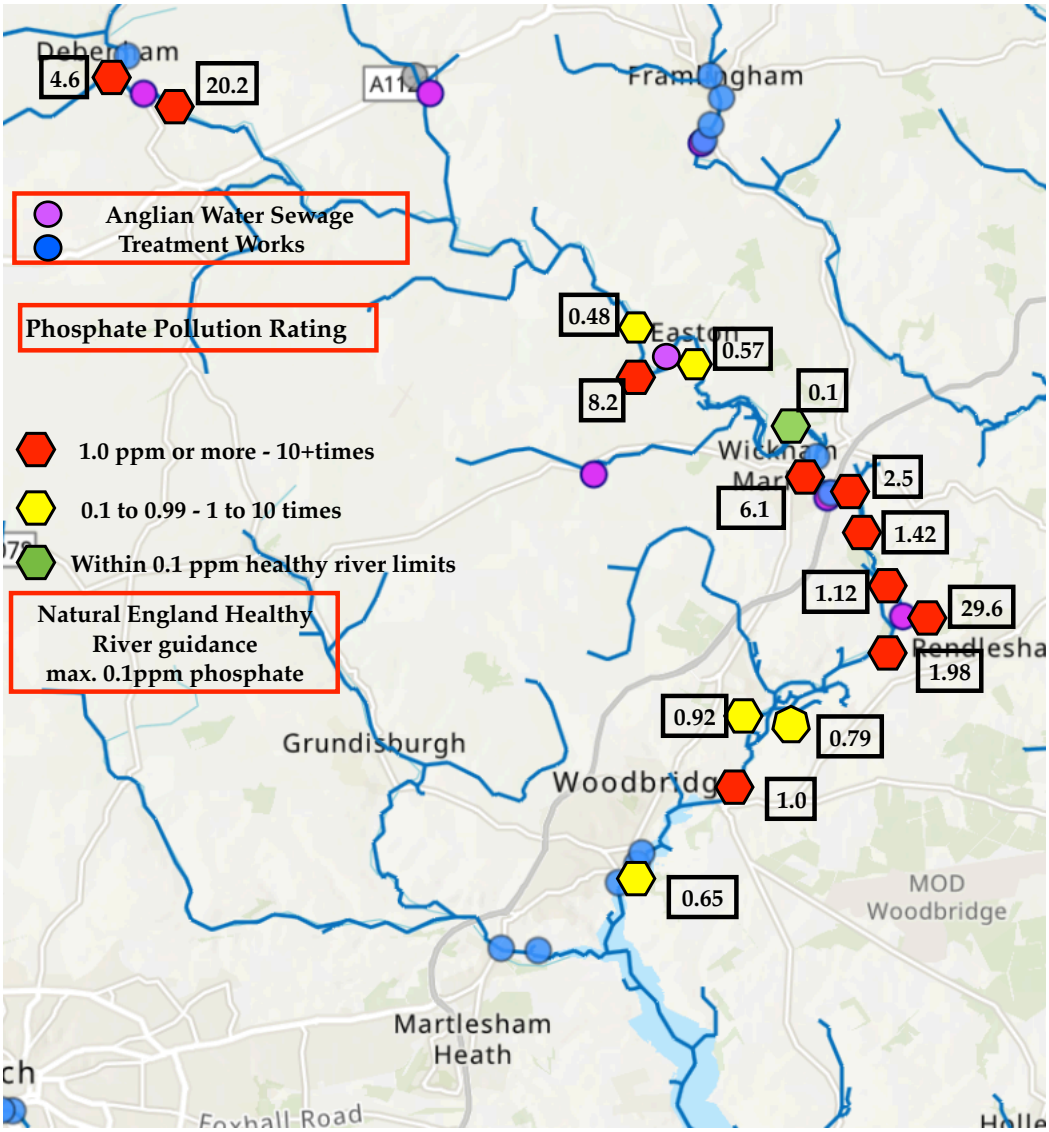
River Deben Water Quality Data Charts

Detailed analysis from the August 2023 and January 2024 sampling expeditions are attached. These spreadsheets are in **Appendix 2 and 3**

Chart 5

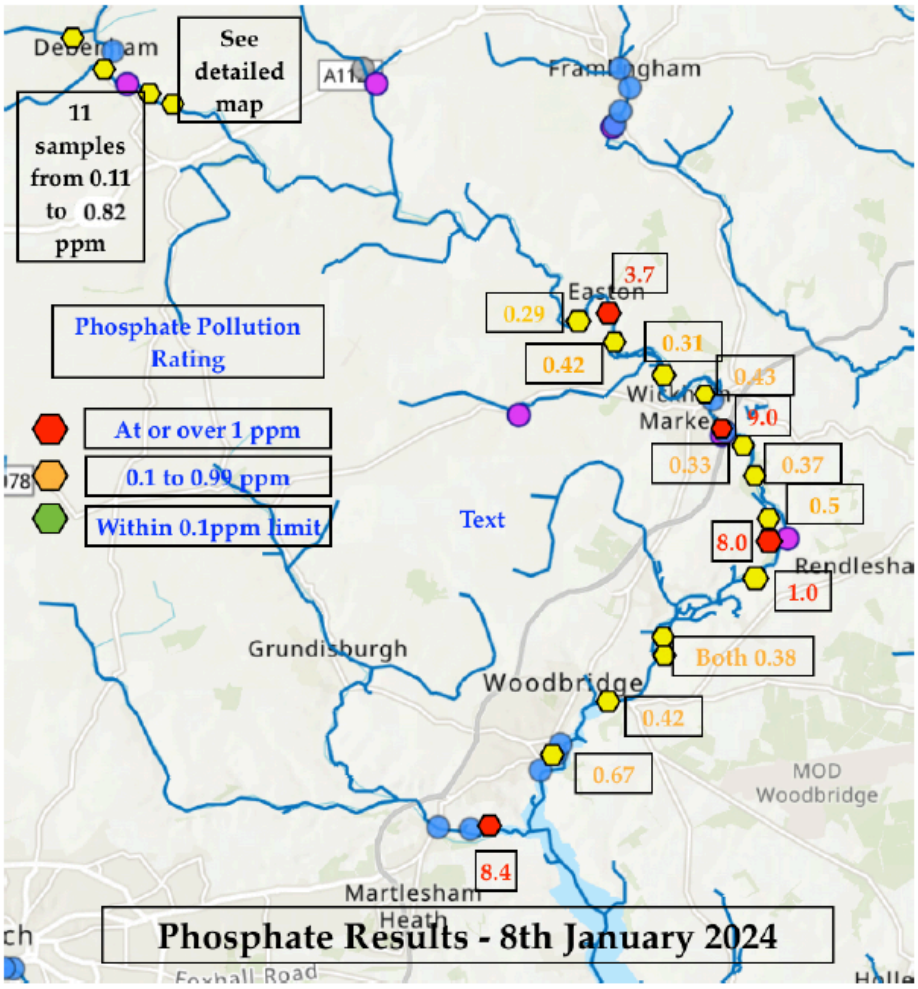
Deben River Safari Results - 24th August 2023

Phosphate Results - actual results noted at sampling points



This map shows the phosphate results at 16 sampling points on the non-tidal River Deben. The stretch of river from Wickham Market WWTW to Rendlesham Weir is particularly polluted with levels of phosphate all at least 10 times and in one case up to almost 300 times the healthy river guideline.

Chart 6



This map shows the phosphate results at 26 sampling points on the non-tidal River Deben. Samples were taken about 5 days after Storm Henk when the river was still swollen. The WWTW outfalls at Easton, Wickham Market, Rendlesham and Martlesham Creek show high levels of phosphate. Downstream dilution is marked but phosphate levels across the whole catchment are all well above the 0.1 ppm Natural England guideline of healthy rivers.

Detailed map ref Chart 6

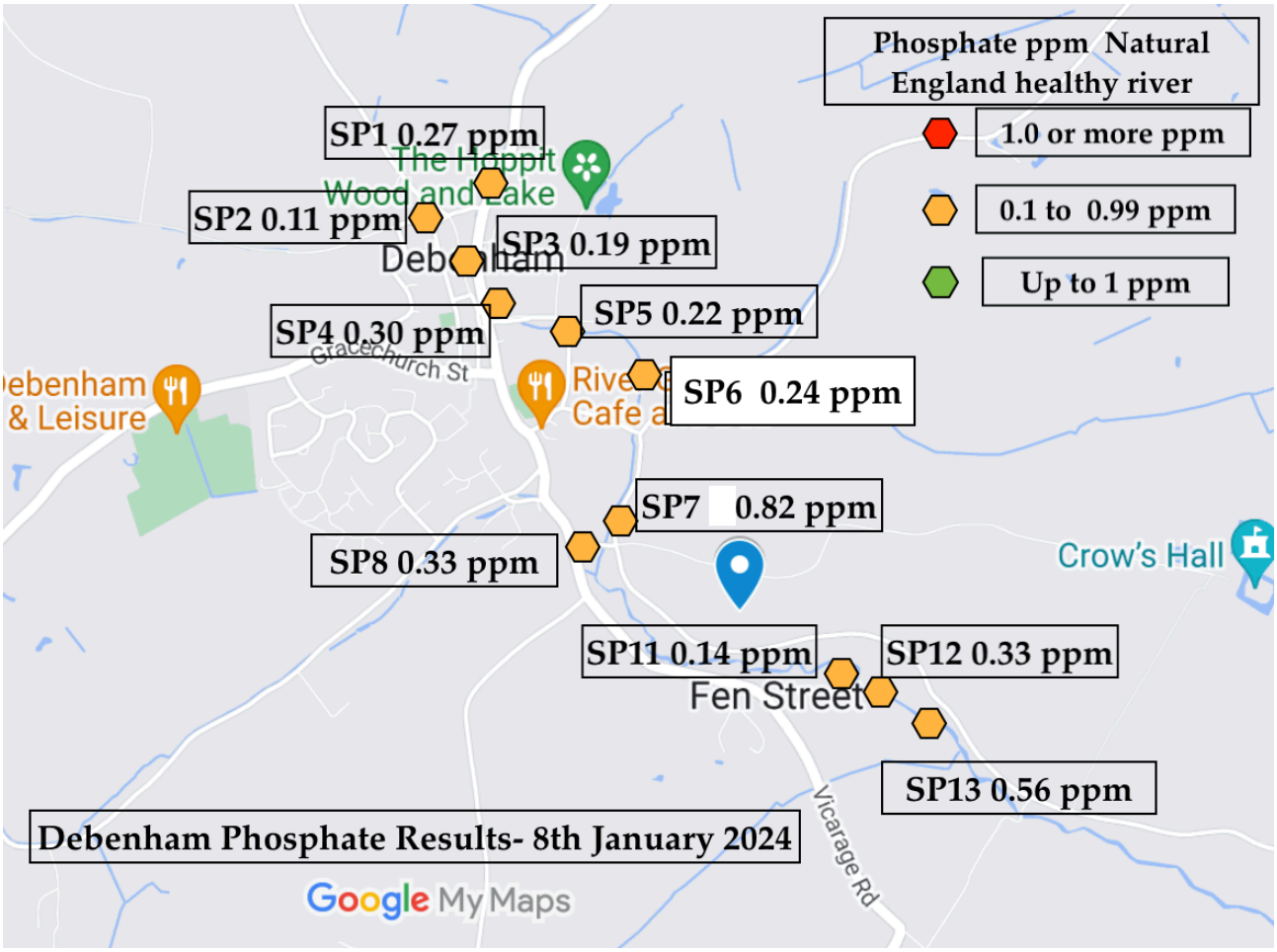
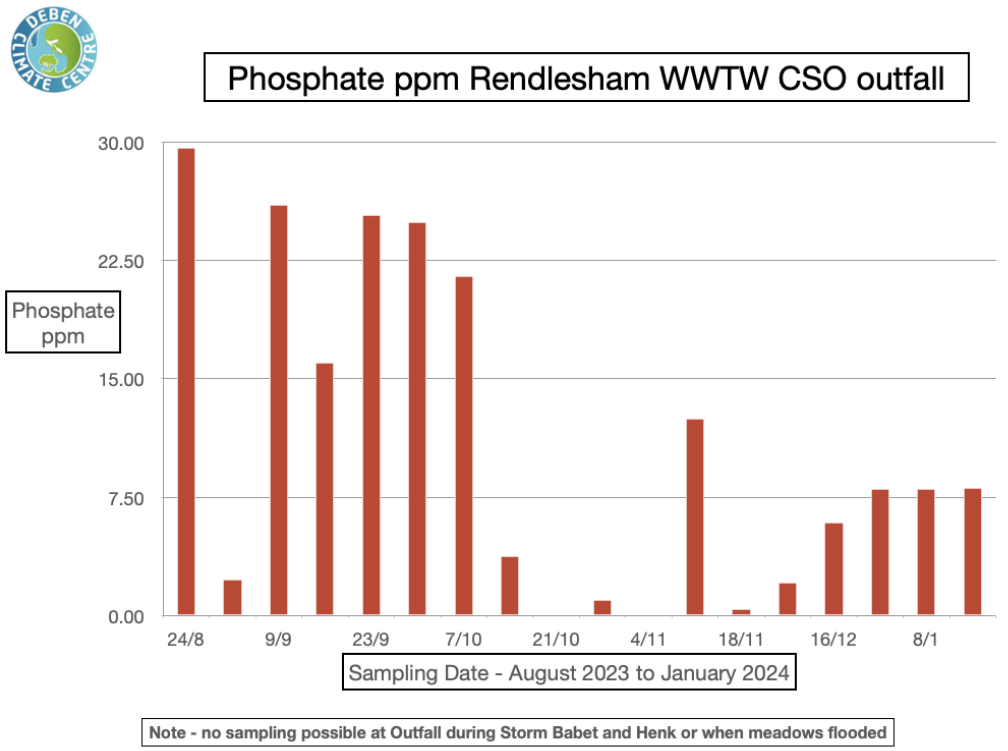
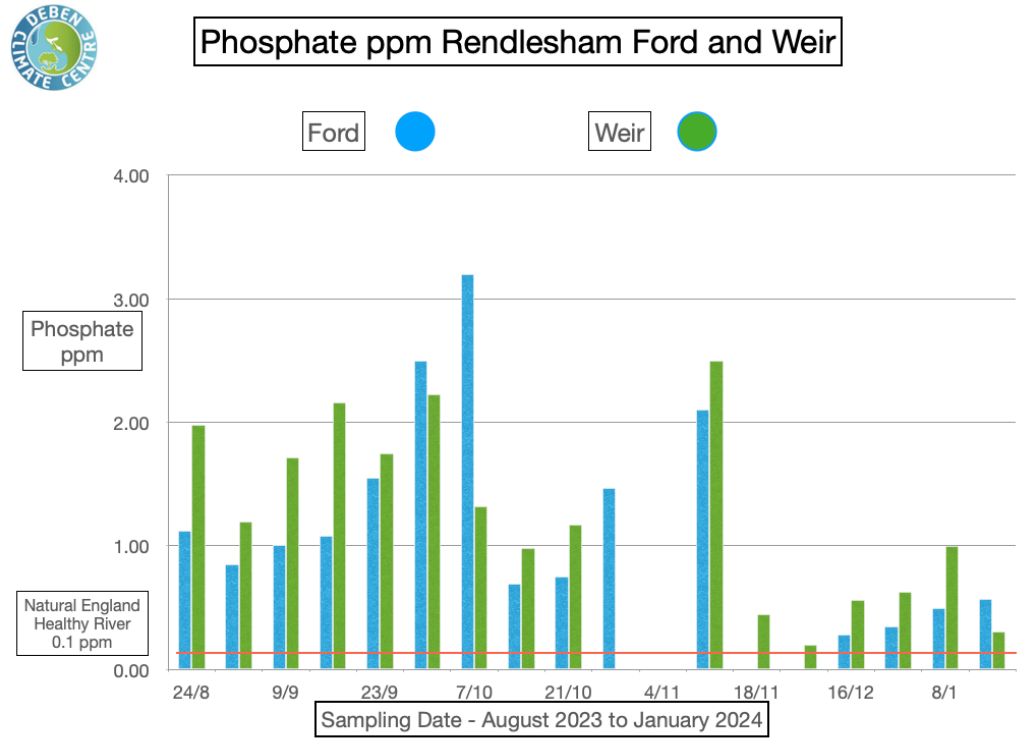


Chart 7


Phosphate ppm Rendlesham WWTW CSO outfall
30.00
22.50
15.00
7.50
0.00
Phosphate ppm
24/8
9/9
23/9
7/10
21/10
4/11
18/11
16/12
8/1
Sampling Date - August 2023 to January 2024
Note - no sampling possible at Outfall during Storm Babet and Henk or when meadows flooded


Phosphate ppm Rendlesham Ford and Weir
Ford
Weir
4.00
3.00
2.00
1.00
0.00
Phosphate ppm
Natural England Healthy River 0.1 ppm
24/8
9/9
23/9
7/10
21/10
4/11
18/11
16/12
8/1
Sampling Date - August 2023 to January 2024

Appendices:

Appendix 1

Phosphorous Improvement work planned at Debenham, Earl Soham and Wickham Market, Rendlesham and Charfield STWs - Extract from email from Greg Hall at Anglian Water on 11th December 2023

Anglian Water plans to install phosphorus removal equipment at these sites to significantly reduce the amount of phosphorus discharged to meet new limits set by the EA as follows.

Deadline December 31st 2024.

STW	New Phosphorus limit set by the EA	Previous Phosphorus limit set
Debenham	0.5mg/l	None
Earl Soham	0.9mg/l	None
Rendlesham	1.0mg/l	None

Wickham Market STW.

Anglian Water has increased storage to 207m3 (up from 127.5m3 previously) to reduce storm overflow frequency. This scheme has been completed early. It had a deadline of March 2024.

Wickham Market will have a new consent of 1.0 mg/l total P and is currently in the process of having traditional ferric sulphate dosing installed for phosphorus removal. The new EA phosphorus limit will come into effect on 31st December 2024 but our delivery team say they are on track to finish the scheme early during the first half of 2024.

Charsfield STW

Charsfield is currently in the process of having traditional ferric sulphate dosing installed for phosphorus removal. The new EA phosphorus limit will come into effect on 31st December 2024 but our delivery team say they are on track to finish the scheme early during the first half of 2024.

Appendix 2

River Deben (non-tidal) Sampling Project - Thursday 24th August 2023

Location	Time	Sampling depth	Weather	River state (subjective)	E coli count Colonies per 1ml	NO3 ppm	Phosphate ppm	Ammonia ppm
Melton Spring Farm	12.15 pm	10cm	Cloudy	Low tide	1	0	0.65	
Wilford Bridge	9.15am	10cm	Light rain	Average flow/ muddy	8	10	1	
Ufford Upper Pool	1.00 pm	30cm	Sunny	Low flow/ clear	1	0	0.92	
Ufford Lower Pool	1.00pm	30cm	Sunny	Low flow/clear	2	0	0.79	
Rendlesham Weir	pm	30cm	Sunny	Average flow	12	0	1.98	
Rendlesham outfall	pm	From outfall	Sunny	Very high flow rate	58	0	29.6	1.41
Rendlesham Ford	pm	30cm	Sunny	Average flow	7		1.12	
Wickham Market White Bridges	pm	30cm	Sunny	Low flow/ clear	9	0	1.42	
Wickham Market A12 bridge (downstream)	pm	30cm	Sunny	Low flow/ clear	300 plus	0	2.5	
Wickham Market outfall	pm	From outfall	Sunny		500 plus	10	6.1	1.12
Wickham Market Spring Lane (upstream)	pm	30cm	Sunny	Very low flow	74	0	0.1	
Easton Field (downstream)	3.15pm	30cm	Cloudy	Very low flow/clear	53	0	0.57	0.45
Easton STW Outfall	3.30pm	From Outfall	Cloudy	Trickle	1000 plus	0	8.2	51.8
Easton Bridge (upstream	3.00pm	30cm	Cloudy	Very low flow/clear	15	0	0.48	
Debenham downstream	2.30pm	30cm		Very low flow	29	50	20.2	
Debenham upstream	3.00pm	30cm		Very low flow	71	0	4.6	

Note 1 - e.Coli results are in colonies per 1ml; Environment Agency guideline maximum for safe bathing is 9 colonies per 1ml

Note 2 - Phosphate results are in ppm; Natural England guideline is 0.1ppm for healthy rivers

Note 3 - Nitrate levels are in ppm and measured by dipstick strips; the healthy river level for nitrates in less than 50ppm

Note 4 - Ammonia levels - the guideline for UK rivers is 0.1ppm; when ammonia concentrations exceed 0.3 to 0.6 mg/l, there are detrimental toxic impacts on fish and other aquatic life

Appendix 3

River Deben Sampling Project - Monday 8th January 2024 Results

Location	Time	Sampling depth	Weather	River Flow (subjective)	River state (subjective)	E coli count Colonies per 1ml	Phosphate ppm	Nitrate ppm	Ammonia ppm
Martlesham Creek STW outfall	10.00 am		Cloudy and cold		Tidal	Circa 250	8.4	10	2.6
Woodbridge Tide Mill	10.15 am		Cloudy and cold		Tidal	7	0.67		0.28
Wilford Bridge	12.45 pm	15cm	Cloudy and cold	Fast	Clear	2	0.42		0
Ufford Upper Pool	2.00 pm	30cm	Cloudy and cold	Fast - river in flood still	Cloudy	10	0.38		0.03
Ufford Lower Pool	2.05 pm	30cm	Cloudy and cold	Fast - river in flood still	Cloudy	5	0.38		
Rendlesham Weir	1.50 pm	30cm	Cloudy and cold	Moderate		4	1		0
Rendlesham STW outfall	2.00 pm	From outfall	Cloudy and cold			22	8	0	0.08
Rendlesham Ford	2.10 pm	30cm	Cloudy and cold	Moderate		4	0.5		0
Wickham Market White Bridges	10.40 am	30cm	Light sleet, cold	Fast	Cloudy	13	0.37		0.05
Wickham Market A12 bridge (downstream)	10.30 am	30cm	Cloudy and cold	Slow	Cloudy	6	0.33		0.06
Wickham Market STW outfall	10.25 am	From outfall	Cloudy and cold	Fast from outfall	Clear	Circa 500	9	0	2.02
Wickham Market Spring Lane (upstream)	10.10 am	30cm	Cloudy and cold	Slow	Brown/ cloudy	10	0.43		0.02
Glavering Bridge	10.00 am		Cloudy and cold	Fast	Cloudy	7	0.31		0
Easton Field (downstream)	9.45 am	30cm	Cloudy	Slow	Muddy	8	0.42		0.1
Easton STW outfall	9.40 am	From Outfall	Cloudy and cold	Fast	Clear	Circa 150	3.7	0	0.16
Easton Bridge (upstream	9.30 am	30cm	Cloudy and cold	Fast	Cloudy	5	0.29		0.07

Location	Time	Sampling depth	Weather	River Flow (subjective)	River state (subjective)	E coli count Colonies per 1ml	Phosphate ppm	Nitrate ppm	Ammonia ppm
Debenham SP13 Downstream of STW outfall	11.45 am		Light sleet; cold	Steady		31	0.56	top pad 0 next pad5	0.16
Debenham SP12 Just above STW outfall	11.45am		Light sleet; cold	steady		4	0.33	top pad 0 next pad5	0.33
Debenham SP 11 Upstream from STW	11.45 am		Light sleet; cold	Steady		9	0.14	top pad 0 next pad5	0.14
Debenham SP8 Kenton Road Bridge/ Thorpe Lane	11.40am			steady		4	0.33	top pad 0 next pad5	0.49
Debenham SP 7 Ipswich Road/ Thorpe Lane	11.30 am			steady		12	0.82	top pad 0 next pad5	0.19
Debenham SP6 Kenton Road Bridge	11.40am			steady		13	0.24	top pad 0 next pad10	0.02
Debenham SP5 Priory Road Bridge	11.30am			steady		18	0.22	top pad 0 next pad 10	0.06
Debenham SP4 Water Lane Ford	11.30 am			steady	clear	28	0.3	top pad 0 next pad 10	0.05
Debenham SP3 Footbridge Chancery Lane Aspall Road	8.55am	30cm	cold/drizzle	steady	clear	5	0.19	top pad 0 next pad 10	0.17
Debenham SP2 Corner Bridge Chancery / Brook Lane	8.50am	30cm	cold/drizzle	steady	clear	12	0.11	top pad 0 next pad 10	0
Debenham 1 Brook Lane Corner Bridge	8.45am	30cm	cold/drizzle	steady	clear	4	0.27	top pad 0 next pad 10	0

Note 1 - e.Coli results are in colonies per 1ml; Environment Agency guideline maximum for safe bathing is 9 colonies per 1ml; Yellow Rating is 10 to 90 colonies (up to ten safe level; Red rating is over 90 colonies per 1ml)

Note 2 - Phosphate results are in ppm; Natural England guideline is 0.1ppm for healthy rivers. Yellow rating is 0.11 to 1.0ppm; Red Rating is over 1.0ppm

Note 3 - Ammonia levels in rivers less than 0.2 ppm are accepted as being within range but anything over this is danger to] aquatic life; 0.21 to 0.4 ppm is judged to be yellow rated; over 0.4 ppm is red rated

The Deben Climate Centre

The Centre was founded in August 2022, with the objective of providing a wide range of climate and environment-focused services and activities to the Deben Catchment communities.

With a strong focus on science to practice approaches, we have to date set up an extensive Water Testing program along the length of the River Deben, delivered a community participatory planning workshop on green infrastructure and nature recovery to stakeholders drawn from 8 Parish Councils, Government Agencies, conservation NGOs, and Local Government, and currently running our second season of science-led seminars. In the spring we intend to open our first community Climate & Environment Hub.

Plans are ahead to deliver, starting this year, a programme of professional short-courses and skills development, which will include nature-positive practices in farmed landscapes, introduction to biotic indicators of rivers and ponds, assessment and conservation management of hedgerows, carbon storage and nature recovery measures in modified landscapes, and rewilding small woods.

You can contact the Deben Climate Centre at zerocarbon@debenclimate.org

Acknowledgements

The Deben Climate Centre and the authors are grateful for the commitment to water sampling and testing from over 30 volunteer citizen scientists from town and villages along the River Deben and its tributaries.

We acknowledge the support and funding contribution to this project from:

Debenham Green Team
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Great Bealings PC
Martlesham Climate Action
Debenham Parish Council
Wickham Market Parish Council
Ufford Parish Council
East Suffolk District Council
Waldringfield Fairways Cttee