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Fareham Lake

(Portsmouth Harbour)

Provisional RMP Assessment

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Applications were received to classify native oysters (*Ostrea edulis*) and hard clams *(Mercenaria mercenaria),* Manila clams (*Tapes philippinarum*) and Palourdes/native clams *(Tapes decussatus*) beds within the western reaches of Portsmouth Harbour, in the approaches to Fareham Lake. The requested classification area for native oysters is bounded by lines drawn from 50°49.631'N 01°9.004'W to 50°50.166'N 01°6.785'W to the mean high water tidal limit. The requested classification area for clams is bounded by lines drawn from 50°50.319'N 01°9.505'W to 50°50.466'N 01°9.135'W to the mean high water tidal limit.

Currently an area in the east of the harbour is classified for hard clams, *Tapes* spp. and cockles (*Cerastoderma edule*). Previously, a more extensive classification zone for these species as well as native oysters extended up to the eastern boundary of the area applied for here. However, this area is no longer classified. A Pacific oyster (*Crassostrea gigas*) classification zone in the east of the *harbour* is also now declassified.

The annual harvested yield is estimated to be > 20 tonnes for native oysters, approximately 20 tonnes for hard clams and around 10 tonnes for *Tapes* spp. All stocks of oysters and clams are wild. The commercial harvesting technique for all is via dredges of varying configurations.

The hard clam classification is currently based on monitoring results from native oysters, and no clam species have ever been sampled. Hard clams accumulate *E. coli* in lower levels to native oysters (Younger and Reese, 2011) assuming they are exposed to the same level of contamination. However, in this area the clams are found in the intertidal zone, whereas the oysters are found in the subtidal channels. There may be marked differences in the exposure to indicator bacteria between these two habitats so results from oyster sampling may not be representative of levels of contamination within the clams. *Tapes* spp. accumulate *E. coli* to higher levels than native oysters (Younger and Reese, 2011) so oyster monitoring would not be an acceptable surrogate for *Tapes* spp. even if they co-occurred in the same habitat type.

Sources of Faecal Contamination

Figure 1 shows the location of potentially significant sources of contamination to the application area, including all sewage discharges within 2 km of the application area and other significant discharges located within the catchment taken from the Environment Agency permit database (August 2015).

Sewage Discharges

Those discharges greater than 5 m^3/day to watercourses relevant to this assessment are listed in Table 1.

Table 1: Significant continuous sewage discharges of over 5 m^3/day to watercourses

Name	Dry weather flow m3/day	Treatment type	NGR	Receiving environment
Southwick STW	540	Biological filtration	SU6182008820	River Wallington

Data from the Environment Agency

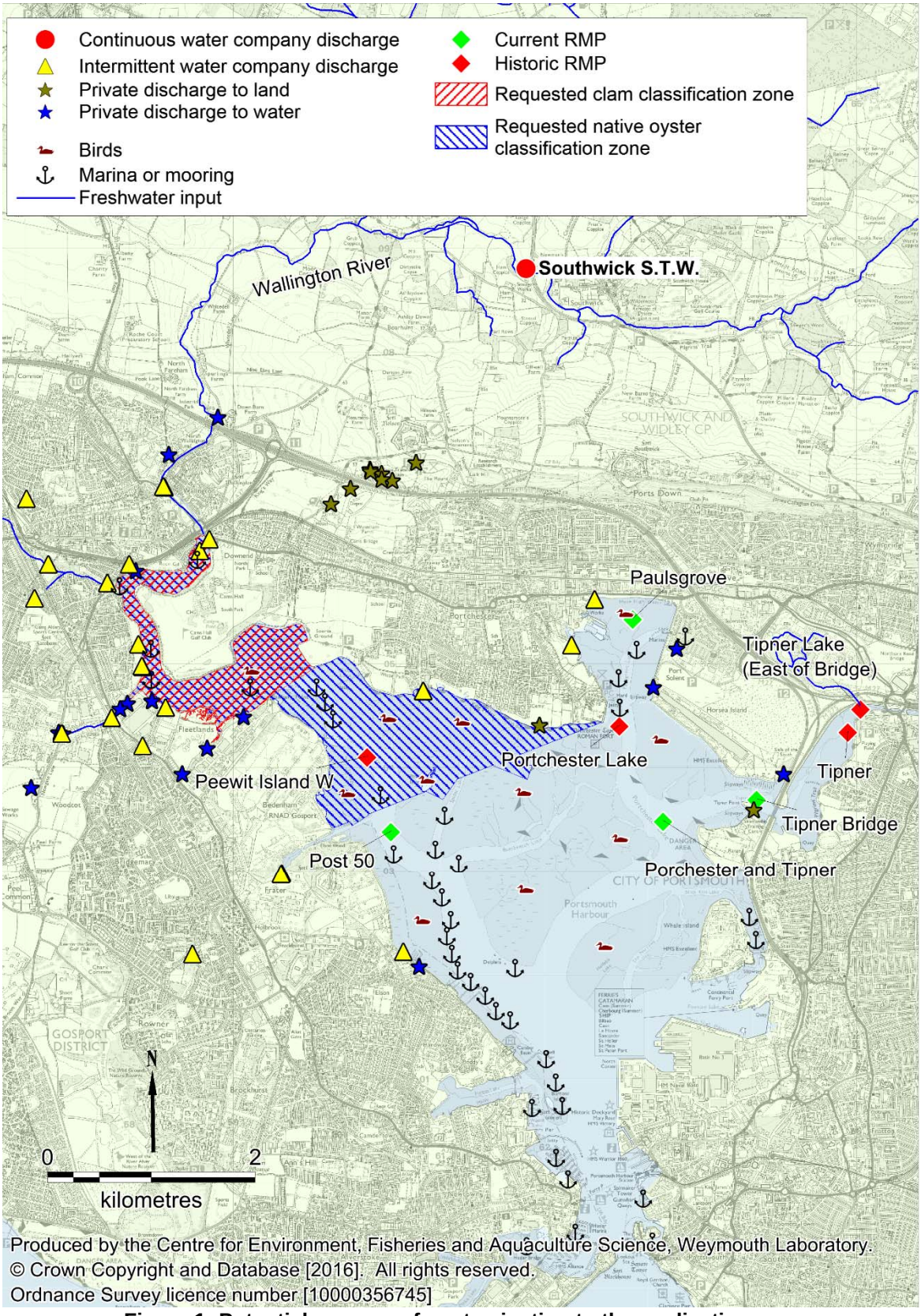

Figure 1: Potential sources of contamination to the application area

There is only one continuous sewage discharge of potential impact on the application area, Southwick STW, which provides secondary biological filtration for a consented Dry Weather Flow

of 540 m^3/day. It discharges to the River Wallington, approximately 7 km upstream of the tidal limit and will contribute to the microbial loading reaching the application area.

Intermittent storm overflow discharges can create issues in management of shellfish hygiene however infrequently they spill, as they discharge raw sewage. There are several intermittent discharges within the vicinity of the application area, with various discharges located around the southern perimeter of Fareham Lake and upstream in the River Wallington. It is possible that these contribute to the overall level of faecal contamination that enters the estuary following heavy rainfall. Some intermittent discharges have event duration monitoring on them, and analysis of this undertaken for the sanitary survey (Cefas, 2013) revealed that most spilled for < 0.5% of the period reviewed (2008-2012). A couple of intermittent discharges to the River Wallington were identified as operating more frequently than others, most notably Bridgefoot PS which discharges within the application area near the tidal limit of the River Wallington. It spilled for 2.9% of the period analysed, discharging a large number of short spill events, the majority of which occurred in the winter. Cams Hill CSO is also located in the vicinity of the tidal limit, and close to Bridgefoot PS. For those without event monitoring it is difficult to assess their potential impacts aside from noting their location and potential to spill untreated sewage.

Although the vast majority of the survey area is served by public sewerage infrastructure, there are also a few private discharges within the vicinity of the application area. The majority of these private discharges are for site drainage from industrial premises and should have very little, if any, microbiological component. Most private sewage discharges are located in the upper reaches of the River Wallington catchment, and these are usually small, serving one or two properties and are generally treated by small treatment works such as package plants. Those that discharge to the River Wallington will contribute to the bacterial loading it carries. Those discharging to soakaway should be of no impact as long as they are functioning correctly.

There are many (>100) minor surface water inputs to the harbour, but little information on these (Cefas, 2013), although they may contribute microbiological loading to the harbour if contaminated with urban run-off. Any impacts from these will be most likely to occur during and immediately after periods of local rainfall.

Boats and marinas

Boat traffic in Portsmouth Harbour in general is heavy, with a mix of commercial, navy, fishing, transport and recreational craft. Boat moorings are present throughout the subtidal channels in the application area. Two marinas, WicorMarine Yacht Haven and Fareham Marina, are located in the area. Given that neither offer sewage pump-out facilities occasional overboard discharges are likely.

Agricultural sources

The catchment in the lower part of the River Wallington is mostly urban, with some pasture in the middle to upper reaches. The livestock numbers and density in the catchment are not high, so agricultural impacts in the harbour will be relatively low, but will contribute to the microbiological loading that the River Wallington delivers to the application area.

Wildlife sources

Portsmouth Harbour encompasses a variety of habitats that attract wildlife, with areas of the harbour maintaining a Special Protection Area (SPA), a Ramsar Site and a Site of Special Scientific Interest (SSSI) designations. The harbour supports populations of European importance of overwintering waders and wildfowl. Grazing species, such as geese, forage on grassland and saltmarsh, with their faeces being carried into coastal waters via tidal creeks or tidal inundation, and waders forage on shellfish in intertidal areas and will contribute directly to microbiological contamination at the intertidal. A UK study found significant quantities of microbiological contaminants in intertidal sediment where large populations of birds are located (Obiri-Danso and Jones, 2000). An average total count of 12,810 waterbirds (wildfowl and waders of a variety of

species) was reported over five winters up to 2010/11 (Holt *et al*., 2012). Birds such as gulls and terns and relatively small numbers of waders remain in the area to breed in the summer, so potential impacts on the hygiene status of the fisheries will be much lower at that time of year.

Classification and monitoring history

The classification history for native oysters and clams in Portsmouth Harbour is shown in Table 1.

Table 2: Classification history of the area from 2005 to present

Bed name	Species	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
East Harbour	Hard clam	-	-	-	-	-	-	-	-	B-LT	B-LT
Paulsgrove and Porchester		-	-	-	-	-	-	-	B-LT	B-LT	B-LT
Portsmouth - Eastern beds		B-LT	B-LT	B-LT	B-LT	B-LT	B-LT	B-LT	B-LT	-	-
Portsmouth - Western beds		C	B	B	B	B-LT	B-LT	B-LT	B-LT	-	-
West Harbour		-	-	-	-	-	-	-	-	B-LT	DC
Paulsgrove	Cockle	-	-	-	-	-	-	-	-	-	C
East Harbour	Native oyster	-	-	-	-	-	-	-	-	DC	DC
Portsmouth - Eastern beds		B-LT	B-LT	B-LT	B-LT	B-LT	B-LT	B-LT	-	-	-
Portsmouth - Western beds		C	B	B	B	B-LT	B-LT	B-LT	-	-	-
West Harbour		-	-	-	-	-	-	-	-	DC	DC
East Harbour	Pacific oyster	-	-	-	-	-	-	-	-	DC	DC

The proposed application area mostly lies within the historical Portsmouth – Western Beds native oyster and hard clam classification zone. This zone had a long term B classification until 2012 for native oysters and 2013 for hard clams. Monitoring for these beds was in the main channel of Fareham Lake (Peewit Island W and Post 50 RMPs) at the eastern and southern ends of the classification zone. Hard clam classification was based on native oyster results from these beds.

Table 3 shows the summary statistics for the shellfish flesh monitoring results for Portsmouth Harbour for the last 5 years, and Figure 1 shows the locations of the sampling sites.

Table 3: Summary statistics for *E. coli* classification monitoring results (MPN/100g) by RMP – 2010 to 2015

Sampling Site	Species	No.	Date of first sample	Date of last sample	Geometric mean	Min.	Max.	% over 230	% over 4,600	% over 46,000
Paulsgrove	Hard clam	24	17/12/2013	11/01/2016	153.3	<18	9,200	29.2	8.3	0.0
Tipner Bridge		22	17/12/2013	11/01/2016	96.0	<18	5,400	13.6	4.5	0.0
Tipner Lake (East of Bridge)		5	09/06/2014	06/10/2014	318.0	40	2,400	60.0	0.0	0.0
Paulsgrove	Cockle	10	18/02/2015	11/01/2016	1,272.2	330	24,000	100.0	20.0	0.0
Peewit Island W	Native oyster	3	08/02/2011	04/04/2011	214.5	130	330	33.3	0.0	0.0
Post 50		41	09/05/2011	14/10/2015	624.3	130	5,400	90.2	7.3	0.0
Portchester Lake		36	08/02/2011	13/05/2014	634.4	130	2,800	80.6	0.0	0.0
Porchester and Tipner		12	17/12/2013	12/11/2015	470.2	80	3,300	50.0	0.0	0.0
Paulsgrove	Tapes spp.	13	14/01/2014	19/01/2015	2,496.0	490	17,000	100.0	23.1	0.0
Tipner		4	09/06/2014	01/07/2014	896.5	<20	9,200	75.0	50.0	0.0
Tipner Lake (East of Bridge)		9	14/01/2014	10/09/2014	4,171.1	20	92,000	88.9	55.6	11.1

These summary statistics show that where more than 10 flesh samples have been collected in a similar timeframe, there is very little variation in *E. coli* levels across the harbour. Variation between sites in these summary statistics is likely due to low sample numbers at some sites resulting in the data not being fully representative of that area. However, there is a clear difference in *E. coli* results between species, with higher results occurring in *Tapes* spp. and possibly cockles than hard clams and native oysters. *Tapes* spp. are known to accumulate faecal indicator bacteria to higher levels than native oysters and hard clams (Younger and Reese, 2011), therefore it would not be valid for the hygiene status of *Tapes* spp. to be represented by monitoring results for native oysters or hard clams.

Water circulation

Portsmouth Harbour covers an area of about 16 km², of which about 60% is intertidal. It has a relatively deep and narrow mouth flanked by dockyards and urban areas. Inside from the mouth it widens significantly and the main channel splits into a further two channels which head north west (Fareham Lake) and north east (Portchester Channel). The channels become progressively shallower, and there are a number of smaller subtidal and intertidal creeks/channels emanating from them. The inner harbour is largely intertidal, mainly consisting of mudflats. The only significant freshwater input is the Wallington River to the head of the Fareham Lake.

Tidal amplitude is 3.9m on spring tides and 1.9m on neap tides, and tides are the principle driver of water circulation within the harbour. Tidal streams move into the harbour and up the channels on the flood, then spread over the intertidal areas, with the reverse occurring on the ebb. Contamination from shoreline sources will tend to be carried down creeks and into the main channels during the ebb tide. Shellfish in the intertidal areas are likely to be more influenced by local sources, whereas the shellfish in the deeper channels will be subject to contamination from a larger range of sources. Currents are strongest at the harbour entrance, peaking at just over 2 m/s during spring ebb tides according to a tidal diamond in the mouth. Currents are slower in the inner reaches of the harbour, particularly over the intertidal areas, as evidenced by the decreasing sediment particle sizes. This suggests that sources of contamination in the intertidal areas of the inner harbour will have more acute but localised effects than those discharging to the deeper channels and the harbour mouth.

In addition to tidally driven currents there are effects of freshwater inputs and wind. Given the large volumes of tidal exchange relative to the volumes of freshwater input the harbour is well mixed so density driven circulation is unlikely to modify tidal circulation patterns. Salinity measurements taken at a number of points within the harbour (Cefas, 2013) indicate average salinities approaching that of undiluted seawater throughout, although slightly reduced salinities were recorded at times in the upper reaches of Fareham Lake. Despite there being little variation in salinity, the concentration of faecal indicator bacteria was negatively correlated with salinity at a monitoring point off Frater in Fareham Lake (Cefas, 2013). This suggests that although the volumes of runoff received by the harbour are small, land runoff is a significant contaminating influence.

The prevailing south westerly winds will tend to push surface water in a north easterly direction, creating return currents either at depth or along sheltered margins. Exact effects are dependent on the wind speed and direction as well as the state of the tide and other environmental variables, so a great range of scenarios may arise. Where strong winds blow across a sufficient distance of water they may create wave action and where these waves break, contamination held in intertidal sediments may be re-suspended.

Recommendations regarding provisional RMP and production area

Provisional production area

It is recommended that the provisional production area (classification zone) for native oysters is bounded by lines drawn from 50°49.631'N 01°9.004'W to 50°50.166'N 01°6.785'W to mean high water springs (MHWS).

It is recommended that the provisional production area (classification zone) for hard clams is bounded by lines drawn from 50°50.319'N 01°9.505'W to 50°50.466'N 01°9.135'W to MHWS.

It is recommended that the provisional production area (classification zone) for *Tapes* spp. is bounded by lines drawn from 50°50.319'N 01°9.505'W to 50°50.466'N 01°9.135'W to the MHWS.

Provisional RMP

The main contaminating influence to this zone is the River Wallington, which receives discharges from Southwick STW, various intermittent and private discharges, as well as agricultural runoff upstream. Several intermittent discharges are located in proximity to the southern periphery of the application zone, including two located at the tidal limit of the River Wallington. During an ebb tide, sources of pollution located upstream in the River Wallington will be transported across the application area and during a flood tide the waters from the main body of Portsmouth Harbour will move upstream over the area. Urban runoff from a large number of small surface water outfalls is also likely to be a significant influence, but these are effectively diffuse, located throughout the harbour. It is recommended that the RMPs are located at the upstream boundary of the application area, and as close to the main channel as possible, to best capture riverine inputs.

Table 4: Provisional Sampling Plan: native oysters

Production Area	pRMP name	NGR	Latitude	Longitude	Classification Species	Sampling species	Collection Method	Sampling tolerance	Sampling frequency	Provisional production area boundary
Portsmouth Harbour	Fareham Lake native oysters	SU 58719 06215	50°51.149'N	01°10.033'W	Native oysters	Native oysters	Dredging	100 m	Monthly sampling, including first two months of the closed season	Area bounded by lines drawn from 50°49.631'N 01°9.004'W to 50°50.166'N 01°6.785'W to the mean high water tidal limit
Portsmouth Harbour	Fareham Lake hard clams	SU 58719 06215	50°51.149'N	01°10.033'W	Hard clams	*Tapes* spp.	Dredging	100 m	Monthly sampling, including first two months of the closed season	Area bounded by lines drawn from 50°50.319'N 01°9.505'W to 50°50.466'N 01°9.135'W to the mean high water tidal limit.
Portsmouth Harbour	Fareham Lake Tapes spp.	SU 58719 06215	50°51.149'N	01°10.033'W	*Tapes* spp.	*Tapes* spp.	Dredging	100 m	Monthly sampling, including first two months of the closed season	Area bounded by lines drawn from 50°50.319'N 01°9.505'W to 50°50.466'N 01°9.135'W to the mean high water tidal limit.

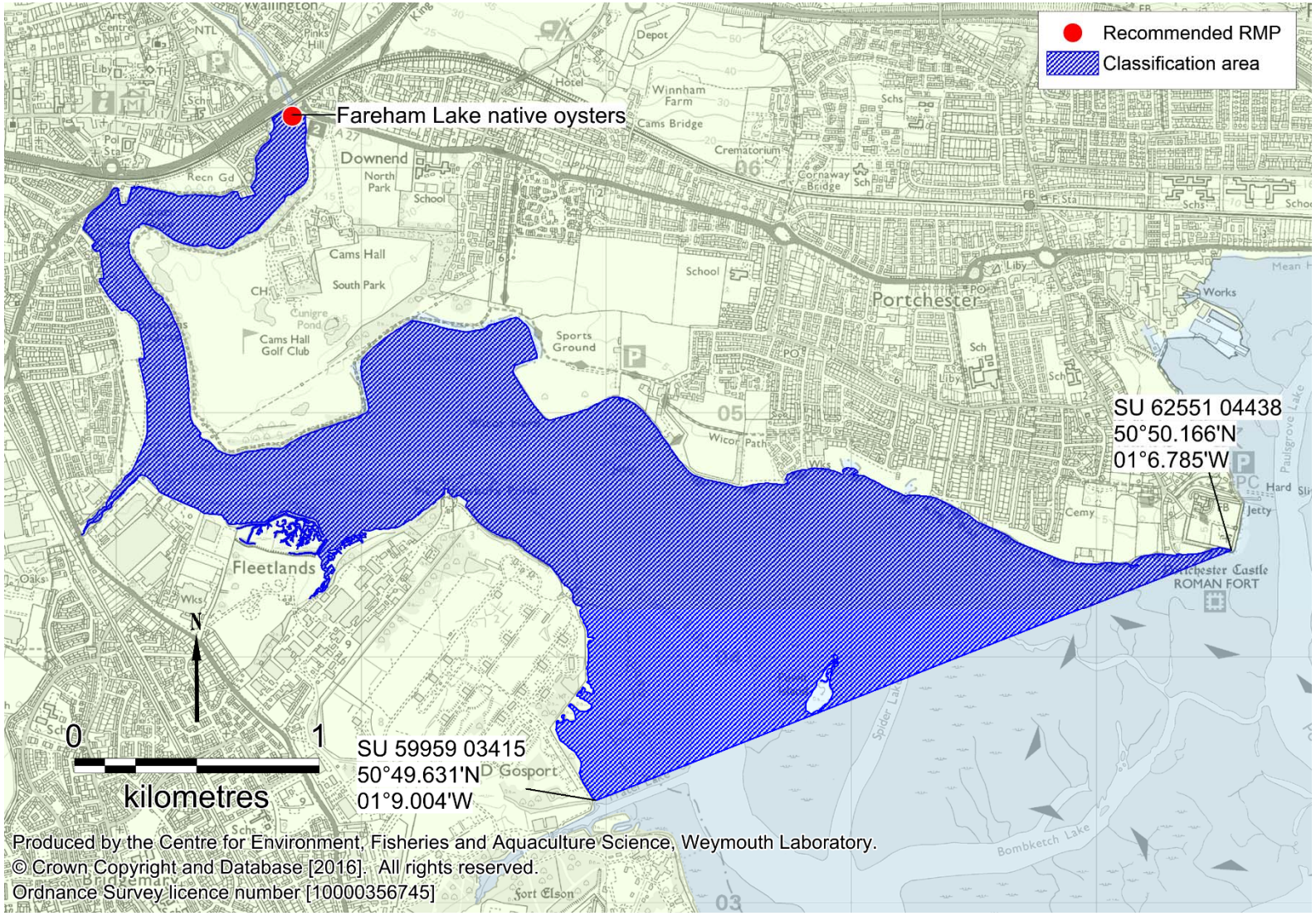

Figure 2: Recommended provisional production area and RMP for native oyster

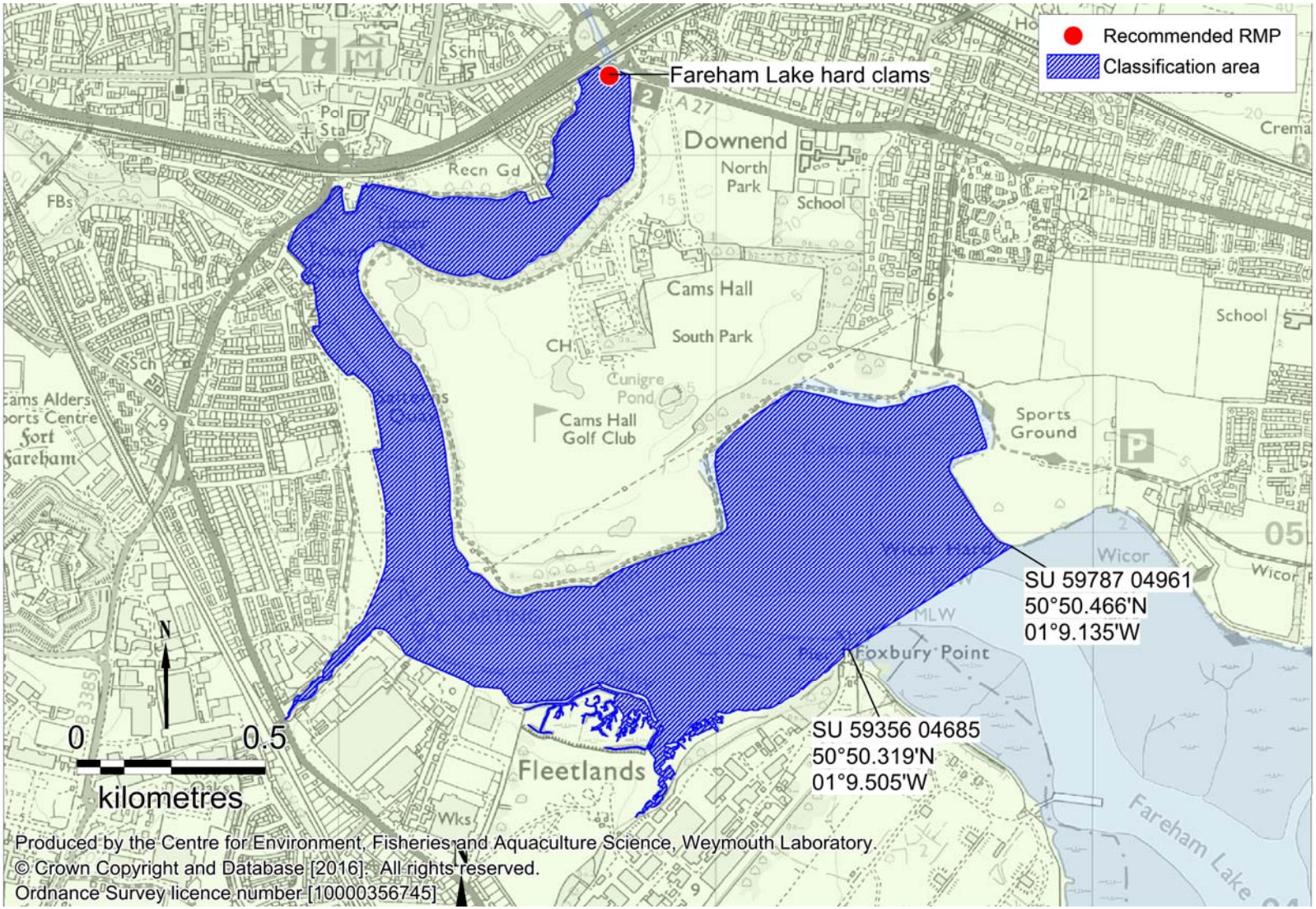

Figure 3: Recommended provisional production area and RMP for hard clams

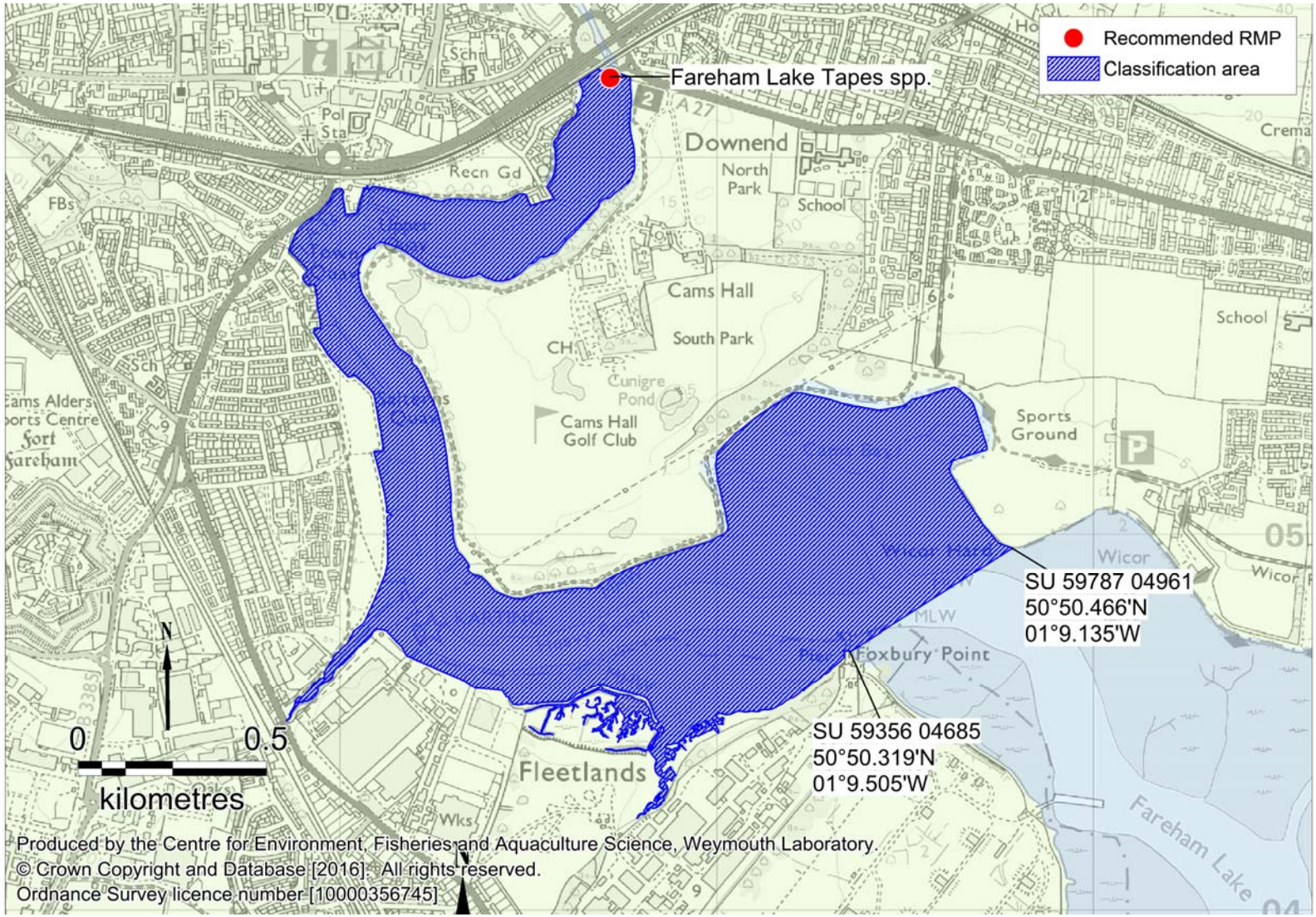

Figure 4: Recommended provisional production area and RMP for *Tapes* spp.

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