# Scottish Sanitary Survey Review

## Campbeltown Loch

## AB-029-008-04

## February 2014

Cefas

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| 0.1 | 11/02/2014 | - | Draft for external consultation |
| 0.2 | 12/03/2014 | vi | Correction of erroneous grid reference for RMP. |
| 1.0 | 7/4/2014 | cover,vi,2,3,7-12,27,33-34 | Corrections to date on cover, correction of current RMP, amendments to sewage discharge information in light of information provided in consultation responses from Scottish Water, amended recommendations/sampling plan in accordance with local authority comments. |

| | Name | Position | Date |
|---|---|---|---|
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| Fraser Anderson | Argyll & Bute Council |
| Mr Donald MacKenzie | Harvester |

# Review Specification and Introduction

Sanitary surveys are used to demonstrate compliance with the requirements stated in Annex II (Chapter II Paragraph 6) of Regulation (EC) 854/2004, whereby if the competent authority decides in principle to classify a production or relay area it must:

- make an inventory of pollution sources of human/animal origin likely to be a contamination source for the production areas;
- examine the quantities of organic pollutants which are released during the different periods of the year, according to the seasonal variations of both human and animal populations in the catchment area, rainfall readings, wastewater treatment, etc.;
- determine the characteristics of the circulation of pollutants by virtue of current patterns, bathymetry and the tidal regime in the production area;
- establish a sampling programme of bivalve molluscs in the production area which is based on the examination of established data, and with a number of samples, a geographical distribution of the sampling points and a sampling frequency which must ensure that the results of the analysis are as representative as possible for the area considered.

The EURL Good Practice Guide (GPG) for the monitoring of bivalve molluscs harvesting areas recommends the re-evaluation of sanitary surveys every six years. Location, extent and nature of fisheries and faecal pollution sources may change over time and the review is conducted to determine whether the sampling plan and/or production area boundaries remain appropriate and protective of public health.

As specified by the Food Standards Agency, this review is comprised of a brief desktop search of publicly available information together with a shoreline survey. No additional queries are submitted to organisations or agencies.

The review is intended to identify whether there have been significant changes in:

- Historic microbiological data.
- Sewage treatment and sewerage infrastructure.
- Housing and development.
- Harvester operations.

The output of the review is a report identifying any new information that has been obtained and/or whether major elements of the original sanitary survey can be regarded as essentially unchanged. That report includes an overall assessment as to whether the production area boundaries and/or RMPs should be modified from those recommended in the original report and if so, a description of the revised

boundaries and a revised sampling plan with the boundaries and RMP(s) locations.

A sanitary survey was undertaken for Campbeltown Loch in 2008. The output of this survey included a report and a sampling plan for the fishery. The 2008 sampling plan is shown alongside recommended amendments arising from this review.

The present review report is not intended to present detailed information relating to pollution sources that were identified in the sanitary survey report. Therefore, this review should be read in conjunction with the 2008 sanitary survey report.

# Table of Contents



**APPENDICES**

# Sampling Plan – Campbeltown Loch

| | 2008 recommendations | 2014 review | Changes |
|---|---|---|---|
| PRODUCTION AREA | Campbeltown Loch | | No change |
| SITE NAME | Kildalloig Bay | | |
| SIN | AB-029-008-04 | | |
| SPECIES | Common cockles | | |
| TYPE OF FISHERY | Wild | | |
| NGR OF RMP | NR 7490 1987 | NR 7476 1999 | Changed to take into consideration new WWTW CSO outfall |
| EAST | 174900 | 174760 | |
| NORTH | 619870 | 619990 | |
| TOLERANCE (M) | 120 m | | Increased by 20m |
| DEPTH (M) | N/A | | No Change |
| METHOD OF SAMPLING | Hand | | |
| FREQUENCY OF SAMPLING | Monthly | | |
| LOCAL AUTHORITY | Argyll and Bute Council | | |
| AUTHORISED SAMPLER(S) | Christine McLachlan<br>William McQuarrie<br>Ewan McDougall<br>Donald Campbell | Fraser Anderson<br>Karen Goodchild<br>William McQuarrie<br>Ewan McDougall<br>Allison Hardie | Change in staff |
| RECOMMENDED PRODUCTION AREA | The area bounded by lines drawn between NR 7522 2031 and NR 7451 2009 and between 7451 2009 and NR 7455 1959 and between NR 7530 1953 and NR 7558 1990 extending to MHWS | | Minor change to southeastern corner of boundary |

# 1. Area and Fishery

Campbeltown Loch is a short east facing loch, approximately 2.4 km long and 1.3 km wide. The loch has a maximum depth of 35 m, though much of the area is 10-20 m deep. A very shallow shoaling area[1] known as the Doirlinn exists southwest of Davaar Island and is uncovered during low tides.




**Figure 1.1 Location of Campbeltown Loch**

[1] A sandy elevation of the bottom of a body of water.

At the time of the 2008 sanitary survey report, two species were classified in the Kildalloig Bay area of Campbeltown Loch: common cockles (*Cerastoderma edule*) and common mussels (*Mytilus edulis*). The survey was undertaken at that time in response to an application to classify the area for Pacific oysters (*Crassostrea gigas*), which were grown on trestles on the north side of Kildalloig Bay. The mussels were declassified from 1 April 2011 and the Pacific oysters from 1 April 2013.

Currently, only the common cockle fishery is still active; particulars are shown in Table 1.1.

**Table 1.1 Current classified fishery at Campbeltown Loch**

| Production area | Site | SIN | Species | RMP* |
|---|---|---|---|---|
| Campbeltown Loch | Kildalloig Bay | AB-029-008-04 | Common cockles | NR 7491 2008 |

*From FSAS 2014/15 Classification Document

The production area boundaries recommended in the 2008 report were the area within lines drawn between NR 7522 2031 and NR 7451 2009 and between NR 7455 1959 and between NR 7530 1953 and NR 7558 1990 extending to MHWS. The production area and RMP are displayed in Figure 1.1 together with the estimated extent of the cockle bed from the 2008 report.

The 2008 survey found wild cockles were mostly harvested by locals for personal consumption. Commercial gangs were also known to occasionally harvest when stocks were sufficiently abundant. Harvesting mostly occurred during the summer, with the majority of the stock located in the northeast part of the Doirlinn.

The 2013 survey found the cockle fishery had become more commercialised, with a named harvester (Mr. Donald MacKenzie) employing six people to harvest the Doirlinn area. Small numbers of locals were noted to continue to harvest the area as well, with local gangs reported to have recently ceased harvesting. Harvesting continues to mostly occur during the summer and also now in the weeks leading up to Christmas. The harvester noted the fishery was currently in a very good state, with plenty of adult and juvenile sized cockles. He also noted the sandy substrate had become less densely packed which he believed was caused by higher numbers of cockles settling.

During the 2013 shoreline survey, cockle samples were taken from over 200 m west of the bed identified in 2008, suggesting that the extent of the bed extends further westward than estimated previously. No information was found on the likely extent of the rest of the bed, but in the absence of other information it is presumed to extend over the majority of the intertidal area shown in the OS map.

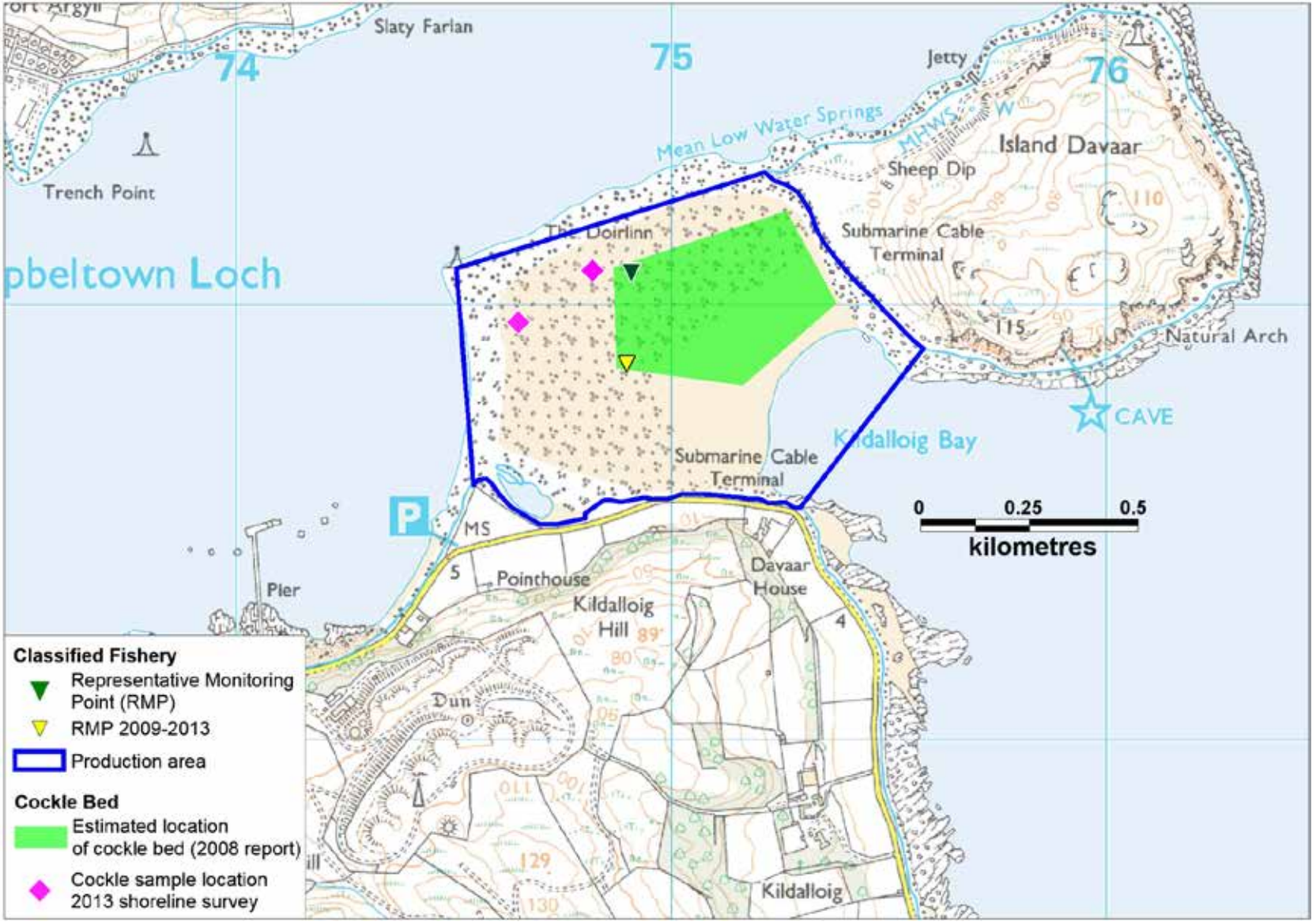




**Figure 1.2 Current Campbeltown Loch cockle fishery production area and RMP, with the 2008 estimated location of the cockle bed**

# 2. Population and Human Sewage Impacts

## *2.1 Population*

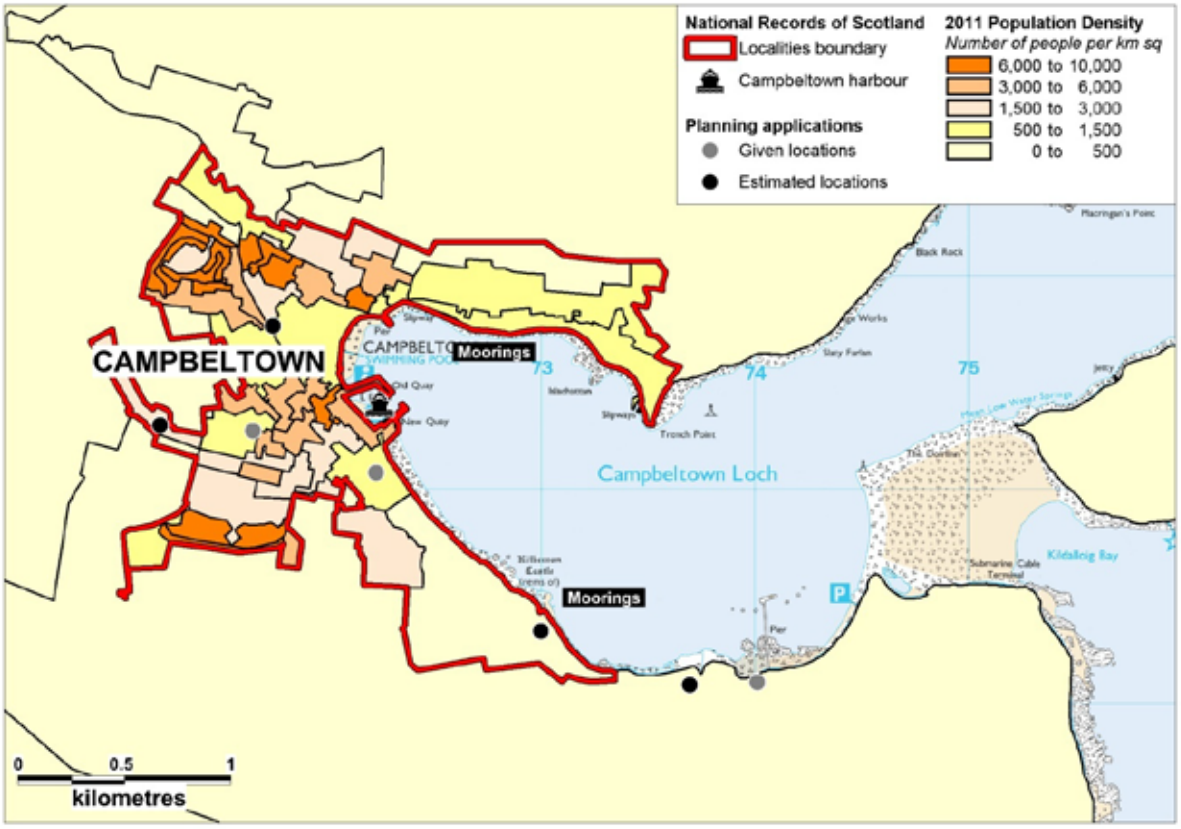




**Figure 2.1 Current distribution of human population around Campbeltown Loch according to 2011 census data**

An update to the human population figures for the area was available via the 2011 Population Census. The resident population within Campbeltown is reported to have decreased since 2001 from 5,114 (SCROL, 2014) to an estimate of 4,810 in 2010, which follows the wider trend in the Argyll and Bute area (National Records of Scotland, 2013). In Figure 2.1, the census areas are shown thematically mapped by 2011 population density.

Since the 2008 report, there have been ten planning applications identified for the areas around Campbeltown Loch. These applications were downloaded from the Argyll and Bute Council Planning portal (Argyll & Bute Council, 2014) in July 2013; the details are presented in Appendix 1. General locations of these applications are displayed in Figure 2.1. Most applications only provided postcodes for locations, therefore some of the symbols in Figure 2.1 represent more than one application in the same postcode.

Seven of the ten planning applications were for new dwelling houses. The remaining three related to an upgrade at Campbeltown creamery, a new water treatment works

associated with Glenramskill Oil Depot and a new fast food outlet in Millknowle at the site of old public toilet facilities. Of the applications involving addition or changes to sewerage, most identified connection to mains sewerage. Three applications involved discharges to watercourses via partial soakaway and one identified a new septic tank discharge to coastal waters.

In 2009 Campbeltown Loch was recognised as one of six towns in Argyll & Bute Council's Regeneration Programme for rural waterfront towns (CHORD) (Argyll & Bute Council, 2013). Of relevance to this review, the following are two projects in the Campbeltown area:

**Kinloch Road regeneration project:** improvements to road access & public transport, housing & community facilities, environmental sustainability and the refurbishment of the Royal Hotel.

**Campbeltown Loch Berthing Facility:** increasing the berthing capacity at Campbeltown Loch.

Increasing the berthing capacity was seen as essential to overcome the problem of overcrowding that is particularly problematic during regattas over the summer months. In the most recent feasibility report (Argyll & Bute Council, 2011), demand projection for 2020 was re-assessed, which lead to the number of berthing spaces being significantly reduced from the original business case proposal of over 145 to just 57 berths. These will be added to the 18 berths and 40 mooring sites currently situated around Old Quay, which is the recommended site for the new marina. No information was available on planned sewage pump out facilities for the new marina.

The programme is at varying stages of completion; some projects are completed e.g. the refurbishment of the Royal Hotel, whilst others are currently in progress e.g. increasing the berthing capacity. These projects are intended to increase settlement and tourism in the Campbeltown area and therefore may lead to increased human pressure on the loch.

Campbeltown Loch is a busy harbour for both pleasure craft and commercial vessels. Boating activity is mostly centred at the head of the loch, where two quays and a pontoon system offer docking/mooring sites to both commercial and pleasure craft. At the time of the 2013 survey several large pleasure yachts, fishing vessels and Campbeltown Lifeboat were moored at Old Quay pier, with 11 yachts/small pleasure craft moored at the adjacent pontoon, with seven additional moorings unoccupied. New Quay is located south of Old Quay and operates as the ferry terminal and docking area for large commercial vessels. At the time of the 2013 survey the berth at New Quay was being deepened to allow larger vessels to dock. The port continues to be used for shipping of timber, as well as for wind turbine components. There are moorings at Kilkerran, with four small pleasure craft and a further three unoccupied moorings visible during the 2013 shoreline survey.

Given that there are regulations controlling discharges from ships and ferries, but not small craft, any faecal contamination that does occur from marine sources is likely to relate to the latter. At present, Welcome Anchorages (2012) a directive for Scottish and Northern Irish pleasure boat facilities, recommended that shore based facilities are used and discharges should be avoided in restricted tidal areas or near to shellfish beds. However, this is offered as guidance only and compliance is voluntary.

### *2.2 Sewage Discharges*

The 2008 sanitary survey report recorded evidence of failings in the Campbeltown public sewerage network which served Campbeltown and the surrounding villages of Machrihanish, Drumlemble and Stewarton. Sewage from these areas was treated at the Slaty Farlan Wastewater Treatment Works (WWTW). Improvement plans were being developed whilst the sanitary survey was undertaken, though full details were not available at that time.

The Campbeltown Flood Alleviation and WWTW project report (Scottish Water, 2009) identified that the main problem was that the combined sewerage network had insufficient capacity to deal with foul sewage and surface water inflow and was overdue infrastructure replacements and upgrades. This was a particular problem at Kinloch Park pumping station (PS) which suffered from recurring, prolonged discharges of untreated sewage, usually during the winter months. At the time of the 2008 sanitary survey report, full details of the proposed network improvements were not available. However, by February 2012, much of the improvement plan had been completed and the main changes are summarised below:

**Slaty Farlan (formerly Campbeltown) WWTW**

- Incorporation of a new storm water inlet works and storm tank to deal with pumped storm water from Kinloch Park Pumping Station. This includes the facility to return storm flows for full treatment at a capacity sufficient to empty the storm tank within 12 hours once inflow stops (unless there are consecutive storms).

- New storm tank outfall pipe to Campbeltown Loch which will also include a CSO discharge and will operate when the storm tank is full. This diverts CSO flows from near the head of the loch to deeper water further out the loch, and is intended to decrease the predicted average year spill volume to the head of the loch to less than 26,000 $m^3$. This represents a 95% reduction in predicted spill volume.

- Increased treatment capacity at the existing membrane bio-reactor (MBR) treatment plant. Currently, approximately half the effluent is treated by MBR

with the other half receiving secondary treatment only (Fiona Garner, personal communication).

**Kinloch Park PS**

- Kinloch Park pumping station upgraded to have increased pump forward capacity to the Slaty Farlan WWTW and improved screening that can handle at least the predicted maximum 5-year spill flow to the storm tank.

- Upgraded storm pumping capacity, now 900 l/s to the new storm water facility at Slaty Farlan.

- Extension of the existing outfall by approximately 80 m.

**Sewer Network**

- Increased capacity of the network at strategic locations in order to reduce the likelihood of sewer flooding in central Campbeltown.

- Reduction of surface water inflow to the network via separation of surface water in the vicinity of Barley Bannocks Hill, thereby reducing pressure on the combined system.

Outfall locations and estimated outfall effluent concentrations taken from the Scottish Water/Hyder Report (2009) are displayed in Table 2.1, alongside spill information taken from a compliance modelling report (Scottish Water, 2010). Outfall locations are also displayed in Figure 2.2.

Information on the location of the Kilkerran WWPS, which was originally identified as discharging near the NATO pier in the 2008 dataset, was corrected by Scottish Water to NR 7305 1944. This location is approximately 1 km west of the NATO pier, and therefore further from the cockle bed.

Final effluent from the Slaty Farlan WWTW may still pose a contamination risk as it lies less than 700 m to the northwest of the cockle bed. The Slaty Farlan WWTW CSO is reported to discharge less than 500 m northwest of the cockle bed, and due to the, albeit diluted, raw sewage content may pose a more significant contamination risk. In the Scottish Water reports (2009; 2010) typical modelled spill frequency from this CSO was between 75.7 and 75.5 spills per year. The predicted duration of these spills was between 264 and 304.5 hours. Effluent from this CSO would receive limited treatment prior to discharging and therefore represents a significant intermittent source of contamination to the cockle bed.

**Table 2.1 Calculated upgraded scheme outfall effluent concentrations and spill information, for community sewage discharges in Campbeltown Loch**

| Name | Information provided by Scottish Water/Hyder Report (2009) | | Information provided by Scottish Water Report (2010) | | |
|---|---|---|---|---|---|
| | NGR | Estimated effluent concentration (FC/100ml) | Discharge information | | |
| | | | Frequency | Volume ($m^3$) | Duration (hrs) |
| Kinloch Park PS (CSO) | NR 7228 2063 | $1x10^6$ | <4/yr | 25,700 | 9 |
| Low Askomill WWPS No. 1 | NR 7315 2064 | $1x10^6$ | -[1] | - | - |
| Low Askomill WWPS No. 2 | NR 7249 2075 | $1x10^6$ | -[1] | - | - |
| Kilkerran WWPS | NR 7305 1944 | $1x10^6$ | -[1] | - | - |
| Slaty Farlan WwTW (FE) | NR 7433 2062 | 500 | continuous | 2,144,200 | - |
| Slaty Farlan WwTW (CSO) | NR 7452 2053 | $1x10^6$ | 75.5 | 311,800 | 304.5 |

Notes: -No information given

[1]Pumping stations identified by SW and SEPA as having CSOs, no predicted spill information given in either Scottish Water Reports

Spills from Kinloch Park PS CSO are expected to have decreased since the completion of the upgrade programme. In light of the low predicted average spill rates and the significant distance from the cockle bed (approximately 2.5 km west), it is expected contamination from this source will have a limited impact on the cockle bed.

Spill information was not available for any of the other pumping stations.

Sewage infrastructure observed during the 2013 shoreline survey is listed in Table 2.2, with locations of the observations mapped in Figure 2.2. Further details of the 2013 survey observations can be found in the Appendix 3.

**Table 2.2 Sewage discharge-related observations around Campbeltown Loch from the 2013 shoreline survey**

| No. | NGR | Description of potential sewage discharge |
|---|---|---|
| 1 | NR 7443 2084 | Slaty Farlan WWTW |
| 2 | NR 7428 2070 | Concrete matting on shore covering probable pipe from treatment works |
| 3 | NR 7358 2050 | Probable pumping chamber for sewage scheme |
| 4 | NR 7347 2054 | Pumping chamber access |
| 5 | NR 7335 2058 | 15 cm pipes, probable disused outfalls |
| 6 | NR 7329 2060 | Offshore cross (X on pole) 50 m offshore, likely site of consented Scottish water discharge point. Evidence of old outfalls from properties tied into combined sewage scheme |
| 7 | NR 7319 2073 | Scottish Water pumping chamber, cabin and manholes in road |
| 8 | NR 7250 2084 | Scottish Water pumping chamber, cabin and manholes in road |
| 9 | NR 7236 2088 | Small piped discharge into watercourse, 30 cm diameter pipe |
| 10 | NR 7203 2065 | Pumping building on main esplanade, no sign of discharge pipe in bay |
| 11 | NR 7243 1993 | 15 cm metal pipe, no visible discharge |
| 12 | NR 7264 1972 | Access Valves, plus start of shoreline section of trunk sewer |
| 13 | NR 7283 1956 | 15 cm metal discharge pipe, end not visible |
| 14 | NR 7293 1951 | Manhole cover - assumed part of trunk main running along shore |
| 15 | NR 7317 1922 | 15 cm metal pipe, outflow below water line |
| 16 | NR 7320 1918 | 15 cm dry metal pipe above shoreline. No discharge |
| 17 | NR 7323 1917 | 10 cm metal discharge pipe running into water. Not sampled |
| 18 | NR 7357 1913 | 15cm metal discharge pipe on shore, ending underwater |
| 19 | NR 7368 1917 | Two discharge pipes, ends out of water, both 15 cm diameter, manhole cover for one of the pipes on upper part of beach |
| 20 | NR 7436 1927 | 15 cm metal pipe with discharge and toilet paper around exit flow |
| 21 | NR 7440 1931 | 20 cm metal discharge pipe, runs into ground at lower tidal area, not able to determine if any discharge |
| 22 | NR 7524 1954 | Discharge pipe from Davaar House, 15 cm metal pipe running to sea. Outflow covered by tide. Manhole open higher up, no flow observed |
| 23 | NR 7529 1952 | Discharge pipe from Davaar House converted outbuilding, no discharge present, 15 cm metal pipe |

The 2013 shoreline survey identified the Slaty Farlan WWTW and the seawater sample taken from the shoreline adjacent to the works returned a result of 9 *E. coli* cfu/ 100 ml. Infrastructure associated with Low Askomill WWPS No. 1 & 2 was also observed onshore (observations 8 and 9). A manhole cover was observed along the upper shore west of Kilkerran WWPS. Two discharge pipes with a manhole cover over one were located over 500 m southeast of Kilkerran PS.

Two samples were taken of observed discharges from metal pipes. One was taken from a pipe thought to have been observed in the 2008 survey (observation No. 11/12), near Kilkerran (>1 km west of the cockle bed). This returned a result of 3000 *E. coli* cfu/100 ml. The second sample was taken from a pipe with toilet paper around the end, approximately 500 m west of the cockle bed. It returned a result of

1000 *E. coli* cfu/100 ml. The *E. coli* concentrations are not as high as would be expected from septic tank discharges.

A further two discharge pipes were observed near Davaar House. One of the pipes was associated with the main house, whilst the other was linked with a converted outbuilding. These pipes were in a similar location to an overflowing septic tank noted during the 2008 shoreline survey. No discharge was seen from the outbuilding pipe and the end of the other pipe was underwater at the time of survey. A seawater sample taken adjacent to the pipe, returned a result of 16 *E. coli* cfu/100 ml suggesting relatively low faecal contamination.

**Scottish Water/Hyder Compliance Assessment Report**

A study on microbiological compliance assessment was undertaken by Hyder on behalf of Scottish Water in support of the proposals for improvements in the Campbeltown Loch sewerage system (Scottish Water/Hyder, 2009). The compliance assessment tool that was used incorporated both a drainage area model and a coastal dispersion model. Only those discharges listed in Table 2.1 were considered. Effluent concentrations used in the modelling were assumed rather than measured, with full tertiary treatment assumed for the Slaty Farlan WWTW final effluent discharge. Potential impacts on recreational waters, shoreline waters, and the shellfish harvesting area were assessed. Only the latter will be considered here. A design standard of 100 FC/100 ml for 89.6% of the time was used for assessment of the output from the modelling. The report does not contain any detail on validation of the models or the outputs from the compliance assessment itself. The predicted minimum percentage compliance was 93.2% and this was found in the vicinity of the proposed Slaty Farlan WWTW Storm Outfall. The predicted maximum FC concentrations were not stated. Predicted compliance in the vicinity of the cockle bed exceeded 99%. However, this does not take into account other sewage discharges (e.g. private septic tanks) or diffuse sources of pollution. Currently, half the final effluent stream from the sewage treatment works receives tertiary treatment, whilst the other half receives secondary treatment, which would result in significantly higher faecal coliform concentrations for this waste stream than were assumed in the model. In addition, the assumed concentration from the storm effluent discharge ($1.0 \times 10^6$) is approximately half the geometric mean concentration reported in the literature for this type of effluent (Kay *et al.*, 2008). Therefore, the modelled impact is likely to underestimate the impact from these sources, in particular the current continuous discharge. Data from bivalve species other than cockles would imply that a 90%ile of markedly less than 100 FC/100 ml of seawater is required in order to consistently achieve class A (Lee & Reese, In Press).

**Conclusions**

Overall, the principal public sewage input to the cockle bed comes from the Slaty Farlan WWTW and CSO discharges, with the latter posing a potentially significant

source of contamination during spills, which are modelled to occur approximately 75 times per year. These discharges would be most likely to affect the northwestern extent of the cockle bed, with impacts highest during significant spill events.

Intermittent discharges from any of the remaining combined sewer/emergency overflows could have an impact on water quality in the loch, depending on the duration of any spills. However spills from these would only be expected to occur in case of equipment failure or extremely high levels of runoff exceeding the capacity of the upgraded system, and therefore are considered less likely to occur on a frequent or regular basis. The nearest of these to the cockle bed is Kilkerran WWPS CSO/EO, and any spills from this location would be most likely to impact at the southwestern end of the cockle bed.

Private discharges associated with Davaar House are the nearest sources to the fishery and are likely to affect water quality at the southeastern extent of the cockle bed. However the impact from these is considered to be relatively minor in comparison to the potential impacts from the relocated Slaty Farlan CSO and storm tank overflow.

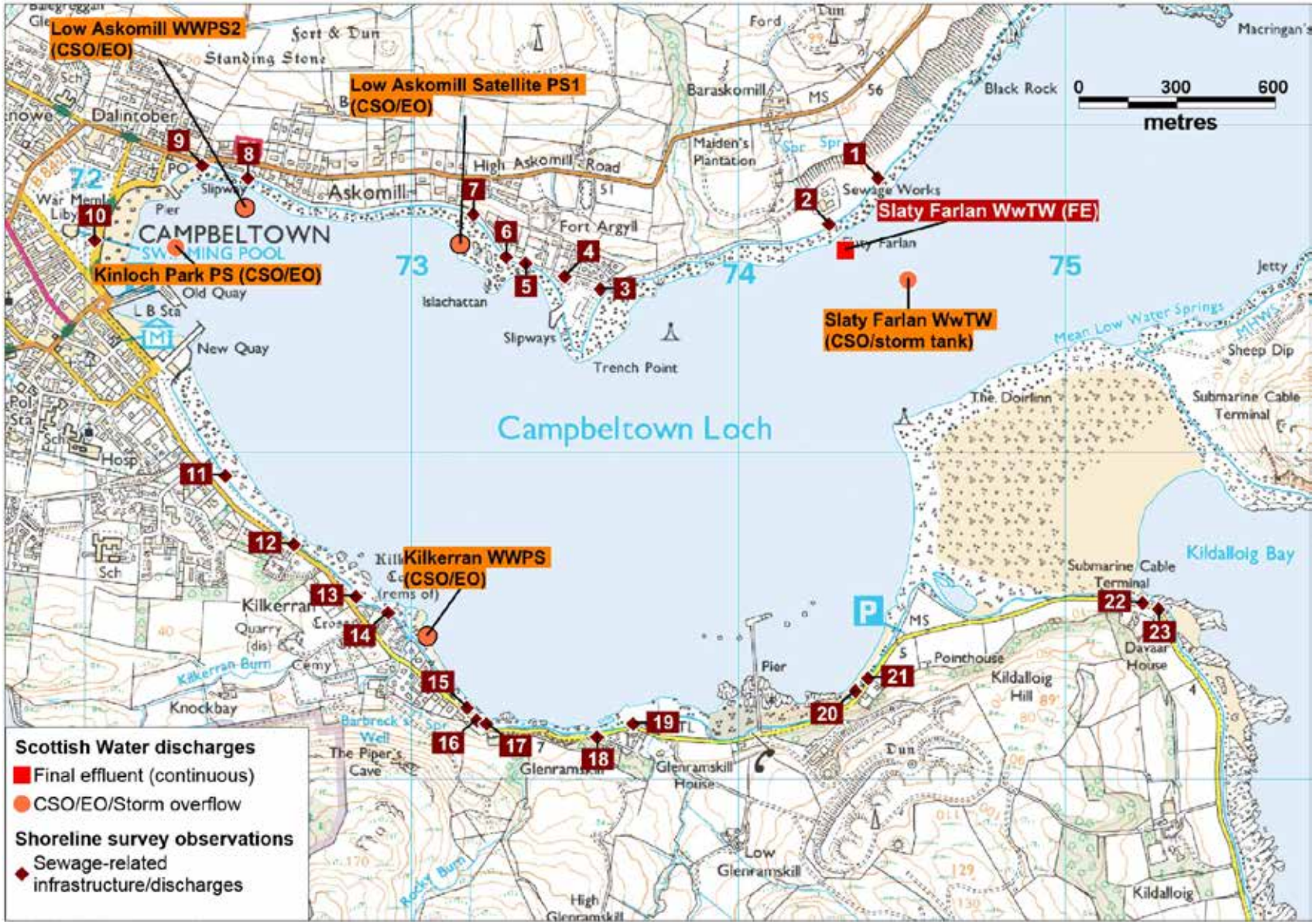




**Figure 2.2 Map of updated sewage discharges and 2013 shoreline survey observations**

# 3. Farm Animal Population and Agricultural Impacts

The 2008 report included information on farm animal populations, including data from the Agricultural Census and the shoreline survey. A recent desk-based search undertaken for this review returned information on the upgrades to Campbeltown Creamery which provides new information on farming practices in the Campbeltown area. Shoreline survey observation information only relates to the time of the surveys undertaken in May 2008 and on the 2nd and 3rd July 2013. Figure 3.1 displays the locations of animals observed during the 2013 survey.

During the 2008 shoreline survey, approximately 262 sheep plus lambs, 10-15 cattle, and three goats were seen around Campbeltown Loch. The majority of sightings were along the southeast shore, particularly around Kildalloig Farm (approx. 1.5 km south of the shellfish bed). A livestock shed and slurry pit were also noted close to Kildalloig Farm, with fields used to grow silage crops in the summer and slurry spread under suitable weather conditions. Sheep were observed along the northern shoreline, east of Askomill, and 20 sheep and three goats were noted on Davaar Island's northern shoreline.

Little livestock was noted in the 2013 shoreline survey. In total, four cattle and 38 sheep were observed in fields to the south, with a further 16 sheep grazing along the foreshore. Twelve sheep were also noted on Davaar Island and several grassy fields located east of the NATO pier were recorded as being used for silage. The shoreline survey route did not cover Kildalloig Farm to the southeast.

The surrounding area of Campbeltown Loch are recognised as important for dairy farming, with wetland areas west of Campbeltown having been drained to form pasture for cattle in the last century. In 2012, First Milk were granted planning permission to build a new manufacturing facility at the site of the old creamery at Campbeltown. Details of upgrades to the existing Campbeltown Creamery were downloaded from the Argyll and Bute Council Planning Portal in July 2013(Argyll & Bute Council, 2014). However, no specific information on discharges from the facility was available.

Overall the largest agricultural impacts to the fishery continue to come from the land south of the cockle bed. This land continues to be used to rear both sheep and cattle. Land around Glenramskill is now reported to be used for silage crops. No updates were made on Kildalloig Farm, due to the survey not extending that far south. Other contamination inputs are expected from livestock reared on Davaar Island itself. Overall, the number of sheep and cattle observed in the 2013 survey is considerably less than was observed during the 2008 survey. It is unclear whether this reflects or true changes in livestock numbers kept in the area, as the surveys were taken close together in terms of season: May and July.




**Figure 3.1 Map of farm animals and associated observations made during the 2013 shoreline survey**

# 4. Wildlife

Information on wildlife for this review has been obtained through the shoreline surveys conducted in 2008 and 2013, and through a desk-based internet search. Shoreline survey observation information only relates to the time of the surveys undertaken in May 2008 and July 2013. Wildlife observations are displayed in Figure 4.1.

**Seals**

During the 2008 shoreline survey, two seals were observed in water; one outside the sewage works (northeast) and the other close to the Doirlinn (south). The grower reported that a seal haul out can be found on rocks to the south of Kildalloig Farm.

Since the 2008 Sanitary Survey Report there have been updated population counts for the area around Campbeltown. Up to 200 common seals observed around the Kintyre Peninsula (which includes Campbeltown Loch) between 2000 and 2006 by the sea mammal research unit (SCOS, 2012). Through anecdotal accounts of seals in Campbeltown Loch, it would suggest that they regularly visit the area (kintyre.org, 2013).

No seals were observed during the 2013 shoreline survey.

**Cetaceans**

No cetaceans were observed during either the 2008 or 2013 shoreline surveys. It is appreciated that the water bodies surrounding Campbeltown Loch: the Kintyre Peninsula, Firth of Clyde and Kilbrannan Sound support populations of dolphins and porpoise, whilst supporting visiting larger cetaceans such as whales (Hebridean Whale and Dolphin Trust, 2008). Small cetaceans such as dolphins and porpoise may visit the loch from time to time, but overall contamination impact from cetaceans is expected to be low.

**Seabirds**

During the 2008 shoreline survey, gulls, oystercatchers and other waders were noted in various locations around the loch, though none were present in high numbers.

New information on the Laggan stretch (a lowland area west of Campbeltown) indicates that it was originally a wetland area. In recent years it has been drained to form pastures for rearing dairy cattle. During the winter this area continues to attract overwintering geese in large numbers. It also hosts populations of teal, widgeon, waders and sea birds. To the west of Campbeltown lies the Seabird Observatory in Machrihanish area (Machrihanish Sea Bird & Wildlife Observatory, n.d.). Although sighting data is specific to the observatory, it does indicate that there are a large number of birds located in the near vicinity that are likely to use the areas

surrounding Campbeltown Loch. The mouth of Campbeltown Loch is also an important area to many overwintering species of duck and wader. Seabirds such as gannets, terns and gull species are also common in the area year round (The Argyll Bird Club, n.d.).

In the 2013 shoreline survey birds were the only wildlife observed. Birds were primarily at Campbeltown, on the shore on the southern side of the Doirlinn, and on Davaar Island. These areas may potentially represent concentrated sources of bird contamination.

**Deer**

Anecdotal accounts exist of roe and sika deer observed around Campbeltown Loch (Forestry Commission Scotland, 2013). There are areas of woodland to the south of Campbeltown Loch that are ideal habitats for deer (Scottish Natural Heritage, Argyll West and Islands 2002), and these may represent concentrated sources of faecal contamination. No deer were observed during the 2008 or the 2013 surveys.

**Otters**

There have recently been new anecdotal accounts of the Eurasian Otter (*Lutra lutra*), around Campbeltown Loch (Kintyreaccomodation.com, n.d.). Although no otters were observed in the 2013 survey, they are likely to have some level of impact on the contamination impact on the shellfishery.

**Conclusions**

Overall, it is anticipated that faecal contamination from wildlife has not changed significantly since the 2008 report, with birds representing the most common sources. It is expected that impacts will be intermittent.

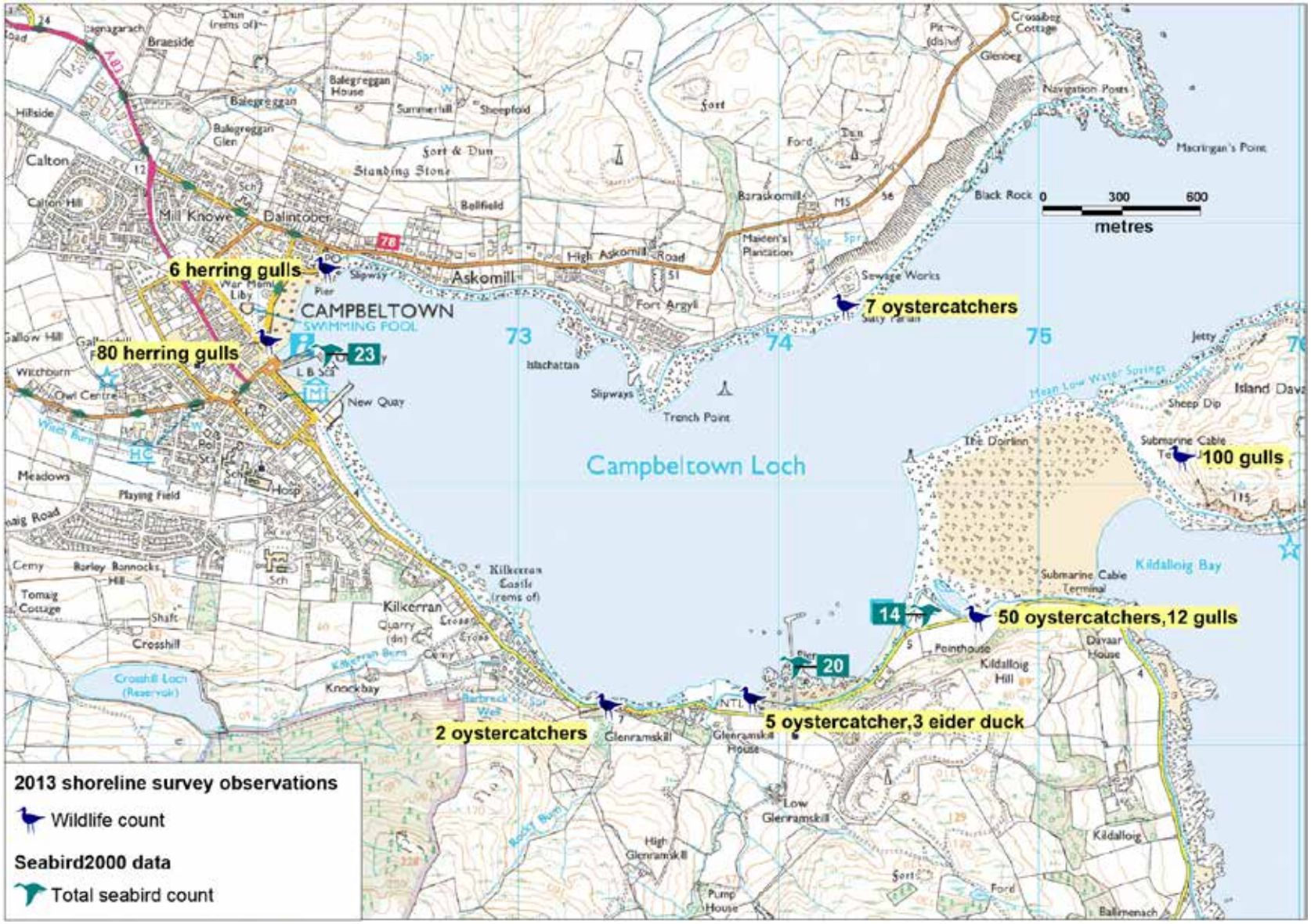




**Figure 4.1 Wildlife observations from 2013 survey and Seabird 2000 data**

# 5. Watercourses

There are no gauging stations on watercourses that enter into Campbeltown Loch. From the Scottish Sea Catalogue, Campbeltown Loch receives a moderate amount of rainfall (1200 mm/ year), with freshwater runoff measured at 12.5 $Mm^3$/yr (Edwards & Sharples, 1986). Weather for the surveys was as follows:

2008: sunny and warm, with no significant rainfall recorded over the 48hrs prior to the survey

2013: intermittent rain turning heavy in the afternoon of the first day of surveying, with the second day dry. Light precipitation fell on the two days prior to survey.

A comparison of watercourse loadings estimated on the basis of the 2008 and 2013 shoreline survey measurements and *E. coli* concentrations are displayed in Table 5.1. In total nine watercourses were measured and sample in the 2008 survey, seven of which were re-sampled in 2013. Sample loadings from the 2013 survey are displayed in Figure 5.1. A full list of recorded flow measurements and sample results from the 2013 shoreline survey can be found in Appendix 3.

**Table 5.1 Watercourse loadings to Campbeltown Loch taken during the 2008 and 2013 surveys**

| No. | Description | NGR | 2008 Loading (*E. coli* / day) | 2013 Loading (*E. coli* / day) |
|---|---|---|---|---|
| 1 | Unnamed watercourse | NR 7484 2131 | $6.4x10^8$ | $9.7x10^9$ |
| 2 | Baraskomill Burn | NR 7389 2060 | $2.0x10^8$ | $3.2x10^8$ |
| 3 | Unnamed watercourse | NR 7236 2088 | $5.5x10^{10}$ | $>4.3x10^{10}$ |
| 4 | Kilkerran Burn | NR 7299 1942 | $4.9x10^{10}$ | $2.0x10^{11}$ |
| 5 | Rocky Burn | NR 7335 1915 | $5.5x10^8$ | $3.0x10^9$ |
| 6 | Glenramskill Burn | NR 7375 1914 | $5.5x10^8$ | $>1.8x10^{11}$ |

-Where an *E. coli* result was denoted with a >, the limit of detection value was used to calculate loading

During the 2008 shoreline survey, the largest freshwater estimated loadings were associated with an unnamed watercourse entering northwest of Campbeltown Loch and from Kilkerran Burn entering from the south. Both watercourses enter the loch more than 1 km from the cockle bed.

Loadings from watercourses in the 2013 survey were generally higher overall, with the highest loadings entering from Kilkerran Burn and Glenramskill Burn, south of the loch. These are located approximately 1.5 km and 1 km to the west of the cockle bed respectively, with Rocky Burn located between them. Two planning applications indicated new sewage inputs to an unnamed watercourse along the south shore. These were to areas close to Kilkerran Burn, so this watercourse may receive contamination from those sources.

In general, loadings estimated from measurements made during the 2013 shoreline survey were higher than those estimated on the basis of the previous shoreline survey. This is likely to have been contributed to by the more recent survey having been undertaken during wet weather. Faecal impacts at the cockle bed associated with freshwater sources will predominate on the southwestern side.

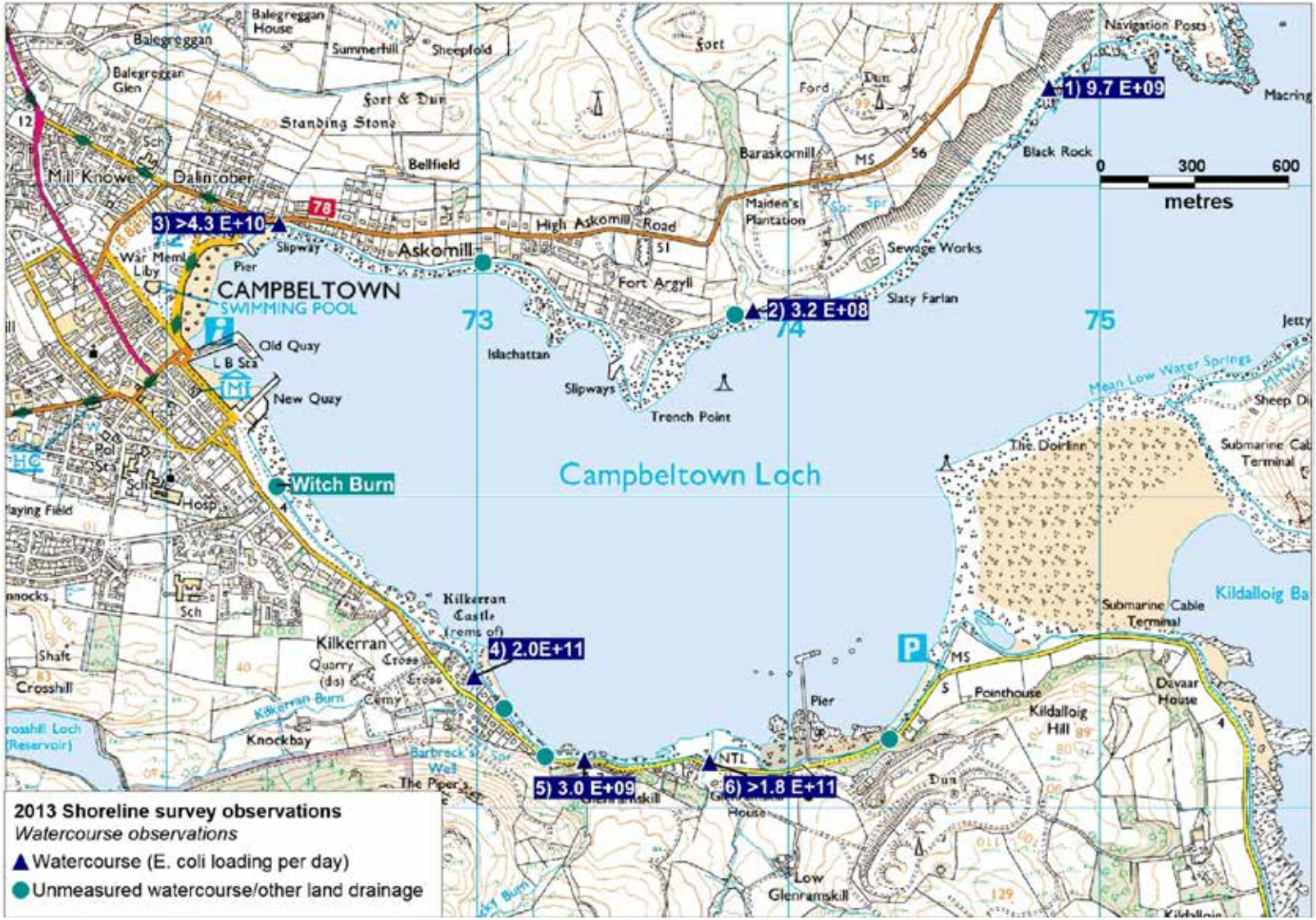




**Figure 5.1 Watercourse loadings into Campbeltown Loch, measured during the 2013 shoreline survey**

Where the bacterial loading is labelled 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 $1x10^3$, in digital format it is written as 1E+03.

# 6. Meteorological data

Meteorological data had been purchased from the Meteorological Office for the survey period 01/01/2003 - 31/12/2007 for the analyses undertaken for the 2008 Campbeltown Loch Sanitary Survey Report: rainfall box-plots and wind roses for 2003-2007 period are presented in that report and have not been reproduced here. Rainfall was recorded in total daily rainfall (mm) were taken from the Machrihanish weather station, which lays 8 km west of the Campbeltown Loch production area. Wind roses were taken from the Prestwick weather station, which lies approximately 62 km east of the Campbeltown Loch production area.

Meteorological data for this Review was purchased from the Meteorological Office in April 2013 for the period 01/01/2008 – 31/12/2012. Rainfall data from Machrihanish was available for 2029/2070 survey days.

## 6.1 Rainfall

Storm events and high rainfall levels are commonly associated with increased faecal contamination of coastal waters through surface water run-off from land where livestock or wild animals are present and through sewer and waste water treatment plant (WWTP) overflows (Mallin, et al., 2001; Lee & Morgan, 2003).

The Machrihanish weather station rainfall dataset for 2008-2012 is presented by year in Figure 6.1 and by month in Figure 6.2.

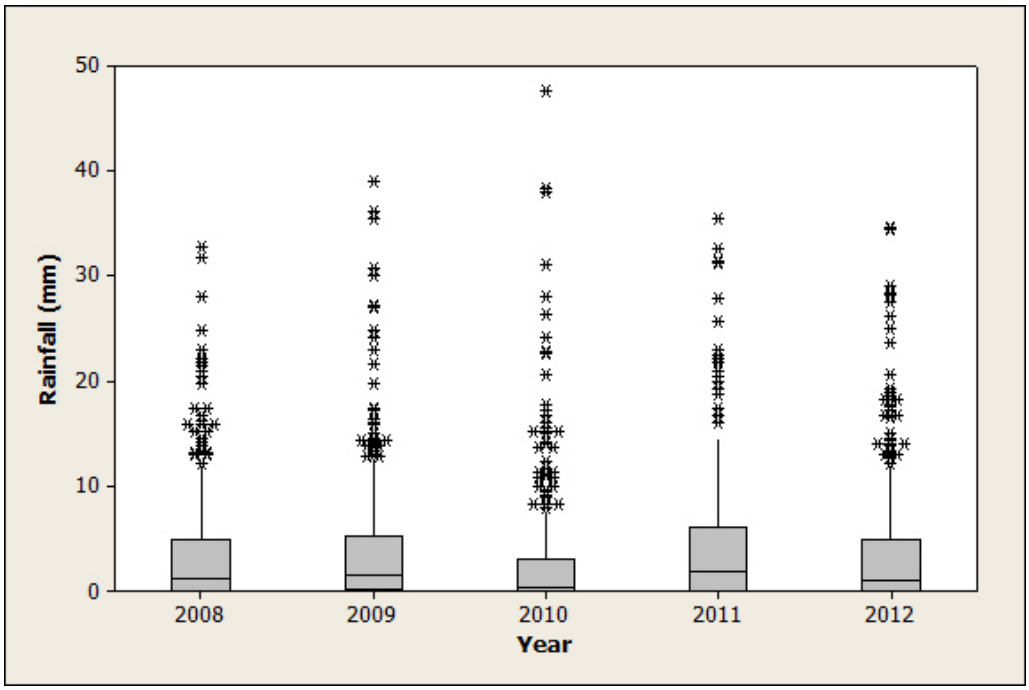


**Figure 6.1 Boxplot of daily rainfall at Machrihanish by year (2008-2012)**

The bulk of the observations are below 10 mm rainfall/day. In the period 2007-2012 there were both wetter and drier years than occurred during the previous period

2003-2006: 2009 was generally wetter and 2010 was drier. The number of rainfall events exceeding 30 mm/day occurred in all years, with an extreme rainfall event of nearly 70 mm/d seen in 2012.

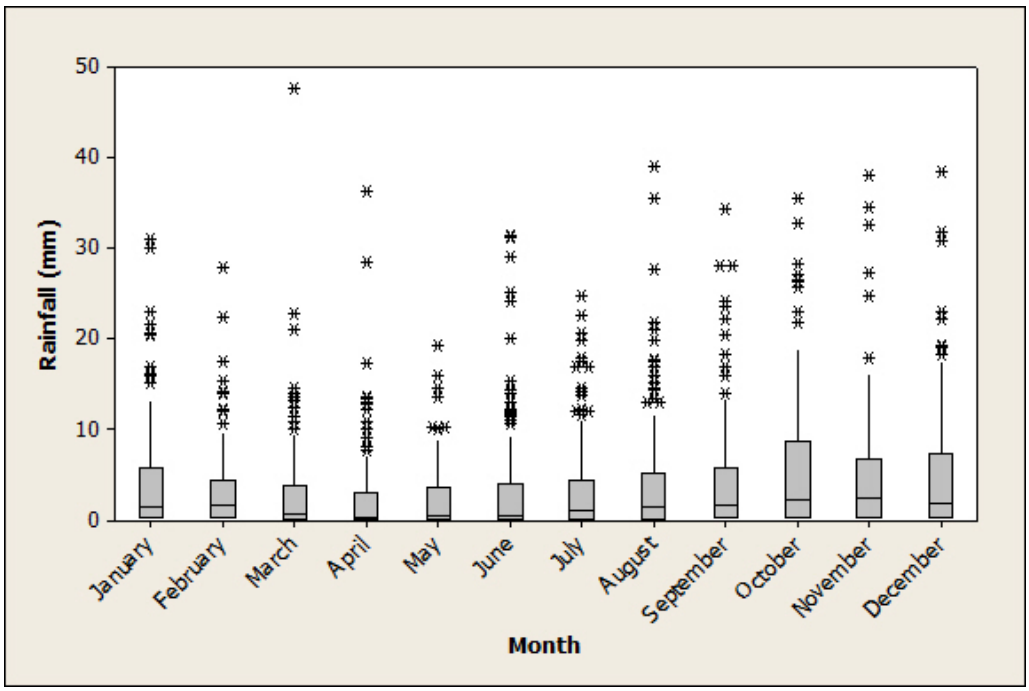


**Figure 6.2 Boxplot of daily rainfall at Machrihanish by month (2008-2012)**

Figure 6.2 presents a boxplot of daily rainfall values by month for the 2007-2012 dataset. The period 2003-2006 had shown a marked difference in rainfall with season, with October to January the wettest months, and August and July the driest. A similar trend was seen in data from the period 2007-2012, with October to January representing the wettest months, and April and May the driest. In 2003-2006 rainfall events greater than 30 mm day were occurred in the months of February, August, October and November; in 2007-2012 they also occurred in the months of July and December. This may simply reflect naturally variability.

### 7.2 Wind

Wind speed and direction drive surface water and currents that play an integral part in particulate dispersal. Winds typically drive surface water at ca. 3% of the wind speed (Brown, 1991) so a gale force wind (a minimum of 34 knots/17.2 m/s) would drive a surface water current of about 1 knot or 0.5 m/s.

Figure 6.3 shows seasonal wind roses for Prestwick for the period 2002-2011 while Figure 6.4 shows the annual wind rose for the same period. The local topography at Campbeltown Loch may result in differing wind patterns to those shown in the wind roses (Prestwick is on the east coast of mainland Scotland, whilst Campbeltown Loch is on the west coast of the Kintyre Peninsula).

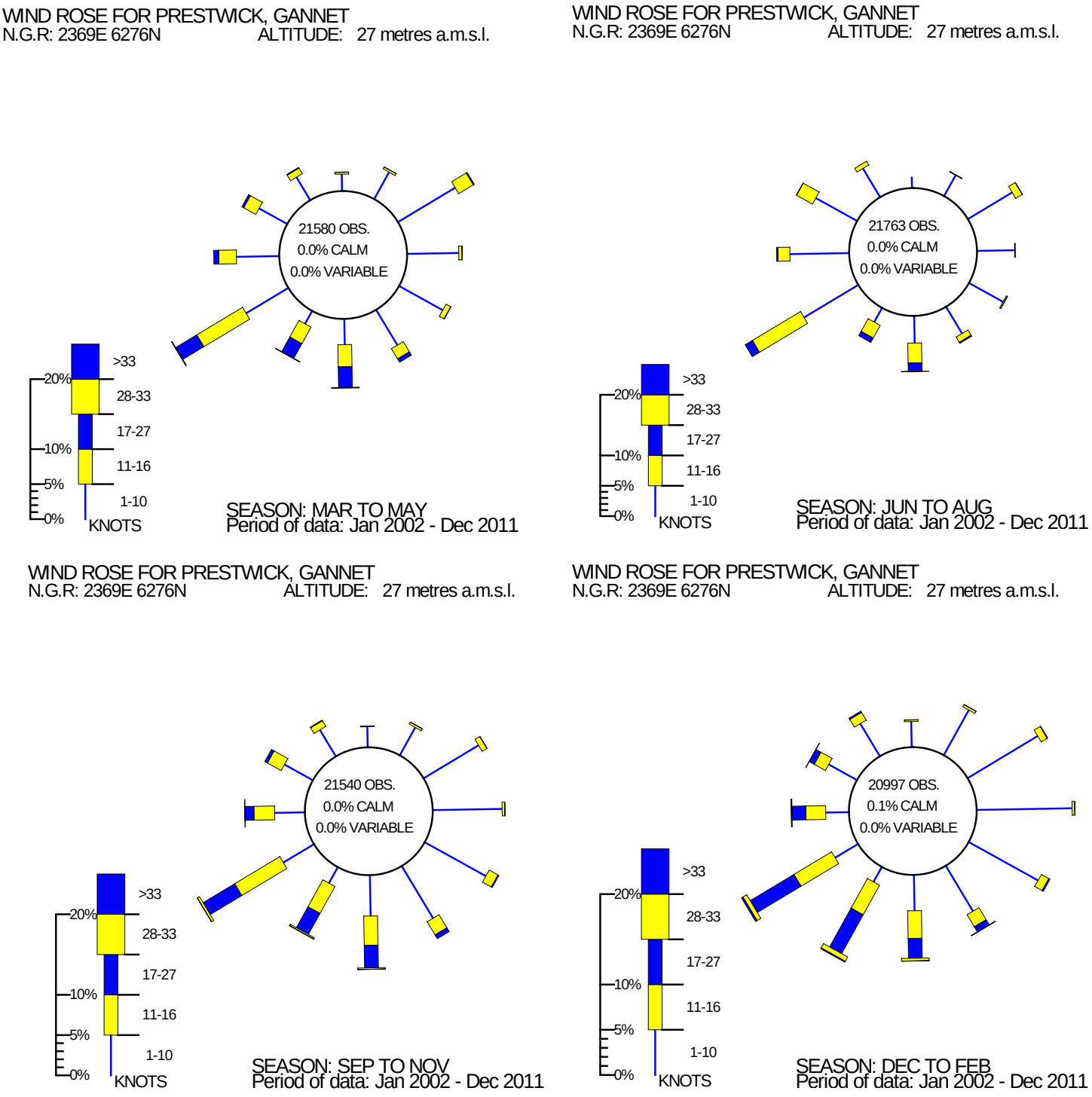


**Figure 6.3 Seasonal wind roses for Prestwick (2002-2011)**

Prevailing winds throughout all four seasons appears to be from the westsouthwest, with the strongest winds in autumn and winter. Summer has the lightest winds

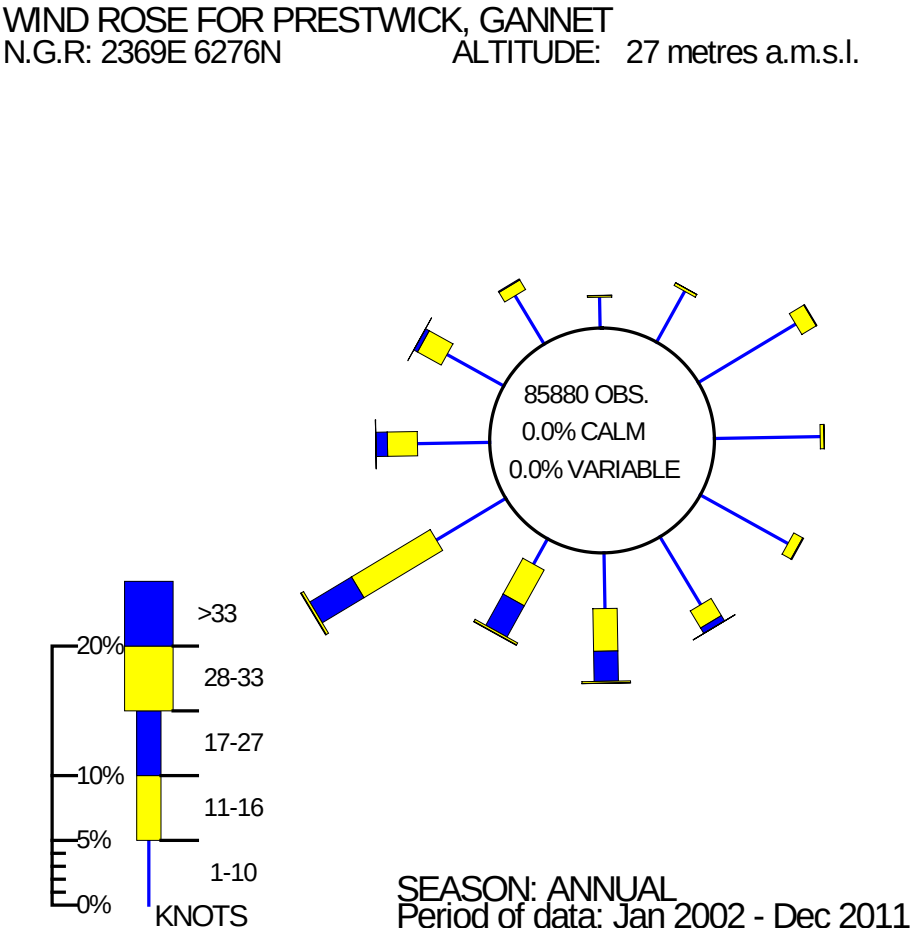


**Figure 6.4 Annual wind rose at Prestwick (2002-2011)**

# 7. Historical *E.* coli Data

Results for common cockles assigned against the Campbeltown Loch production area between 01/01/2008 and 27/06/2013 were extracted from the FSAS database and validated according to the criteria described in the standard protocol for validation of historical *E. coli* data. Data was extracted from the database in June 2013. Historical *E. coli* data used in the 2008 report had already been extracted and validated. For the purposes of this review, results from samples pre-dating 2001 were excluded from the analyses.

All *E. coli* results were reported as most probable number per 100 g of shellfish flesh and intravalvular fluid. *E. coli* results for all areas reported as <20 were reassigned a value of 10 *E. coli* MPN/100 g, and results >18000 were reassigned a value of 36000 *E. coli* MPN/100 g for the purposes of statistical evaluation and graphical representation.

All samples were recorded on the database as valid and were received at the laboratory within 48 hours of sample collection. All box temperatures were ≤8$^{o}$C.

### *7.1 Summary of microbiological results*

Summary results are displayed for the cockles at Campbeltown Loch in Table 7.1.

**Table 7.1 Sampling summary results for Campbeltown Loch common cockle fishery between 2004 and 2013**

| **Sampling Summary** | | | | |
|---|---|---|---|---|
| Production area | Campbeltown Loch | | | |
| Site | Kildalloig Bay | | | |
| Species | common cockles | | | |
| SIN | AB-029-008-04 | | | |
| Location | Various | | | |
| Years | 2004-2007 | | 2008-2013 | |
| Total no. of samples | 39 | | 55 | |
| | No. 2004 | 10 | No. 2008 | 6 |
| | No. 2005 | 11 | No. 2009 | 8 |
| | No. 2006 | 12 | No. 2010 | 12 |
| | No. 2007 | 6 | No. 2011 | 10 |
| | | | No. 2012 | 12 |
| | | | No. 2013 | 7 |
| **Results Summary** | | | | |
| Minimum | 40 | | 70 | |
| Maximum | >18000 | | >18000 | |
| Median | 700 | | 750 | |
| Geometric mean | 837 | | 737 | |
| 90 Percentile | 9100 | | 4260 | |
| 95 Percentile | >18000 | | 9200 | |
| No. exceeding 230/100g | 31 (80%) | | 38 (69%) | |
| No. exceeding 1000/100g | 18 (46%) | | 26 (47%) | |
| No. exceeding 4600/100g | 6 (15%) | | 5 (9%) | |
| No. exceeding 18000/100g | 2 (5%) | | 1 (2%) | |

The proportions of results exceeding 230 and 4600 *E. coli* MPN/100 g were lower during 2008-2013 than during 2004-2007.

### *7.2 Geographical patterns of results*

The location of the current common cockle RMP, the estimated location of the cockle bed taken from the 2008 report and sampling locations for the period 01/01/2008 – 27/06/2013 are shown in Figure 7.1. The symbols for the sample locations are shown thematically graduated in proportion to the magnitude of the *E. coli* result.

The cockle samples have mostly been taken in two areas; at the northeastern and southwestern extents of the estimated cockle bed.

The majority of cockle samples have been taken within 100 m of the RMP (NR 7490 1987), located to the southwest corner of the 2008 estimated extent of the cockle bed. Samples taken between 2008 and 2009 predominantly came from an area approximately 400 m northeast of the RMP. The highest results (>4600 *E. coli* MPN / 100 g) were from samples taken within 50 m of the RMP.

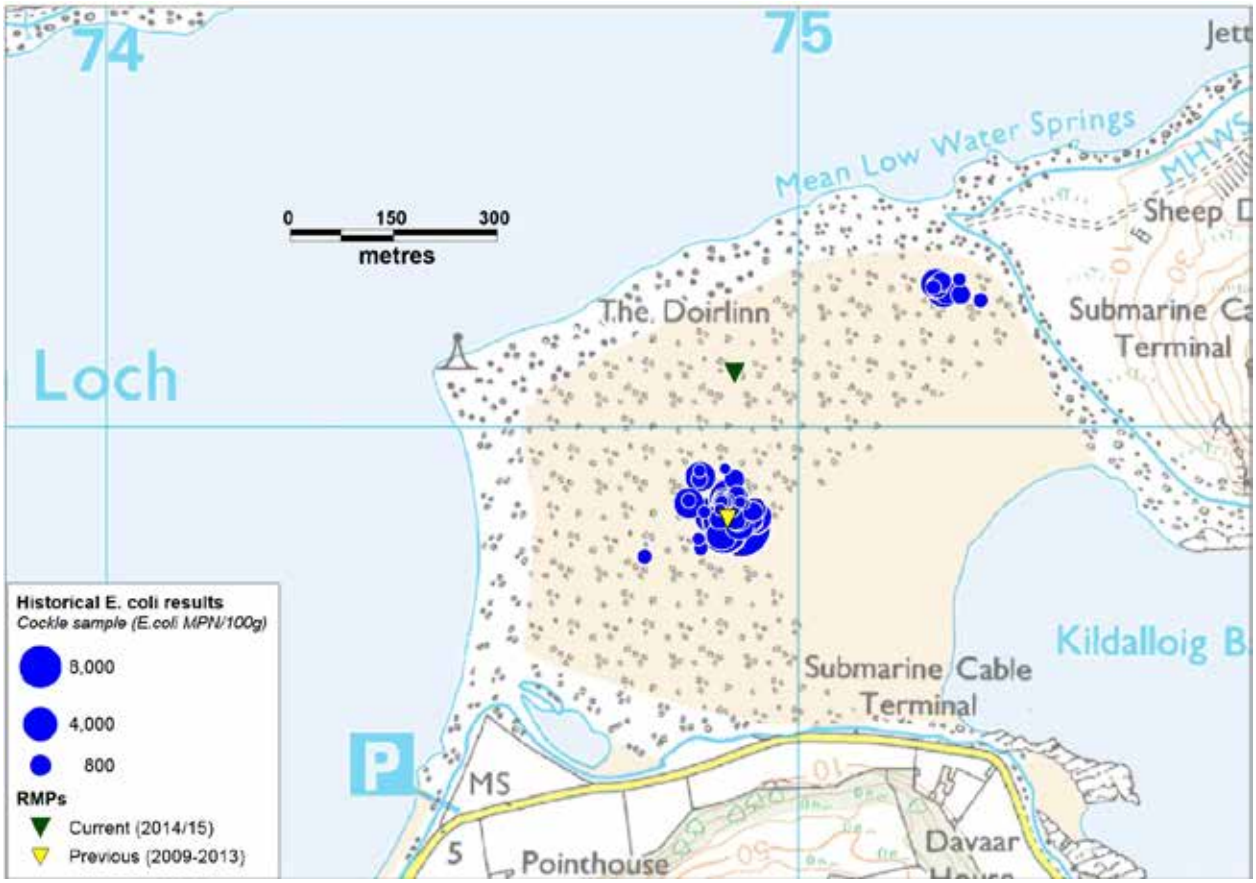




**Figure 7.1 Sample results and locations at Campbeltown Loch**

### *7.3 Temporal patterns of results*

Trends in common cockle *E. coli* results in Campbeltown Loch have been analysed for the years between the previous sampling period (2001-2007) and the current sampling period (2008-2013). A scatterplot of the results is shown in Figure 7.2. The dataset is fitted with a lowess trend line. Lowess trendlines allow for locally weighted regression scatter plot smoothing. At each point in the dataset an estimated value is fitted to a subset of the data, using weighted least squares. The approach gives more weight to points near to the x-value where the estimate is being made and less weight to points further away. In terms of the monitoring data, this means that any point on the lowess line is influenced more by the data close to it (in time) and less by the data further away. A trend line helps to highlight any apparent underlying trends or cycles.

To test for significance differences between results taken over the two sampling periods, the following statistical analyses were carried out on the statistical software package Minitab:

A two sample t-test (using $\log_{10}$ transformed *E. coli* data) to determine whether there was a statistically significant difference between *E. coli* results between the two sampling periods.

A Chi squared test to test for the significant difference in the observed and expected common cockle *E. coli* results above critical levels (230 and 1000 *E. coli* MPN/ 100 g) from both sampling periods.

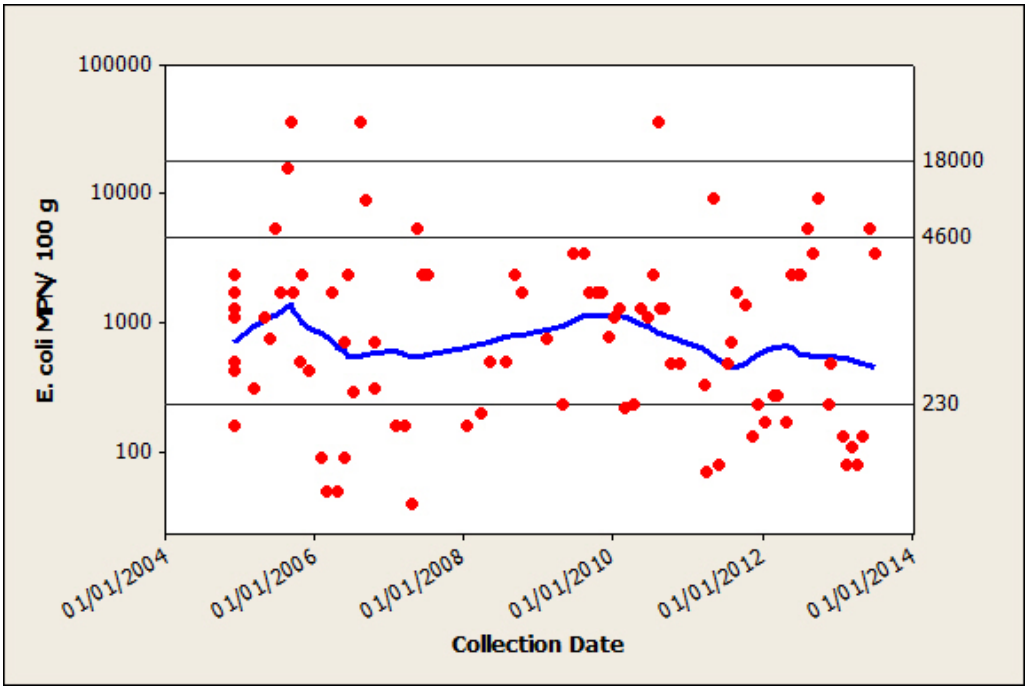


**Figure 7.2 Scatterplot of Campbeltown Loch common cockle *E. coli* results by date (2005-2013), with a lowess line**

Contamination levels have generally stayed the same over the period 2004 to 2013, as indicated by the trend line. No significant difference was found between Campbeltown Loch common cockle log transformed *E. coli* results from the two survey periods (Two sample t-test, t = 0.39, DF = 73, p = 0.701).

**Table 7.2 Chi-squared test results above and below 230 and 1000 *E. coli* MPN/100 g for Campbeltown Loch common cockle *E. coli* results**

| | | *E. coli* MPN/100g | | | *E. coli* MPN/100g | | |
|---|---|---|---|---|---|---|---|
| | | ≤230 | >230 | **Total** | ≤1000 | >1000 | **Total** |
| **2001-2007** | Observed | 8 | 31 | 39 | 21 | 18 | 39 |
| **2008-2013** | Observed | 17 | 37 | 55 | 29 | 26 | 55 |
| | **Total** | 25 | 69 | 94 | 50 | 44 | 94 |

No statistically significant difference was found between sampling results ≤230 *E. coli* MPN/ 100 g and >230 *E. coli* MPN/ 100 g between sampling periods (Chi-square test, $X^2 = 1.263$, DF = 1, p = 0.261).

A statistically significant difference was found between sampling results ≤1000 *E. coli* MPN/ 100 g and >1000 *E. coli* MPN/ 100 g between sampling periods (Chi-square test, $X^2 = 0.011$, DF = 1, p = 0.915), with a greater proportion of results >1000 *E. coli* MPN/ 100 g occurring in the period 2008-2013.

# 8. Movement of contaminants

The main conclusions of the 2008 sanitary survey report with respect to movement of contaminants were as follows:

- Currents from a combination of tide, wind and freshwater inputs would be the main drivers of water and contamination movement on Campbeltown Loch.
- The bathymetry around the Doirlinn would prevent movement southeast during low tides.
- Water movement on an incoming tide along the northern shoreline is westwards, in a counter-clockwise direction, and water would move eastwards on the ebb tide.

Since the 2008 report, a Campbeltown Marina Feasibility and Technical Report has been produced which included a bathymetric survey and wave modelling to support a decision on the location for a new marina (Argyll & Bute Council, 2011). The publicly available report did not include the results of the bathymetric survey itself and it is not clear whether the survey was confined to the vicinity of the current quays and proposed new marina. Predictions of wave height in the inner loch were that these would not exceed 0.4 m in the loch itself, and 0.3 m in the vicinity of the new marina, under normal conditions (up to a 1 in 5 year wind/wave conditions and mean high water springs). The report did highlight that dredging for marina construction could re-suspend contaminants and that further sediment contaminant investigations would be required.

The Scottish Water/Hyder report on microbiological compliance assessment in Campbeltown Loch refers to the use of a Delft3D coastal model (Scottish Water/Hyder, 2009). However, no details were given on the bathymetric input or the predicted hydrodynamic outputs.

Therefore, while significant data does potentially exist on the hydrography of Campbeltown Loch, it was not available for consideration within this review. Movements of contaminants are therefore considered to remain largely the same as those identified in the 2008 report.

# 9. Overall Assessment

This assessment considers the information obtained since the 2008 Report and the potential changes in extent and location of faecal contamination.

**Human sewage Impacts**

The new marina associated with the CHORD project is expected to better accommodate the peak demand from yachts already visiting the area, and will be smaller than originally planned. However, no information was available regarding whether sewage pump out facilities were planned for the new marina. Although there has been a campaign to reduce the amount of overboard discharge from boats in marinas, many of those boats following the advice will discharge holding tanks whilst transiting in and out of the loch, and potentially nearer the cockle bed. Harbour improvements at New Quay are expected to bring additional commercial ship traffic to the loch, though this is not expected to increase sewage disposal in the loch it may increase movement of sediment and therefore resuspension of silt and associated microbes.

Improvements to the public sewerage network have generally revolved around refurbishments and increased capacity of the works. Although modelling undertaken in support of the project indicated compliance with 100 FC/100ml, details of this modelling were not available. A 13% increase in treated final effluent volume was predicted. According to Scottish Water, half the effluent volume receives tertiary treatment and the other half secondary treatment, therefore this discharge is still expected to contribute a significant faecal loading to the waters of the outer loch.

The new storm discharge and CSO outfall from Slaty Farlan WWTW is closer to the cockle bed than the final effluent outfall (within 500 m), and therefore may have a greater impact on water quality on the northwest side of the cockle bed when operating. Contamination is also expected to continue to come from private discharges located to the south of the cockle bed, including those associated with Davaar House to the southeast and around Glenramskill.

**Agricultural impacts**

Livestock continue to be reared on land adjacent to Campbeltown Loch, though numbers appear to have decreased since the 2008 report. It is unclear whether the observations represent a true decline in livestock numbers in the area. The highest agricultural impact continues to come from the south shore, with some also expected from livestock kept on Davaar Island.

**Wildlife Impacts**

Wildlife impacts are not expected to have changed significantly since the 2008 report. New information does however highlight that high numbers ducks and wading

birds may be present around the mouth of the loch during the winter months. Large numbers of gulls were seen on Davaar island and a large flock of oystercatchers were seen at the south end of the Doirlinn. Large concentrations of birds on or near the cockle bed would be likely to contribute to faecal contamination levels there, and higher numbers would be expected in winter when more wading birds are likely to be present.

**Seasonal Variation**

Highest rainfall levels continued to fall between October and January. No additional information on seasonal variations in populations of wildlife or livestock was obtained during this review. However, the increase in both tourist accommodation and berthing capacity at the marina is expected to result in significant seasonal increase in demand on the sewerage network. Discharge of sewage from boats in the marina may also pose as a significant contamination risk during peak season in the summer.

**Watercourses**

Overall, contamination observed in watercourses discharging to the loch was higher in the 2013 survey than the 2008 survey. This may have been due to a difference in prevailing conditions at the time of survey: the 2008 shoreline survey was undertaken during dry weather whilst there had been rain prior to and during the 2013 shoreline survey. The most significant freshwater sources of contamination with respect to the fishery lay between approximately 1 and 1.5 km to the southwest of the fishery.

**Movement of contaminants**

The hydrography and bathymetry is not expected to have changed significantly since the 2008 report. Tidal currents continue to represent the most significant transport pressure, with increasing boat traffic and size of vessels likely to increase wake incidence and size which may cause water to inundate the cockle bed during times of low water.

**Analysis of Results**

Historical *E. coli* results

The majority of common cockle results were greater than 230 *E. coli* MPN/100 g. A statistically significant difference was found between the two sampling periods with regard to the proportion of results exceeding 1000 *E. coli* MPN/100 g: a higher proportion occurred during 2008-2013 period than during 2004-2007.

Shoreline Survey results

Two cockle samples were taken to the west of the cockle bed identified in the 2008 sanitary survey report: the locations were within 200 m of each other. The sample taken to the southwest gave a higher result (16000 *E. coli* MPN/100 g) than the sample taken to the northeast (9200 *E. coli* MPN/100 g) although the difference is not marked. Two mussel samples were taken on the south side of the intertidal area: both gave results of 330 *E. coli* MPN/ 100 g. The difference may reflect species differences in uptake of contamination as well as differences in the influence of sources of contamination.

Five seawater samples were taken during the survey. The highest result was from a sample taken at the south of the cockle bed and returned a result of 1800 *E. coli* cfu/ 100 ml, which is very high compared to seawater results seen in many Scottish shoreline surveys. The source of this contamination was not clear.

## Conclusions

The conclusions from the 2008 Report indicated that the following were the main potential sources of faecal contamination to the fishery at Campbeltown Loch:

- Main sources of contamination were sewage effluent from the treatment works at Slaty Farlan and from private discharges at Daavar House and along the south shore of the loch, diffuse agricultural contamination arising largely from Daavar farm, and potential discharges from boats.

- Sampling results were significantly higher in summer, with highest mean results occurring in August.

- Agricultural activity at Kildalloig Farm along the south shoreline – livestock are removed from these fields during summer, when fields are left to grow to produce silage. Slurry is spread during the summer when weather permits.

The 2013 survey has found the following main changes:

- Overall improvements made at the Slaty Farlan WWTW have been predicted to result in a 13% increase in final effluent volume discharged to the loch. Half of the total volume receives secondary treatment and half receives tertiary treatment.

- The installation of a new CSO/storm tank outfall extending beyond the main WWTW outfall will result in a 95% decrease in sewage spills to the inner loch and an increase in the flow of partially treated effluent to deeper waters 500 m north of the cockle bed. Due to their proximity to the shellfishery, both changes may potentially result in an overall increase in the proportion of faecal indicator bacteria attributable to sewage contamination in the waters of

the outer loch and across the Doirlinn. A modelling assessment undertaken in support of the proposals for improvement in the sewerage system predicted compliance with a design standard of 100 FC/100 ml at the cockle bed. However, the modelled FC concentrations for the final effluent stream from Slaty Farlan in particular are considered to be underestimates based on the treatment levels currently in place.

- An application to install a new cheese processing facility at the Campbeltown Creamery did not provide sufficient information to determine whether this would have any impact on the levels of faecal indicator bacteria in the loch.

- Loadings found in watercourses during wet weather, as seen in 2013, were higher than those seen in 2008 and indicate that freshwater-borne contamination arising to the southwest of the fishery may be a more significant factor than previously identified.

# 10. Recommendations

**Production area**

It is recommended that the production area boundaries be amended slightly to exclude observed discharge pipes associated with Davaar House. The amended boundary is recommended as the area bounded by lines drawn between NR 7522 2030 and NR 7451 2008 and between NR 7451 2008 and NR 7455 1959 and between NR 7518 1955 and NR 7558 1990, extending to MHWS.

**RMP**

It is recommended that the RMP be amended to NR 7476 1999. This point lies toward the northwest extent of the cockle bed and takes into consideration the CSO/storm tank inputs from Slaty Farlan WWTW, as well as local authority comment regarding the location of sufficient densities of cockles for sampling purposes.

**Tolerance**

It is recommended that the tolerance zone be expanded to 120 m. This extends the sampling area to the northern edge of the cockle bed and should ensure sufficient scope to allow monthly sampling from the bed.

**Depth**

Not applicable

**Frequency**

No change in monthly sampling frequency is recommended.

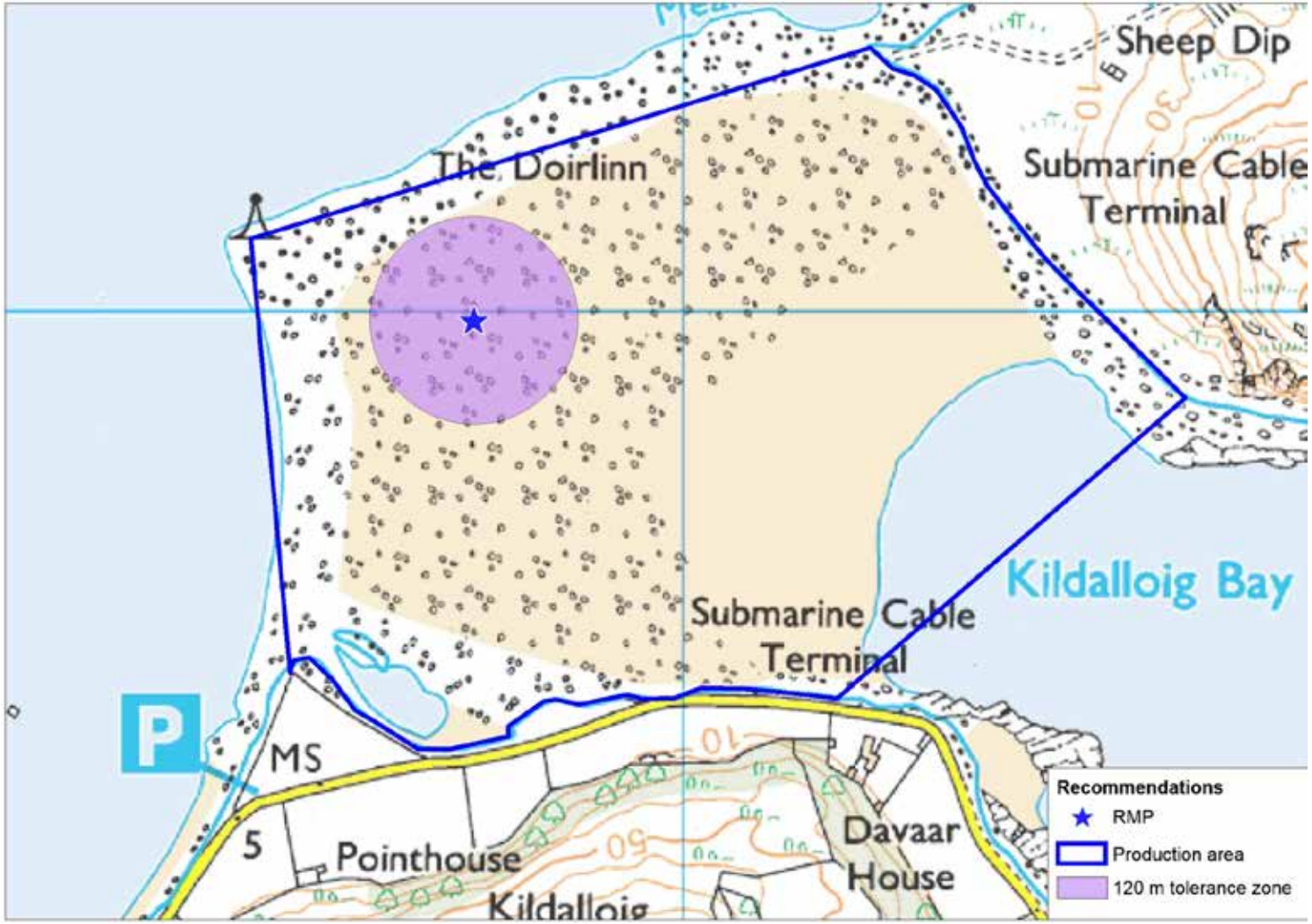




**Figure 10.1 Map of recommended production area boundaries and RMP for Campbeltown Loch cockle fishery**

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# 12. List of Figures and Tables

# Appendices

1. List of planning applications

2. Shoreline Survey Report 2013

# Appendix 1 Planning Applications

Planning applications expected to change the human population and overall faecal loading to Campbeltown Loch are listed in Table 1.

**Table 1 Planning applications to Glenramskill, Witchburn and Millknowe areas respectively.**

| Date | Ref no. | Description | Location |
|---|---|---|---|
| May-13 | 13/01187/PP | Erection of dwellinghouse and detached garage, installation of septic tank and formation of vehicular access, discharge to watercourse including partial soakaway | Land West Of Glenramskill House Kilkerran Road Campbeltown Argyll And Bute, PA28 8RD |
| Oct-12 | 12/02259/PP | Replacement boiler house (demolish existing), associated fuelstore, flues and fuel storage tank; new reverse-osmosis plant, associated silos (4 no.) and replacement chilled water plant; extension of, and re-cladding of store building for new cheese room, associated silo (1 no.) and associated plant | Campbeltown Creamery Witchburn Road Campbeltown Argyll And Bute PA28 6JU |
| Nov-11 | 11/02211/PPP | Site for the erection of dwellinghouse and formation of new access, join to existing public sewer | Garden Ground Of Courthill Kilkerran Road Campbeltown Argyll PA28 6JL |
| May-10 | 10/00914/PPP | Site for erection of 3 dwelling houses and installation of treatment plant., Other type of private system, soakaway outfall to burn | Land West Of Glenramskill House Kilkerran Road Campbeltown Argyll And Bute |
| May-10 | 10/00864/PP | Erection of water treatment works and water storage tank. New septic tank discharging to coastal waters | Glenramskill Oil Depot C19 East Of Campbeltown From Kilkerran Road At Glenramskill House To Corphin Bridge Campbeltown Argyll And Bute PA28 6RD |
| Jul-09 | 09/01006/DET | Erection of 2 semi-detached dwellinghouses, connect to public sewers and SUDS | Plot East Of Kilkerran Farm Kilkerran Campbeltown Argyll |
| Aug-08 | 08/01469/OUT | Site for erection of two dwelling houses - renewal of previous planning consent ref. 05/00687/OUT, connecting to existing public sewer | Courthill House Kilkerran Road Campbeltown Argyll And Bute, PA28 6JL |
| Mar-08 | 08/00477/DET | Erection of dwellinghouse, connect to public sewer | Garden Ground Of Leanamhor Kilkerran Road Campbeltown Argyll And Bute |
| Jun-08 | 08/01072/OUT | Site for erection of dwelling house and garage (renewal of 05/00381/OUT), connecting to existing public sewers | Land To Rear Of Former Clinic Witchburn Road Campbeltown Argyll And Bute |
| Jul-12 | 12/01562/PP | Change of use and extensions to form fast food outlet(Sui Generis)/catering premises (Class 4), change of use of land to form external seating area, erection of detached storage building and formation of new vehicular access. Sewage to existing sewer | Public Toilet Millknowe Campbeltown Argyll And Bute |

# Appendix 2 Shoreline Survey Report

| | |
|---|---|
| **Report Title** | Campbeltown Loch Shoreline Survey Report |
| **Project Name** | Shellfish Sanitary Surveys |
| **Client/Customer** | Cefas |
| **SRSL Project Reference** | 00561_B0067 |

| | |
|---|---|
| **Document Number** | B0067_Shoreline 0013 |

**Revision History**

| Revision | Changes | Date |
|---|---|---|
| A | Issue for internal review | 15/07/2013 |
| 01 | First formal issue to CEFAS for comments | 16/07/2013 |
| 02 | Second issue to CEFAS addressing comments at Rev 01 | 06/08/2013 |
| | | |
| | | |

| | Name & Position | Date |
|---|---|---|
| **Author** | Lars Brunner & Peter Lamont | 04/07/13 |
| **Checked** | Andrea Veszelovszki | 31/07/2013 |
| **Approved** | John Hausrath | 06/08/2013 |



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# Shoreline Survey Report

| | |
|---|---|
| Production area: | Campbeltown Loch |
| Site name: | Kildalloig Bay |
| SIN: | AB-029-008-04 |
| Species: | Common cockle (*Cerastoerma edule*) |
| Harvester: | Mr Donald MacKenzie |
| Local Authority: | Argyll & Bute |
| Status: | Review |
| | |
| Date Surveyed: | 2nd & 3rd July 2013 |
| Surveyed by: | Lars Brunner, Peter Lamont |
| Existing RMP: | NR 7490 1987 |
| Area Surveyed: | Campbeltown Loch from NE shore, in an anti-clockwise route ending on the S shore at Davaar House. |

**Weather**

Light precipitation over the preceding 48hrs.

2nd July: Wind SW/S F4-5, gusting 6, intermittent rain from mid-morning, increasing to heavy by the afternoon. Temp 12°C, cloud cover 100%.

3rd July: Wind S/SE F2, dry, temp 13°C, cloud cover 100% morning, decreasing to around 60% later.

**Stakeholder engagement during the survey**

The local Regulatory Services Officer (Shellfish), Mr Fraser Anderson was not contactable prior to the survey, but did provide information following completion of the survey. Ewan McDougall, one of the sampling officers for the area was able to provide information about the site and the likelihood of cockle collection during survey preparations. The local authorities were invited to join the team on site during the survey but due to staff availabilities were not able to attend.

Mr Donald MacKenzie, the cockle harvester, was met on the 2nd of July by the survey team as they were preparing to access the site at Kildalloig Bay.

**Fishery**

The common cockle (*Cerastoerma edule)* fishery being surveyed occurs in a large bed of sand & rough shingle in Kildalloig Bay. Kildalloig Bay is bordered to its west by a large shingle spit called The Doirlinn. The boundary of the fishery area for cockles is to the north and east of the bay and for mussels, to the west of the bay.

Mr MacKenzie informed the survey team that in his opinion the fishery was in a very good state with plenty of adult sized cockles present, also finding many young cockles, which they return, rather than harvest. He has noticed a change in the sand composition while walking the bay over the last year, with the sand becoming less densely packed, believing that this may be due to a higher number of cockles settling.

He regularly provides employment for 6 people through harvesting, and on the 2nd of July there were 5 other people out with him working the beach. The method of harvest is by hand, with harvest being busier during the summer months and in the run up to Christmas. He noted that there was some small scale harvesting (mostly people for their own consumption), but that he was the only commercial harvester. He noted that there was a brief period of harvesting by another local gang, but this had ceased.

At present mussels are not commercially harvested, and the survey team saw no evidence during the survey of commercial harvest. The method of harvest for mussels is also by hand, although at present only cockles are actively harvested. Although the team surveyed most of mussel bed fishery area while on survey (the area to the east of the bay, and closer in to Davaar Island was not accessible due to the tide state), very few mussels were noted, and those that were present were individuals or in pairs rather than in the mass clumps usually seen. There were a lot of empty mussel shells over the entire fishery area.

Mr Anderson later commented on the present state of the mussel fishery noting that the area had not been classified for harvesting since June 2009, with the local authority aware of casual gatherers, but not commercial activity to harvest mussels.

The survey team kept a look out for any signs of the previous oyster farm to the east of Kildalloig Bay, but no trace of it was observed from the survey path (around 400m from the old oyster trestle location).

Mr Anderson later commented that there were oyster trestles still present at the site but they are only evident at certain states of tide. Mr Anderson also confirmed that declassification of the oyster site had occurred by the 1st of April 2013.

**Sewage Sources**

The shores of Campbeltown Loch are largely inhabited, with population density increasing towards the centre of Campbeltown itself, which is situated in the north-west of Campbeltown Loch. The survey area consists of a mix of residential and business properties, with a greater number of residential properties at the town fringe (i.e. Askomill and Kilkerran).

Much of the Campbeltown area is on a sewage treatment system, which appears to start to the north of Kilkerran and runs in a clockwise direction round the bay, culminating at the Slaty Farlan Waste Water Treatment Works (WWTW) on the northern shore. There were Scottish Water discharges noted

at regular intervals around the bay, and south & east of Kilkerran there were some active private discharge pipes on the foreshore.

### Seasonal Population

No campsites or caravan parks were noted in the survey area. There are many B&Bs and hotels located within the survey area, and there are also likely to be some holiday homes within the town as well, although the numbers are difficult to verify.

### Boats/Shipping

Piers were located on the survey route in Campbeltown at NR 7287 2079 (old masonry pier, disused), NR 7221 2049 (town old quay), NR 7231 2031 (new quay) and NR 7406 1948 (NATO Pier). The old quay contained a pontoon system immediately adjacent to it, and there were a mix of yachts & small pleasure craft using this, while fishing vessels, larger pleasure craft and the Campbeltown lifeboat utilised the old quay itself. The new quay was being used for loading of timber by a large commercial vessel, and on the eastern side, as a car ferry terminal (although unoccupied at time of survey). The NATO pier was unoccupied at the time of survey.

Anchorages were noted at the head of the bay near the town centre, where a total of 11 yachts and small pleasure craft were at anchor, with a further 7 moorings unoccupied. To the south, in the Kilkerran area, there were more dispersed moorings, with a total of 4 small pleasure craft at anchor, and a further 3 moorings visible.

### Farming and Livestock

Comparatively little livestock was observed on this survey, and that observed was towards the end of the survey on day 2. This consisted of a small field with cattle (4) and sheep (38), just to the south of Kildalloig Bay, with further sheep grazing along the foreshore. Using binoculars, it was possible to identify livestock on Davaar Island, with 12 sheep noted. It was not possible to determine whether the sheep on the island were derived from the same flock as on mainland shore, although noting that access to the island is possible across Kildalloig Bay at low tide.

### Land Use

To the north of the loch, east of Trench Point, the land is ungrazed countryside with light native woodland and overgrown grassland, with no habitation on the foreshore area. Trench Point itself is the site of the old Campbeltown boatyard and is a disused industrial site. In the same area private housing begins and continues along the shoreline west towards the centre of Campbeltown. The centre of the town consists of a typical mix of businesses & housing, and passing the New Quay on the west shore, starts to revert to purely private housing once again. The land use becomes more rural around Glenramskill, with a mix of detached houses and native woodland. Finally east of the NATO pier, it becomes agricultural, with several fields set aside for grass growth for silage, along with the livestock noted above.

## Land Cover

Land cover noted along the survey area varied, with the first section east of Trench Point being mixed native woodland and overgrown scrub/grassland. The land use from Trench Point round the bay as far as Glenramskill is largely urban, with small areas of recreational grassland. From Glenramskill to the area around the NATO pier is a mix of native woodland and scrub/grassland, with the final section to the south of Kildalloig bay being agricultural, with improved grassland and small areas of native woodland present.

## Watercourses

Numerous watercourses enter Campbeltown Loch – the largest of which is the Glenramskill Burn, which enters the loch at grid reference NR 7376 1917. Other large streams/rivers encountered on the survey were an un-named stream in the town centre at grid reference NR 7235 2087, the Kilkerran Burn at NR 7300 1944, the Rocky Burn at NR 7333 1916, and the Baraskomill Burn at NR 7388 2062.

## Wildlife/Birds

No wildlife other than birds were seen during the survey, these included 7 oystercatchers and ~80 herring gulls on the first survey day, with a total of 37 oystercatchers, 3 eider ducks and ~12 gulls observed on the second survey day. In addition, using the binoculars, another 100 gulls were observed on the shorelines of Davaar Island.

## Shoreline Survey Maps




Figure 1. Campbeltown waypoints




Figure 2. Campbeltown samples

Table 1 Shoreline Observations

| No. | Date | Time | NGR | East | North | Associated photograph | Associated sample | Description |
|---|---|---|---|---|---|---|---|---|
| 1 | 02/07/2013 | 8:40 | NR 74837 21313 | 174838 | 621313 | | | Start of survey |
| 2 | 02/07/2013 | 8:42 | NR 74838 21312 | 174838 | 621312 | | CLFW1 | Freshwater sample CLFW1 (NR 7483 2131). Sample associated with waypoint 3. |
| 3 | 02/07/2013 | 8:45 | NR 74837 21314 | 174838 | 621314 | | | Stream observation : depth 6cm , width 65cm, flow 0.366m/s SD 0.006 |
| 4 | 02/07/2013 | 9:00 | NR 74433 20843 | 174434 | 620843 | Fig 3 | | Campbeltown WWTW - large site within fenced area and surrounded by earth bund and bushes - access not possible to site and pictures difficult to obtain. |
| 5 | 02/07/2013 | 9:04 | NR 74394 20773 | 174395 | 620774 | | CLSW1 | Planned seawater sample CLSW1. |
| 6 | 02/07/2013 | 9:09 | NR 74282 20697 | 174283 | 620697 | | | Concrete matting on shore covering probable pipe from treatment works – no pipes visible. Slaty Farlan WWTW had no visible pipework outside the footprint of the plant, which had a bund and security fencing running around it – the photo in Fig. 3 was the best image that could be obtained without entering the plant itself. |
| 7 | 02/07/2013 | 9:12 | NR 74257 20685 | 174258 | 620685 | | | Bird count : 7 oystercatchers |
| 8 | 02/07/2013 | 9:22 | NR 73887 20598 | 173887 | 620598 | | CLFW2 | Freshwater sample CLFW2 (NR 7388 2059). Sample associated with waypoint 9. |
| 9 | 02/07/2013 | 9:25 | NR 73886 20598 | 173887 | 620598 | | | Stream observation: depth 10cm, width 1.25m, flow 0.114m/s SD 0.003. |
| 10 | 02/07/2013 | 9:30 | NR 73828 20590 | 173829 | 620590 | | | One 50mm field drain pipe under path, no discharge. |

| No. | Date | Time | NGR | East | North | Associated photograph | Associated sample | Description |
|---|---|---|---|---|---|---|---|---|
| 11 | 02/07/2013 | 9:36 | NR 73582 20504 | 173582 | 620505 | | | Probable pumping chamber for sewage scheme. Start of houses along shore. |
| 12 | 02/07/2013 | 9:39 | NR 73494 20400 | 173494 | 620401 | Fig 4 | | Site of old Campbeltown Boat Yard (disused), no sign of any discharges, some waste materials on shore. |
| 13 | 02/07/2013 | 9:44 | NR 73466 20460 | 173467 | 620460 | | CLSW2 | Planned seawater sample CLSW2. |
| 14 | 02/07/2013 | 9:49 | NR 73453 20503 | 173454 | 620503 | | | Plastic pipe 15cm, possible storm water drain, no discharge. |
| 15 | 02/07/2013 | 9:54 | NR 73467 20538 | 173468 | 620538 | | | Pumping chamber access. |
| 16 | 02/07/2013 | 9:57 | NR 73398 20562 | 173399 | 620562 | | | 55cm diameter storm drain, plastic, small flow running through - not sampled. Assessed as low risk of contamination due to smell, low flow and surroundings. |
| 17 | 02/07/2013 | 10:00 | NR 73345 20582 | 173345 | 620583 | Fig 5 | | 2 x 15cm pipes, ends of pipe visible in concrete at top of foreshore, no discharge from either pipe at time of survey. |
| 18 | 02/07/2013 | 10:02 | NR 73293 20599 | 173294 | 620600 | | | Offshore cross (X on pole) 50m offshore, likely site of consented Scottish water discharge point. Evidence of old outfalls from properties tied into combined sewage scheme. |
| 19 | 02/07/2013 | 10:05 | NR 73273 20617 | 173274 | 620617 | Fig 6 | | Example of tied-in outfall (see waypoint 18 above). These seemed to occur at regular intervals, with concrete infill below them on the shore. |
| 20 | 02/07/2013 | 10:08 | NR 73190 20726 | 173190 | 620727 | | | Scottish Water pumping chamber, cabin and manholes in road. |
| 21 | 02/07/2013 | 10:13 | NR 73016 20757 | 173017 | 620758 | | | Small freshwater stream running under road. |
| 22 | 02/07/2013 | 10:23 | NR 72496 20839 | 172497 | 620839 | Fig 7 | | Scottish Water pumping chamber, cabin and manholes in road. |

| No. | Date | Time | NGR | East | North | Associated photograph | Associated sample | Description |
|---|---|---|---|---|---|---|---|---|
| 23 | 02/07/2013 | 10:26 | NR 72362 20876 | 172363 | 620876 | | CLFW3 | Freshwater sample CLFW3 (NR 7326 2087). Sample associated with waypoint 24. |
| 24 | 02/07/2013 | 10:30 | NR 72362 20877 | 172363 | 620878 | | | River Observation: depth 5cm, width 2.9m, flow 0.346m/s SD 0.007. Smell present. Sample taken from main river, above discharge pipe. Small piped discharge also present, 30cm diameter pipe, 100ml/s discharge, not sampled. |
| 25 | 02/07/2013 | 10:41 | NR 72263 20826 | 172264 | 620827 | | | Boat count, 10 yachts and 1 small powerboat, 7 unused moorings. Bird Count : 6 herring gulls |
| 26 | 02/07/2013 | 10:49 | NR 72032 20646 | 172033 | 620646 | | | Pumping building on main esplanade, no sign of discharge pipe in bay. |
| 27 | 02/07/2013 | 10:52 | NR 72038 20549 | 172039 | 620550 | Fig 8 | | View of pontoon and old quay, 11 yachts, 7 smaller powerboats on pontoon, on main pier 9 fishing boats and 1 lifeboat. Bird count: 80 herring gulls. |
| 28 | 02/07/2013 | 11:00 | NR 72168 20502 | 172168 | 620503 | | CLSW3 | Planned Seawater sample CLSW3. |
| 29 | 02/07/2013 | 11:02 | NR 72093 20468 | 172093 | 620469 | | | End of Survey route, Day 1 |
| 30 | 02/07/2013 | 12:47 | NR 74657 19963 | 174658 | 619963 | Fig 9 | CLSF1 | Shellfish sample 1 - cockles |
| 31 | 02/07/2013 | 13:07 | NR 74826 20083 | 174827 | 620084 | | CLSF2 | Shellfish sample 2 - cockles |
| 32 | 02/07/2013 | 13:35 | NR 74611 19730 | 174612 | 619730 | | CLSF3 | Shellfish sample 3 - mussels. Separate adult mussels collected from sands as no clumps of animals present. |
| 33 | 02/07/2013 | 15:14 | NR 75024 19578 | 175025 | 619579 | | CLSF4 | Shellfish sample 4 - mussels. Returned after posting samples to collect remaining Shellfish sample, sample was not able to be collected on main beach as there were few adult mussels present on the sand and shingle, instead was collected from shoreline on south of the bay. |

| No. | Date | Time | NGR | East | North | Associated photograph | Associated sample | Description |
|---|---|---|---|---|---|---|---|---|
| 34 | 03/07/2013 | 8:47 | NR 72087 20468 | 172088 | 620468 | | | Start of survey - day 2 |
| 35 | 03/07/2013 | 8:50 | NR 72190 20519 | 172191 | 620520 | Fig 10 | | Boat count, old quay, 7 fishing vessels, one lifeboat, 4 yachts & 4 smaller pleasure craft at pontoon. Noticed some oil on water. |
| 36 | 03/07/2013 | 8:55 | NR 72109 20452 | 172109 | 620452 | | | Storm drains on main esplanade, no discharge. |
| 37 | 03/07/2013 | 8:59 | NR 72185 20304 | 172185 | 620305 | Fig 11 | | Vessel 'Scot Ranger' at New Quay berth, loading wood. |
| 38 | 03/07/2013 | 9:03 | NR 72270 20226 | 172270 | 620227 | | | New Quay & car ferry terminal. Access not permitted to pier, so no walk around - photographs taken instead. Other than vessel noted in waypoint 37, no vessels present and no discharges visible. |
| 39 | 03/07/2013 | 9:07 | NR 72337 20063 | 172338 | 620064 | | | Manhole and drain on coastal pathway. No discharge. |
| 40 | 03/07/2013 | 9:12 | NR 72355 20037 | 172355 | 620037 | | | Stream flow under culvert, depth estimated 1.1m, width 1.4m, flow 0.429m/s SD 0.062. No sample taken. Assessed as low risk of contamination due to surroundings. |
| 41 | 03/07/2013 | 9:19 | NR 72428 19933 | 172428 | 619933 | | | 15cm metal pipe, no visible discharge. |
| 42 | 03/07/2013 | 9:25 | NR 72636 19718 | 172636 | 619718 | Fig 12 | | Access valves, plus start of shoreline section of trunk sewer. |
| 43 | 03/07/2013 | 9:26 | NR 72685 19677 | 172685 | 619678 | | | British Telecom pole, plus cable running into pipe. |
| 44 | 03/07/2013 | 9:31 | NR 72829 19562 | 172829 | 619562 | Fig 13 | | 15cm metal discharge pipe, end not visible. |
| 45 | 03/07/2013 | 9:33 | NR 72888 19527 | 172889 | 619528 | | | Manhole on upper beach next to marine beacon surrounded by fence (no connection). Discharge pipe heading into water. |
| 46 | 03/07/2013 | 9:36 | NR 72928 19510 | 172928 | 619510 | Fig 14 | | Manhole cover - assumed part of trunk main running along shore. |

| No. | Date | Time | NGR | East | North | Associated photograph | Associated sample | Description |
|---|---|---|---|---|---|---|---|---|
| 47 | 03/07/2013 | 9:43 | NR 72993 19424 | 172994 | 619424 | | CLFW4 | Freshwater sample CLFW4 (NR7299 1942). Sample associated with waypoint 48. |
| 48 | 03/07/2013 | 9:43 | NR 72989 19422 | 172990 | 619422 | | | Stream observation : depth 20cm, width 3.6m, estimated flow 0.35m/s, but flow meter behaving erratically |
| 49 | 03/07/2013 | 10:00 | NR 73086 19322 | 173087 | 619322 | | | 25cm diameter drain, clear water running, not sampled. Assessed as low risk of contamination due to smell, low flow and surroundings. |
| 50 | 03/07/2013 | 10:02 | NR 73114 19285 | 173115 | 619285 | | CLFW5 | 15 cm diameter PVC pipe, just running clear at tide mark. Sample taken CLFW5 (contaminated). Sample associated with waypoint 51. |
| 51 | 03/07/2013 | 10:10 | NR 73171 19216 | 173171 | 619217 | | | 15cm metal pipe, outflow below water line. |
| 52 | 03/07/2013 | 10:12 | NR 73203 19180 | 173203 | 619180 | | | 15cm dry metal pipe above shoreline. No discharge. |
| 53 | 03/07/2013 | 10:13 | NR 73218 19168 | 173218 | 619169 | | | Small stream flowing under road. Not sampled. Assessed as low risk of contamination due to surroundings. |
| 54 | 03/07/2013 | 10:14 | NR 73234 19165 | 173235 | 619165 | | | 10cm metal discharge pipe running into water. Not sampled. Assessed as low risk of contamination due to surroundings. |
| 55 | 03/07/2013 | 10:21 | NR 73345 19148 | 173345 | 619149 | | CLFW6 | Freshwater sample CLFW6 (NR7334 1914). Sample associated with waypoint 56. |
| 56 | 03/07/2013 | 10:21 | NR 73345 19149 | 173345 | 619150 | | | Stream observation: Depth 4cm, width 1.62m, flow 0.332m/s SD 0.028. Concrete footing at upper tidal mark. Boat count 2 yachts, 2 small boats, 3 extra moorings. Bird count: 2 oystercatchers. |
| 57 | 03/07/2013 | 10:32 | NR 73420 19136 | 173421 | 619137 | Fig 15 | | General photo of the bay area. |

| No. | Date | Time | NGR | East | North | Associated photograph | Associated sample | Description |
|---|---|---|---|---|---|---|---|---|
| 58 | 03/07/2013 | 10:36 | NR 73565 19132 | 173566 | 619133 | | | 15cm metal discharge pipe on shore, ending underwater. |
| 59 | 03/07/2013 | 10:40 | NR 73682 19171 | 173682 | 619171 | | | 2 discharge pipes, ends out of water, both 15cm diameter, manhole cover for one of the pipes on upper part of beach. |
| 60 | 03/07/2013 | 10:44 | NR 73745 19142 | 173745 | 619142 | | CLFW7 | Freshwater sample CLFW7 (NR 7374 1914). Sample associated with waypoint 60. |
| 61 | 03/07/2013 | 10:47 | NR 73746 19143 | 173747 | 619144 | Fig 16 | | River observation: width 6.7m. Depth 1: 19cm, flow 0.185m/s SD 0.024. Depth 2: 28cm, flow 0.184m/s SD 0.012. Depth 3: 21cm, flow 0.139m/s SD 0.013, Depth 4: 14cm , flow 0.09m/s SD 0.016. Old 20cm pipe in wall adjacent to bridge with discharge. Assessed as low risk of contamination due to smell, low flow and surroundings. |
| 62 | 03/07/2013 | 10:58 | NR 73898 19175 | 173899 | 619176 | | | Bird count : 5 oystercatchers, 3 eider ducks, photos of NATO jetty taken from the south west. |
| 63 | 03/07/2013 | 11:03 | NR 74091 19143 | 174091 | 619144 | Fig 17 | | NATO pier, no discharges visible. |
| 64 | 03/07/2013 | 11:08 | NR 74325 19224 | 174326 | 619224 | | | Culvert under road, 20cm earthen pipe with flow. Not measured or sampled as surrounding wooded, uninhabited area suggested low risk of contamination. |
| 65 | 03/07/2013 | 11:11 | NR 74361 19265 | 174362 | 619266 | | CLFW8 | 15 cm metal pipe with discharge and toilet paper around exit flow - sample taken CLFW8 (contaminated). Flow estimate using bucket of 40ml/s. |
| 66 | 03/07/2013 | 11:17 | NR 74400 19312 | 174400 | 619313 | | | 20cm metal discharge pipe, runs into ground at lower tidal area, not able to determine if any discharge. |

| No. | Date | Time | NGR | East | North | Associated photograph | Associated sample | Description |
|---|---|---|---|---|---|---|---|---|
| 67 | 03/07/2013 | 11:26 | NR 74768 19488 | 174768 | 619488 | Fig 18 | | Field by road: 38 sheep, 4 cows. 16 sheep noted on mainland shore. Bird count: 50 oystercatchers, 12 gulls. 12 sheep and 100 gulls noted on Davaar Island using binoculars. |
| 68 | 03/07/2013 | 11:34 | NR 74536 19621 | 174537 | 619621 | | CLSW4 | Planned Seawater sample CLSW4 |
| 69 | 03/07/2013 | 11:48 | NR 75241 19538 | 175241 | 619539 | | | Discharge pipe from Davaar House, 15cm metal pipe running to sea. Outflow covered by tide. Manhole open higher up, no flow observed. |
| 70 | 03/07/2013 | 11:52 | NR 75290 19519 | 175291 | 619519 | | | Discharge pipe from Davaar House converted outbuilding, no discharge present, 15cm metal pipe. |
| 71 | 03/07/2013 | 11:57 | NR 75292 19538 | 175292 | 619538 | | CLSW5 | Planned Seawater sample CLSW5. |
| 72 | 03/07/2013 | 12:00 | NR 75317 19513 | 175318 | 619513 | | | End of Survey route. |

Photographs referenced in the table can be found attached as Figures 3 – 18.

## Sampling

The majority of the shellfish samples were taken on the 2nd of July. The weather was poor that afternoon, with a strong S/SW wind that was holding the ebbing tide back in Kildalloig Bay, but which was sufficiently low to allow sampling. The two cockle samples were collected first, and as the cockles were relatively abundant, this was achieved quickly. Finding mussels proved slightly more difficult, as noted elsewhere in this report, they were not particularly abundant, and where they did occur, they occurred individually rather than in clumps. However, one sample was obtained, and these were packaged within 1hr of being sampled into a biotherm 25 box and dispatched to GSS in Glasgow. The sample temperature on arrival at GSS was 5.6°C

The remainder of the samples were dispatched in a biotherm 10 box on the 3rd of July, and the temperature on arrival at GSS was noted as 4.3°C.

Seawater samples were tested for salinity by GSS and the results were reported in mg Chloride per litre. These results have been converted to parts per thousand (ppt) using the formula:

$$\text{Salinity (ppt)} = 0.0018066 \times \text{Cl (mg/L)}$$

**Table 2. Water Sample Results**

| No. | Date | Sample | Grid Ref | Type | *E. coli* (cfu/100ml) | Salinity (ppt) |
|---|---|---|---|---|---|---|
| 1 | 02/07/2013 | CLFW1 | NR 7483 2131 | Freshwater | 790 | |
| 2 | 02/07/2013 | CLSW1 | NR 7439 2077 | Seawater | 9 | 33.96 |
| 3 | 02/07/2013 | CLFW2 | NR 7388 2059 | Freshwater | 26 | |
| 4 | 02/07/2013 | CLSW2 | NR 7346 2046 | Seawater | 2 | 33.78 |
| 5 | 02/07/2013 | CLFW3 | NR 7326 2087 | Freshwater | >1000 | |
| 6 | 02/07/2013 | CLSW3 | NR 7216 2050 | Seawater | 44 | 34.14 |
| 7 | 03/07/2013 | CLFW4 | NR 7299 1942 | Freshwater | 910 | |
| 8 | 03/07/2013 | CLFW5 | NR 7311 1928 | Freshwater | 3000 | |
| 9 | 03/07/2013 | CLFW6 | NR 7334 1914 | Freshwater | 160 | |
| 10 | 03/07/2013 | CLFW7 | NR 7374 1914 | Freshwater | >1000 | |
| 11 | 03/07/2013 | CLFW8 | NR 7436 1926 | Freshwater | 1000 | |
| 12 | 03/07/2013 | CLSW4 | NR 7453 1962 | Seawater | 1800 | 30.53 |
| 13 | 03/07/2013 | CLSW5 | NR 7529 1953 | Seawater | 16 | 33.96 |

**Table 3. Shellfish Sample Results**

| No. | Date | Sample | Grid Ref | Type | *E. coli* (MPN/100g) |
|---|---|---|---|---|---|
| 1 | 02/07/2013 | CLSF1 | NR 7465 1996 | Cockles | 16,000 |
| 2 | 02/07/2013 | CLSF2 | NR 7482 2008 | Cockles | 9,200 |
| 3 | 02/07/2013 | CLSF3 | NR 7461 1973 | Mussels | 330 |
| 4 | 02/07/2013 | CLSF4 | NR 7502 1957 | Mussels | 330 |

## Photographs

**Figure 3:** Overview of Slaty Farlan WWTW, looking west (Waypoint 4)

**Figure 4:** Overview of the abandoned site of the Campbeltown boatyard, looking SW across Campbeltown Loch (Waypoint 12)

**Figure 5:** Discharge pipes on shoreline at Lower Askomill Road (Waypoint 17)

**Figure 6:** Example of tied-in sewage discharge pipe along the shore side of Lower Askomill Road (red arrow) with concrete infill on foreshore (blue arrow). (Waypoint 19)

**Figure 7:** Lower Askomill Road, with shore tie-in (centre, lower picture), manhole cover for main sewer (to left on shore) with pumping station in middle centre of picture on shore. Scottish Water consented discharge is indicated by yellow pole in water in centre left of photograph. (Waypoint 22)

**Figure 8:** Old Quay in Campbeltown town centre with pontoon system in foreground and main pier behind. (Waypoint 27)

**Figure 9:** Fishery area in Kildalloig Bay, looking SW towards The Doirlinn. Campbeltown is situated to the right of the photograph. (Waypoint 30)


**Figure 10**: South side of Old Quay, with fishing vessels present, and vessel 'Scot Ranger' loading wood on the New Quay. (Waypoint 35)

**Figure 11**: New Quay, with vessel 'Scot Ranger' in foreground left. Car ferry terminal is on the far side of the pier, with linkspan visible in centre. (Waypoint 37)

**Figure 12:** Small manholes at SE end of esplanade. (Waypoint 42)

**Figure 13:** Typical discharge pipe running into Campbeltown Loch from shore in Kilkerran. (Waypoint 44)

**Figure 14:** Manhole on inter-tidal shore in village of Kilkerran. (Waypoint 46)

**Figure 15:** Overview of upper Campbeltown Loch, looking North West from Glenramskill. (Waypoint 57)

**Figure 16:** Glenramskill Burn, with unidentified discharge pipe on right shore next to bridge wall. (Waypoint 61)

**Figure 17:** NATO refuelling Pier. (Waypoint 63)

**Figure 18:** Livestock present in field adjacent to fishery area (behind fence at rear of field) with Davaar Island in the background. (Waypoint 67)