Scottish Sanitary Survey Project

Restricted Sanitary Survey Report
Ouse Ness
OI 452
March 2009

Report Distribution – Ouse Ness

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1. Area Overview

The Ouse Ness shellfish bed is located on the western coastline of the Isle of Westray in Papa Sound. The Isle of Westray is in the Orkney Islands off the north coastline of Scotland. The depth of the water surrounding the Ouse Ness headland is shallow ranging from 0 – 10 m and 1.4 km further away from the coastline this depth increases to 20 m. A restricted sanitary survey at Ouse Ness was conducted in response to receipt of an application to classify the area for commercial harvest of razor clams, rayed artemis, surf clams and sand gapers.

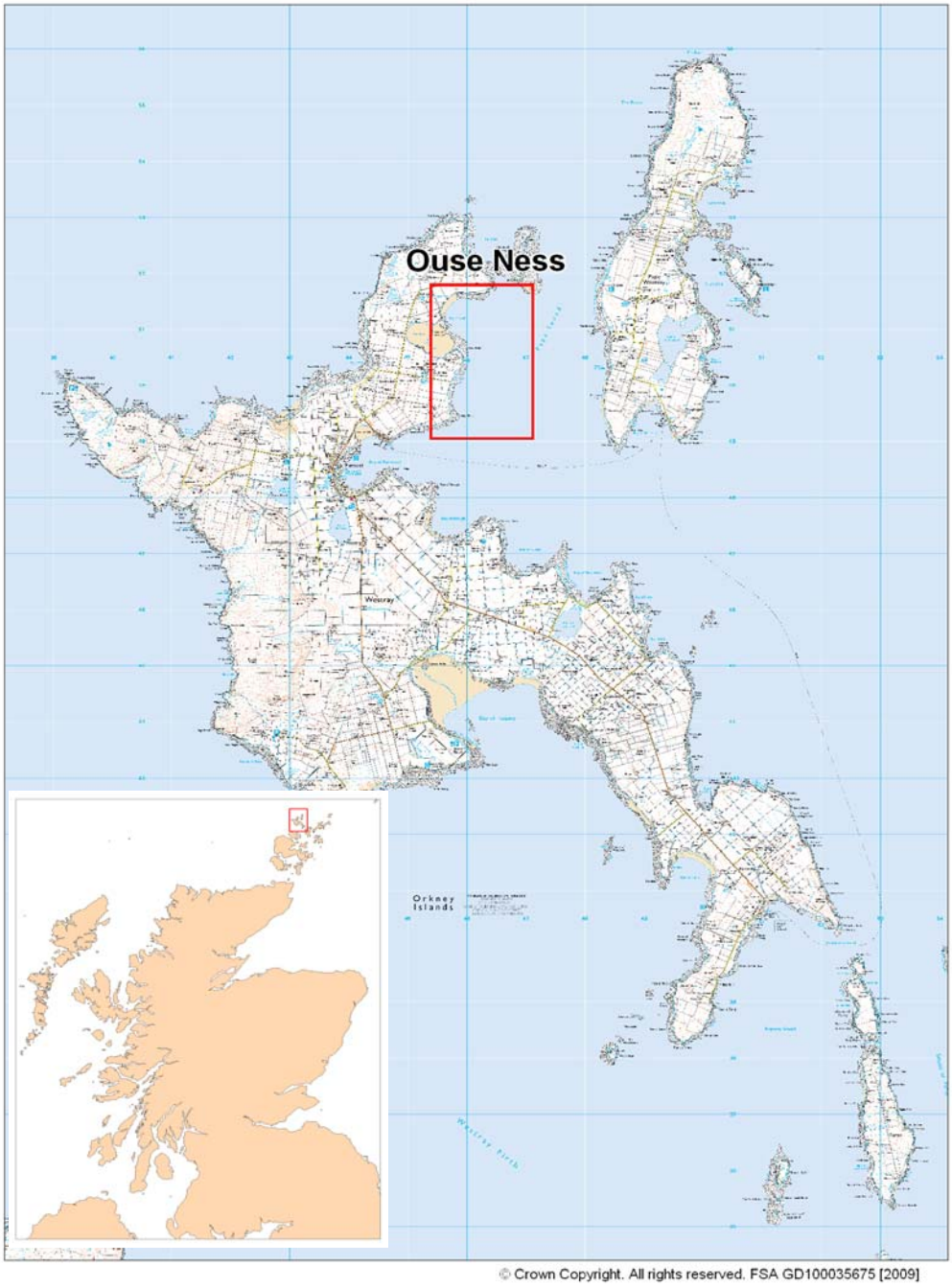


Figure 1.1 Location of Ouse Ness

As this was a restricted survey, and the proposed harvesting area was closer to Westray than Papa Westray, only potential sources of faecal contamination from the former are considered in this report. If a full survey is subsequently undertaken, sources on Papa Westray should also be considered.

1.1 Land Cover

The land cover along the immediate coastline of the Ouse Ness shellfish bed is composed primarily of improved grassland with some small areas of rough grassland. The areas of improved grassland along the coastline adjacent to the Ouse Ness shellfish bed would be expected to contribute significant amounts of contaminated runoff after heavy rainfall (Kay *et al*. 2008). Land cover characteristics were determined using aerial photographs and observations from the shoreline survey.

1.2 Human Population

Figure 1.2 shows the census output areas that are directly adjacent to Ouse Ness. There are five census output areas in close vicinity to Ouse Ness. There is only one large settlement, Pierowall, in this area. Pierowall is located southwest of the shellfish bed. Outside of Pierowall the rest of the population is scattered throughout the area. The main sources of human pollution are therefore likely to be concentrated around the Bay of Pierowall.

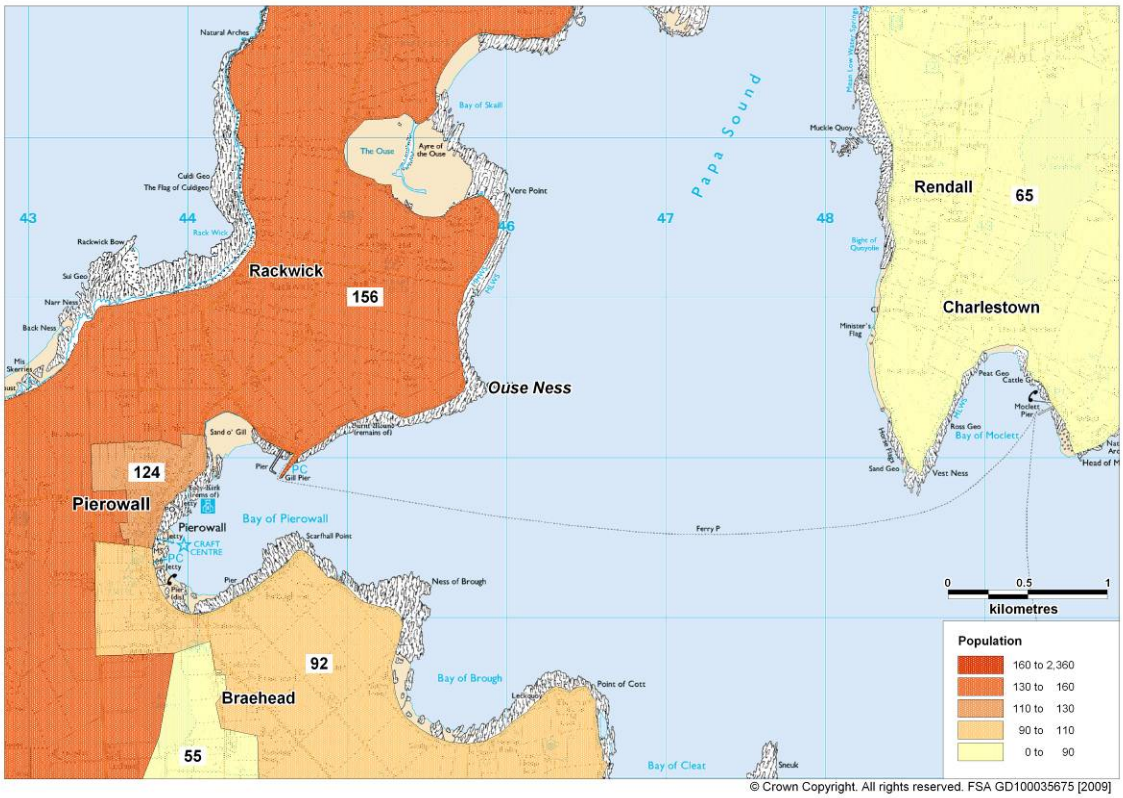


Figure 1.2 Human population surrounding Ouse Ness

2. Fishery

The fishery at Ouse Ness is comprised of the following wild shellfish beds:

Table 2.1 Ouse Ness shellfish

Production Area	Site	SIN	Species
Ouse Ness	Ouse Ness Razors	OI 452 856 16	Razors (*Ensis spp*)
Ouse Ness	Ouse Ness Surf Clams	OI 452 886 19	Surf Clams (*Spisula solida*)
Ouse Ness	Ouse Ness Rayed Artemis	OI 452 887 05	Rayed Artemis (*Dosinia exoleta*)
Ouse Ness	Ouse Ness Sand Gapers	OI 453 888 18	Sand Gapers (*Mya arenaria*)

Prior to the restricted sanitary survey, the production area boundaries and representative monitoring point (RMP) had not been assigned. There is no Crown Estate lease associated with this site. The shellfish beds do not fall within designated shellfish growing waters.

The Ouse Ness site is the area bounded by lines drawn between HY 466 505, HY 473 505, HY 473 491 and HY 465 491. The actual shellfish bed is located within the Ouse Ness site but the exact boundaries are not known.

During the shoreline survey, access to significant portions of the mapped site was restricted by the presence of creels. Dredging for samples was also not successful at all points where this was attempted. These aspects will restrict both the area that can be practically fished and the location of the recommended RMP.

The Ouse Ness site is intended to be harvested primarily for Razors (*Ensis spp*), but the harvester also plans to sell any surf clams, rayed artemis and sand gapers that are by-catch from the razor dredging. The shellfish are mechanically dredged within an area stretching from Aiker Ness down to Ouse Ness point (see Figure 2.1). The harvester plans to harvest the shellfish most of the year, apart from June to August.

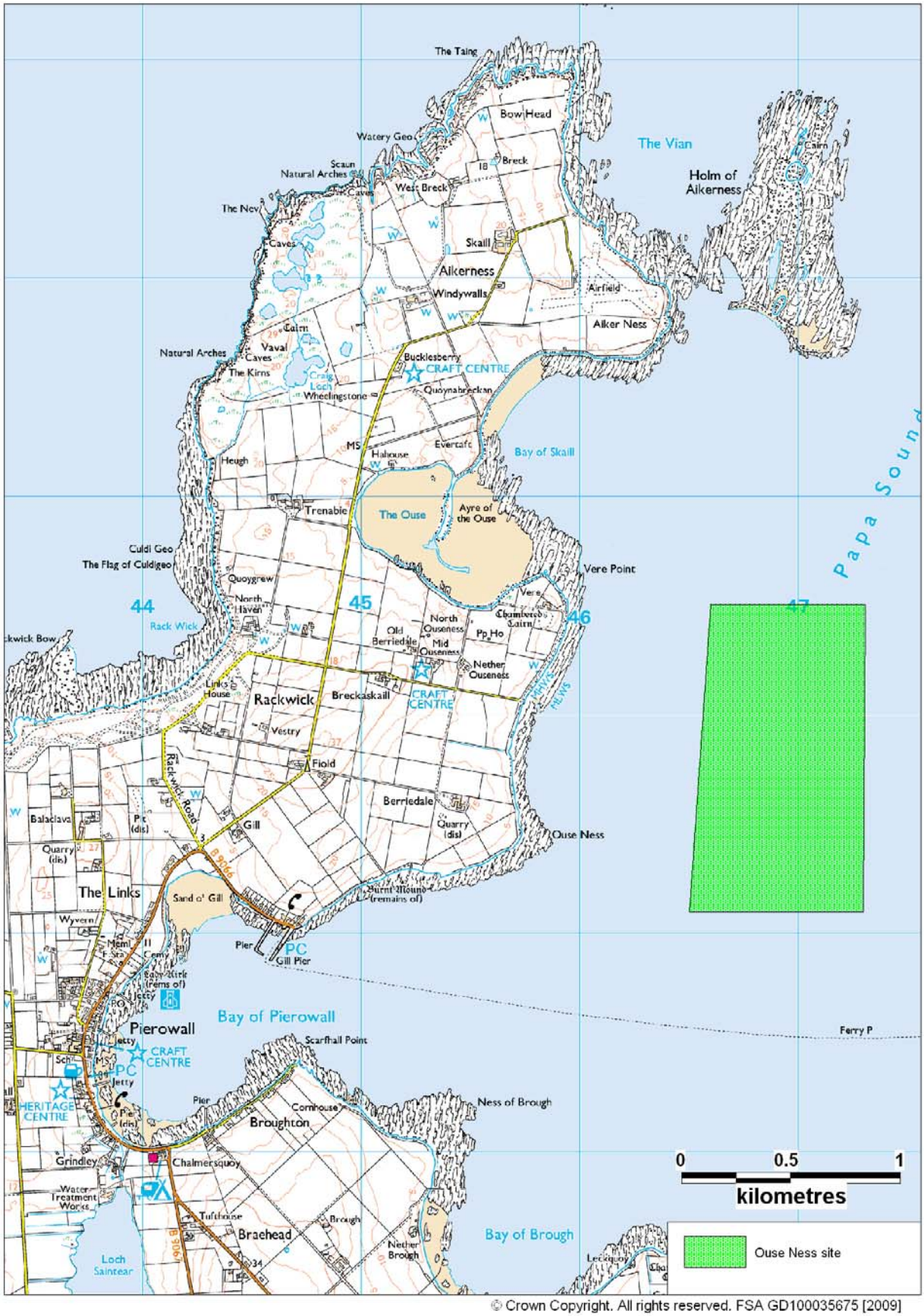


Figure 2.1 Ouse Ness fishery

3. Sewage Discharges

A number of discharge consents were issued by SEPA for the area adjacent to Ouse Ness. These are listed in Table 3.1 and mapped in Figure 3.1.

Table 3.1 SEPA discharge consents

Ref No.	NGR of discharge	Discharge Type	Discharges to	PE	Discharge m^3 day^{-1}
CAR/R/1011343	HY 4429 4995	Continuous	Land	5	-
CAR/L/1011950	HY 4386 4829	Continuous	Bay of Pierowall	100	22
CAR/R/1022170	HY 4414 4803	Continuous	Bay of Pierowall	5	-
CAR/R/1021578	HY 4446 4749	Continuous	Land	5	-
CAR/R/1029605	HY 4529 4762	Continuous	Bay of Brough	5	-

Community septic tanks and sewage discharges were identified by Scottish Water for the area adjacent to Ouse Ness. They are detailed in Table 3.2 and mapped in Figure 3.1.

Table 3.2 Discharges identified by Scottish Water

Discharge Name	NGR of discharge	Discharge Type	Level of Treatment	Consented flow m^3/day	Consented/ design pop
Pierowall Beach grove	HY 4387 4868	Continuous	Septic tank	16	92
Pierowall Lasting / Westray School	HY 4384 4853	Continuous	Septic tank	22	96

No sanitary or microbiological data were available for these discharges. SEPA did not provide permit information for these discharges.

Septic tanks and outfall pipes were also observed during the shoreline survey and these are listed in Table 3.3. Their locations have been included in the mapped discharges in Figure 3.1. Further details can be found in the shoreline survey report in the appendix. All of these sewage discharges were observed around the Bay of Pierowall. No discharges were reported or observed on the shoreline adjacent to the fishery itself.

Table 3.3 Observations of potential sewage discharges

No.	Date	NGR	Description of potential sewage discharge
1	02/04/2009	HY 44580 49053	Two pipes running into the sea. One pipe with a header cap & 59cm diameter.
2	02/04/2009	HY 44655 49020	Pipes x 2 coming out of the wall. Flowing down from Westray Fish Processor Ltd plant.
3	02/04/2009	HY 44658 48990	Pipe coming out of wall.
4	02/04/2009	HY 44565 49037	More pipes (13cm diameter) running into the sea.
5	02/04/2009	HY 44635 48945	Ferry waiting room toilets. Don't know where the toilets discharge.
6	02/04/2009	HY 44619 49031	15cm diameter pipe flowing out of wall.
7	02/04/2009	HY 44533 49057	15cm diameter pipe concreted over, suspected sewage pipe.
8	02/04/2009	HY 44545 49056	15cm diameter broken pipe, no flow.
9	02/04/2009	HY 44667 49002	12cm diameter pipe leading down into sea.
10	02/04/2009	HY 44502 49096	Two pipes, sewage fungus below both. One flowing, one not. Smell of sewage.
11	02/04/2009	HY 44476 49107	15cm diameter pipe covered in concrete. Suspected sewage pipe.
12	02/04/2009	HY 44459 49115	15cm diameter broken pipe, small flow.
13	03/04/2009	HY 45280 49271	10cm diameter yellow pipe flowing onto shoreline.

No.	Date	NGR	Description of potential sewage discharge
14	03/04/2009	HY 44696 49011	Large flow coming from broken pipe in wall.
15	03/04/2009	HY 44122 49233	Concrete pipe.
16	03/04/2009	HY 44103 48944	Pipe coming out of hill, going into the sea (can not sample).
17	03/04/2009	HY 43923 48775	15cm diameter pipe flowing onto shoreline.
18	03/04/2009	HY 43842 48680	10cm diameter pipe coming out of the wall going straight into the sand.
19	03/04/2009	HY 43839 48667	15cm diameter pipe flowing into the sea.
20	03/04/2009	HY 43823 48651	Suspected storm overflow for community septic tank. 30cm diameter pipe encased in concrete.
21	03/04/2009	HY 43818 48595	Suspected sewage pipe coming down from house under sand into the sea (can not sample).
22	03/04/2009	HY 43803 48571	16cm diameter pipe coming out of the wall, no flow.
23	03/04/2009	HY 43808 48555	11cm diameter pipe encased in concrete flowing into the sea, no flow.
24	03/04/2009	HY 43799 48552	10cm diameter pipe coming out of wall into pile of rocks/pebbles.
25	03/04/2009	HY 43797 48549	10cm diameter pipe on jetty, no flow.
26	03/04/2009	HY 43793 48546	Another 10cm diameter pipe coming from the same building as above.
27	03/04/2009	HY 43781 48515	Two pipes flowing out of the concrete block into the sea. Seafood processing plant behind.
28	03/04/2009	HY 43780 48511	Further pipes from above plant.
29	03/04/2009	HY 43782 48504	New pipes x 4, 3 x 11cm diameter, 1 x 15cm diameter.
30	03/04/2009	HY 43772 48438	11cm diameter pipe coming out of wall, very little flow, not enough to sample.
31	03/04/2009	HY 43766 48412	Two pipes, 1 x 11cm diameter, 1 x 9cm diameter, no flow. Houses behind.
32	03/04/2009	HY 43765 48334	17cm iron pipe (from Pierowall public toilets) flowing down to shoreline.
33	03/04/2009	HY 43776 48285	16cm diameter pipe, very small flow. 6 houses behind.
34	03/04/2009	HY 43782 48226	11cm diameter pipe. Possibly coming from the Pierowall Hotel.
35	03/04/2009	HY 43796 48192	30cm diameter pipe flowing into the sea, spilt in the middle (leaking).
36	03/04/2009	HY 43796 48185	11 cm pipe encased in concrete, small flow, sewage fungus present. House behind.
37	03/04/2009	HY 43816 48141	11cm diameter pipe flowing from house, sewage fungus.
38	03/04/2009	HY 43849 48106	15cm diameter pipe flowing from a house onto shoreline.
39	03/04/2009	HY 43843 48102	9cm diameter pipe, no flow.
40	03/04/2009	HY 44142 48040	11cm diameter pipe flowing out to sea (est. 30m out).
41	03/04/2009	HY 44277 48087	15cm diameter pipe, flow (jug) 28ml/3 seconds. Smell of sewage.
42	03/04/2009	HY 44314 48111	11cm diameter pipe encased in concrete
43	03/04/2009	HY 44357 48132	Pipe flowing into stream.
44	03/04/2009	HY 44441 48184	11cm diameter pipe going into sea.

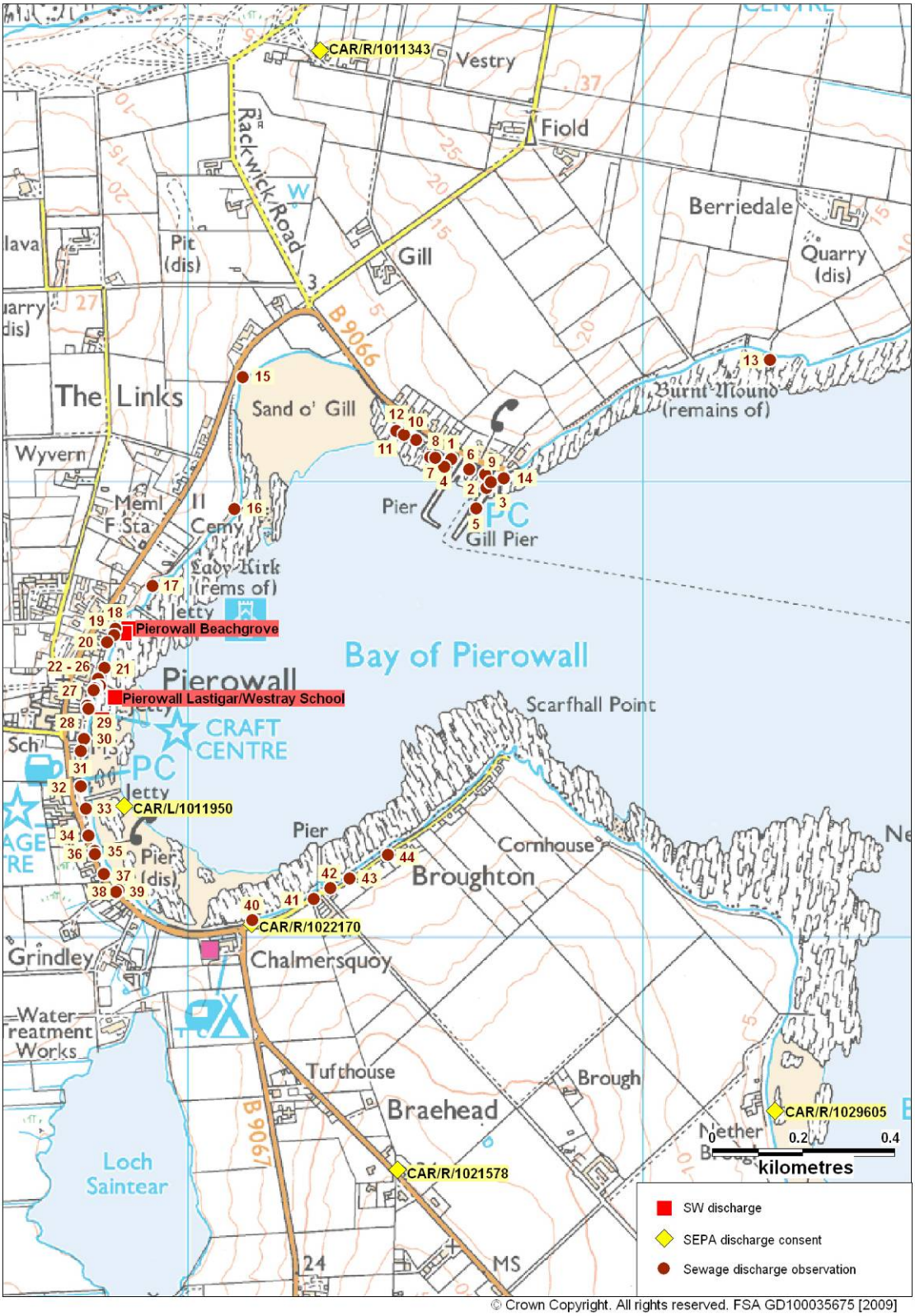


Figure 3.1 Sewage discharges at Ouse Ness

4. Animals

4.1 Livestock

The only significant source of information concerning livestock numbers in the area surrounding Ouse Ness was available from the shoreline survey. The shoreline survey only relates to the time of the site visits on the 2nd and 3rd March 2009.

During the shoreline survey, a dozen cattle were observed close to the shoreline near Everaft at the South end of the Bay of Skaill (see Figure 4.1). Two cattle troughs were observed near Hahouse on the west shore of The Ouse. The troughs were very close to the shoreline but separated from it by a fence. No sheep were observed during the shoreline survey; however sheep droppings were seen close to the shoreline just off the Ouse Ness headland, indicating that sheep had been present.

Overall based on this information any impact on the quality of the fishery from livestock would be expected to be slight but to be principally to the north of the Ouse Ness site.

4.2 Wildlife

While the Isle of Westray does host some colonies of breeding seabirds, the eastern coastline of Westray of does not host significant colonies. Seabirds such as gulls will always be present in the area but their distribution is likely to be even over time and as such would not materially affect placement of an RMP. During the shoreline survey oystercatchers and gulls were observed along most of the coastline (see Figure 4.1).

During the shoreline survey three individual groups of seals were spotted. The largest consisted of 6 seals, which were spotted resting on the shoreline at Vere Point. No specific data is available; however according to the harvester seals are frequently spotted resting all along the coastline.

The amount of *E. coli* and other faecal indicator bacteria contained in seal faeces has been reported as being similar to that found in raw sewage, with counts showing up to 1.21×10^4 cfu (colony forming units) *E. coli* per gram dry weight of faeces (Lisle et al 2004).

Given the proximity and numbers of seals present near the fishery and the numbers of faecal indicator bacteria present in seal faeces, it is possible that they contribute significantly to the load of faecal bacteria in the waters around Ouse Ness. As these animals are highly mobile and likely to hunt throughout the area, their impact may be widely spread and unpredictable.

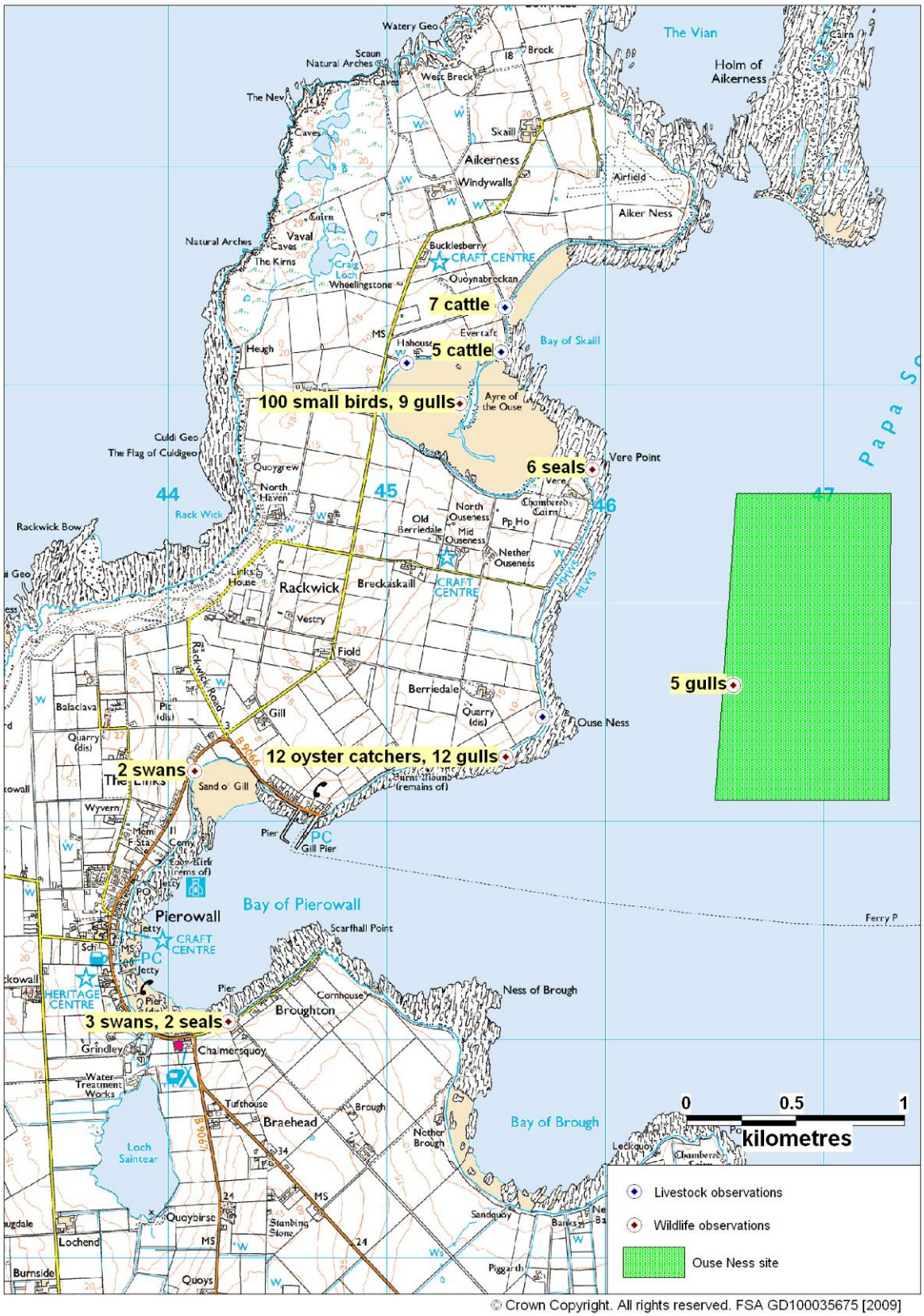


Figure 4.1 Livestock and wildlife present at Ouse Ness

5. Rainfall

The nearest weather station is located in Kirkwall approximately 39 km south of Ouse Ness. Rainfall data was supplied for the period 01/01/03 to 31/12/06 (total daily rainfall in mm). Rainfall data is complete for this period. Although the weather station is some distance from the production area, it is likely that the rainfall experienced in Kirkwall is broadly similar to that experienced at Ouse Ness and so is included in the analysis here.

High rainfall and storm events are commonly associated with increased faecal contamination of coastal waters through surface water run-off from land where livestock or other animals are present, and through sewer and wastewater treatment plant overflows (Mallin et al. 2001, Lee and Morgan 2003).

5.1 Rainfall at Kirkwall

Total annual rainfall and mean monthly rainfall were calculated, and are presented in Figures 5.1 and 5.2.

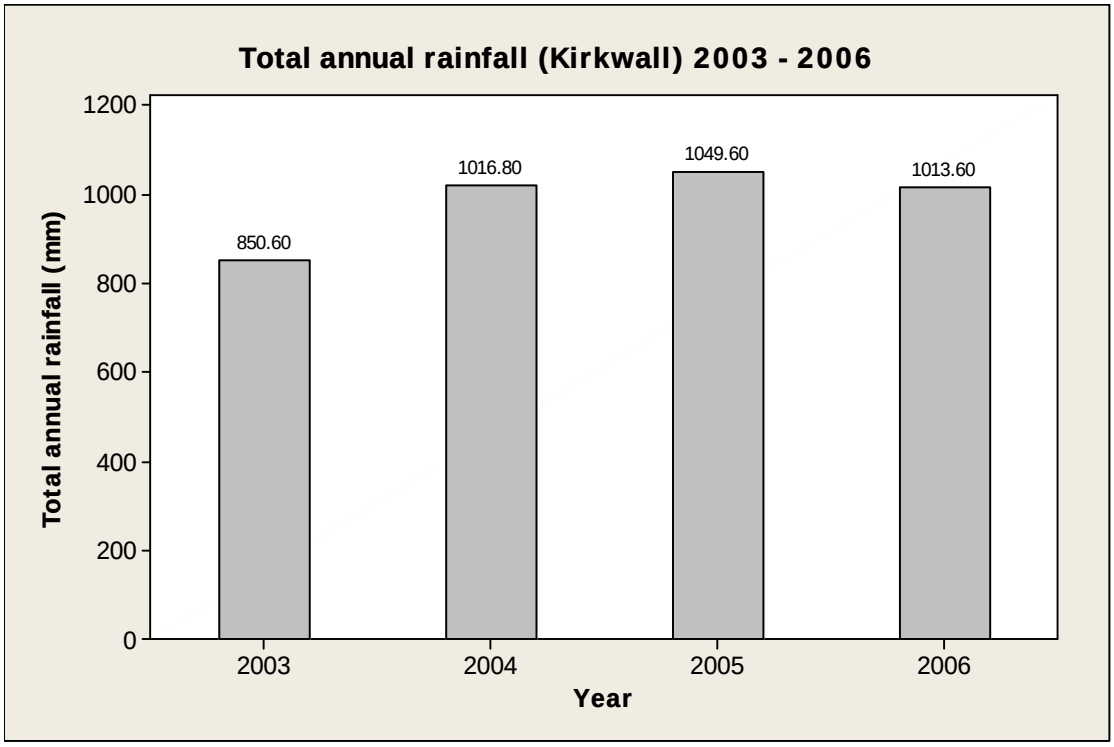


Figure 5.1 Total annual rainfall at Kirkwall 2003 – 2006

Total annual rainfall was considerably lower in 2003 compared to the following three years.

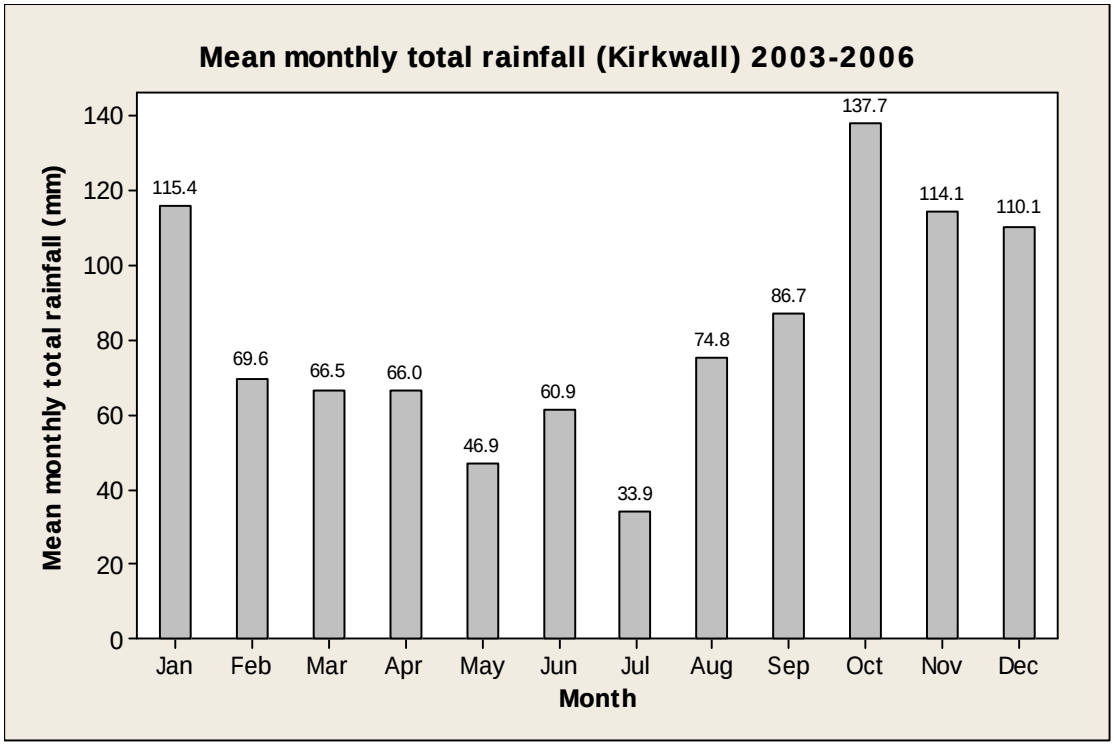


Figure 5.2 Mean total monthly rainfall at Kirkwall 2003 – 2006

Mean rainfall varies markedly between months. The wettest months were January, October, November and December. The largest increases in rainfall over the previous months occurred in August and October. For the period considered here (2003 – 2006), 26.8% of the days experienced no rainfall while 24.6% of days experienced rainfall between trace and 1 mm.

Periods of increased rainfall are generally associated with higher levels of contaminated surface water runoff. Marked changes in the level of rainfall may also cause significant wash off of accumulated material. This effect would be likely to be most significant in August but may possibly also occur in October.

Faecal contaminants from other sources may be independent of rainfall and so episodes of contamination may occur outside identified periods of higher rainfall, for example when livestock are present on the shoreline.

6. River Flow

There is no river gauging station in the vicinity of Ouse Ness. Five fresh water inputs were observed during the shoreline survey. These represented the largest freshwater inputs to the area and are listed in Table 6.1 and mapped in Figures 6.1.

Table 6.1 River flow and loadings – Ouse Ness

No	Grid Ref	Description	Width (m)	Depth (m)	Measured Flow (m/s)	Flow in m^3/day	*E. coli* (cfu/ 100 ml)	Loading (*E. coli* per day)
1	HY 45543 51359	Large stream	1.50	0.12	0.137	2130	70	1.5×10^9
2	HY 45018 51034	Stream	0.23	0.03	0.45	268	20	5.4×10^7
3	HY 44973 50989	Stream	0.12	0.05	0.074	38.4	170000	6.5×10^{10}
4	HY 44258 49268	Stream	0.25	0.15	0.453	1470	230	3.4×10^9
5	HY 43764 48313	River	0.12	0.08	0.23	190	24000	4.6×10^{10}
6	HY 43903 48040	River	2.0	0.20	0.895	30900	30	9.3×10^9

Calculated loadings are based on the flows and dimensions recorded during the shoreline survey and do not necessarily reflect those that would apply under different conditions. They show that at the time of the survey significant fresh water inputs were located both to the northwest and southwest of the Ouse Ness site but not immediately to the west of it.

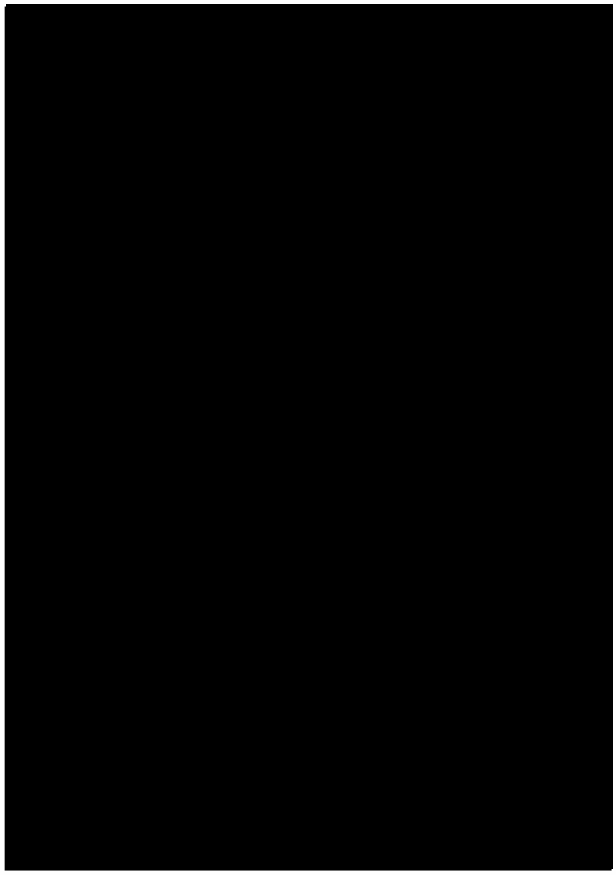
Figure 6.1 Location of river flows and loadings at Ouse Ness

Where the bacterial loading is labelled as on the map, the scientific notation is written in digital format, as this is the only format recognised by the mapping software. So, where normal scientific notation for 1000 is 1×10^3, in this case it would be written as 1E+3.

7. Historical *E. coli* Monitoring Data

There was no historical *E. coli* monitoring data available for Ouse Ness at the time of writing this report.

8. Bathymetry and Hydrodynamics



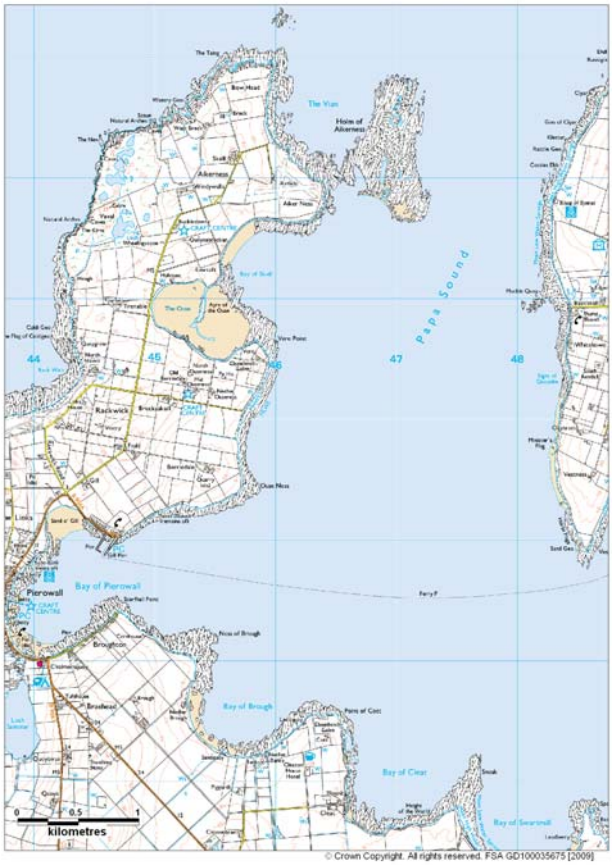


Figure 8.1 Ouse Ness bathymetry
Figure 8.2 Ouse Ness

The bathymetry chart above (Figure 8.1) shows that there is a drying area following the length of the coastline. The depth of the shellfish bed varies from 5 m to more than 10 m. The depth then increases up to 50 m in the channel between Westray and Papa Westray in the south and off the north west coast of Westray.

8.1 Tidal curve and description

The two tidal curves below are for the port of Pierowall, the nearest secondary port– they have been output from UKHO TotalTide. The first is for seven days beginning 00.00 GMT on 19th February 2009. The second is for seven days beginning 00.00 GMT on 26th February 2009. Together they show the predicted tidal heights over high/low water for a full neap/spring tidal cycle.

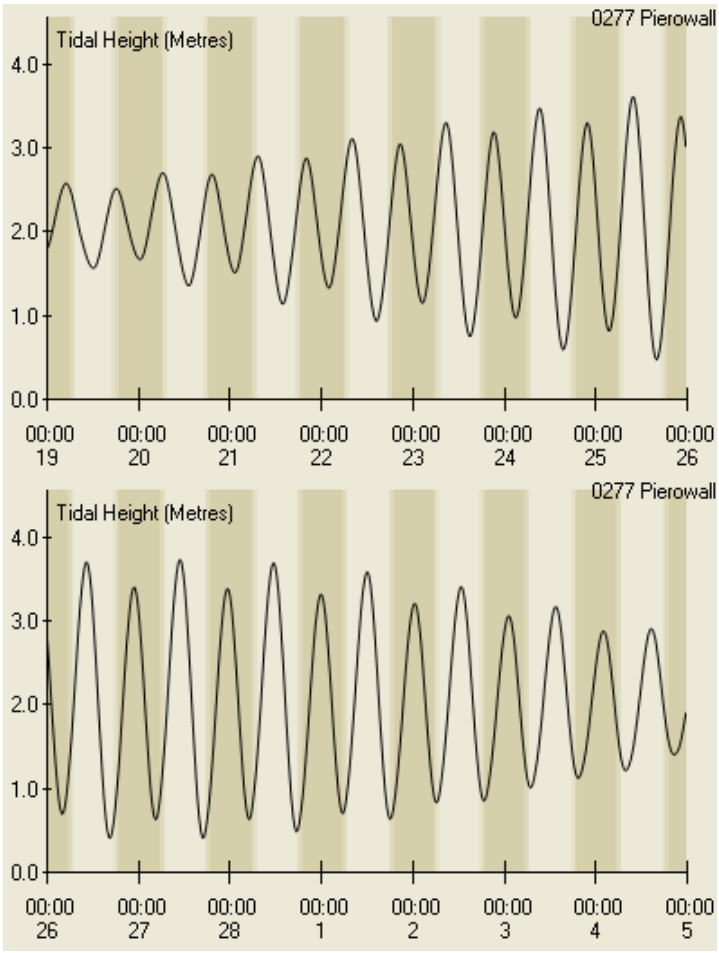


Figure 8.3 Tidal curves for Pierowall

The following is the UKHO summary description for Pierowall:
The tide type is Semi-Diurnal.

MHWS	3.7 m
MHWN	2.8 m
MLWN	1.4 m
MLWS	0.6 m

Predicted heights are in metres above chart datum. The tidal range at spring tide is therefore approximately 3.1 m and at neap tide 1.4 m.

8.2 Currents

There is no tidal diamond on the northern side of the Isle of Westray. Those on the southern side would not be suitable for analysis at the Ouse Ness site. In general, tidal currents between the Orkney Isles vary between 1 and 5 knots (0.5 to 2.5 m/s) at spring tides (they will be approximately half of this at neap tides) depending on channel width, depth and orientation. Comparing with channels to the south for which there is tidal stream information, it was estimated that peak currents at Ouse Ness will be between 3 and 5 knots (1.5

to 2.5 m/s). The Clyde Cruising Club Sailing Directions (2003) for the Orkneys gives the spring tide current through the Holm of Aiker Ness as 3 knots.

Without further information it is not possible to predict the direction of flow through Papa Sound in relation to flood and ebb tides as the tidal flows in the vicinity are complicated by the interaction of water flowing around the eastern and western isles of the British mainland and the flows around the islands themselves.

8.3 Conclusions regarding effect on impacting sources

In general, relatively strong southerly flows could take diffuse contamination originating to the north of the fishery down across the area and northerly flows could take the human inputs from the Pierowall area up across the area. However, in practice, it is likely that contamination from these sources would actually be transported along between the Westray shore and the fishery. Any contamination arising from the Papa Westray side would also be likely to impact the fishery. Additionally, the relatively deep water at the fishery (5-10 metres chart datum) would markedly dilute any contamination and the relatively strong currents would quickly flush any residual contamination out of the area, this effect would be greatest around spring tide.

9. Shoreline Survey Overview

A restricted shoreline survey of the Ouse Ness shoreline was undertaken by staff from Cefas and Orkney Islands Council on the 2nd and 3rd March 2009.

Sub surface sea water samples were taken at several points along the coastline from Vere Point to Chalmersquoy and also from the fishing boat within the shellfish bed area. Results ranged from <1 to 310 *E. coli* cfu/100 ml. There was one very high result of 2.5 x 10^3 *E. coli* cfu/100 ml; this was taken from Vere Point.

Fresh water samples were taken all along the coastline of the Ouse Ness shellfish bed area at streams and flowing outfall pipes. Results ranged from <10 to >3.0 x 10^5 *E. coli* cfu/100 ml. There are seven samples above 300 *E. coli* cfu/100 ml. Five of these samples were taken from suspected sewage outfall pipes discharging into the Bay of Pierowall. One of the streams with a result of 1.7 x 10^5 *E. coli* cfu/100 ml discharged into The Ouse and the second stream with a result of 2.4 x 10^4 *E. coli* cfu/100 ml discharged into the Bay of Pierowall. The most likely source of contamination to these is diffuse pollution from livestock.

Some cattle were present near the shoreline north of The Ouse and some sheep droppings were observed near the shoreline at Vere Point. However, fences often restricted direct access to shoreline.

Razor samples were collected at one point at the southern end of the shellfish bed, off the coast of the Ouse Ness headland. The razor samples returned low results of <20 and 80 *E. coli* MPN/100 g. Rayed artemis samples where also sampled at the same point as the razor clam samples. The rayed artemis samples returned two low results of <20 *E. coli* MPN/100 g.

A map is provided in Figure 9.1 that shows the relative locations of the most significant findings of the shoreline survey. Where the bacterial concentration is labelled, the scientific notation is written in digital format, as this is the only format recognised by the mapping software. So, where normal scientific notation for 1000 is 1 x 10^3, in this case it would be written as 1E+3.

In summary, identified sources of potentially significant contamination are:

- Contaminated freshwater streams in the area
- Contaminated outfall pipes in the area
- Livestock grazing on the shoreline

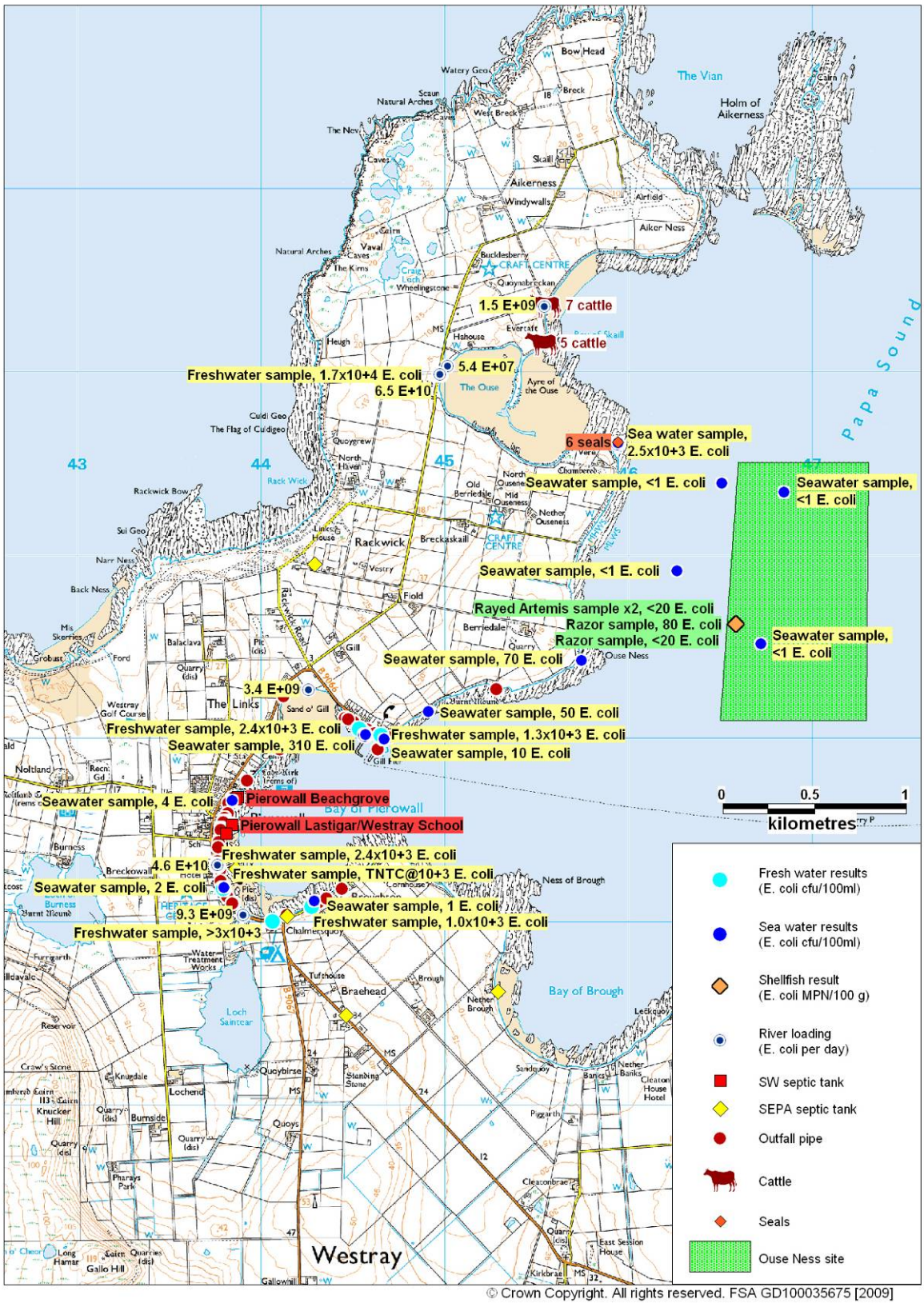


Figure 9.1 Summary of shoreline observations

10. Overall Assessment

Human sewage inputs

The town of Pierowall has a population of 124 (2001 census) and is the largest settlement adjacent to the Ouse Ness shellfish bed. North of Pierowall there are some scattered dwellings. In Pierowall there are some public toilets, four identified septic tanks and numerous outfall pipes discharging into the Bay of Pierowall. The bulk of the human contamination is therefore located south of the fishery.

Agricultural inputs

The only livestock observed during the shoreline survey were a dozen cattle grazing close to the shoreline just north of The Ouse. Sheep droppings were observed on the Ouse Ness headland close to the shoreline but no sheep were visible. The concentration of livestock overall is generally low in this area. The exact amount, location and timing of faecal inputs from these livestock sources is likely to be variable and unpredictable. However, they could primarily be located to the north of the fishery.

Wildlife inputs

During the shoreline survey 100 small birds and 9 gulls were observed in The Ouse. A dozen oyster catchers and gulls were also spotted close to the Ouse Ness headland. Five swans were observed in the Bay of Pierowall. A group of seals was spotted at Vere Point and also in the Bay of Pierowall. Whilst the Isle of Westray does host some colonies of breeding seabirds, the Ouse Ness stretch of coastline does not host significant colonies. Seabirds such as gulls will always be present along the coastline but their distribution is likely to be even over time and as such would not materially affect placement of an RMP.

Wildlife such as dolphins, porpoises, whales, water birds and otters may be present at times in the area, but not in large numbers.

Seasonal variation

There were no historical monitoring results available to establish a pattern of seasonal variation.

Seasonal rainfall is highest in winter and historically much higher in August and October than in the preceding months.

Livestock numbers in the area as a whole are likely to be at their highest during the summer months when calves and lambs are present. During the warmer months livestock may access streams to drink and cool off more frequently, leading to higher levels of faecal contamination in freshwater streams and the shellfish bed itself. There is likely to be an increase in human presence during the summer months.

Rivers and streams

All five streams and rivers discharging onto the Ouse Ness shellfish bed were sampled. There was one stream discharging into the Bay of Skaill and two streams discharging into The Ouse. The *E. coli* loading of these streams were 1.5×10^9, 5.4×10^7 and 6.5×10^{10}. There were also three streams discharging into the Bay of Pierowall with *E. coli* loadings of 3.4×10^9, 4.6×10^{10} and 9.3×10^9. None of these fresh water inputs discharge directly onto the shellfish bed but either into The Ouse or the Bay of Pierowall. Overall it is expected that the freshwater inputs into Ouse Ness will have a relatively low effect on the bacterial contamination of shellfish.

Rainfall

Rainfall patterns at Kirkwall (the nearest rainfall station) show rainfall levels are higher between August and January than during the remainder of the year. An increase in rainfall, especially early in this period and after the dry summer months, may be expected to wash a flush of bacteria from the surrounding land into the production area. The impact of this is likely to be most acute nearest where the streams enter the sea.

Analysis of results

There are no historical monitoring results available for Ouse Ness.

Seawater samples were taken at several points along the coastline. Results were low overall ranging from <1 to 310 *E. coli* (cfu/100 ml). There was one high result of 2.5×10^3 *E. coli* (cfu/100 ml), taken from Vere Point.

Fresh water samples were taken all along the coastline of the Ouse Ness shellfish bed area from flowing outfall pipes. Results ranged from <10 to >3.0×10^5 *E. coli* (cfu/100 ml).

Razor clam samples were collected at one point at the southern end of the shellfish bed, off the coast of the Ouse Ness headland. The razor clam samples returned low results of <20 and 80 *E. coli* (MPN/100 g). The rayed artemis samples returned two low results of <20 *E. coli* (MPN/100 g).

Movement of contaminants

Contamination originating on Westray to the north and south of the estuary will be expected to be transported north/southwards (depending on the tidal state) between the coast and the fishery and not to impact on the latter. There will be significant dilution of any contamination and the area will be subject to significant flushing, especially at spring tide.

Overall conclusions

The main human sources of contamination were in the Bay of Pierowall and would mostly likely to impact on the south-western end of the harvesting area, if at all. The low number of farm animals and wildlife at the time of the

shoreline survey were located at the north and west of the harvesting area and would be not likely to affect there parts of the fisheries again, if at all. However, a high seawater result of 2.5 x 10^3 *E. coli* (cfu/100 ml) was obtained at Vere Point on the day of the shoreline survey. It should be noted that no estimate of contamination was undertaken for possible sources on Papa Westray, although these would be assured to be less significant than those on Westray.

11. Recommendations

The only successful dredging attempt was at HY 46586 49627. Razor clams and rayed artemis were obtained at this point. This is on the western side of the harvesting area and would be expected to be most impacted by sources on Westray. It is therefore proposed that the RMP be located at HY 4660 4970 with a tolerance of 150 m. All four species should be sampled initially and this approach reviewed when sufficient data is available.

It is proposed that the production area be defined as the area bounded by lines drawn between HY 4640 4900 and HY 4640 5060 and between HY 4640 5060 and HY 4740 5060 and between HY 4740 5060 and HY 4740 4900 and between HY 4740 4900 and HY 4640 4900. This area will cover the fishery as identified by the harvester and the locations when dredged during the day of the survey.

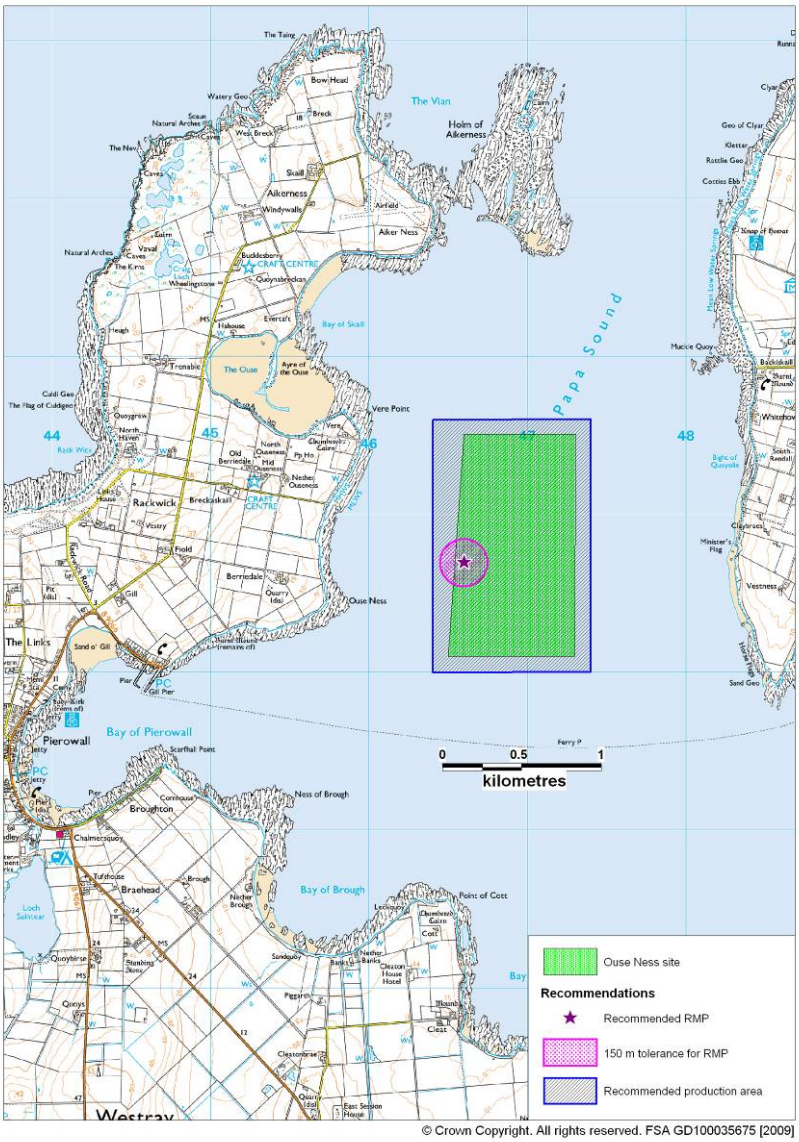


Figure 11.1 Recommendations for Ouse Ness

12. References

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13. List of Figures and Tables

Figures

Tables

Appendices

1. **Summary Sampling Plan**
2. **Shoreline Survey Report**

Sampling Plan for Ouse Ness

PRODUC-TION AREA	SITE NAME	SIN	SPECIES	TYPE OF FISH-ERY	NGR OF RMP	EAST	NORTH	TOLER-ANCE (M)	DEPTH (M)	METHOD OF SAMPLING	FREQ OF SAMPLING	LOCAL AUTHORITY	AUTHORISED SAMPLER(S)	LOCAL AUTHORITY LIAISON OFFICER
Ouse Ness	Ouse Ness Razors	OI 452	Razor clams, Rayed Artemis, Surf Clams, Sand Gapers	Wild harvest	HY 4660 4970	346600	1049700	150	NA	Dredging	Monthly	Orkney Islands Council	Julie Murphy	Julie Murphy

Shoreline Survey Report

Ouse Ness
OI 452

Shoreline Survey Report

Production area:	Ouse Ness	
Site name:	Ouse Ness	
Species:	Razor Clams	
	Rayed Artemis	
	Surf Clams	
	Sand Gapers	
Harvester:	Robert Hutchinson	
Local Authority:	Orkney Islands Council	
Status:	New application	
Date Surveyed:	Monday 2nd March 2009 & Tuesday 3rd March 2009	
Surveyed by:	Jessica Larkham	Cefas
	Dr Ron Lee	Cefas
	Julie Murphy	Orkney Islands Council
Existing RMP:	N/A	
Area Surveyed:	See Figure 1 & 2.	

Weather observations
Monday 2nd March: Cloudy, strong winds, 3-4m swell, some showers, 5.8°C.
Tuesday 3rd March: Scattered clouds, moderate wind, 1-2m swell, heavy showers late afternoon.

Site Observations

Fishery

The Ouse Ness site is intended to be primarily harvested primarily for Razors (*Ensis spp*), but the harvester also plans to sell any Rayed artemis, Surf clams and Sand gapers that are by catch from the razor dredging. The shellfish are mechanically dredged within an area stretching from Aiker Ness down Ouse Ness point. The razors are priority to the harvester with any clams being collected from the by catch. The harvester plans to harvest the shellfish every month apart from June to August.

Sewage/Faecal Sources

The area surveyed includes the town of Pierowall and then individual scattered dwellings along the rest of the coastline. There are three large community septic tanks and two smaller ones registered within the town of Pierowall. During the shoreline survey a large number sewage outfall pipes were recorded and sampled. Outfall pipes were present every 5 – 20m on the shoreline around the Bay of Pierowall and on the road leading from Gill Pier. There were only two outfall pipes observed along stretch of coastline leading from the Bay of Skaill down to Gill Pier. The first pipe was observed mid way round The Ouse and was suspected surface water and the second pipe was south west along from the Ouse Ness headland and located down from a farm.

Seasonal Population

There is one caravan and several tent pitches on the western side of Pierowall. There is one large hotel and three B&Bs in Pierowall and about eight self-catering flats and cottages.

Boats/Shipping

There is occasional shipping activity some distance offshore from Westray. There are two ferry routes going from Pierowall (Pierowall to Rapness and Pierowall to Papa Westray) and another ferry route going from Rapness at the south of the island of Westray to Kirkwall on the mainland. Pierowall harbour had 9 fishing boats moored at the time of the survey, with no visible pump out facilities. One yacht was observed moored off shore from the Sand O'Gill.

Land Use

The land use surrounding Ouse Ness was primarily grassland and bog. Few livestock was observed at the time of the shoreline survey. No sheep were observed and a dozen cattle were spotted close to the shoreline near Evertaft at the south end of the Bay of Skaill.

Wildlife/Birds

During the shoreline survey seals were seen resting on the shoreline around Vere Point and in the Bay of Pierowall. Oyster catchers and gulls were observed all along the shoreline. Two swans were also seen in the Bay of Pierowall.

Shoreline observations can be found in Table 1 and the locations are shown in Figure 1.

Figure 1. Shoreline observations – Bay of Skaill to Pierowall

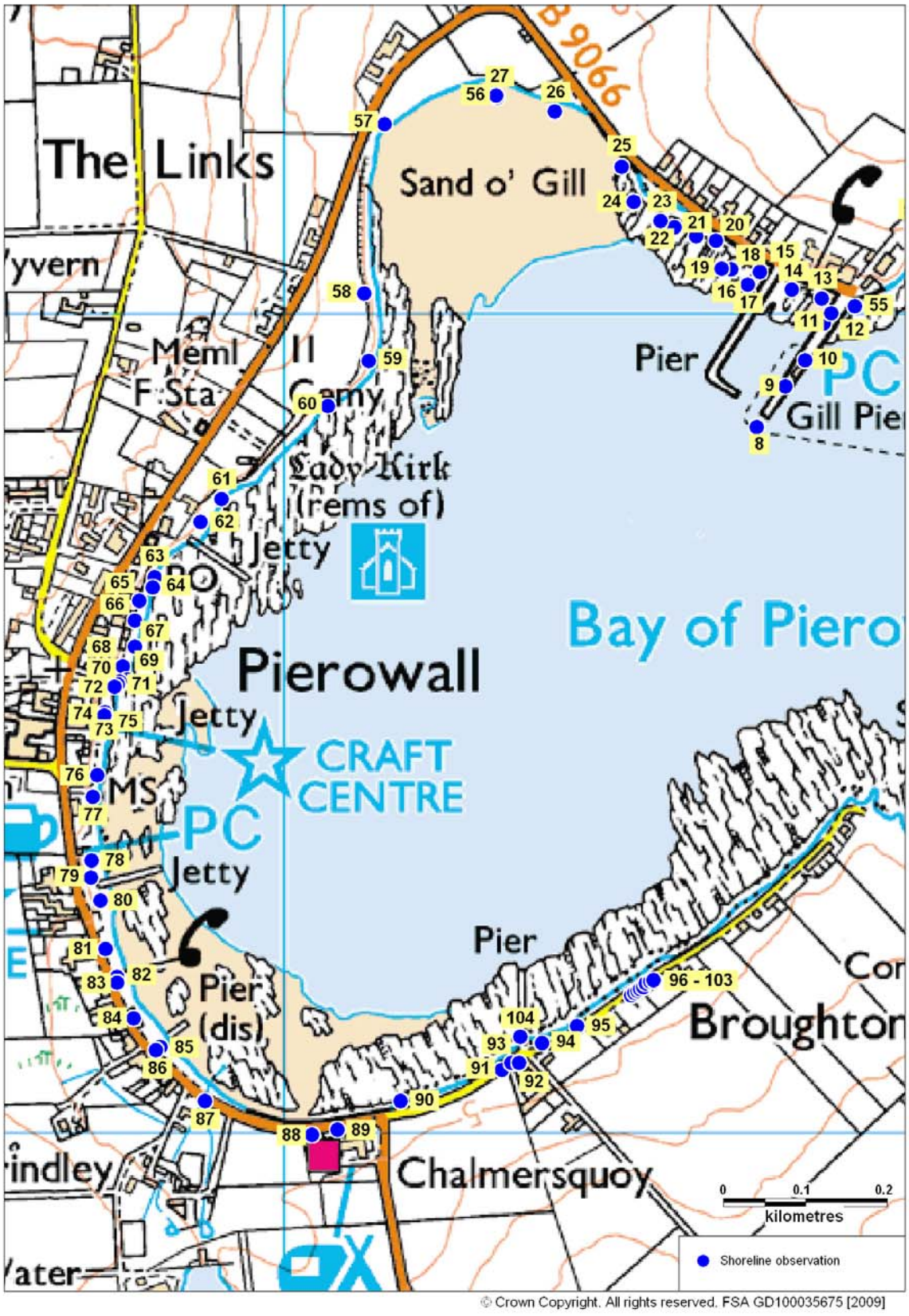

Figure 2. Shoreline observations – Bay of Pierowall

Table 1. Shoreline observations

No.	Date	Time	NGR	East	North	Associated photograph	Description
1	02/03/09	9:33 AM	HY 46484 49506	346484	1049506	-	Start of dredge no.1 (failed). Dredging in circular motion. 4 fathoms depth. Looking towards Ouse Ness shoreline from boat: approx. 40 houses scattered along the shoreline.
2	02/03/09	9:48 AM	HY 46472 49902	346472	1049902	Figure 7	Second attempt at 1st dredge. Dredging in a circular motion.
3	02/03/09	9:54 AM	HY 46586 49627	346586	1049627	Figures 8 & 9	5 gulls. Ouse Ness shellfish sample 1 & 2 (Razors). Ouse Ness shellfish samples 3 & 4 (Rayed Artimis).
4	02/03/09	10:33 AM	HY 46263 49919	346263	1049919	-	Ouse Ness seawater sample 1.
5	02/03/09	10:42 AM	HY 46507 50397	346507	1050397	-	Ouse Ness seawater sample 2. Salinity = 34ppt.
6	02/03/09	10:46 AM	HY 46846 50349	346846	1050349	-	Ouse Ness seawater sample 3. Salinity = 34.5ppt.
7	02/03/09	10:52 AM	HY 46720 49521	346720	1049521	-	Ouse Ness seawater sample 4. Salinity = 34.6ppt.
8	02/03/09	3:41 PM	HY 44576 48863	344576	1048863	Figure 10	End of Gill Pier - Start of walk. 9 fishing boats moored.
9	02/03/09	3:44 PM	HY 44611 48913	344611	1048913	-	Bunded oil storage tank.
10	02/03/09	3:45 PM	HY 44635 48945	344635	1048945	-	Ferry waiting room toilets. Don't know where the toilets go.
11	02/03/09	3:46 PM	HY 44658 48990	344658	1048990	-	Flow coming out of pipe in wall. Ouse Ness fresh water 1.
12	02/03/09	3:51 PM	HY 44667 49002	344667	1049002	Figure 11	12cm diameter pipe leading down into sea. Ouse Ness seawater 5 (15:55).
13	02/03/09	3:55 PM	HY 44655 49020	344655	1049020	Figure 12	Pipes x 2 coming out of the wall. Ouse Ness fresh water sample 2. Flow (jug) 1 litre/4 seconds. Flowing down from Westray Fish Processor Ltd plant.
14	02/03/09	4:00 PM	HY 44619 49031	344619	1049031	Figure 13	15cm diameter pipe flowing out of wall. Ouse Ness fresh water sample 3 (16:03). Flow (jug) 0.5 litre/4 seconds.
15	02/03/09	4:06 PM	HY 44580 49053	344580	1049053	Figure 14	Two pipes running into the sea. One pipe with a header cap/59cm diameter.
16	02/03/09	4:14 PM	HY 44565 49026	344565	1049026	-	Ouse Ness seawater sample 6 (16:15). Taken next to pipes mentioned above.
17	02/03/09	4:16 PM	HY 44565 49037	344565	1049037	-	More pipes (13cm diameter) running into the sea.
18	02/03/09	4:19 PM	HY 44545 49056	344545	1049056	-	15cm diameter broken pipe, no flow.
19	02/03/09	4:20 PM	HY 44533 49057	344533	1049057	-	15cm diameter pipe concreted over. Ouse Ness fresh water sample 4 (16:22), suspected sewage pipe.
20	02/03/09	4:24 PM	HY 44526 49091	344526	1049091	-	Pipe from wall, small flow, suspected surface water runoff.
21	02/03/09	4:26 PM	HY 44502 49096	344502	1049096	Figure 15	Two pipes, sewage fungus below both. One flowing, one not. Ouse Ness fresh water sample 5 (16:32). Flow (jug) 0.5 litre/3.5 seconds. Smell of

No.	Date	Time	NGR	East	North	Associated photograph	Description
							sewage.
22	02/03/09	4:33 PM	HY 44476 49107	344476	1049107	Figure 16	15cm diameter pipe covered in concrete. Ouse Ness fresh water sample 6 (11:35). Suspected sewage pipe.
23	02/03/09	4:37 PM	HY 44459 49115	344459	1049115	Figure 17	15cm diameter broken pipe, small flow. Ouse Ness fresh water sample 7. Approx. 20 houses along this road, pipes running to shore from most of them.
24	02/03/09	4:40 PM	HY 44426 49138	344426	1049138	-	Mound of broken pipes - no apparent source or attachments. Photo of Sand O'Gill
25	02/03/09	4:42 PM	HY 44411 49181	344411	1049181	-	Surface water drain.
26	02/03/09	4:45 PM	HY 44330 49249	344330	1049249	-	Boats on shore. Several farms behind on hill (photo).
27	02/03/09	4:47 PM	HY 44260 49266	344260	1049266	Figure 18	Stream running onto beach. Will be sampled and measured on following day.
28	03/03/09	9:30 AM	HY 45543 51359	345543	1051359	Figures 19, 20, 21 & 22	Large stream running into Bay of Skaill. W 1.50, D 0.07 - Flow 0.137, D 0.12 - Flow 0.219. Ouse Ness fresh water sample 8. 7 cattle in field behind.
29	03/03/09	9:40 AM	HY 45558 51225	345558	1051225	-	End of Bay of Skaill. Start of rocky shoreline. Fields behind shoreline fenced off.
30	03/03/09	9:44 AM	HY 45526 51154	345526	1051154	-	5 cattle 100m inland. 1 seal off the shoreline.
31	03/03/09	9:57 AM	HY 45336 50917	345336	1050917	-	100 small birds, 9 gulls. 2 houses on the shoreline.
32	03/03/09	10:03 AM	HY 45093 51105	345093	1051105	-	2 cattle troughs in field close to shoreline that is fenced off. No cattle visible.
33	03/03/09	10:06 AM	HY 45018 51034	345018	1051034	-	Small stream W 0.23, D 0.03, Flow 0.450. Ouse Ness fresh water sample 9. Farm inland, 500m to W slightly.
34	03/03/09	10:13 AM	HY 44999 51008	344999	1051008	-	Flooded field next to shoreline causing runoff down to beach.
35	03/03/09	10:18 AM	HY 44973 50989	344973	1050989	Figure 23	Stream coming down from field with farm, suspected sewage content - sewage fungus and foaming present. W 0.12, D 0.05, Flow 0.074. Ouse Ness fresh water sample 10. Farm in background. Rabbit droppings.
36	03/03/09	10:22 AM	HY 44971 50851	344971	1050851	-	30cm diameter blue pipe. Probably surface water draining from field behind.
37	03/03/09	10:32 AM	HY 45397 50526	345397	1050526	-	Crofts, derelict house behind.
38	03/03/09	10:36 AM	HY 45611 50504	345611	1050504	-	Surface water flowing down onto the beach, pond behind.
39	03/03/09	10:45 AM	HY 45941 50617	345941	1050617	Figure 24	6 seals resting on the shore at Verepoint. Ouse Ness seawater sample 7.
40	03/03/09	10:49 AM	HY 45888 50569	345888	1050569	-	Possible derelict farm building 50m inland from Vere Point.
41	03/03/09	11:01 AM	HY 45769 50101	345769	1050101	-	Surface water flowing down onto the beach. 3 houses, 300m inland.

No.	Date	Time	NGR	East	North	Associated photograph	Description
42	03/03/09	11:08 AM	HY 45687 49873	345687	1049873	-	Surface water flowing down to shoreline.
43	03/03/09	11:11 AM	HY 45674 49825	345674	1049825	-	Scrap heap.
44	03/03/09	11:16 AM	HY 45688 49634	345688	1049634	-	Farm inland.
45	03/03/09	11:19 AM	HY 45709 49552	345709	1049552	-	Rabbits.
46	03/03/09	11:21 AM	HY 45715 49484	345715	1049484	-	Sheep droppings on shoreline, no sheep visible.
47	03/03/09	11:25 AM	HY 45743 49429	345743	1049429	-	Ouse Ness seawater sample 8 taken from headland.
48	03/03/09	11:31 AM	HY 45546 49298	345546	1049298	-	12 oyster catchers, 12 gulls.
49	03/03/09	11:37 AM	HY 45280 49271	345280	1049271	Figure 25	10cm diameter yellow pipe flowing onto shoreline. Ouse Ness fresh water sample 11. Flow (jug) 550ml/2 seconds. Farm inland.
50	03/03/09	11:42 AM	HY 45235 49281	345235	1049281	-	Derelict farm buildings directly on the shoreline.
51	03/03/09	11:45 AM	HY 45140 49266	345140	1049266	-	Surface water run off onto shoreline.
52	03/03/09	11:50 AM	HY 44912 49150	344912	1049150	-	Surface water coming through rocks at the bottom of a 2m cliff on shoreline edge.
53	03/03/09	11:52 AM	HY 44907 49150	344907	1049150	-	Ouse Ness sea water sample 9
54	03/03/09	11:58 AM	HY 44766 49103	344766	1049103	-	End of planned walk, back at Gill Pier.
55	03/03/09	12:01 PM	HY 44696 49011	344696	1049011	Figure 26	Large flow coming from broken pipe in wall. W 0.17, D 0.10, Flow (jug) more than 1 litre/ second. Ouse Ness fresh water sample 12.
56	03/03/09	1:15 PM	HY 44258 49268	344258	1049268	-	Stream (from end of day 1). D 0.15, W 0.25, Flow 0.453. Ouse Ness fresh water sample 13.
57	03/03/09	1:19 PM	HY 44122 49233	344122	1049233	Figure 27	Concrete pipe. Stagnant stream down to shoreline with farm behind. 2 swans on shore.
58	03/03/09	1:28 PM	HY 44097 49026	344097	1049026	-	10 rabbits
59	03/03/09	1:30 PM	HY 44103 48944	344103	1048944	-	Pipe coming out of hill, going into the sea (cant sample). Houses behind.
60	03/03/09	1:33 PM	HY 44053 48889	344053	1048889	-	Stagnant water with sewage fungus on shoreline.
61	03/03/09	1:38 PM	HY 43923 48775	343923	1048775	Figure 28	15cm diameter pipe flowing onto shoreline. Flow (jug) 950ml/2 seconds. Houses in field behind.
62	03/03/09	1:42 PM	HY 43898 48747	343898	1048747	-	13cm diameter pipe, very little flow. Joins to guttering of building behind.
63	03/03/09	1:46 PM	HY 43842 48680	343842	1048680	-	10cm diameter pipe coming out of the wall going straight into the sand.
64	03/03/09	1:48 PM	HY 43839 48667	343839	1048667	Figure 29	15cm diameter pipe flowing into the sea. Ouse Ness seawater sample 10 taken towards end of the pipe.
65	03/03/09	1:53 PM	HY 43823 48651	343823	1048651	Figure 30	Suspected storm overflow for community septic tank. 30cm diameter pipe

No.	Date	Time	NGR	East	North	Associated photograph	Description
							encased in concrete. Flow (jug) 1 litre/4 seconds. Ouse Ness fresh water sample 15.
66	03/03/09	1:58 PM	HY 43818 48627	343818	1048627	-	Culvert with sewage fungus growing in it, no flow.
67	03/03/09	1:59 PM	HY 43818 48595	343818	1048595	-	Suspected sewage pipe coming down from house under sand into the sea, cant sample. 24cm^2 concrete with the pipe inside it.
68	03/03/09	2:00 PM	HY 43803 48571	343803	1048571	-	16cm diameter pipe coming out of the wall, no flow. 6 houses behind.
69	03/03/09	2:01 PM	HY 43808 48555	343808	1048555	-	11cm diameter pipe encased in concrete flowing into the sea, no flow.
70	03/03/09	2:02 PM	HY 43799 48552	343799	1048552	-	10cm diameter pipe coming out of wall into pile of rocks/pebbles.
71	03/03/09	2:03 PM	HY 43797 48549	343797	1048549	-	10cm diameter pipe on jetty, no flow.
72	03/03/09	2:03 PM	HY 43793 48546	343793	1048546	-	Another 10cm diameter pipe coming from the same building as above.
73	03/03/09	2:05 PM	HY 43781 48515	343781	1048515	Figure 31	Two pipes flowing out of the concrete block into the sea. Seafood processing plant behind.
74	03/03/09	2:05 PM	HY 43780 48511	343780	1048511	-	Further pipes from above plant.
75	03/03/09	2:06 PM	HY 43782 48504	343782	1048504	Figure 32	New pipes x 4, 3 x 11cm diameter, 1 x 15cm diameter.
76	03/03/09	2:09 PM	HY 43772 48438	343772	1048438	-	11cm diameter pipe coming out of wall, very little flow, not enough to sample.
77	03/03/09	2:10 PM	HY 43766 48412	343766	1048412	-	Two pipes, 1 x 11cm diameter, 1 x 9cm diameter, no flow. Houses behind.
78	03/03/09	2:13 PM	HY 43765 48334	343765	1048334	Figure 33	17cm iron pipe (from Pierowall public toilets) flowing down to shoreline.
79	03/03/09	2:14 PM	HY 43764 48313	343764	1048313	-	Small stream (frothing) W 0.12, D 0.08, Flow 0.230. Ouse Ness fresh water sample 16.
80	03/03/09	2:18 PM	HY 43776 48285	343776	1048285	-	16cm diameter pipe, very small flow. 6 houses behind.
81	03/03/09	2:23 PM	HY 43782 48226	343782	1048226	-	11cm diameter pipe, flow (jug) 680ml/2 seconds. Ouse Ness fresh water sample 17. Possibly coming from the Pierowall Hotel.
82	03/03/09	2:26 PM	HY 43796 48192	343796	1048192	Figure 34	30cm diameter pipe flowing into the sea, spilt in the middle (leaking). Ouse Ness seawater sample 11.
83	03/03/09	2:31 PM	HY 43796 48185	343796	1048185	Figure 35	10 cm pipe encased in concrete, small flow, sewage fungus present. Flow more than 30ml/second. Ouse Ness fresh water sample 22. House behind.
84	03/03/09	2:33 PM	HY 43816 48141	343816	1048141	-	11cm diameter pipe flowing from house, sewage fungus.
85	03/03/09	2:34 PM	HY 43849 48106	343849	1048106	-	15cm diameter pipe flowing from a house onto shoreline. Flow (jug) 450ml/5 seconds. Ouse Ness fresh water sample 18.
86	03/03/09	2:37 PM	HY 43843 48102	343843	1048102	-	9cm diameter pipe, no flow.

No.	Date	Time	NGR	East	North	Associated photograph	Description
87	03/03/09	2:40 PM	HY 43903 48040	343903	1048040	Figure 36 & 37	River, strong flow. W 2.0. One side D 0.20, Flow 0.895, other side D 0.18, Flow 0.968. Ouse Ness fresh water sample 19. Two streams link together to create this river. Water treatment works inland.
88	03/03/09	2:48 PM	HY 44034 47999	344034	1047999	-	Culvert through wall, no flow.
89	03/03/09	2:49 PM	HY 44065 48005	344065	1048005	-	Culvert, flow (jug) 25ml/25 seconds. Strong smell of sewage and sewage fungus. Ouse Ness fresh water sample 20. B&B behind.
90	03/03/09	2:55 PM	HY 44142 48040	344142	1048040	-	11cm diameter pipe flowing out to sea (est. 30m out).
91	03/03/09	3:00 PM	HY 44265 48078	344265	1048078	Figure 38	Two seals on shoreline. Culvert, no flow.
92	03/03/09	3:01 PM	HY 44277 48087	344277	1048087	Figure 39	15cm diameter pipe, flow (jug) 28ml/3 seconds. Smell of sewage and sewage fungus present. Ouse Ness fresh water sample 21. 3 swans.
93	03/03/09	3:04 PM	HY 44286 48087	344286	1048087	-	Suspected water flowing out of pile of concrete rubble/rocks. No pipes visible.
94	03/03/09	3:08 PM	HY 44314 48111	344314	1048111	-	11cm diameter pipe encased in concrete
95	03/03/09	3:09 PM	HY 44357 48132	344357	1048132	-	Pipe flowing into stream. Stream travelling under road above pipe.
96	03/03/09	3:12 PM	HY 44423 48169	344423	1048169	-	11cm diameter pipe, no flow, suspected surface water pipe.
97	03/03/09	3:12 PM	HY 44427 48172	344427	1048172	-	11cm diameter pipe, no flow, suspected surface water pipe.
98	03/03/09	3:12 PM	HY 44431 48175	344431	1048175	-	11cm diameter pipe, no flow, suspected surface water pipe.
99	03/03/09	3:12 PM	HY 44434 48177	344434	1048177	-	11cm diameter pipe, no flow, suspected surface water pipe.
100	03/03/09	3:13 PM	HY 44438 48179	344438	1048179	-	11cm diameter pipe, no flow, suspected surface water pipe.
101	03/03/09	3:13 PM	HY 44441 48184	344441	1048184	-	11cm diameter pipe going into sea.
102	03/03/09	3:14 PM	HY 44446 48186	344446	1048186	-	11cm diameter pipe, no flow, suspected surface water pipe.
103	03/03/09	3:14 PM	HY 44450 48188	344450	1048188	-	11cm diameter pipe, no flow, suspected surface water pipe.
104	03/03/09	3:21:14PM	HY 44288 48119	344288	1048119	-	Ouse Ness seawater sample 12.

Photos referenced in the table can be found attached as Figures 7 – 39.

Sampling

Water samples were collected at sites marked on the map in Figure 3. Both fresh water and seawater samples were collected on the 2nd and 3rd March. Shellfish samples were collected on 2nd March. Bacteriology results follow in Tables 2 and 3.

Seawater samples were tested for salinity using a hand held refractometer. These readings are recorded in Table 1 as salinity in parts per thousand (ppt).

Water and shellfish samples were collected at sites marked on the maps given in Figures 4 - 6.

Table 2. Water sample results

No.	Date	Sample	Grid Ref	Type	E. coli (cfu/ 100ml)	Salinity (ppt.)
1	02/03/2009	Ouse Ness FW 1	HY 44658 48990	Fresh water	200	-
2	02/03/2009	Ouse Ness FW 2	HY 44655 49020	Fresh water	$1.3x10^3$	-
3	02/03/2009	Ouse Ness FW 3	HY 44619 49031	Fresh water	10	-
4	02/03/2009	Ouse Ness FW 4	HY 44533 49057	Fresh water	$2.4x10^3$	-
5	02/03/2009	Ouse Ness FW 5	HY 44502 49096	Fresh water	300	-
6	02/03/2009	Ouse Ness FW 6	HY 44476 49107	Fresh water	50	-
7	02/03/2009	Ouse Ness FW 7	HY 44459 49115	Fresh water	140	-
8	03/03/2009	Ouse Ness FW 8	HY 45543 51359	Fresh water	70	-
9	03/03/2009	Ouse Ness FW 9	HY 45018 51034	Fresh water	20	-
10	03/03/2009	Ouse Ness FW 10	HY 44973 50989	Fresh water	$1.7x10^4$	-
11	03/03/2009	Ouse Ness FW 11	HY 45280 49271	Fresh water	250	-
12	03/03/2009	Ouse Ness FW 12	HY 44696 49011	Fresh water	<10	-
13	03/03/2009	Ouse Ness FW 13	HY 44258 49268	Fresh water	230	-
14	03/03/2009	Ouse Ness FW 14	HY 43923 48775	Fresh water	10	-
15	03/03/2009	Ouse Ness FW 15	HY 43823 48651	Fresh water	<10	-
16	03/03/2009	Ouse Ness FW 16	HY 43764 48313	Fresh water	$2.4x10^3$	-
17	03/03/2009	Ouse Ness FW 17	HY 43782 48226	Fresh water	<10	-
18	03/03/2009	Ouse Ness FW 18	HY 43849 48106	Fresh water	<10	-
19	03/03/2009	Ouse Ness FW 19	HY 43903 48040	Fresh water	30	-
20	03/03/2009	Ouse Ness FW 20	HY 44065 48005	Fresh water	$>3x10^5$	-
21	03/03/2009	Ouse Ness FW 21	HY 44277 48087	Fresh water	$1.0x10^3$	-
22	03/03/2009	Ouse Ness FW 22	HY 43796 48185	Fresh water	$>3x10^5$	-
23	02/03/2009	Ouse Ness SW 1	HY 46263 49919	Sea water	<1	34.5
24	02/03/2009	Ouse Ness SW 2	HY 46507 50397	Sea water	<1	34
25	02/03/2009	Ouse Ness SW 3	HY 46846 50349	Sea water	<1	34.5
26	02/03/2009	Ouse Ness SW 4	HY 46720 49521	Sea water	<1	34.6
27	02/03/2009	Ouse Ness SW 5	HY 44667 49002	Sea water	10	35
28	02/03/2009	Ouse Ness SW 6	HY 44565 49026	Sea water	310	35
29	02/03/2009	Ouse Ness SW 7	HY 45941 50617	Sea water	$2.5x10^3$	35
30	02/03/2009	Ouse Ness SW 8	HY 45743 49429	Sea water	70	35
31	02/03/2009	Ouse Ness SW 9	HY 44907 49150	Sea water	50	35
32	02/03/2009	Ouse Ness SW 10	HY 43839 48667	Sea water	4	35
33	02/03/2009	Ouse Ness SW 11	HY 43796 48192	Sea water	2	34
34	02/03/2009	Ouse Ness SW 12	HY 44288 48119	Sea water	1	35

Table 3. Shellfish sample results

No.	Date	Sample	Grid Ref	Type	E. coli (cfu/100g)
1	02/03/2009	Ouse Ness 1	HY 46586 49627	Razors	80
2	02/03/2009	Ouse Ness 2	HY 46586 49627	Razors	<20
3	02/03/2009	Ouse Ness 3	HY 46586 49627	Rayed artemis	<20
4	02/03/2009	Ouse Ness 4	HY 46586 49627	Rayed artemis	<20

Figure 4. Water sample results – Bay of Skaill to Pierowall

Figure 5. Water sample results – Bay of Pierowall

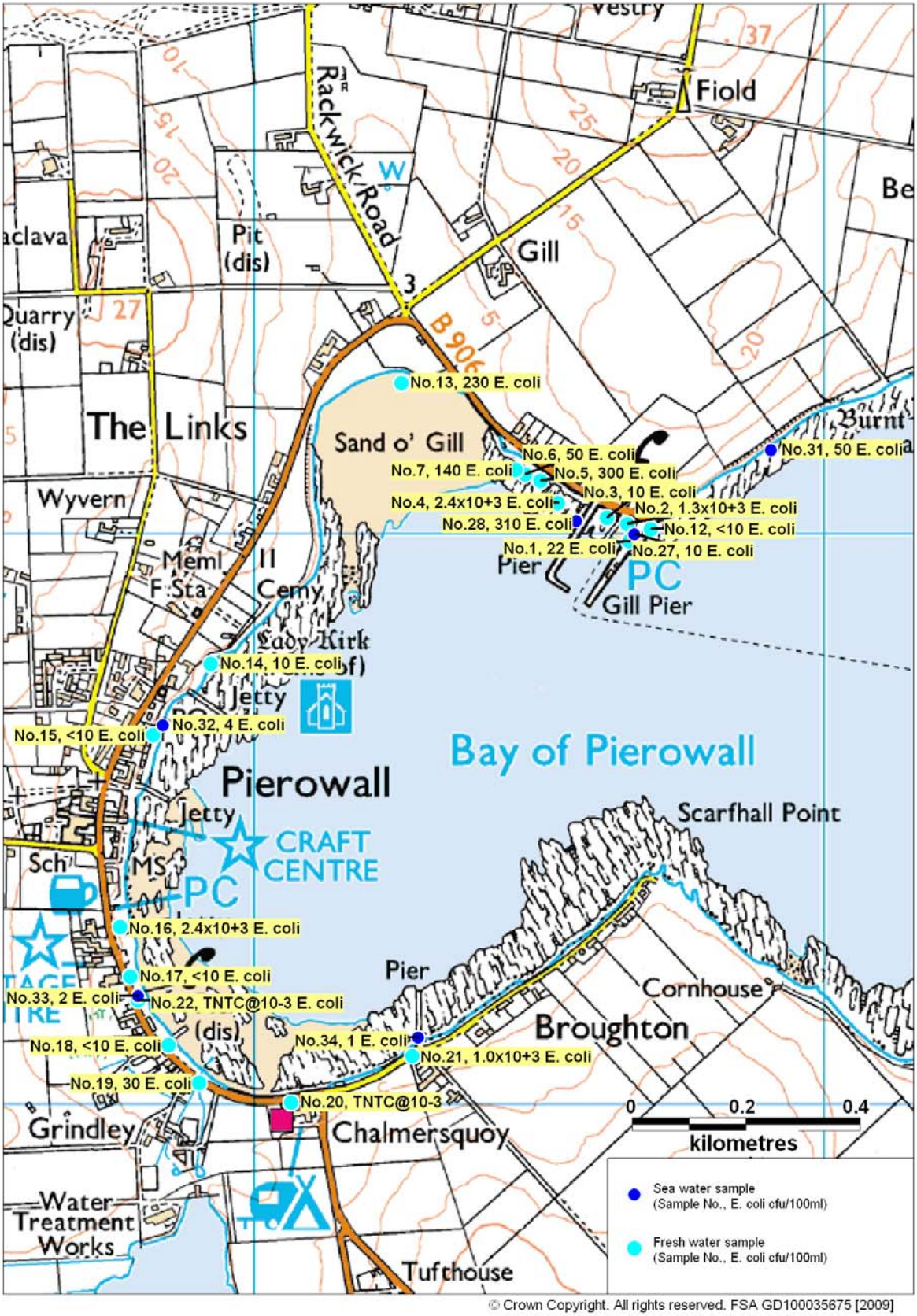

Figure 6. Shellfish sample results

Photographs

Figure 7. Catch from second attempt at 1st dredge

Figure 8. Rayed artemis shellfish sample with two *Mya arenaria*

Figure 9. Razor clam sample

Figure 10. Gill Pier

Figure 11. Pipe leading down into sea, location of sea water sample 5

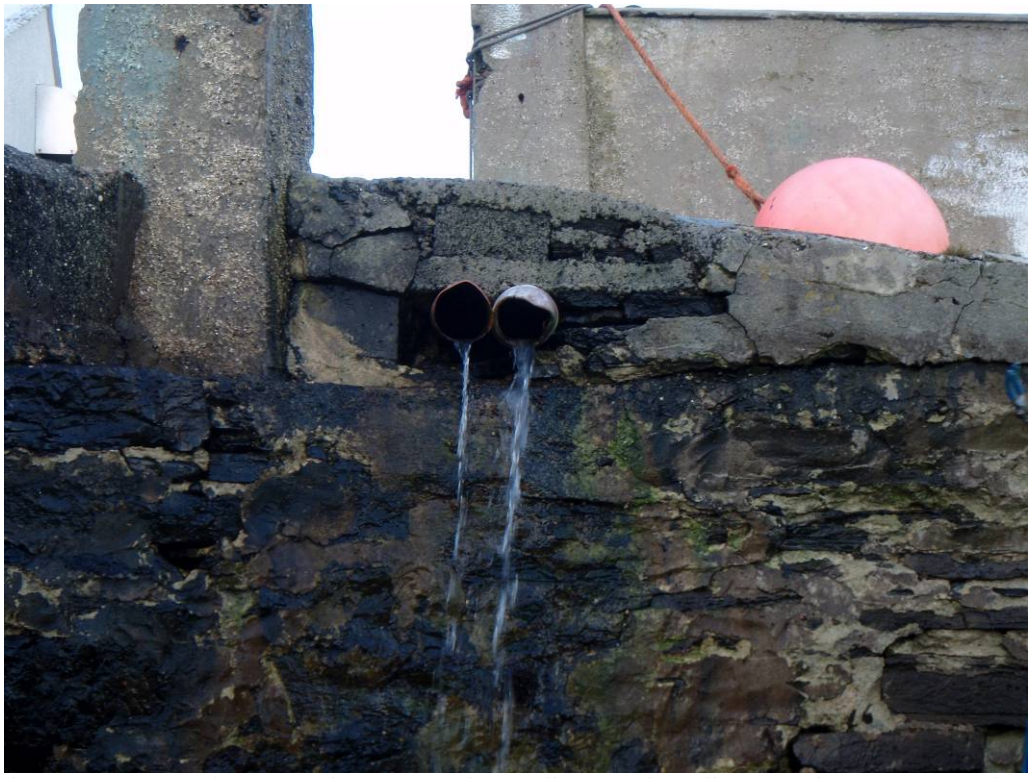

Figure 12. Two pipes coming out of the wall onto shoreline, fresh water sample 2

Figure 13. Pipe flowing from wall onto shoreline, fresh water sample 3

Figure 14. Two pipes running into the sea

Figure 15. Two pipes with sewage fungus below, fresh water sample 5

Figure 16. Pipe covered in concrete, fresh water sample 6

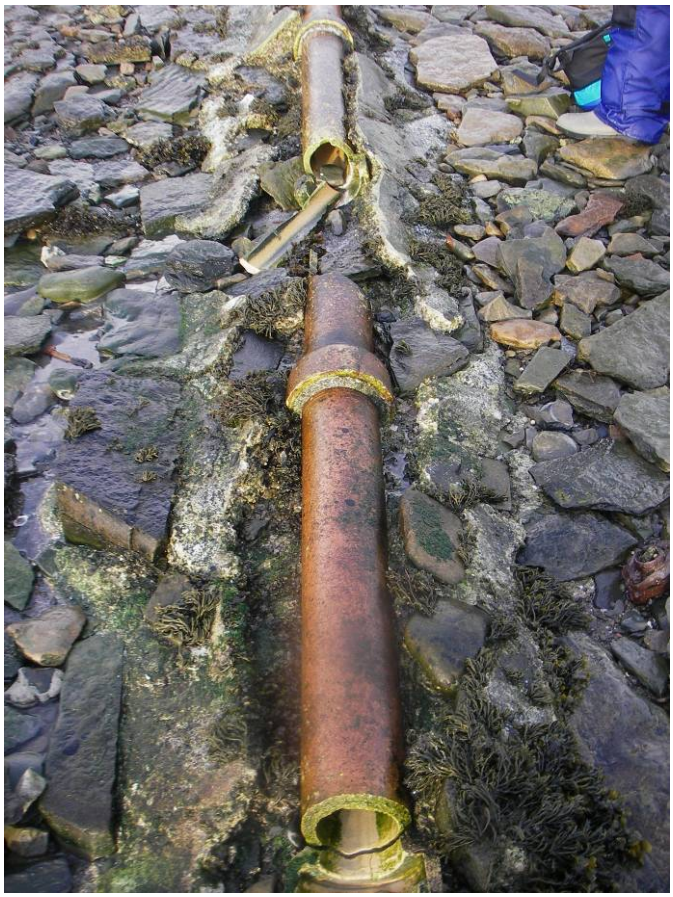

Figure 17. Broken pipe, fresh water sample 7

Figure 18. Stream running onto beach

Figure 19. Stream running onto Bay of Skaill.

Figure 20. Stream running onto Bay of Skaill, fresh water sample 8

Figure 21. Location of fresh water sample 8

Figure 22. Cattle in field next to Bay of Skaill beach

Figure 23. Stream flowing down from farm, fresh water sample 10

Figure 24. Seals on shoreline at Vere Point, sea water sample 7

Figure 25. Pipe flowing onto shoreline, fresh water sample 11

Figure 26. Large flow coming from broken pipe, fresh water sample 12

Figure 27. Concrete pipe with stagnant stream below

Figure 28. Pipe flowing onto shoreline

Figure 29. Pipe flowing into sea, sea water sample 10

Figure 30. Suspected storm overflow for community septic tank, fresh water sample 15

Figure 31. Two pipes flowing from concrete block

Figure 32. New pipes

Figure 33. Pierowall public toilets and outfall pipe

Figure 34. Broken pipe flowing out to sea, sea water sample 11

Figure 35. Pipe encased in concrete, sewage fungus, fresh water sample 18

Figure 36. River, fresh water sample 19

Figure 37. Two streams leading into previous river

Figure 38. Seal and swan on shoreline

Figure 39. Broken pipe with sewage fungus, fresh water sample 21