STATES OF JERSEY REVIEW OF MARINE ENVIRONMENTAL PROTECTION

FINAL REPORT TO STATES OF JERSEY ENVIRONMENT SCRUTINY PANEL REVIEW FROM WCA ENVIRONMENT LIMITED

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EXECUTIVE SUMMARY

A healthy marine environment is very important to the social and economic wellbeing of the island of Jersey. The waters and beaches around Jersey support a vibrant aquaculture and tourism industry and are home to sites of international environmental significance. The importance of the marine environment to Jersey understandably increases the concerns of stakeholders to potential impacts from any major developments or discharges on the coastline.

Much of the available resources for monitoring the marine environment are focussed on microbiological analysis. This is to be expected given the health protection requirements for bathing waters and shellfish. However, the present arrangements for microbiological analysis do *not* provide sufficient capacity to allow the desired degree of reactive or investigative monitoring. A policy review of delivery capability for reactive monitoring is urgently required.

The aquaculture industry is, unsurprisingly, passionate about the potential risk to their livelihood and is deeply concerned about sporadic high coliform values. Also, the bathing waters at Bonne Nuit are subject to occasional elevated levels of the indicator organisms. While the elevated coliform levels do seem to be correlated with high rainfall, it cannot be determined with any certainty what the main sources of pollution are. Environmental Protection has undertaken drainage and outfall studies including the involvement of the aquaculture industry but these have not identified major sources of pollution. Targeted and intensive surveys are required in order to understand the relative contribution of different sources of coliforms. The existing resources for microbiological monitoring on Jersey are insufficient to be able to deliver the necessary evidence to identify sources of coliforms both in the quantity of sample data needed and also in the sophistication of analysis required. At the moment, this resource can only be realistically provided by external providers. If answers to these long standing microbiological quality issues are to be found, the costs of gathering the necessary evidence will be substantial and are certain to be beyond existing budgets. Discussions indicate that there may be some scope for cost sharing and collaborative working with the aquaculture industry to undertake the necessary monitoring.

Jersey is not part of the European Union and so has no legal obligation to adhere to EU Directives although Jersey does aim to implement best practice arising from EU legislation and has its own laws to achieve this. Jersey complies well with European regulations where the protection goal is human health, such as the Bathing Waters Directive or shellfish hygiene regulations. In contrast, the requirements of marine environmental directives such as the Water Framework Directive are addressed at a minimal level. There is insufficient knowledge of the pressures on Jersey's marine environment arising from the discharges and emission of chemicals other than some monitoring of metals. Therefore, it is impossible to know the chemical status of the marine environment in terms required by the Water Framework Directive although

the high nitrogen levels are likely to mean that locally some areas are at less than good status.

Bellozanne sewage treatment plant fails the Urban Waste Water Directive total nitrogen limits and the locally applied discharge consent. The recent CREH[1] trophic status report indicates that St Aubins bay is probably not subject to eutrophication although the potential for eutrophication was identified when the models were more stringently applied. Overall, there remains a risk of more subtle effects on local ecosystems arising from high nutrients such as dominance of particular species which would benefit from periodic monitoring.

One submission has criticized the limited scope of marine monitoring and has argued that information is lacking on other hazardous chemicals. They have also expressed the opinion that the shellfish metals monitoring is outdated. In our opinion, the long term monitoring of shellfish and seaweed for metals is a powerful set of data as it allows meaningful analysis of trends and comparisons with other datasets to be undertaken. However, the criticism of the limited scope of monitoring is justified. We believe there are some important priority pollutants not included in the current monitoring programme. For example, there is no data on mercury or persistent organics, such as PCBs or brominated flame retardants. Some limited monitoring for these substances is recommended to understand the baseline concentration of these chemicals at the sites likely to be at greatest risk. These chemicals are found at elevated concentrations in UK biota and there are potential sources of these substances on Jersey.

We recommend undertaking a risk-based assessment of the chemical contaminants most likely to be present in Jersey's waters and the estimated reasonable worst case loads of these substances. This exercise should then be followed up with limited, but targeted, monitoring of effluents and sessile biota for any chemicals at risk of breaching predicted no effect concentrations.

Save Our Shoreline have vigorously raised a number of concerns about pollution arising from the construction of the incinerator. Some of these issues are pending decisions on potential legal action and EP has submitted an extensive case file to the AG for legal opinion. This quite rightly places limits on the discussion and the information that the regulator, EP can make public at this stage in the investigation. However, having been briefed in camera on the events that took place and the samples taken during that time, we have seen no evidence that significant pollution of the sea has occurred. This does not mean that there were no inappropriate working practices, just that there is no evidence of harm to the environment.

There is mistrust and cynicism amongst some stakeholders about the regulator's work to protect the environment. It is clear from the submissions and from face to face meetings that some believe strongly in conspiracies to cover up potentially

[1] Centre for Research into Environment and Health, University of Wales

embarrassing information and unwillingness by the authorities to tackle difficult issues. We have seen no evidence of actions to deliberately mislead stakeholders and the correspondence suggests that Environmental Protection communicate in a polite and factual manner. Where stakeholder aspirations are not met, this has been due to the lack of resource, misunderstandings, the constraints of current practices or a lack of closure on contentious issues. This atmosphere of mistrust and the use of correspondence out of context on web sites inevitably results in the regulators being very cautious and communicating in a formal and factual way. These more formal responses to stakeholders can further fuel suspicion. It should be noted that in the UK, non-governmental organisations such as SOS would not normally have the same direct frequent access to regulatory staff. This closer relationship between the regulator and the community is a beneficial outcome but does require resource to deliver.

The regulatory teams work in a cross functional manner with the small team of staff willing and able to cover for colleague's work areas. This is helpful as the regulator has budget and resources constraints and has to prioritise areas of its extensive remit. This multifunctional working provides resilience and flexibility and is to be commended. We were also impressed by EPs commitment to positive environmental outcomes and willingness to try new approaches. There may be opportunities to reduce some of the workload and 'free up' resources by streamlining some processes such as input into environmental impact assessments and planning applications with the objective to avoid iterative work.

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1 INTRODUCTION

The States of Jersey Environment Scrutiny Panel have conducted a review into the monitoring and regulation of coastal water quality, entitled "Protecting our Marine Environment". This review is being undertaken against a backdrop of growing public and stakeholder concern in Jersey about pollution of the marine environment. The aim of this report is to support the review by comparing activities currently undertaken in Jersey for the protection of the marine environment with UK best practice and relevant European legislation.

The overall purpose of the review is to evaluate:

- the importance of protecting Jersey's marine environment against pollution
- concerns about marine water quality and the potential effect on island residents, recreational users, and the island's fish farming industry, of any potential for reduction in water quality
- the effectiveness of States monitoring and regulatory activities in protecting the marine environment

In making observations and recommendations on marine monitoring activities on Jersey, they need to be put into context within Jersey's special environmental and constitutional position. For example, the coastal waters of Jersey support an exceptionally rich and diverse environment that is of international importance. The good environmental conditions also bring huge social and economic benefit to the island from tourism and shellfish cultivation. However, Jersey is also a relatively small island with limited resources and a different regulatory framework to the Environment Agency of England and Wales. Therefore it is important to recognise the importance of a 'Jersey solution' to the protection of their marine environment, so it is not appropriate to undertake a simple gap analysis between Jersey and UK systems. Instead, this report will focus on existing marine protection processes in Jersey and examine how well they meet the aspirations of stakeholders and address the protection goals of relevant European legislation. This report is based on the submissions received from stakeholders by the Jersey Scrutiny Panel, literature sources and observations from the authors' visit to the Island during 27 to 29 September 2010 and the 10 and 11 January 2011.

1.1 Terms of Reference

The Scrutiny Panel review of marine protection terms of reference includes examination of the following activities:

1. Applicable environmental legislation, including consideration of relevant international standards and any anticipated developments

2. The remit of Environmental Protection, Health Protection, Harbours, Fisheries and Marine Resources, States Veterinary Officer and Transport and Technical Services Department

3. Existing and potential sources of pollution

4. Pollution prevention work undertaken

5. Regulatory powers including enforcement activities, procedures for investigation, prosecution and sanctions

6. Monitoring activities, current testing regimes, planning controls, emergency planning and discharge consents

7. Laboratory resources and arrangements for analysis of results

8. Information available to the public on environmental protection and health issues

9. Resources available for marine environmental monitoring, regulation and protection

10. The role of, and engagement with, stakeholders.

1.2 Structure of the Report

The report summarises the current Jersey situation with respect to regulatory frameworks and monitoring in Section 2. A discussion on the underpinning scientific and regulatory issues, together with an opinion, is provided in Section 3. Overall conclusions are presented in Section 4. Finally, recommendations for the way forward are summarised in Section 5.

1.3 Submissions

Written submissions were received from the following stakeholders:

Environmental Protection
Health Protection Services
Save Our Shoreline
Société Jersiase
Jersey Recreational Fisherman's Association
Mr S Luce (on behalf of the Connetable of St Martin)

Opinion and concerns were also expressed verbally by aquaculture industry representatives.

The key concerns and opinions expressed in the submissions and discussions are:

- A decline in the last few years in microbiological standards in marine waters that is adversely affecting the quality of bathing beaches and financially impacting the aquaculture industry
- The current waste water treatment infrastructure is inadequate
- The current chemical monitoring programme is insufficient to assess the state of Jersey's marine environment
- A perceived lack of sufficient transparency and engagement with stakeholders by regulators
- In the absence of data on chemicals of concern, a more precautionary approach should be adopted in controlling emissions to coastal waters
- More emphasis should be given to responding more swiftly to pollution events
- International standards on environmental protection are not adequately met
- The controls on emissions from major discharge points, such as the energy from waste plant, may be too lenient
- Regulators have resource (manpower and budget) and logistical constraints that prevent them from doing more

These opinions are examined throughout this report and viewed against the available evidence to explore if the concerns are justified.

2 EXISTING ARRANGEMENTS

2.1 Existing regulatory functions

The relevant regulatory functions for marine issues on Jersey are Environmental Protection, Health Protection, Jersey Harbours, Fisheries and Marine Resources, The States Veterinary Officer, and Transport and Technical Services. Their individual functions and resources are summarised below.

2.1.1 Environmental Protection

- Environmental Protection administers and enforces environmental legislation, and Memoranda of Understanding. Specific areas in which Environmental Protection works are as follows:
- To safeguard the quality and availability of water for the health and sustainability of the Island
- To protect the environment and people from the harmful effects of waste management operations
- To ensure we can comply with our wider legal implications allowing the Island to have an equitable footing on the international stage
- To ensure the safe use, storage and transport of pesticides
- To ensure the safe disposal of banned/revoked products
- To ensure there are minimum standards for the export of edible product.
- To promote animal welfare and enforce registration which ensures the health status of food.
- To prevent the introduction, establishment and spread of pests and diseases
- To prevent the spread of injurious weeds

Environmental Protection consists of Water Resources, Waste Management and Agricultural Inspection. Environmental Protection have 13 staff, of which five staff are responsible for monitoring, assessment and regulation of all of the Island's controlled waters (including groundwater, streams, coastal waters and water supply.

As well as responsibility for aquatic monitoring, staff in the Water Resources section is also responsible for implementation, promotion and enforcement of relevant legislation, policy, and codes of practise. These include Water Pollution (Jersey) Law 2000, the Water Resources (Jersey) Law 2007, the Water (Jersey) Law 1972, the OSPAR convention and several Memoranda of Understanding. The Water Resources section also responds to and investigates pollution incidents, writes up follow-up reports and undertakes enforcement action. The team also develop programmes of

pollution prevention, awareness and education, and policy development. They are responsible for monitoring the fresh and marine aquatic environment. Water Resources register, licence and enforce water abstractions. Water Resources also act as a consultee to States Departments and other bodies for planning applications and Environmental Impact Assessments (EIAs) that may impact the aquatic environment.

Waste Management area is responsible for enforcing the Waste Management (Jersey) Law 2005. Waste Management administer, determine and advise on notifications for proposed transfrontier waste shipments. Waste Management are also responsible for the issuing of waste management licences. The section undertakes inspections of licensed, exempt, and unlicensed waste activities including fly tipping. The Waste Management section register carriers of hazardous or healthcare wastes, and advise on the system of control procedures for transport of hazardous or healthcare wastes. Waste Management also provides advice during consultations on planning applications, environmental impact assessments, and other States-sponsored projects.

Agricultural Inspection enforces the Export of Agricultural Produce (Jersey) Order 1972, the Pesticide (Jersey) Law 1991 and other relevant legislation. Agricultural inspection is responsible for addressing issues and concerns arising from modern agricultural practises. They work with a range of stakeholders, particularly concerning the use of agrochemicals and fertilisers and their potential effects on the environment. The section also works to prevent the introduction and establishment of non-indigenous pests or diseases on local and imported material.

A Memorandum of Understanding has been in place since 2003, between the Minister for Planning and Environment and the Minister for Economic Development, in order to clarify roles with respect to marine pollution. The Water Pollution (Jersey) Law 2000 has complimentary, but separate, enforcement powers to some elements of the Shipping (Jersey) Law 2002, the MARPOL Convention and FEPA. The Memorandum of Understanding was established in order to avoid duplication of effort across departments, to provide efficient and cost-effective pollution prevention and control, and to clarify the roles of Jersey Harbours and the Planning and Environment Department in the event of a pollution incident in Jersey's territorial seas or coastal waters.

2.1.2 Health protection

Health Protection is concerned with any environmental issues that have the potential to affect public health. This includes beach and the impacts arising from bathing water quality, and aquaculture. Health Protection are responsible for warning beach users, or closing beaches, if there are concerns about the standard of water quality following receipt of the results of the bathing water monitoring carried out by Environmental Protection. They are also responsible for advising on health issues associated with microbiological or heavy metal contamination of fish and shellfish.

2.1.3 Jersey Harbours

Jersey Harbours are responsible for their duties under Shipping (Jersey) Law 2002. They contract out the monitoring of harbour waters to the Fisheries and Marine Resources section.

A Memorandum of Understanding has been in place since 2003, between the Minister for Planning and Environment and the Minister for Economic Development, in order to clarify roles with respect to marine pollution. The Memorandum of Understanding states that the Harbour Master is responsible for the administration of harbours and territorial waters and other issues that may be required related to shipping and navigation, under the Harbours (Administration) (Jersey) Law 1961. Jersey Harbours are required to keep Environmental Protection informed about any areas for which they are responsible. For example, Harbours must inform Environmental Protection of any pollution incident in territorial and coastal waters it is aware of, and will provide assistance through the use of suitable vessels and equipment. Environmental Protection will consult with the Harbour Master before discharge permits or certificates are issued for discharges to territorial seas or coastal waters.

2.1.4 Fisheries and Marine Resources

Fisheries and Marine Resources are responsible for monitoring farmed shellfish, monitoring of heavy metals accumulation in marine biota, annual harbour monitoring, marine mammal monitoring, off-shore reef assessment, and assessment of fishing stocks.

The Memorandum of Understanding between the Minister for Planning and Environment and the Minister for Economic Development was updated in 2010, in order to clarify roles with respect to marine pollution. The updated MOU included Fisheries and Marine Resources who are responsible for administering the Food and Environmental Protection Act 1985 (Jersey) Order 1987 (FEPA) and covers areas such as dumping, dredging or blasting at sea.

2.1.5 States Veterinary Officer

The States Veterinary Officer is responsible for the monthly monitoring of Escherechia coli levels in shellfish. The cost of shellfish monitoring is paid by the States and this cost has been increasing with the desire to include more investigative samples.

2.1.6 Transport and Technical Services Department

Transport and Technical Services has responsibility for minimising the impact of waste on the environment, developing on-island travel networks that meet the needs of the community, and providing well maintained public amenities and infrastructure. The areas of responsibility that may impact on marine quality are:

- the provision of waste management facilities
- the provision, management and maintenance of the foul and surface water sewerage system
- the treatment and disposal of the island's liquid waste

Transport and Technical Service Department also undertakes monitoring of effluent discharge from sewage treatment plants for operational clarity, sampling of trade effluent, and monitoring levels and spills of pumping stations and the cavern.

2.2 Current Monitoring Activities

Monitoring of Jersey's environmental waters including coastline and coastal waters is carried out by Environmental Protection. Marine biota monitoring is undertaken by Fisheries and Marine Resources

Monitoring programmes currently carried out include:

- Bathing water quality
- Beach outfalls
- Surface water quality (SSIs)
- Surface flow monitoring (mostly on off measurements of low flows in summer 2010)
- Groundwater quality
- Groundwater quantity
- Macroinvertebrates
- Diffuse pollution project
- Heavy metal monitoring of outfalls
- Crabbe monitoring boreholes
- Monitoring with respect to pollution incidents
- Regulatory samples for discharge permits

2.2.1 Monitoring of pollution incidents

The type and number of samples taken depends on the type and severity of the pollution incident. Typically, Environmental Protection aim to take samples from at least 3 points for pollution to streams, reservoirs or ponds. The points are upstream of the pollution incident to demonstrate background quality, and at the pollution incident and downstream of it, to assess the extent of the event.

Environmental Protection investigates, writes up and, where appropriate administers or recommends enforcement action to approximately 120 pollution incidents a year, although few of these are marine related. To ensure consistent approach all pollution incidents are signed off by at least three EPOs. Officers adhere to enforcement policy and guidance protocols which have been agreed by the Attorney General (AG).

To ensure consistency of approach to States departments, all incidents concerning States Departments are detailed each quarter in a written report to the AG. EPOs report directly to the AG and not via the Minister.

2.2.2 Surface freshwater quality

For the purposes of carrying out functions within the Water Pollution (Jersey) Law 2000 officers monitor controlled waters (inc. surface waters) sediments and biota (including activities or inputs into controlled water and the impact of these inputs). The States of Jersey also aim to achieve EU standards where possible, although are not obliged to comply with them. Jersey law requires a duty to monitor the environment but is not prescriptive about the detail of what monitoring is required.

From 1995 surface water monitoring has been carried out at nine sites across Jersey, identified as sites of potential ecological significance. In 2000, three new sites were included. The monitoring programme has created a database of background levels for some water quality parameters (approx. 360,000 water quality records for controlled waters). These are used to analyse long-term trends, as well as impacts from diffuse pollution and pollution incidents. Surface water monitoring is used to determine whether selected water quality objectives are met under the Water Framework Directive (WFD) although Jersey has not developed local standards to describe good chemical status.

Monitoring takes place at the SSI sites located at Grouville, Grand Vaux, Longueville, Millbrook, Mourier Valley, Pre d'Auvergne, Tesson Mill, Vallee des Vaux and Pont Rose. The Surface Water Monitoring Protocol is followed. Monitoring is carried out quarterly. Field monitoring includes measuring pH, conductivity, dissolved oxygen and temperature. Samples are then analysed by the Official Analyst to the States of Jersey for chemical and microbiological parameters[2].

Surface water monitoring data are loaded onto the bespoke WQMIS database quarterly and abnormal results are investigated. The UK Environment Agency similarly loads all monitoring data onto an archive (WIMS) with reports for abnormal samples being generated by the laboratory.

2 inc. suspended solids, ammonia, chloride, nitrite, nitrate, phosphate, sulphate, sodium, potassium, magnesium, calcium, presumptive total coliforms, presumptive faecal coliforms and presumptive faecal streptococci.

2.2.3 Outfall monitoring

Routine monitoring of drainage outfalls along Jersey's coast is carried out, especially following high rainfall events, in order to quantify changes in bacteriological loading. Environmental Protection work alongside Transport and Technical Services in order to identify potential sources of bacteriological loading. Following heavy rainfall events, shellfish farmers have expressed concern over microbiological pollution from outfalls. EP have liaised with shell fish farmers and sampled and investigated all instances where the farmers have expressed concern. This has included drainage investigations. EP have further equipped farmers with sample bottles so that they can take samples of outfalls themselves when they are concerned. No major pollution sources, including no unreported discharges of sewage by TTS have been identified. However, this still does not satisfy stakeholder expectations who have expressed a desire to see more done and whom remain suspicious of unreported spills.

An outfall monitoring programme was carried out between 1994 and 1997, following concerns regarding shellfish contamination. Between 2003 and 2006 routine water samples have been collected from 23 outfalls.

Outfalls were monitored in 2008, following the detection of increased levels of *E. coli* in shellfish. Since 2009, up to 15 outfalls have been monitored every other month although these are limited to a maximum of 8 at a time by constraints at the Analyst This monitoring covered outfalls that discharge into bathing waters which failed the 'guide' standard in 2008 and several outfalls into Grouville Bay (the location of the oyster beds). Occasional samples have also been taken from outfalls between Le Hurel and Seymour slip, Le Bourg west, Pontac slip, Greve d'Azette, Weighbridge, and First Tower. Outfall monitoring is tide-dependent. Some outfalls can only be accessed safely at lowest spring tide, for example the Weighbridge outfall and First Tower outfall.

Outfall monitoring includes field monitoring such as temperature, pH, conductivity and dissolved oxygen. The States of Jersey Analyst then carries out analysis of the samples determining Chemical Oxygen Demand (COD), suspended solids, ammonia, chloride, nitrite, nitrate, phosphate, sulphate, sodium, potassium, magnesium, calcium, presumptive total coliforms, presumptive faecal coliforms and presumptive faecal streptococci.

The outfall monitoring programme, and in particular monitoring after storm events, is constrained by the resources of the States of Jersey Official Analyst laboratory (Section 2.3).

Currently data are checked every month for abnormal results by Environmental Protection.

2.2.4 Macroinvertebrates

Macroinvertebrate monitoring of streams is carried out to fulfil the biological element of the surface water assessment under the Water Framework Directive and to gather evidential impact following pollution events. Approximately 40 stream (and latterly pond) sites are surveyed per year. Macroinvertebrate analysis is labour intensive and requires considerable skill and experience, so the current sampling regime represents a significant investment of resources.

The budget allocation has been fixed within a quinquenial review (approx £15,000 per year or almost two thirds of the consultancy budget) which has allowed EP to assess "Good" biological status for the Island under the Water Framework Directive using selected measures from the Directive. This has now been completed and EP have been able to reduce expenditure significantly.

2.2.5 Metal monitoring

Following previous concerns regarding the accumulation of metals in marine organisms, a study was started in 1993 by Fisheries and Marine Resources to assess if there was any contamination of marine biota due to metals mobilised from the incinerator ash at the Waterfront Reclamation Site (St Aubins Bay). Sampling has taken place since 1993 and is carried out up to four times a year at five coastal sites to the south and south-east of Jersey. The species sampled were the common limpet, *Patella vulgate*, slipper limpet, *Crepidula fornicata* and a serrated seaweed, *Fucus serratus.*

Baseline data have started to be collected from potential sources of metal inputs such as seawater from and off the reclamation site at La Collette, ground / surface water from land drainage (road run-off etc.), and the discharge from Bellozanne Sewage Treatment Works. These data were not available for this report.

Environmental Protection assess whether additional regulatory monitoring is required for the Bellozanne Sewage Treatment Works discharge. TTS provide Environmental Protection with updates regarding new trade effluent consents issued under the Drainage Law (administered by TTS). Where appropriate, metals monitoring will be a requirement in waste management licences issued by Environmental Protection.

2.3 Available resources

2.3.1 Laboratory resources

In December 2003 laboratory analysis services moved from the then Water Resources Section, Bellozanne to the States Official Analyst. All agreed analytical requirements and service delivery conditions are detailed in a Service Level Agreement (SLA) between Environmental Protection and the States Official Analyst. Analysis covered by the SLA includes:

- Pollution incidents

- Routine monitoring of surface waters and outfalls
- Routine monitoring of groundwater
- Crabbe monitoring boreholes
- Bathing waters
- Discharge permits
- Macroinvertebrate monitoring

The Service Level Agreement was updated on 1st January 2010 and will expire on 31st December 2011 with an annual cost of £58,496 which was set in 2003 and has not increased since. Ad hoc analysis not covered by the SLA is arranged by prior agreement and separately funded from Environmental Protection's budget.

Samples from pollution incidents are analysed the same working day, if possible, or as soon as reasonably practicable. For routine monitoring, analysis takes place according to the timetable established each year by Environmental Protection.

2.3.2 Monitoring resources

Staff time for monitoring work is 20 days during the bathing water season and 30 days a year related to bathing water work. The cost for analysing the bathing water samples is covered by the Service Level Agreement. The cost for preparation of a report by CREH, assessing compliance with the 1976 Directive, the 2006 Directive, and WHO guidelines, was around £4,000 for 2009. Environmental Protection have prepared draft bathing water profiles for each bathing water catchment under the 2006 Bathing Waters Directive. This involved pulling together and mapping various data collected by a variety of departments (for example, septic tanks and soakaways, livestock etc).

Staff time for carrying out surface water monitoring is 8 days a year, with a further 2 days for inputting and checking data and following up abnormal results. The analytical cost of the monitoring is included in the Service Level Agreement with the Official State Analyst.

Staff time for carrying out outfall monitoring is 12 days per year, plus 3 days for data input and checking and preparing equipment. Analysis costs are covered in the Service Level Agreement.

Other monitoring activities are: borehole monitoring 20 days, borehole water level dipping 24 days, monitoring for the diffuse pollution project (DPP) 34 days, macro invertebrate sampling 40 days. Sampling is also undertaken of Crabbe boreholes (former green waste site) and sewage treatment works to regulate discharge permits (approximately 6 days). Each year, Environmental Protection collect approximately 2000 water samples as part of its monitoring programme.

Much of the analysis of samples is carried out under the Service Level Agreement; however there are additional activities, such as monitoring of heavy metals and

storm samples for the diffuse pollution project that are not planned and need to be funded from Environmental Protection's budget.

2.4 Information available to the public on the environment

Environmental Protection are responsible for providing public information about pollution prevention, assisted by other States Departments where appropriate. This includes production of information leaflets, making information available on the States of Jersey website, specific campaigns such as the Oil Care Campaign, and producing material as and when it is required in response to pollution concerns.

Environmental Protection have produced a range of public information and guidance leaflets, which include the Ships and Boats leaflet, Oil Pollution leaflet, Organic Waste, Pesticide and home pollution leaflets. These leaflets are based in part on information obtained from the Environment Agency, DEFRA and EU websites and so reflect accepted best practice.

These leaflets are available from a range of outlets including shops, parish halls, museums and garden centres. Environmental Protection have mailed these leaflets out to businesses and engaged the fuel distribution companies and boiler engineers as part of the Oil Care Group. Fisheries and Marine Resources also assist with distribution of some of the leaflets.

Water Made Clearer Leaflets are available on the States of Jersey website, along with other information including bathing water and groundwater monitoring results and application forms for registering water abstraction or applying for a discharge permit.

Environmental Protection has also carried out specific campaigns to promote particular issues. For example, the Oil Care campaign aims to increase public awareness and provide practical advice to reduce the risk of oil pollution. This includes the formation of an Oil Care Group that aims to bring together the oil industry (oil companies, plumbers, boiler engineers) with Environmental Protection to discuss common concerns, approaches and joint solutions. Initiatives of the group include the distribution by the fuel companies of an oil care tank sticker to the majority of owners (domestic and business) on the island and a letter targeted at owners of single-skinned oil tanks informing them of the environmental risks of these tanks. Other initiatives of the group are the production of a Code of Best Practice, a redesign of the oil pollution leaflet (funded by members of the group) and provision of more stringent building bye laws relating to the installation of oil tanks and associate pipework. Following concerns from the oil industry as to their statutory responsibilities, a joint training day with Jersey Water was organised to inform the industry of the Law and potential impact of oil loss on Jersey's water resource. Both Building Control (Planning and Environment) and OFTEC (Oil Firing Technical Association) have also participated in Oil Care Group meetings, following concerns raised by members about industry regulation.

Environmental Protection joins in with other initiatives. For example, they are currently piloting the Blue Fish Campaign under the umbrella of Eco-Active. This is a public/business awareness campaign which aims to protect the Island's water resource (streams, reservoirs and coastal waters) from pollution, whilst promoting correct use of the Island's drainage. The campaign will be targeting schools, businesses and the States of Jersey.

The campaign fits into Eco-Active Business - Water Guidance and includes the provision of a pollution prevention plan for business to complete. This enables a better understanding of company's site drainage which offers the opportunity to reduce the risk of pollution and minimise waste. States Departments will also be encouraged to complete a pollution prevention plan to become Eco-Active State member.

The annual budget for producing, printing, distributing of pollution prevention materials and running the oil care group is £1500, and staff time is approximately 25 days. Options for cost-sharing are explored and used, such as using fuel delivery drivers to distribute oil-related information, and other States Departments to distribute pollution prevention material. Financial contributions from partners in oil distribution companies and Jersey Water also help to mitigate costs.

3 DISCUSSION

In this section, the principal issues and procedures in place relating to Jersey's marine environment are analysed in detail. Within each section opinions are provided on the adequacy of existing arrangements. The subject areas explored are:

- Compliance with international regulations
- Microbiological pollution and monitoring
- Chemical pollution and monitoring
- Adequacy of resources
- Engagement with stakeholders
- Sources of pollution

3.1 Compliance with international regulations

The most significant current piece of protective legislation for the marine environment is the Water Framework Directive (WFD) (2000/60/EC). There is also the older Shellfish Waters Directive (2006/116/EEC) which sets the standard for water quality in areas where shellfish grow and reproduce. Although the Shellfish Waters Directive appears from its EU reference to be relatively new, the 2006 version is just an update of the original 1979 Directive. The Shellfish Hygiene Directive (91/492/EEC) complements the water quality protection by laying down the health conditions for the production and placing on the market of live bivalve molluscs intended for human consumption. The Bathing Waters Directives (76/1160/EEC and 2006/7/EEC) seek to protect human health and the environment principally from faecal pollution. The Marine Strategy Framework Directive (2008/56/EC) is a recent development that seeks to protect marine ecosystems from all potential pressures. The Urban Waste Water Directive (91/271/EEC) is also relevant as the Bellozanne effluent is one of the largest point source discharges to Jersey's coastal waters.

Jersey is not a member of the European Union and its Directives or guidance are not legally binding. However the aim is wherever possible and appropriate to adhere to the Directives as best practice. The process by which certain parts of EU environmental Directives are selected as appropriate to Jersey is unclear. For a relatively small geographic area such as Jersey some of the detailed requirements of the Directives are certainly not relevant. However, from the evidence available, a structured risk based analysis of which parts of the Directives are meaningful to Jersey's situation has not been undertaken.

3.1.1 Shellfish Waters Directive

The Environment Agency is the competent authority in England and Wales for the Shellfish Waters Directive[3] and its purpose is to support the shellfish farming industry by protecting shellfish waters. In the UK, businesses that need permits to discharge to shellfish waters have to comply with the requirements of the directive. The Shellfish Waters Directive will, like a number of existing environmental directives, be revoked by 2013 and replaced by the WFD. However, the level of environmental protection for shellfish waters within the WFD must be at least as strong as in the revoked directives.

The Shellfish Waters Directive lists a number of parameters which must be monitored and sets standards for these in shellfish waters, although many of these standards are qualitative and not numeric. The parameters which must be monitored include:

Physicochemical conditions	(pH, colour, dissolved oxygen, temperature, suspended solids, and salinity)
Petroleum hydrocarbons	(No visible film must be observed)
Organohalogens	(Unspecified)
Metals	(Silver, arsenic, cadmium, chromium, copper, mercury, nickel, lead, and zinc)
Faecal coliforms	No more than 300 per 100 ml of shellfish flesh

Opinion:

Jersey complies reasonably well with the Shellfish Waters Directive with respect to the scope of parameters monitored. The important missing parameters are organohalogens and mercury. Organohalogens would include persistent and bioaccumulating substances such as polychlorinated biphenyls (PCBs). Of these missing parameters, mercury is the most crucial due its potential to bioaccumulate through marine food chains and cause damaging effects to organisms at the top of those food chains, including humans.

3.1.2 Shellfish hygiene

The quality of commercially harvested shellfish intended for human consumption must comply with the EU Food Hygiene Regulations (852/853/854), which took effect on 1st January 2006. In the UK, these regulations are enforced by the Food

[3] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:376:0014:0020:EN:PDF

Standards Agency. Harvested shellfish were previously classified under the Shellfish Hygiene Directive.

As with previous shellfish hygiene legislation, under the new Hygiene Regulations European Union Member States are still required to put in place a programme for monitoring and classifying shellfish harvesting areas. Production areas are categorised by the level of microbiological contamination, using the level of E. coli found in shellfish as an indicator organism. These areas are classified as Class A, B, C, or prohibited:

- Class A - shellfish contain less than 230 E. coli per 100 grams of flesh
- Class B - shellfish contain less than 4,600 E. coli per 100 grams of flesh
- Class C - shellfish contain less than 46,000 E. coli per 100 grams of flesh
- Prohibited area - above 46,000 E. coli per 100 grams of flesh

Shellfish from Class A beds can be sold without further treatment, whereas shellfish from Class B beds require a period of depuration before sale.

It is interesting to note that the Shellfish Waters Directive microbiological standard of no more than 300 faecal coliforms per 100 ml of shellfish flesh implies a requirement to achieve Class A status for classification of harvesting areas. However, the current policy in the UK[4] is only to aim to improve water quality such that at least Class B classification can be achieved. This is stated as an achievable interim target towards meeting the guideline faecal coliform standard for shellfish flesh quality under the Shellfish Waters Directive.

There does not appear to be a similar policy statement in Jersey on the level of ambition for shellfish quality, and the degree of influence that this will have in infrastructure investment and operational resources. The lack of a clear policy position on the objectives for shellfish quality can cause misunderstandings with stakeholders on the level of support and investment they can expect. The recent draft Jersey Aquaculture Strategy recommends the establishment of shellfish quality objectives for the Jersey Liquid Waste Strategy and Water Framework Directive which should lead to clearer policy in this area.

Opinion:

Jersey complies with European shellfish hygiene regulations. A position statement clearly stating the aims for desired shellfish quality and a strategy for achieving these objectives would be helpful to stakeholders and would deliver confidence in the process.

4 http://www.defra.gov.uk/environment/quality/water/waterquality/shellfish/index.htm#related

3.1.3 Water Framework Directive

The Water Framework Directive (WFD) is one of the most ambitious pieces of environmental regulation in the EU's history. The WFD aims to deliver overall general environmental outcomes in terms of ecology rather than tackling individual chemicals or industrial scenarios as previous regulations have tended to. The WFD requires that member states plan to achieve 'Good' status for surface waters, including coastal waters. Good status is defined in terms of the quality of a number of biological elements and environmental quality standards (EQSs) for chemicals. The following elements define Good status with a 'one out, all out' principle such that if one metric is less than good, the whole water body cannot be classified as Good status, even if the other metrics are all top quality:

- biology (phytoplankton, diatoms, macrophytes, invertebrates and fish)
- hydromorphology
- physico-chemical (including chemical pollutants that influence ecological status)
- priority and priority-hazardous substances.

The WFD also establishes minimum monitoring requirements for these. However, monitoring in the marine environment is limited to the physico-chemical and priority and priority hazardous substances. The elements of the WFD that are most relevant for Jersey are considered in turn below:

WFD Priority Pollutants

Thirty three chemicals are considered to be of sufficient concern to require Europe-wide EQSs to be implemented and thirteen of these ('priority hazardous substances') are of such a concern that all emissions, discharges and losses must ultimately cease with the aim of reducing concentrations to near zero. The current list of the chemicals viewed as being so hazardous that they require Europe-wide action is shown in Table 3.1. For the WFD priority and priority hazardous substances separate EQSs may be set for marine and freshwaters. EQSs set for the marine environment within the WFD can be very low and reflect the very low effect concentrations of the most hazardous chemicals. For example, the EQS for tributyl tin is 0.0002 µg l^{-1}.

The list of priority and priority hazardous substances is under review within the EU. The potential change to the list of priority pollutants is shown in Appendix 1. In addition to new substances, the current EQS for nickel and lead is likely to be made more stringent. The new EQSs being developed for the proposed additions and changes to the WFD priority list will also include sediment and biota EQSs where there are sufficient data to allow derivation of values.

Table 3.1 Priority pollutants within the Water Framework Directive (2010)

Priority Substances		Priority Hazardous Substances	
Alachor	Atrazine	Anthracene	Brominated Diphenyl Ethers
Benzene	Chlorfenvinphos	Cadmium	Chloroalkanes C_8 to C_{13}
Chlorpyrifos	1,2-dichloroethane	Endosulfan	Hexachlorobenzene
Dichloromethane	DEHP	Mercury	Hexachlorobutadiene
Diuron	Fluoranthene	Nonylphenol	Hexachlorocyclohexane
Isoproturon	Lead	PAHs	Pentachlorobenzene
Naphthalene	Nickel		Tributyltin
Octylphenol	Pentachlorophenol		
Simazine	Trichlorobenzenes	***Priority substances require that the EQS not be exceeded. Priority hazardous substances also require cessation of all emissions***	
Chloroform	Trifluralin		

The Environment Agency has adopted a risk-based approach to monitoring the elements of the WFD, including the priority and priority hazardous substances, such that parameters will only normally be monitored where there is evidence that the substance may be present in significant concentrations.

WFD physico-chemical elements

Perhaps rather confusingly, the WFD also sets standards for some chemical elements as part of the ecological classification. These physico-chemical standards are meant to protect or support the biology and so describe basic parameters such as oxygen concentrations or acceptable levels of nutrients. The most relevant physico-chemical element in the WFD for marine waters is nitrogen as this protects against eutrophication. Nitrogen is a known pressure on Jersey's coastal waters with elevated loads running into the sea from the use of nitrate fertilizers and the Bellozanne outfall.

The proposed UK WFD nitrogen standards for coastal waters are shown in Table 3.2. The standards are based on the mean from November to February, and preferably should be from 5 years of monitoring data. To enable comparison with any monitoring data these standard values have been converted from those expressed as µmoles N in the UK Technical Advisory Group WFD Phase 2 standards[5].

Table 3.2 UK nitrogen standards for coastal waters

Class boundaries **Winter Mean Dissolved Inorganic Nitrogen (µg l^{-1} N)**			
High Status	Good Status	Moderate Status	Poor Status
168	252	378	567

It should be noted that these standards are expressed as dissolved inorganic nitrogen which is the sum of nitrate, nitrite and ammoniacal nitrogen. This cannot be directly compared to the total nitrogen values reported in the Bellozanne outfall as they also include organic nitrogen species. However, it is certain from the concentrations of nitrogen in the outfall that there will be an area in the vicinity of the Bellozanne outfall that is at less than 'Good' status.

WFD biological monitoring

Biological monitoring for the WFD consists of four metrics which measure impacts to the following biological elements:

- Macroinvertebrates
- Diatoms
- Phytobenthos
- Fish

These biological monitoring metrics are relevant only for freshwater. Of these four potential metrics, only macroinvertebrate monitoring is undertaken on the island. Each of the four biological metrics is sensitive to different pressures. For example, the diatom measure used responds principally to nutrient loading whereas the macroinvertebrate tool responds to many different pressures including the presence of chemical pollutants.

In the EU, statistical analysis of biological data has been used as a line of evidence when deriving EQSs for WFD chemicals to reality-check that the EQS is not too

[5] www.wfduk.org

stringent or insufficiently protective. The most useful biological metric for correlating with chemical pressures has proved to be macroinvertebrate monitoring. Therefore, the biology data collected on Jersey are relevant and useful, and macroinvertebrates are a wise choice of biological metric to use. Monitoring for the other biological elements (diatoms etc.) would be extremely resource-intensive and would only be necessary if Jersey chose to comply with all the legislative requirements of the WFD.

As the stream lengths are short on Jersey, the freshwater macroinvertebrate data provide a good indication of the overall water quality flowing into coastal waters.

Opinion:

The surface water macroinvertebrate and general chemical monitoring provide useful evidence of the status of Jersey's rivers and streams with respect to the protection goals of the WFD. However, the lack of monitoring in coastal waters means that the risks of ecological damage are unknown. Urgent consideration should be given to ongoing monitoring the nutrient status of Jersey's coastal waters, especially if the loads of nitrogen being discharged remain high. WFD priority pollutant chemicals should be assessed for the likelihood of emissions or losses to sea and monitored accordingly in sediment or biota.

3.1.4 The Bathing Water Directive and revised Bathing Water Directive

The main objective of the Bathing Water Directives is to protect public health and the environment from faecal pollution at bathing waters. Member States are required to identify popular bathing areas and to monitor water quality there throughout the bathing season, which in England and Wales runs from mid May to the end of September.

The original Bathing Water Directive established in 1976 set a number of microbiological and physico-chemical standards that bathing waters must either comply with ("mandatory" standards) or endeavour to meet ("guideline" standards). The two main standards used to assess the quality of bathing water are total coliforms, and faecal coliform bacteria found in the guts of humans and other warm-blooded animals.

Bathing water on Jersey has been monitored annually since 1991. Monitoring is carried out following the 1976 EU Bathing waters Directive (76/160/EEC)[6] and compliance measured against the standards.

Currently 16 sites are monitored for bathing water quality. Sites currently sampled are:

[6] http://ec.europa.eu/environment/water/water-bathing/index_en.html#1976

- Archirondel
- Beauport
- Bonne Nuit
- Bouley Bay
- Green Island
- Greve de Lecq
- Grouville
- Havre des Pas
- La Haule
- Le Braye
- Plemont
- Portelet
- Rozel
- St Brelade's Bay
- Victoria Pool
- The Watersplash

From 2004 onwards monitoring has been carried out by Environmental Protection with analysis carried out by The States of Jersey Official Analyst Laboratory. Prior to this analysis was undertaken at the Hospital Pathology lab and Bellozanne lab.

Bathing water monitoring is undertaken following the internal Bathing Water Protocol to ensure consistency, and a commendable amount of ancillary visual observations are also recorded during sampling. Data from the bathing water monitoring are uploaded onto the States of Jersey website weekly throughout the bathing water season. Results are sent to The Marine Conservation Society for the 'Good Beach Guide' website at the end of the bathing water season. Annually, compliance is reported in the 'Jersey in Figures' publication. Results are audited and an annual report is prepared by the Centre for Research into Environment and Health, (CREH) University of Wales.

Historically, Environmental Protection have worked closely with CREH with respect to the assessment of the health risk arising from differing bacterial loadings of bathing waters. This led to the development of recognised WHO standards which are now used within Europe.

Research into bathing water and human health since the original Directive's introduction in 1976 has led to the development of the revised Bathing Water Directive (2006/7/EC), which will be implemented in stages between now and 2015, when the original Directive will be repealed. The revised Directive uses two parameters to assess water quality, Escherichia coli and intestinal enterococci, using a four year data set for each set of results, and sets much tighter standards than the original Directive.

There will be four classification categories: Excellent (approximately twice as stringent as the current Guideline standard); Good (similar to the current Guideline); Sufficient (approximately twice as stringent as the current Mandatory standard) and Poor, for waters which do not comply with the Directive's standards.

Key dates for the introduction of the revised Directive from a UK perspective are:

- 2011: The Environment Agency will publish a profile for each bathing water in England and Wales
- 2012: Signs must be in place at all bathing waters by the beginning of the bathing season. The Environment Agency will begin monitoring using the parameters of the revised Directive
- 2014: Final bathing water report using the standards of the current Directive
- 2015: First set of classifications using the new parameters will be published, based on the data set commenced in 2012
- 2016: New classifications will appear on the signs using symbols that are being prepared by the EC

The creation of bathing beach profiles is a new requirement. A bathing water profile is primarily intended to gain an understanding of the faecal sources and routes of pollution, and focuses on indicators for faecal pollution. It will be necessary to assess and report on the sources of potential pollution and the location-specific characteristics of the bathing beach. A bathing beach profile also offers an opportunity as a convenient mechanism for communicating the local coastal environment management action plans in place on Jersey to the general public. Jersey Environmental Protection have mapped out and drafted all 16 of the bathing beach profiles and this has involved considerable work with the pulling together of relevant data collected by the States of Jersey. As of September 2011, all bathing water profiles are now available on the Jersey website[7].

There is no standard format for a bathing beach profile and its minimum content is expressed only in general terms. However, detailed EU guidance on drafting bathing beach profiles has recently become available[8]. The general requirements for a bathing beach profile are:

(a) A description of the physical, geographical and hydrological characteristics of the bathing water, and of other surface waters in the catchment area of the bathing water concerned, that could be a source of pollution;

(b) An identification and assessment of causes of pollution that might affect bathing waters and impair bathers' health;

[7] http://www.gov.je/ENVIRONMENT/PROTECTINGENVIRONMENT/SEACOAST/Pages/SeawaterMonitoring.aspx
[8] http://ec.europa.eu/environment/water/water-bathing/pdf/profiles_dec_2009.pdf

(c) An assessment of the potential for proliferation of cyanobacteria;

(d) An assessment of the potential for proliferation of macro-algae and/or phytoplankton;

(e) If the assessment under point (b) shows that there is a risk of short-term pollution, the following additional information is required:

– The anticipated nature, frequency and duration of expected short-term pollution,

– Details of any remaining causes of pollution, including management measures taken and the time schedule for their elimination,

– Management measures taken during short-term pollution and the identity and contact details of bodies responsible for taking such action,

(f) The location of the monitoring point

The first rounds of bathing beach profiles produced and displayed on the Jersey website meet these requirements and are in a clear and easily understood format.

In the case of bathing waters classified as less than 'excellent', there is a requirement to periodically review the profile against the above criteria depending on the condition of the bathing beach. Beaches classified as 'good', 'sufficient' and 'poor' require review every 4 years, 3 years and 2 years respectively. Also, in the event of significant construction works or significant changes in the infrastructure in the vicinity of the bathing water, the bathing water profile has to be updated before the start of the next bathing season. This would be particularly relevant for a small island with many popular beaches such as Jersey, as most development is likely to be in the vicinity of bathing water.

The provision of bathing beach profiles offers potential benefits to Jersey's tourist industry as it is an opportunity to provide more information to the public and communicate the generally good condition of the beaches. It does, however, require additional cross departmental working to implement and maintain.

Opinion:

Jersey complies with the existing Bathing Water Directive requirements. High results are investigated by follow up sampling and work is in hand to undertake beach profiling as required by the amended directive. Producing bathing beach profiles is a significant extra piece of work for Environment Protection but is a useful tool for communicating environmental issues to the public.

Jersey bathing water data are reported in a clear and easily accessible format on the internet.

3.1.5 The Marine Strategy Framework Directive

The Marine Strategy Framework Directive (MSFD) came into force on 15 July, 2008. Key requirements of the Directive are:

- An assessment of the current state of UK seas by July, 2012
- A detailed description of what Good Environmental Status means for UK waters, and associated targets and indicators by July, 2012
- Establishment of a monitoring programme to measure progress toward Good Environmental Status by July, 2014
- Establishment of a programme of measures for achieving Good Environmental Status by 2016

The MFSD shares the same conceptual model as the WFD in that it aims to protect marine ecosystems by describing the overall environmental outcomes that are desired, and attempts to consider all the significant pressures that might be detrimental. Good Environmental Status for marine ecosystems is described in a high level manner using the following descriptors:

Biological diversity – the quality and occurrence of habitats, and the distribution and abundance of species, are in line with prevailing physiographic, geographic and climatic conditions.

Non-indigenous species – non-indigenous species introduced by human activities are at levels that do not adversely alter ecosystems.

Fisheries – populations of commercially exploited marine species exhibit a population age and size distribution indicative of healthy stocks.

Food webs – all elements of marine food webs (to the extent they are known) occur at abundance, diversity, and levels capable of ensuring long-term abundance and retention of full reproductive capacity.

Eutrophication – human-induced eutrophication is minimized with respect to losses in biodiversity, ecosystem degradation, harmful algal blooms, and oxygen deficiency.

Sea floor integrity – sea floor integrity is at a level that ensures the structure and function of its ecosystems is safeguarded.

Hydrographical conditions – permanent alterations of hydrographical conditions does not adversely affect ecosystems.

Contamination – concentrations of contaminants do not give rise to pollution effects.

Seafood contamination – contaminants in seafood for human consumption do not exceed levels established by EU legislation or standards.

Marine Litter – the properties and quantities of marine litter do not cause harm to marine environments.

Noise – the introduction of energy, including noise, do not adversely affect the marine environment.

The Directive leaves it to Member States to describe in more detail what Good Environmental Status means at a local level through the development of national targets and indicators. A workshop was held by Defra in 2010 to bring experts together with the aim of providing more descriptive detail to the high level normative definitions above. A report summarizing the output of the workshop and recommendations has been published (WCA 2010).

The requirements of the marine strategy directive were transposed into UK law in July 2010 via a Statutory Instrument[9]. The UK's aim is to determine what Good Environmental Status means for its seas by 2012 and the UK is actively working with the European Commission to enable delivery of the Directive requirements. The further detail on the proposed timeline for UK implementation is given in figure 3.1. The European Commission has recently (September 2010) published a Decision[10] which provides more clarity and detail on what Good Environmental Status looks like. However, while the recent Decision provides more detailed advice on each of the eleven descriptors, much of the text remains at a fairly high level stating generalized ambitions for each descriptor. Some of the defined criteria supporting the descriptors refer to those safeguards and standards already in place such as chemical standards under the Water Framework Directive. However, the marine strategy directive has more inclusive and holistic intentions than simply compliance with some numerical standards. The underpinning philosophy of the directive is that good environmental status is that protecting the marine environment must be seen within the context of sustainable use of the sea's resources. The directive is also risk based as it recommends that geographical areas or environmental indicators be screened out as low risk or inappropriate allowing resources to be targeted where it matters most.

[9] http://www.opsi.gov.uk/si/si2010/pdf/uksi_20101627_en.pdf
[10] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:232:0014:0024:EN:PDF

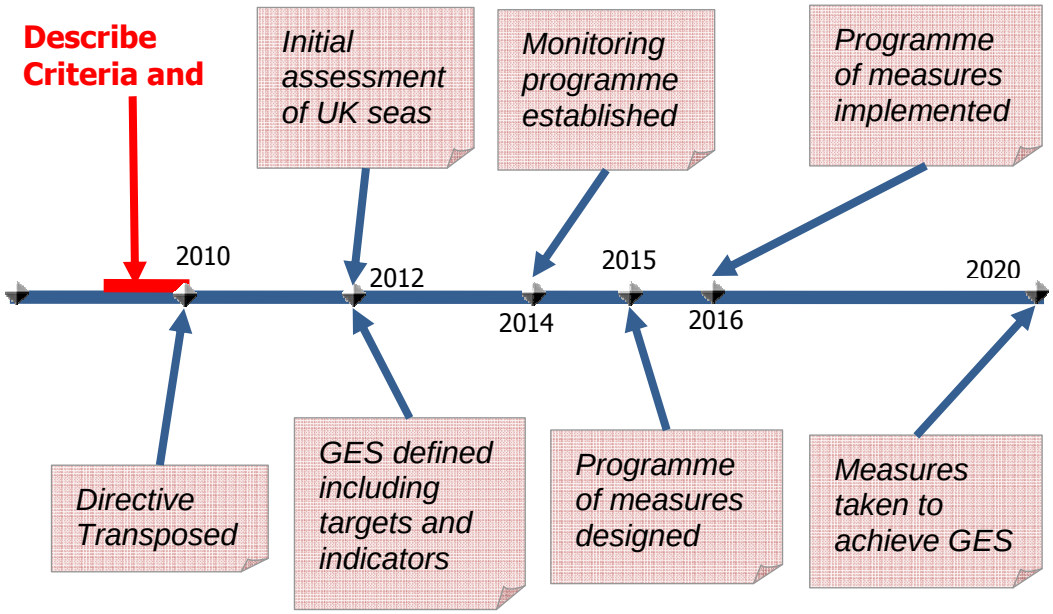

Figure 3.1 Timescales for implementation of the Marine Strategy Framework Directive

Opinion:

The marine strategy directive offers Jersey an opportunity to have a clear framework for protecting the marine environment as a whole entity against the various pressures it faces. As the marine environment is so important to Jersey, we recommend that Jersey actively explores the potential for adopting and complying with the provisions of this directive. Adopting this directive need not be a tick box exercise against a list of standards but could provide a risk based framework for protecting all aspects of the Jersey's coastal waters.

3.1.6 Urban Waste Water Directive

The aim of the Urban Waste Water Directive (91/271/EEC)[11] is to protect the environment from the adverse effect of waste water discharges. It sets out guidelines and legislation on how to collect, treat and discharge urban waste water. In 1998 the Commission issued Directive 98/15/EC, amending Directive 91/271/EEC, to clarify the requirements of the Directive in relation to discharges from urban waste water treatment plants to sensitive areas which are subject to eutrophication. The minimum quality of the effluent required for discharge to a sensitive area is shown in Table 3.3.

[11] http://www.legislation.gov.uk/uksi/1994/2841/contents/made

Table 3.3 Requirements for discharges from urban waste water treatment plants to sensitive areas which are subject to eutrophication

Parameters	Concentration	Minimum percentage of reduction
Total phosphorus	**2 mg l^{-1}** (10 100-100 000 p.e.) **1 mg l^{-1}** (more than 100 000 p.e.)	**80**
Total nitrogen[12]	**15 mg l^{-1}** (10 000-100 000 p.e.) **10 mg l^{-1}** (more than 100 000 p.e.)	**70-80**

The total nitrogen standard is on an annual average basis. However, this can be replaced with a daily average of 20 mg l^{-1} as long as this gives the same level of environmental protection.

Discussion around compliance with the Urban Waste Water Directive requirements often focuses on whether or not the receiving water is defined as sensitive to eutrophication or not. The two most relevant definitions of 'sensitive' in the directive are:

- where waters are found to be eutrophic or where they may in the near future become eutrophic if protective action is not taken
- areas where further treatment is required in order to meet other directives

Two studies (1997 and 2010) have been undertaken in St Aubin's bay by CREH to determine the eutrophic status and potential. The first study concluded that St. Aubin's bay displayed some evidence of eutrophication in the nearshore area and potential for eutrophication in the bay itself. The overall conclusion of the first study was that nutrient removal at Bellozanne would be a prudent precautionary measure

[12] Total nitrogen means the sum of total Kjeldahl nitrogen (organic and ammoniacal nitrogen), nitrate-nitrogen and nitrite-nitrogen

to adopt. The results of the second study indicated that St Aubin's bay is not subject to eutrophication.

One important difference between the two reports is that the accepted methodology (CSTT) used to assess eutrophication was modified soon after the first report. The main change in the methodology between the two reports is in the definition of 'hypernutrification'. The 1997 report bases its conclusions on the expectation of no summer hypernutrification whereas the 2010 assesses against no winter hypernutrification.

The two trophic studies indicate that total nutrient fluxes into St Aubin's bay have not materially changed between 1997 and 2010. The more recent study also demonstrated that 72% of the annual input of dissolved inorganic nitrogen derives from Bellozanne. Of the two principal nutrients, phosphorous and nitrogen, it is usually the latter that is the controlling factor for marine eutrophication.

Although the headline conclusion of the most recent CREH report is that St Aubin's bay is not subject to eutrophication, the assessment does conclude that a more stringent application of the model to the data between March and June could yield predicted chlorophyll a concentrations above the eutrophic summer threshold. Some additional seasonal monitoring may help clarify these risks. The 2010 report also suggests that the near shore surf zone showed elevated nutrient and chlorophyll areas. This increases the probability of near shore luxuriant macroalgae growth with the potential for subsequent odour nuisance or low dissolved oxygen levels when the algae decay.

In addition to the assessment for the potential of eutrophication, an area may also be described as sensitive with respect to the urban waste water directive if further effluent treatment is required to meet the goals of other directives. These other requirements could be, for example, to meet bathing water directive, water framework directive, habitats directive etc. While Jersey has not implemented all these directives, the principle of considering the wider goals of environmental protection when considering nutrient loads is an important one. The proximity of the Ramsar site to the discharge point may also be relevant as elevated nutrient levels could cause subtle effects such as changes in species abundance. A Ramsar site might not by itself be considered by the UK Environment Agency as a formal 'protected area' under the water framework directive unless the site was also included in a register for a supporting habitats based EU directive; although it would still receive the appropriate protection in permits etc. In practice, many of the UK Ramsar sites are also Special Protection Areas (SPAs) classified under the Birds Directive and so their protection and environmental objectives would form part of UK river basin management plans.

Bellozanne currently cannot achieve the 10 mg l^{-1} total nitrogen standard due to operational difficulties achieving sufficient denitrification. At the time of writing, discussions are underway on the future treatment options for Bellozanne. Much of the debate is focussing around the designation of St Aubin's bay as a sensitive area

as defined by the urban waste water directive. This is an important line of evidence to inform policy decisions but it should not be used in isolation and other wider environmental objectives also need to be considered.

Opinion:

The discharge from Bellozanne does not comply with the Urban Waste Water Directive requirements for a sensitive area. The latest CREH trophic study suggests that St Aubin's bay is not subject to eutrophication when using the established methodology although there may be risks if a more precautionary approach is adopted.
However, the Urban Waste Water Directive trigger values should not be viewed in isolation when making policy decisions on infrastructure etc. as the overall impacts on other ecological receptors need also to be considered.

3.1.7 Concluding remarks, compliance with international regulations

Comparison of existing practices against EU environmental protection regulation needs to be viewed in the context of Jersey's special political position. As Jersey is not part of the EU, it has no obligation to comply with its regulations. However, Jersey does aim to use other international regulations to drive forward its own best practice. This has led to the situation where some EU environmental regulatory protections are adhered to very closely whilst others are not followed. It is not clear whether the current situation with regard to compliance with EU regulations has come about from a structured risk based decision making process or whether it has evolved over time to respond to pressing needs to protect specific areas such as bathing beaches.

Historically, EU Directives tended to target one activity or protection goal such as setting limits on the concentrations on dangerous substances. This approach resulted in inconsistencies and the risk of gaps in overall environmental protection. Directives were also not always based on environmental outcomes so that there was often little guidance in what a problem free environment would look like. It was often assumed that simply if certain limit values were met then the protection goal had been achieved.

Recent framework directives have replaced the specific protections provided in older Directives with risk based provisions that are described in terms on ecological outcomes. The risk based approaches and considerations of economic feasibility in the Water Framework Directive and Marine Strategy could be helpful for Jersey to demonstrate a more inclusive level of environmental protection for the marine compartment. Some of the relevant framework directive needs are already partially in place and adhered to. Completing the implementation of these framework

directives on Jersey could be undertaken with a pragmatic approach. However, no matter how pragmatically this was undertaken, it is certain that this could not be accommodated within the existing regulatory resources.

3.2 Microbiological pollution and monitoring

3.2.1 Microbiological concerns on Jersey

Concern has been expressed by the States of Jersey Health Protection Services, Société Jersiaise, and Save our Shoreline, about microbial contamination around Jersey's coastline. This issue was one of the major concerns in discussions with stakeholders and the feedback received included disbelief of the explanations provided by regulators, and frustration at a perceived lack of action to resolve the problem

Although there is public concern about microbiological contamination, bathing beach seawater quality is generally very good with all sixteen of Jersey's beaches meeting the Directive Imperative standard, and fourteen out of sixteen meeting the more stringent Guide standard in the 2010 season. Notwithstanding a few specific beaches where intermittent quality problems are observed, such as Bonne Nuit, principal stakeholder concerns seem focused on their perceived failings in the waste water treatment infrastructure and its effects on water quality and shellfish hygiene.

In Jersey the main microbiological pollution incidences are believed to be during periods of high rainfall, due to storm discharge from the Bellozanne sewage treatment plant and from private discharges and run-off from agricultural land. The Health Protection Services note that currently 87% of Jersey's population are on mains drainage but that the Bellozanne treatment plant requires significant investment to upgrade infrastructure to meet the increased demands brought about by the rise in population. Bellozanne has a UV treatment process that operates all year round that should significantly reduce microbial loading under normal conditions. During periods of heavy rainfall the mains drainage system flows into and is retained in a cavern under Fort Regent until conditions improve. When wet weather flows exceed the storage area, the cavern has an overflow and diluted sewage is released untreated to sea. There have been a number of occasions over the past few years when this has happened due to exceptional periods of rainfall. On the eastern part of the island sewage is pumped to Bellozanne and storage tanks are attached to the pumping station for use in wet weather. When their limit is exceeded dilute sewage is pumped into water courses or onto east coast beaches. This has been reported more regularly in the past few years due to the increase in large storm events. However, the number of overflows to the east coast beaches remains relatively infrequent with two events reported between 2006 and 2010. The number of reported incidences also needs to be put into the context of the ongoing substantial investment in modern telemetry systems by Transport and Technical Services which may also mean that now less overflow events go unreported. As well as the issues with mains drainage, private plants can fail when they are flooded with

surface water Contamination from such overflows under conditions of high rainfall is combined with runoff from agricultural land and flushing of surface drains which also increases with heavy rainfall events. Some of these storm flows can discharge directly to the beaches via gullies and small streams and be a significant source of microbial contamination.

Environmental Protection have worked alongside with Transport and Technical Services drainage staff to investigate all potential sewage infrastructure and septic tank overflows (inc. those of concern reported by stakeholders). Outfalls have been monitored during storm events and high bacteria levels have been traced back up stream and investigated. The ongoing monitoring programme of outfall discharges supports this work. However, as yet no large and defined source of pollution has been found.

The shellfish industry is greatly affected by any microbial contamination of coastal waters. Shellfish are currently tested for levels of E. coli before sale for consumption, and the shellfish beds are graded accordingly. Based on the regular samples the classification can be reviewed and may be changed. Any deterioration in water quality around Jersey could lead to the reclassification of shellfish beds which would have significant economic implications for a major industry.

Coliforms are used as indicator organisms and high coliform concentrations may therefore suggest the presence of other pathogenic bacteria and viruses. Some viruses which can cause severe illness or unpleasant symptoms, such as norovirus, may survive in shellfish flesh longer than the indicator coliforms, which may mean that the health risk from any large transient peaks in microbiological pollution are not reflected in the coliform data.

3.2.2 Sources of microbiological pollution

Total coliforms and faecal coliforms are currently monitored on Jersey in line with international regulatory requirements and the level of potential microbial pollution is being monitored using accepted indicator organisms. However, occasional elevated results are observed in bathing waters and shellfish, and the current monitoring does not give clear indication of the source of pollution. Where breaches of microbiological standards occur, a fair question that stakeholders have asked is "where does the faecal contamination come from?" This is a challenging question to answer as it is very difficult to assign unambiguous sources of faecal pollution. This difficulty in part arises from the unspecific nature of the indicator organisms used and the large amount of monitoring required building the necessary evidence. One additional difficulty in interpreting the monitoring data is that faecal coliforms are present in large numbers in warm blooded animals and not exclusively humans. For example, Table 3.4 lists typical faecal coliform concentrations excreted by some shorebirds in Morecambe Bay, England, and Table 3.5 illustrates the coliform levels in faecal matter from agricultural origin.

Table 3.4 Excretion of faecal indicator bacteria by wild birds on Morecambe Bay (Jones 2002)

Bird	Faecal Coliforms (per gram faeces)
Bar-tailed godwit	7.1×10^{11}
Oystercatcher	4.7×10^{11}
Knot	5.3×10^{5}
Shellduck	7.4×10^{8}
Lapwing	2.6×10^{5}
Gulls (bay)	1.8×10^{7}
Gulls (waste tip)	1.0×10^{10}
Mallard	7.8×10^{10}

Table 3.5 Faecal coliforms in livestock faeces, farm slurry and sewage sludge (Jones 2002)

Sample	Faecal Coliforms per gram
Faeces – grazing sheep	2.8×10^{9} to 4.5×10^{12}
Faeces – grazing cattle	2.3×10^{5} to 6.7×10^{9}
Farm slurry to land	2.2×10^{4} to 3.2×10^{6}
Sewage sludge to land	1.7×10^{6} to 2.0×10^{6}

3.2.3 Microbial Source Tracking

A number of techniques have been developed to help identify pollution sources, such as ribotyping in order to distinguish E. coli of human origin from E. coli of different animal sources (Carson et al. 2001). The Environment Agency has recently issued an

operational instruction[13] on Microbial Source Tracking (MST) with advice on survey design and data interpretation. The Environment Agency approach for MST is to recommend using two different techniques; counting bacteriodetes, and mitochondrial DNA analysis, with greater emphasis being given to the former technique. Bacteriodetes are excreted by most animal species but genetic markers allow them to be distinguished. The Environment Agency laboratories can specifically report human and ruminant bacteriodete markers, together with a total count that will include organisms from all sources. Mitochondrial DNA markers can be considered as a separate test if distinguishing between dogs, birds and humans is important. These MST techniques have been shown by the Environment Agency to provide good information on the sources of faecal contamination. Results from this technique have been proven correct in a number of instances, even when the conclusions seemed counter intuitive to what was thought to be happening.

Although MST techniques provide reliable data, they do need careful interpretation to avoid false conclusions. For example, although UV treatment as used at Bellozanne dramatically reduces the number of viable coliform organisms, MST techniques use specific pieces of DNA as markers. These DNA markers can survive UV treatment, although the organism does not, with the result that MST analysis of waters receiving UV treated effluent will give a falsely high indication of human faecal contamination. MST techniques should therefore not be used in isolation to make conclusions but are a valuable line of evidence alongside other monitoring data and local knowledge.

From the submissions received, Environmental Protection does not have the budget to enable UK specialists to be employed to carry out microbial source tracking. If resources were made available for a monitoring survey utilising these techniques, the surveys would need to be carefully designed so that useful information were obtained as there is a high risk of confounding results with no overall conclusion. The preferred outcome of a microbial source tracking survey is a 'smoking gun' that provides clear evidence of a source of pollution and a pathway for dispersing the pollution. In the case of Jersey, the main continuous point sources (sewage effluent discharges) of coliforms are reasonably well controlled, few in number and subject to advanced tertiary treatment except in exceptional circumstances such as storm events. However, the dispersion patterns of pollution outside the effluent mixing zones are poorly understood and the fate and behaviour of the effluent derived coliforms in the coastal waters is unknown. For example, a proportion of the surviving coliform organisms from UV treatment may be immediately viable when sampled at the discharge point but may be damaged sufficiently to reduce their survival time in the sea.

The contribution of the remaining intermittent point sources and diffuse sources to the local total coliform loading will be dependent on tide, location, weather, presence of bird flocks, sea state etc. Altogether, therefore, there many variables that affect

[13] www.environment-agency.gov.uk/static/documents/Business/985_10.pdf

the potential for shellfish beds to be impacted by microbial pollution and so it will be impossible to draw definitive conclusions from one or even a few surveys. Insufficient evidence from monitoring is likely to result in conclusions being spurious or speculative.

As an example of the potential scale of monitoring required to draw definitive conclusions, a quantitative source apportionment for faecal coliforms was undertaken in the Ribble catchment in North West England in 2002 (Stapleton 2006). The aim of this study was to understand the total coliform budget for the catchment under normal and high flows. In order to obtain sufficient data, intensive sampling was undertaken over a 44 day period with samples being taken every two or three days. Additional opportunistic samples were also taken during rainfall events. Although the Ribble catchment is about ten times the surface area of Jersey and has more complex wastewater treatment infrastructure, it would be necessary to undertake a similarly structured programme of intensive monitoring to fully characterise the relative importance of the different sources of coliforms to Jersey's coastal waters.

This would be a substantial exercise both in manpower resource and direct costs. It is not possible to give an estimate of the likely costs prior to design of the monitoring programme but it will almost certainly be more than the existing total monitoring budget.

Opinion:

The present level of investigative monitoring will not provide sufficient evidence to answer key questions about the sources and origins of coliforms.

In order to determine, with reasonable confidence, the relative contribution of the various sources of coliforms to Jersey's marine environment, a number of targeted and intensive monitoring exercises of potential sources are required. This monitoring will need to be able to react to rainfall events or sewer overflows.
If budgets permit, some typing analysis to indicate the specific animal origin of coliforms would be helpful although this will probably be more useful in investigating any residual unacceptable level of coliforms remaining once the principal sources in discharges, streams etc., have been addressed.

3.2.4 Use of Impedance Technology

One verbal submission received from an Aquaculture representative urged that consideration be given to the use of impedance techniques for microbiological analysis in order to produce quicker sample analysis. This method is based on the principle that bacteria actively growing in a culture medium produce positively or negatively charged end-products that cause an impedance variation of the medium. This change in impedance in the medium arises from bacterial metabolism of sugars

etc., so is linked to bacterial growth. The time at which growth is first detected is inversely proportional to the log number of bacteria in the sample, which means that bacterial counts can be predicted from the detection time. The principal benefit of impedance techniques is speed of analysis. Results are available from impedance analyzers within 5 to 10 hours for E. coli in shellfish, in contrast to 3 days for the standard Most Probable Number (MPN) method. There are also some savings in staff time once the impedance methods are in routine operation within a laboratory.

Impedance techniques and the associated instrumentation have been available for decades for a range of microbiological assays, but their use for regulatory purposes such as shellfish classification has been limited. This is due to concerns about specificity and compatibility of the data with long established reference methods. Impedance methods for shellfish have been recently calibrated against the reference MPN method (Dupont 2004) using two different impedance systems (Malthus and BacTrac). This study found that the impedance signal was attributable to E. coli in 99% of cases and concluded that impedance measurement is an alternative to the MPN method for rapid quantitative estimation of E. coli in live bivalve shellfish. However, most reference laboratories for coliform analysis in shellfish continue to use the MPN method.

Impedance systems cost around £30K and would require an extensive period of staff training and on-site validation before routine use. Techniques using impedance like the Malthus method are best used where the infrastructure is highly centralised and there is a high throughput of samples (hundreds a week). Therefore, laboratory investment in impedance systems on Jersey is unlikely to be cost effective as much of the need is for irregular surveys. The use of impedance systems for coliform analysis is more common in France than the UK and it may be more convenient for any samples requiring this analysis to be sent to a French laboratory. Alternatively, mobile impedance laboratory facilities are available and these may be helpful during large scale investigations to enable more samples to be analysed. Mobile impedance laboratories also offer the potential to adapt monitoring strategies during investigations in light of preliminary results.

Impedance methods are unlikely to be able to assist in management action of shellfish beds in response to pollution events. The analysis times of impedance methods are still much longer than the time taken for bivalves to concentrate faecal coliforms from seawater. Table 3.6 shows the time taken for mussels and oysters to reach maximum concentrations of faecal coliforms under differing conditions.

Table 3.6 Time needed for bivalves to reach maximum concentrations of faecal coliforms (FC) in their bodies (Solic 1999)

		Time (hr)	
Water Temp (°C)	**Concentration of FC in seawater (L^{-1})**	**Mussels**	**Oysters**

		Time (hr)	
Water Temp (°C)	**Concentration of FC in seawater (L^{-1})**	**Mussels**	**Oysters**
12	10 to 10^3 10^3 to 10^5 10^5 to 10^7	5.54 2.45 1.51	11.13 6.51 4.25
18	10 to 10^3 10^3 to 10^5 10^5 to 10^7	3.33 1.68 1.10	1.67 1.01 0.88
24	10 to 10^3 10^3 to 10^5 10^5 to 10^7	1.85 1.11 0.71	3.97 2.52 1.64

As can be seen, the shellfish will have achieved maximum burdens of coliforms much quicker than it would be realistically possible to obtain sample results and take any corrective action. The same study showed that the rates of faecal coliform concentration in bivalves were high at the beginning of the experiments, when the initial concentrations of faecal coliforms in bivalves were low, and decreased as the concentration in bivalves increased. Therefore, any management action of shellfish beds to mitigate contamination with faecal coliforms would need to be taken before any pollution plume arrived to be effective.

Opinion:

Impedance techniques are not yet widely accepted as suitable for regulatory coliform analysis and are unlikely to be helpful in influencing management action of shellfish beds during suspected pollution events. However, they may be useful for any large planned investigations and could allow follow up samples to be taken within meaningful timescales. This could allow sources with indicative high levels of coliforms to be investigated while the discharge is still occurring. The use of mobile impedance laboratories would also remove much of the logistical problems associated with shipping large numbers of samples to external laboratories.

3.3 Chemical pollution and monitoring

3.3.1 Adequacy of chemical monitoring

Two submissions were received (Save Our Shoreline and Société Jersiaise) which expressed the view that size and scope of the existing marine chemical monitoring is insufficient to understand the risks to the island's environment.

Information submitted for the review by Société Jersiaise suggested that additional monitoring be considered. This would include an increase in baseline data, with the suggestion to follow that undertaken in England or France as best possible practice. Increased baseline data could make any future management issues easier to assess. Société Jersiaise also suggest that commercial species such as bass, mullet, lobster, crab and whelks, be tested over periods of time for PCBs and other known chemical toxins. Indicative costs (Environment Agency National laboratory Service) for PCBs and mercury in biota are £55 and £35 per sample respectively. More specialised analysis such as brominated diphenyls may cost £200 per sample or more. The actual number of samples analysed need not be high to obtain the desired information with an analytical budget of no more than £5000 being sufficient. If the data is to be used for baseline information, then sessile or non-migratory species should be selected.

Much of the historic chemical monitoring in Jersey's marine environment has been limited to metals. Although the number of substances monitored has been relatively few, the long term monitoring in shellfish and seaweed does provide valuable information on trends in pollutant concentrations. The quantity of data available from this long term survey allows meaningful conclusions to be drawn and so the value of these data should not be underestimated. The scope of the parameters tested is limited to six metals (arsenic, cadmium, chromium, copper, lead, zinc) and while this provides valuable data, some other potentially important hazardous chemicals are missing. Save Our Shoreline also challenged the choice of species monitored, suggesting that perhaps greater emphasis should be given to bivalves. The optimum species for monitoring to assess local risks should be sedentary, representative, plentiful and valid for comparison against other geographic areas. The three species chosen fulfil these criteria. The Save Our Shoreline submission suggests that they do not consider slipper limpets as filter feeders. However, slipper limpets are marine snails that have a grazing habit when juvenile but then become immobile and adopt a filter feeding habit when adult (Clark 2008). Fisheries sample adult specimens for the surveys and so Save Our Shoreline's concerns on this issue are based on a misunderstanding. Studies have shown that the particle size range removed by adult slipper limpets in the filtering process is comparable to oysters allowing comparison with other oyster monitoring data.

Aside from the shellfish metal surveys, the level of marine chemical monitoring is very limited. This lack of evidence on environmental concentrations of other hazardous substances is of clear concern to stakeholders. Without either measured monitoring data, or modelling of the potential emissions of other chemicals of concern to the marine compartment, it is impossible to assess the true chemical status of Jersey's coastal waters.

If the need for improved chemical monitoring is accepted, the question then becomes "what should we do differently with limited resources"? The ambition of any environmental monitoring is always limited by available resources, and needs to be prioritised to provide data on those substances that present the greatest risk. As

mentioned above, the long term shellfish and seaweed monitoring is extremely useful, so, if affordable, it would be better to supplement rather than replace this monitoring.

Selecting which chemicals to prioritise for additional monitoring can be daunting given the huge number of potentially hazardous chemicals. A structured prioritisation process for selecting potential chemical pollutants has been undertaken for the WFD and this provides a good basis for chemicals that may be of sufficient concern to require monitoring. The chemicals on the original list of priority pollutants and subsequent review represent those substances that are of EU-wide concern. The prioritisation process to select these substances was based on the intrinsic hazardous properties of the chemical (persistence, bioaccumulation potential, and toxicity) and the detection in environmental monitoring databases.

The list of WFD priority pollutants provide a good starting point for identifying which chemicals could be usefully monitored, resources permitting. However, many of the chemicals are not likely to be relevant on Jersey due to the island's particular circumstances. For example, many of the substances on the priority pollutant list are pesticides which are no longer in use, and may never have been used in any significant quantity on Jersey. The UK position is not to monitor where there is information to suggest no risk. One example is the herbicide alachlor which is a priority substance within the WFD but there is no evidence of significant use or detection in UK waters so it is not monitored by the Environment Agency.

It would be helpful to undertake a review of all available data to determine if any of the WFD priority list of chemicals or other hazardous substances are likely to be entering Jersey's marine environment. A desk top study of potential sources on Jersey of hazardous chemicals together with an analysis of any pathway for them to reach the marine environment and the likelihood of exceeding biological effect concentrations would also inform any future monitoring strategy. This is the approach used by the Environment Agency when prioritising its monitoring requirements for new chemicals of concern. The number of samples taken by the Environment Agency for this sort of targeted risk-based monitoring is very small; sometimes no more than ten samples. If no risks are detected the sampling is stopped.

At sites where a more complete set of data for chemical pollutants is desired, or if data is more urgently required, the Environment Agency often uses gas chromatograph mass spectrometry (GCMS) screening methodologies as a cost effective approach. The principle of these methods differs from traditional analytical techniques in that, instead of specifically measuring one a few specific substances, all the accessible organic chemicals in the water are identified. The screening GCMS methods do not meet all the very low limits of detection required by some of the EQSs but provide invaluable data on the scale of environmental levels of substances for which little historical monitoring data are available. The screening GCMS method used by the Environment Agency and others also identify and estimate the

concentrations of tens of thousands of other organic substances which are present. These screening analytical methods are extremely helpful in addressing concerns that discharges to the marine system may contain unknown potentially harmful chemicals. It is important to note however, that one practical problem often encountered when using these screening analytical methodologies is, ironically, the large amount of information they generate. Often, samples will be found to contain a long list of chemicals at the microgram per litre concentration range for which there is no toxicological information. Therefore, careful interpretation of the results is necessary as the raw data may unnecessarily increase public concerns.

Opinion:

The existing chemistry monitoring of Jersey's marine environment is very limited with no data for a number of internationally recognised hazardous substances. Although the metals monitoring is relatively extensive, there is no data on substances which may be causing more long term effects. This paucity of data makes it impossible to assess whether potential point sources of chemicals are causing harm.

The metals monitoring in shellfish and seaweed provides useful long term data and should be continued if possible to allow trend analysis. If resources permit, the addition of mercury analysis to these samples should be considered as a high priority. In addition, some limited analysis of persistent organics such brominated fire retardants and PCBs in slipper limpets in the proximity of potential point sources such as La Collette would be informative and hopefully provide stakeholder reassurance.

It would be helpful to undertake a prioritisation exercise of the chemicals most likely to reach the marine environment from inland point and diffuse sources to inform any monitoring strategy. This would ensure the best allocation of resources.

3.3.2 Substances of potential concern

Although the information on locally relevant chemical pressures on Jersey's marine environment is not available, we can suggest some substances of potential concern based on monitoring experiences in the UK and across Europe and these are discussed below.

3.3.2.1 Substances of potential concern - Endocrine disruptors

Oestrone and 17β-oestradiol are natural steroids and are present in sewage effluents as a result of excretion of from humans. The synthetic steroid, 17α-ethynyl oestradiol (EE2) is contained in some contraceptive pills. These chemicals are extremely potent endocrine disruptors and can cause effects at the sub-nanogram per litre concentration. These oestrogen steroids have been shown to be responsible for the feminisation of fish and in extreme cases can cause the intersex condition where both sexual tissues are present. Feminised male fish have also been shown to have reduced reproductive capability (Jobling 2002).

The issue of endocrine disruption has been the subject of large research programmes in the UK including academic studies, development of analytical techniques, and a large demonstration programme investigating the efficacy of different sewage treatment technologies at removing steroid oestrogens (UKWIR 2009). Other chemicals such as nonylphenol can also cause endocrine disrupting effects but the alkylphenols are subject to extensive marketing and use restrictions and are also much less potent than the steroid oestrogens.

The vast majority of the environmental impacts and subsequent research from endocrine disruption in the UK has been in freshwaters where the dilution of sewage effluents is relatively low. Also, the feminisation effect seen is proportional to the dose, and longer timescales of exposure are more relevant which reduces the risk to migratory fish species. The large dilution of effluent from the Bellozanne works also significantly reduces the risk of impacts but offsetting this are the extremely low effect concentrations of EE2. As can be seen from Appendix 1, EE2 is among the candidate list for new WFD priority substances. The final EQS value for EE2 has yet to be agreed but tentative annual average EQS are in the region of 0.035 ng l^{-1} which is at the limit of analytical capability. Due to the very large scale of the monitoring required for the UK demonstration programme and the growing interest in endocrine disruptors, a number of laboratories have now implemented sensitive methods for the oestrogen steroids. Typical analytical costs are likely to be in the range of £75 to £150 per sample.

Opinion:

Laboratory analysis of steroid oestrogens is expensive and the detection limits quoted may be too high to be relevant to the effect concentrations. Alternative or complementary options that could be considered if monitoring the risks from endocrine disrupters at Bellozanne were planned are, in order of ease:

- Modelling of reasonable worst case EE2 concentrations in the receiving waters using data for influent volumes, person equivalents, EE2 removal rates through the works etc.
- Histological examination of fish near the outfall for evidence of abnormal gonad tissue
- Analysis of blood samples from fish for elevated vitellogenin (egg yolk protein)
- Use of bioassays such as the yeast based system (YES) or light emitting luciferase system (CALUX).

3.3.2.2 Substances of potential concern - Mercury

Mercury is used in making mercury-vapour lamps and advertising signs, and in mercury switches, batteries, diffusion pumps and other electrical apparatus and

instruments. Another common use is in dental fillings. Mercury has also been widely used in thermometers, barometers, and other measuring devices, but marketing and use is now restricted for many of these purposes. Former uses in pesticide, pharmaceutical and paint manufacturing have now been phased out. As a substance of widespread historical use in domestic and industrial applications, it is possible that trace levels of mercury may be present in the La Collette infill material in contact with the sea. Mercury monitoring in water is being carried out by Transport and Technical Services to inform their La Collette monitoring strategy. The environmental quality standard for mercury in seawater is lower than 0.05µg l^{-1} which is beyond the capability many analytical laboratories. Therefore, any detections of mercury in seawater may be by itself a cause of concern. It will also helpfully be a requirement in the waste management licence for biota monitoring of mercury.

Mercury can be transformed in the environment into other compounds such as methyl mercury that can accumulate and concentrate in aquatic food chains. Mercury is one of three substances in the WFD to have a standard set in biota in preference to water. The current EQS is 20 µg kg^{-1} wet weight and is intended for prey tissue i.e. in molluscs, crustaceans etc. in order to protect predator species. As mercury is a naturally occurring element, any monitoring near sites at potential risk such La Collette would need to be compared to clean control site data with similar geology.

If shellfish or other biota were monitored for mercury, the data would also need to be put into context with values found elsewhere as reported concentrations can often exceed the EQS of 20 µg kg^{-1} wet weight. For example a UK survey (FSA 2005) of 82 mussels found a minimum, maximum and mean concentration of 4, 96 and 24 µg kg^{-1} wet weight respectively.

3.3.2.3 Substances of potential concern – Brominated flame retardants

Brominated Flame Retardants (BFRs) are used to reduce the risk of fire in a wide variety of applications including plastics, domestic electronic equipment and textiles. Therefore, the La Collette land reclamation site is a potential source of these chemicals although the risk of long term pollution is probably low as the permanent disposal of bulky shredded wastes will not take place. One group of BFRs (Polybrominated diphenyl ethers (PBDEs)) is of sufficient concern to be a priority hazardous substance under the WFD. These compounds are frequently detected in fish.

PBDEs have a high bioaccumulation potential and are preferentially absorbed from the water into fatty tissue or sediment. The aqueous WFD EQS for PBDEs is very low at 0.0002 µg l^{-1} in marine waters and this value is beyond the capability of most laboratories. However, given the propensity for PBDEs to concentrate in tissues, monitoring of waters is probably not appropriate and analysis of sediments or biota is more relevant. PBDEs are one of a few WFD substances for which the UK Environment Agency is investigating the derivation and implementation of biota EQSs because monitoring in water is impractical.

There are no industrial applications for PBDEs so any inputs of PBDEs would be from diffuse sources such as discarded furniture, building materials or electrical goods. PBDEs are subject to stringent marketing and use restrictions and are now effectively banned from use. Therefore, any concentrations of PBDEs in fish and shellfish should gradually decline, although PBDEs are very persistent and there is no evidence yet of a declining trend.

As PBDEs are, in effect, a legacy chemical, they may not be considered a priority for monitoring. However, if resources permit, a limited assessment of BFRs in shellfish would enable a comparison against concentrations reported in the literature. This comparison could provide an indicator of any trace levels of bioaccumulating pollutants leaching from areas of land reclamation.

3.3.2.4 Substances of potential concern – PCBs

PCBs are substances of long standing environmental concern. They are extremely resistant to degradation, build up in food chains, and are thought to have been partly responsible for the marked decline of the otter and other top predators around forty years ago. Public awareness of PCBs as a toxic chemical is high and the lack of local data for PCB concentrations has been raised by stakeholders.

Although PCB production ceased many years ago, they are widely dispersed in the environment. Modern analytical techniques are also very sensitive for PCBs with the result that most, if not all, sediment and fauna samples will contain detectable levels. PCBs are virtually insoluble in water and their propensity to accumulate in fatty tissues or sediment means that these compartments are more relevant for monitoring.

The inertness of PCBs means that they were frequently used as a component of transformer oil. In the UK, point source pollution from PCBs has been associated with spillage of transformer oil, for example when old transformers are cut up for scrap. Any evidence of metal recycling of transformers on Jersey may therefore indicate an increased risk of point source pollution from PCBs and these sites should be a priority for monitoring.

Although PCBs are a legacy chemical, a limited monitoring exercise of shellfish would help place the local concentrations into context and should be considered.

3.4 Adequacy of resources

3.4.1 Capability for microbiological monitoring

Obtaining microbiological monitoring data on Jersey in reaction to intermittent discharges or storm events is currently severely constrained by the available analytical resources. This limits the capacity for effective investigation of pollution events, and can frustrate stakeholders who have a strong economic or environmental interest in acquiring monitoring evidence to understand sources of pollution.

The States of Jersey Official Analyst Laboratory can only accept microbiological samples on Monday to Wednesday and there are also capacity limitations such that little or no extra sampling can take place during the Bathing Water Beach season. The analytical restrictions arise from unavoidable fixed timings within the methodology that the laboratory is required to follow. These methodological timings would require staff to work at weekends if microbiological samples were submitted outside the Monday to Wednesday window. Also, samples need to be delivered to the Analyst by 14:00 hrs to avoid laboratory staff working outside normal hours. In addition to extra staffing resource to address the capacity limitations, providing a more flexible service for microbiology would therefore require staff working routinely at weekends or into the evenings.

The Environment Agency uses a relaxed maximum time of 48 hrs, in place of the normal 24 hrs, between sampling and analysis for investigative coliform analysis. It is unclear whether the sampling protocols in Environmental Protection take advantage of the increased flexibility that the extra 24 hrs offers. If not, this may help improve the time window available for sampling. The 48 hrs time limit also means that out-sourcing the analytical requirements of large surveys to mainland laboratories is feasible.

Sampling resources are also limited with double manning required for safety reasons when sampling Bathing Beaches (for activities such as staff wading into surf to collect the sample). Although these limitations provide severe constraints on meeting stakeholder expectations, Environmental Protection and the other functions are flexible and collaborate internally to attempt to meet these expectations. Flexible working and systems based on the evident goodwill is not, however, providing a level of microbiological service that meets expectations.

Therefore, any significant microbiological surveys are likely to require out-sourcing of the analytical workload, possibly using a commercially available mobile laboratory or facilities on mainland France or the UK. Additional contracted-in sampling effort would probably also be required to ensure enough sampling points to allow conclusions to be drawn from the data.

There may be some scope for improving the flexibility of the Jersey analytical services by incorporating this function within Environmental Protection. This would assist better planning and implementation of surveys as the whole sampling and analysis process could be organised within the regulatory function with the greatest need for analytical data. If the current philosophy within Environmental Protection of training staff to develop broad team-based skills also included the pool of staff in the analytical services, then this would also have the benefit of improving the overall flexibility and resilience of the combined functions to unplanned staff shortages.

Opinion:

The existing arrangements on Jersey are a barrier to meeting public expectations for investigative microbiological monitoring, and any significant microbiological survey work will need to be out-sourced. Solutions to the chronic microbiological quality issues will not be found with existing approaches and resources.

If the maximum sample storage time of 48 hrs for investigative microbiological samples is not currently used in full, using this could widen the time window available for sampling although this will not resolve the underlying laboratory resource problems.

The option to restructure the regulatory functional structures by incorporating the Jersey Analyst into Environmental Protection to potentially improve flexibility should be considered.

3.4.2 Laboratory analytical quality

Unlike many previous directives, the WFD explicitly states minimum requirements for the analytical performance of the methods to be used. The minimum quality criteria are that the limit of quantitation of the analytical method should not be greater than 30% of the EQS. The minimum criteria of sampling and analysis are set out in a WFD daughter directive, often referred to as the QA/QC Directive.[14]

The WFD also requires that metals samples are measured as dissolved; that is, filtered through a 0.45 μm membrane. All the WFD metal EQSs are expressed as dissolved so a comparison against these standards cannot be made from total metals data. It is not clear from the submissions received whether the existing metals analysis meets these recommendations.

In principle, if monitoring data are intended to be compared against WFD standards then these conditions should be met. However, in practice many European laboratories are struggling to meet the WFD data quality criteria for a number of chemicals, and it is likely to take a number of years until these quality criteria are fully met. For example, some member states still monitor total metals and not dissolved, although this situation is improving.

Opinion:

The current laboratory analytical performance and sampling protocols should be reviewed against European recommendations and guidance. This will ensure that data can be meaningfully compared with recent EU environmental standards.

This review is important, but not urgent.

[14] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:201:0036:0038:EN:PDF

3.4.3 Analytical budgets

As mentioned above, the current amount of routine environmental monitoring of chemicals in Jersey's marine waters is modest compared to the UK where much of the marine monitoring is driven by EU Directive reporting or to understand local pressures such TBT contamination, etc. Meeting the expectations of stakeholder's desires for more information on marine environmental quality will inevitably require more resources to be allocated to laboratory analysis.

Given the lack of baseline data for chemicals of concern, it will require a small number of targeted surveys to prioritise any longer term surveillance monitoring. The lack of large scale chemical or industrial activity on Jersey means that the likelihood of discovering significant contamination is low. If this confirmed, any long term surveillance monitoring can be very limited. The required scale of the initial targeted environmental monitoring is relatively modest and the necessary budget for the surveys shouldn't exceed £10,000.

The operator self-monitoring, required as part of the discharge permit at the Energy from Waste plant and the monitoring conditions placed by the regulator on waste licenses for la Collette, will also offer the opportunity to contribute useful monitoring data and support the development of better monitoring datasets for the marine environment.

There is little scope for rationalising the existing regulatory monitoring to release resources for monitoring of chemicals of concern in marine waters as the current monitoring regimes are so limited. Reducing or ceasing the invertebrate or shellfish metals monitoring would release resources but would be at the cost of losing powerful long term datasets.

Commenting on the efficiency of the Jersey Analyst is outside the scope of this report. However, it is interesting to note that the quoted Jersey analytical cost for metals at £52 per sample is around two to three times that of the Environment Agency laboratories. This is not surprising or unreasonable given the relatively small sample throughput in the Jersey Analyst compared to the thousands of samples analysed in a highly automated fashion within the Environment Agency. Contracting out the analytical services to a large commercial laboratory would probably reduce the unit analytical costs, but these benefits need to be weighed against the sizeable administrative burdens and high costs of shipping samples together with the loss of a local service that has an established rapport with regulators.

Opinion:

If public concerns are to be addressed about the lack of data on important chemicals in Jersey's marine environment, a significantly increased monitoring budget will be required in the short term to fund targeted surveys. Longer term monitoring budget requirements will be dependent on the risks identified from these surveys and modelling, but are likely to be greater than at present.

3.4.4 Pollution incident response

Pollution incident response to the out of hours call out system is potentially constrained due to the voluntary nature of the existing system. There is a rota system in place to call staff out to out-of-hours pollution events. This system is based on the goodwill of officers and their willingness to be called out during unsocial hours. Although funding has been investigated for a more formal arrangement, such a solution is not yet in place due to the lack of budget. Out of hours responses are also limited because supporting services, such as the analyst, are not available at weekends or evenings.

Although it is agreed that only large impact incidents are expected to be attended out of hours, in practice most incidents are currently attended due to the difficulties in gauging the scale of the event over the phone. Currently only one officer is available to cover Waste Law infringements.

Environmental Protection have taken a long term view and recognised the value of pollution prevention work to drive down the number of pollution incidents. For example, education such as the Oil Care campaign could help to decrease pollution incidents and reduce resource pressure for pollution control in the future.

Discussions with Environmental Protection officers indicated a shared resolve to deliver an effective pollution incident response. There is a clear system in place for prioritising pollution response and planning staff availability to deal with incidents together with a clear sense of ownership of the issue by the officers. No evidence was presented that the current voluntary system is not working.

3.5 Engagement with stakeholders

Environmental Protection is the first point of contact for those interested in matters related to potential pollution concerns of the local marine environment. A detailed submission (EP 3.1) was provided by Environmental Protection describing their activities supporting the engagement with the community. The submission also recognises the value of stakeholder engagement in supporting the wide ranging work of Environmental Protection. Against this backdrop of committing resources to engagement, and examples of initiatives to involve others, the evidence from interviews with some stakeholders and their written submissions would suggest a

strained and sometimes adversarial relationship, particularly with SOS and some aquaculture industry representatives. The regulatory engagement with these two stakeholders is considered further below.

3.5.1 Engagement with Save Our Shoreline (SOS)

The evidence from the written submission, SOS website content, and interviews suggests a difficult relationship and occasional mistrust between the SOS members contributing to this review and regulators. There is also a clearly held belief among some, of conspiracies to cover up environmental problems, perhaps for reasons of political expediency, and a lack of ambition by regulators to investigate and respond to pollution events. Examples of the views expressed can be found on the Jersey in Peril website[15] . Much of SOS's expressed suspicions of conspiracy and negligence relate to the alleged pollution arising from the construction of the energy from waste plant, and this is commented on below.

SOS is an organisation that vigorously defends what it sees as potential environmental damage to Jersey's marine environment and it tenaciously holds regulators to account for its actions on issues such as discharge permits, suspected pollution and Ramsar activities. This scrutiny of regulator's policies and actions in environmental protection leads to extensive dialogue between the parties as can be seen from the summary of email traffic in Table 3.7. In addition, SOS seem to adopt a more hazard-based approach when commenting on environmental pressures; i.e. they are concerned about the intrinsic dangerous properties of chemicals entering the environment, whereas regulators have to work in a risk-based framework where the likelihood of harm occurring is given more emphasis. This difference in philosophy, and the consequent greater degree of precaution for environmental protection that SOS expects, is a normal tension between regulator and non-governmental environmental organisation. A risk based approach is the only way for Environmental Protection can operate as it ensures that the regulated community and taxpayers are not asked to deliver measures which are unlikely to make a material difference to the environment.

Table 3.7 Summary of email correspondence between SOS and Jersey regulators

	Year	Environmental Protection	Fisheries and Marine Resources	Planning
Jan	2010		1	
Feb				
Mch		2		
Apr				1
May		1		1
Jun		2		
Jly			1	
Aug			1	

[15] http://www.jerseyinperil.com/january11.html

	Year	Environmental Protection	Fisheries and Marine Resources	Planning
Sept		1	1	
Oct		3	1	1
Nov		1	1	1
Dec		2		
Jan	2009			
Feb				
Mch		2		
Apr		2		
May		4		
Jun		2		
Jly		3		
Aug		1		1
Sept				1
Oct				
Nov		2		1
Dec				

As a robust non-governmental organisation, one might expect a tendency for regulators to adopt a defensive and formal attitude in communications with SOS. The relationship between the regulators and SOS is potentially further challenged when pollution events have been reported on the 'Jersey in Peril' website (for example, polystyrene foam on La Collette rock wall) without using the normal procedures, whereby pollution incidents are reported by the public through the advertised pollution hotline number. However, a review of the email correspondence with SOS indicates that, despite the potential for a confrontational relationship, regulators have provided objective and factual responses in a generally friendly and open manner. The email responses have also generally been reasonably timely, although one email thread ("RE: Energy from Waste Plant discharge permit applications") does suggest some frustration by SOS in delays in receiving a response. In this case, the principal recipient was unavailable for three weeks and left an automated out of office response, although it appears from the email that the issue was dealt with in the interim by a colleague.

Within the UK Environment Agency, this direct personal correspondence, and requests for information between a non-governmental organisation and the regulator would not normally occur. Typically, enquiries are collated centrally with responses either provided from existing information or from specialist staff who are tasked with providing a response within timescales set by agreed standards of service. The direct interaction between regulatory officers and the community is a beneficial outcome of Jersey's special situation but does require more effort than the arms length approach adopted by the Environment Agency.

SOS has also expressed strong misgivings about their engagement with the Ramsar Management Authority (RMA). From the SOS submissions and discussions, the two facets of the RMA's function that most concern SOS are the perceived lack of

ambition by regulators for protecting the Ramsar sites, and administrative arrangements such as selection of Chairperson and the recording of minutes. The overall impression reflected in SOS's correspondence and submissions on their RMA involvement is a suspicion of a lack of commitment by regulators to tackle what are seen as threats to the environmental status of the Ramsar sites. The submissions and correspondence also suggest that SOS feel that they have insufficient influence within the RMA decision making process.

The RMA is a relatively new functional group, and the evidence from discussions with members and correspondence suggests that it is still finding its feet from an administrative perspective in areas such as the operation of technical sub groups, recording of meetings etc. However, as the administrative operation of the RMA has evolved, it does appear to endeavour to be inclusive and open. Environmental Protection have indicated that the technical group appears to work well given that some valuable responses have been received by the RMA as part of the various consultation exercises (discharge permit and waste license applications). The SOS submission and discussion with other RMA members suggests differences of opinion on priorities and ambitions for RMA activity which need to be resolved though clearly defined terms of reference for the group and an agreed way of working.

Opinion:

There is evident mistrust by SOS of the importance that regulators place on marine environmental protection. SOS is a vigorous environmental group which actively challenges regulators and holds them to account, which may be expected to lead to a difficult relationship with regulators. However, the evidence suggests that regulatory staff respond to SOS questions and challenges in an open, factual and friendly manner.

There is no evidence of marginalisation or exclusion of SOS with the Ramsar Management Authority. There may, however, be a lack of clarity on the roles of stakeholders and the aims and ambition for the group. It would be helpful to publish clear and detailed terms of reference for the RMA which also includes a description of the expected ways of working.

3.5.2 Engagement with the aquaculture industry

The shellfish farming industry on Jersey is represented by a single body, the Jersey Aquaculture Association. The members of the aquaculture association depend on the cleanliness of the marine waters for their livelihoods and so, not surprisingly, they engage actively with Environmental Protection to pursue improvements in water quality. The principal water quality issue for the aquaculture industry is microbiological pollution and the effect that this has on shellfish bed grading. Environmental Protection works with the aquaculture industry to share their monitoring data and to discuss industry issues and concerns. Environmental Protection has also sought to inform shellfish farmers about the effluent treatment

systems in place by organising visits to telemetry systems and the cavern. Environmental Protection have also facilitated joint meetings so that the aquaculture industry can express their concerns and plan the way forward with TTS, Vets section (who administer the bed grading) and CREH. They have also investigated all claims received from the aquaculture industry of potential pollution etc. that they were concerned of.

However, during my meetings with aquaculture representatives, feelings were passionately expressed that the regulators were not adequately listening and responding to stakeholder concerns about microbiological quality problems and the impacts on their livelihoods. There is clear scepticism about the efficacy of the Bellozanne disinfection system and a strong desire to urgently identify and reduce microbiological loads. These views are very challenging for Environmental Protection to address and resolve as the investigations by Environmental Protection have failed to highlight any major source of pollution that can then be addressed.

Coliform counts are monitored before and after UV treatment at Bellozanne made for operational reasons by Transport and Technical Services but these data are not readily available to the public. To improve relationships with the aquaculture industry, it might be helpful if microbiological data from Bellozanne were routinely shared and discussed. Regulatory samples of the UV kills rates of bacteria have been shared with the industry by Environmental Protection.

Any aspiration by the aquaculture industry for grade A beds needs to be compared to the situation in the UK where the policy is to aim for Grade B together with no deterioration of current status. The 2011 shellfish classification for England and Wales reports only one Grade A bed with 326 Grade B and 35 Grade C.

Opinion:

During interviews and discussions to gather evidence for this report, Aquaculture representatives clearly demonstrated frustration and anger with what they suggest is a lack of action to address microbiological pollution.

As discussed above, identifying principal sources of faecal pollution will require substantially more monitoring resources than are presently available. Environmental Protection does not have the monitoring budget or resources to resolve these issues, so the relationship between the aquaculture industry and regulators is likely to remain difficult.

It may be helpful to establish a formal task group that includes both regulators and industry representatives with the objective to collaborate on action to improve microbiological quality. To be effective, the task group would need to influence the allocation of the available resources for monitoring of microbiological quality.

In order to address stakeholder concerns about the efficacy of Bellozanne, it would be helpful if there were greater openness about the operational performance of the Bellozanne works by TTS, including the sharing of effluent monitoring data with the aquaculture industry.

3.6 Sources of Pollution

3.6.1 Construction of the EfW plant at La Collette

During construction of the new energy from waste plant at La Collette, it is alleged that releases of substantial quantities of dirty excavation drainage waters were released to the sea causing pollution and potentially threatening the local Ramsar site. There have also been suggestions of poor environmental practice reported by an eyewitness which have not been followed up to the satisfaction of SOS. This whole issue has been of great concern[16] and the matter has been the subject of extensive correspondence between SOS and regulators. The correspondence has been contentious and difficult for regulators due to the open reporting of numerous statements, speculation and opinions from the stakeholders. The public interest and concerns generated by this incident presents a communications challenge for regulators who have to follow due process as laid down in the Enforcement Policy (as agreed by the Attorney General) which necessitates a measured and guarded approach. This can be interpreted by some as prevarication or a lack of conviction to address the matter which further adds to the communication challenges. Even allowing for due process, the matter remains unresolved as the regulator is awaiting the legal advice regarding the case file that was submitted on 10 August 2010. After

[16] www.jerseyinperil.com/january11

many months as a final decision is still awaited on whether legal action is warranted and it is unclear what is delaying matters in the AGs office.

The belief that a significant pollution event had occurred at the EfW plant led to a debate whether an Article 3.2 report should be submitted to the Ramsar Secretariat. In Article 3.2 of the Ramsar convention, each Party commits itself "to arrange to be informed at the earliest possible time if the ecological character of any wetland in its territory and included in the List has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference. Information on such changes shall be passed without delay to the Ramsar Secretariat". Initially the Scrutiny panel recommended that an Article 3.2 report was necessary but further reflection on the evidence by the Planning and Environment Department (now the Department of the Environment) concluded that the conditions of an Article 3.2 notification were not met and the Ramsar Secretariat accepted this.

Overall, therefore, the matter of potential pollution from the EfW plant has been of great public interest and regulatory attention. This report cannot comment in detail on the events at the EfW construction site as the matter is being considered within the context of potential legal action. However, as this issue has been of such general interest, the available monitoring evidence from the incident and details of the pollution response were described to us by Environment Protection. From these discussions, there was no evidence presented that a significant pollution of the adjacent seawater had occurred.

Opinion:

No evidence has been presented to this report that a significant pollution event occurred at the EfW construction site. This does not imply that working systems on site were correctly followed or that adequate environmental controls were in place.

In order to address stakeholder speculation on this issue, an early decision on potential legal proceedings is needed.

3.6.2 Bellozanne Sewage Treatment Plant

Bellozanne STW is the largest point source emission from Jersey to the marine environment. The plant uses activated sludge treatment as a secondary process after primary settlement together with all year round UV disinfection as an advanced tertiary treatment. Bellozanne discharges a maximum of around 78,000 cubic metres per day of effluent into St. Aubin's Bay of principally domestic origin.

Bellozanne STW has been recognised as operating at less than the desired performance for some time and in December 2009 a number of recommendations were proposed (Decision reference MD-T-2009-0111) by Transport and Technical

Services for upgrading processes together with an analysis of any eutrophication impacts in St Aubins Bay.

Since 2006, Bellozanne has had a total nitrogen standard of 10 mg l^{-1} in line with Urban Wastewater Directive requirements. However, as can be seen from Table 3.8 which summarises sample data obtained at the discharge point, the nitrogen standard has been exceeded for a number of years and there is no evidence of an improving trend in spite of changes in treatment processes.

During this period, Environmental Protection has been in extensive discussions with TTS concerning the proposed engineering mitigation, including timescales and anticipated improvements to the discharge. This has led to substantial further investment by TTS to try and alleviate the problem as well as them conducting studies on nutrient apportionment within the bay and trophic status of the bay. During the period, Environmental Protection has issued two formal warning letters and is currently compiling a case file regarding the total nitrogen failure of the sewage treatment works.

Table 3.8 Average total nitrogen concentrations in Bellozanne effluent.

	Total Nitrogen Consent condition	**Total Nitrogen Average(mg l^{-1})**
2005	20 (mg l^{-1})	20.78
2006 Jan-July	20 (mg l^{-1})	27.96
2006 July	10 (mg l^{-1})	25.91
2007	10 (mg l^{-1})	24.05
2008	10 (mg l^{-1})	27.28
2009	10 (mg l^{-1})	38.79
2010	10 (mg l^{-1})	29.69
2011	10 (mg l^{-1})	28.43[17]

Nutrient standards are required to be met for by the Urban Wastewater Directive for 'sensitive waters' and the most relevant definition of these in the UK regulations is:

"*estuaries, bays and other coastal waters which are found to have a poor water exchange, or which receive large quantities of nutrients. Discharges from small agglomerations are usually of minor importance in those areas, but for large*

[17] Running average value up to September 2011

agglomerations, the removal of phosphorus and/or nitrogen should be included unless it can be demonstrated that the removal will have no effect on the level of eutrophication"

Therefore, there is a clear need to reduce total nitrogen concentrations from Bellozanne unless it can be shown that the risk of eutrophication is minimal. Given the proximity of the Ramsar site to the effluent outfall, the evidence for a lack of eutrophication will need to be particularly strong.

The Environment Agency does not interpret Ramsar sites as special protected areas under the Water Framework Directive. This means that in principle an alternative objective other than the normally required 'Good' status could be established for the area in proximity to the Ramsar site. The major pressure threatening 'Good' status in St Aubin's Bay is likely to be nutrients and so it might be considered that setting an alternative, lower, environmental objective for nutrients in the receiving water body is an option. However, any lower objectives for nutrients would still need to meet the Ramsar convention protection goals. Also, failure to address the total nitrogen levels in Bellozanne outfall would still leave it non-compliant with the Urban Waste Water Directive. Overall, taking into account the proximity of important ecological sites, it is unlikely that the Environment Agency would consider accepting less than 'Good' status for the receiving water and such a situation would be anomalous.

There is also concern about the potential for high levels of metals to be discharging from Bellozanne. In addition to normal sources of metals, leachate from ash cells is disposed of by feeding into Bellozanne influent. Ash leachate will normally contain high levels of metals but data on the volumes of leachate handled in this manner were not available for this report.

Historically, Bellozanne effluent has not been monitored for metals. Metals analysis is now undertaken on the effluent and one set of sample data was available for this report. Conclusions about the overall risk of metals to the marine environment cannot be drawn from a single sample. It is also unknown whether the sample was taken at a time recently after any ash cell leachate disposal. However, for illustration, the Bellozanne metals data are compared to some typical UK STW effluents in Table 3.9.

Table 3.9 Comparison of Bellozanne effluent metals concentrations with typical Environment Agency STW data.

	Copper µg l^{-1}	**Zinc µg l^{-1}**	**Iron µg l^{-1}**	**Manganese µg l^{-1}**
Bellozanne effluent*	10	50	120	50
Typical STW mean**	5.3	34	444	88

*****Lead, arsenic, chromium, cadmium, nickel, selenium and mercury were also measured but not detected.

**Copper and zinc data based on 10 STWs, iron 45 STWs and manganese at 61 STW sites.

If the available Bellozanne effluent monitoring data is representative of normal conditions, the metals concentrations are within the normal expected range of values for effluent of principally domestic origin. Copper and zinc concentrations are commonly elevated in sewage effluent as these metals are released from domestic plumbing and this is, in part, why many Environment Agency sewage effluent permits historically contain consent conditions for these metals.

The report of a study into the impacts of the disposal of ash cell leachate via Bellozanne STW[18] was made available at late stage in the drafting of this review. The 2011 Capita Symonds report explores the overall contribution of metals originating from ash cell leachate to the total mass of metals discharged from Bellozanne. The report also examines the relevance of the metals which partition to solids which are then ultimately applied to land. The conclusions of this study are that the ash cell leachate makes a relatively small contribution to the total metals discharged and that the spreading of affected sludge is not likely to have a negative impact on land quality.

A number of the marine water quality standards used in the Capita Symonds report are older standards which have been replaced by the Water Framework Directive EQSs. The new marine EQSs for under the Water Framework Directive tend to be lower than historic EQSs. For example, the marine water quality standards for cadmium, lead and mercury quoted in the report are 2.5µg/l, 25µg/l and 0.3µg/l whereas the EQSs in use to assess chemical status for these three metals are 0.08µg/l, 7.2µg/l and 0.05µg/l respectively. Therefore, caution is required with the assessment in the report of metals concentrations in the effluent or leachate against marine standards.

The Capita Symonds report acknowledges that the existing data on metals at Bellozanne and in the receiving water are limited and restrict the confidence of any conclusions. The report goes on to recommend additional monitoring to clarify risks and we agree with this. Some of the existing limits of detection in the metals monitoring data are higher than the EQSs and it is essential that future monitoring data is of sufficient sensitivity to allow meaningful comparison with standards.

[18] La Collette Waste Management Facility ash cell leachate disposal: Updated desk study 2 September 2011 (Capita Symonds)

Opinion:

Bellozanne effluent consistently fails required total nitrogen levels. This increases the risk of eutrophication in the receiving marine environment and could contribute to changes in ecological community function at the Ramsar site.

As the receiving environment is of high ecological, social and economic value any relaxation of nutrient emission targets should be supported by particularly strong evidence that this will not lead to long term adverse impacts.

Conclusions on the risk from metals in the effluent cannot be made until more monitoring data is available and any future metals monitoring data needs to be sufficiently sensitive to allow meaningful comparison with marine water quality standards.

3.6.3 Bonne Nuit Sewage Treatment Plant

Bonne Nuit is the second of two sewage treatment plants on Jersey. It is a small and modern package plant that discharges close to an adjacent bathing water monitoring site.

The available monitoring data suggests that the site is sampled weekly to monitor parameters indicative of general plant performance (Chemical Oxygen Demand, Suspended Solids, Biochemical Oxygen Demand). In March 2009, a failure of the upper tier standard occurred and a warning letter issued by Environmental Prtoection. Other than this one instance, the monitoring data indicates that the plant performs well.

There have been public concerns about odour from the Bonne Nuit plant (for example http://www.thisisjersey.com/2010/09/16/decision-leaves-a-bad-smell/). Odour abatement equipment has recently been fitted at Bonne Nuit which hopefully has resolved this problem.

The nearby bathing waters monitoring site has experienced sporadic failures of the guideline standards and the Bonne Nuit sewage treatment plant has been implicated in contributing to these failures. The Bonne Nuit plant has UV disinfection as final treatment. Microbiological data from investigations undertaken in 2009 into sources and loads of coliforms at Bonne Nuit (Table 3.10) indicate that the disinfection process was working well at the time with final presumptive coliforms reduced down to 102 to 104 per 100ml. The effluent flows from the package plant are low although actual flow data were not available for this report.

Table 3.10 Investigative coliform monitoring data at Bonne Nuit. Figures in brackets are confirmed enterococci.

Site	Presumptive total coliforms (cfu/100ml)	Presumptive faecal coliforms (cfu/100ml)	Presumptive faecal streptococci (cfu/100ml)
28/04/2009 09:30	Time of high tide: 09:21	Weather: sunny	Flow: high
Post STP	10455	309	15 (15)
Manhole stream	364	<100	30 (30)
Cafe stream	1441	1081	455 (455)
Hotel stream	1802	200	414 (414)
Bathing water	100	<100	30 (30)
06/05/2009 09:15	Time of high tide: 05:07	Weather: dry	Flow: low
Post STP	330	<10	<10
Lavoir	500	<100	<10
Cafe stream	600	600	240 (230)
Hotel stream	<100	<100	10 (10)
Bathing water	300	282	283 (283)
12/05/2009 11:00	Time of high tide: 09:00	Weather: rain/overcast	Flow: med
Post STP	5182	882	82 (82)
Manhole stream	700	100	282 (282)
Cafe stream	1091	1000	573 (500)
Hotel stream	500	500	418 (418)
Bathing water	300	282	93 (93)
12/08/2009 09:30	Time of high tide: 10:41	Weather: not recorded	Flow: high
Post STP	3909	1436	27
Manhole stream	700	500	182
Lavoir	<100	<100	10
Cafe stream	2000	300	791
Hotel stream	900	300	2727
Bathing water	600	55	127 (97)
26/08/2009 09:00	Time of high tide: 10:56	Weather: not recorded	Flow: high
STP cover effluent	182	<100	<10
Post STP	364	<100	10
Manhole stream	300	<100	209
Cafe stream	3000	1000	3091
Hotel stream	200	100	118
Bathing water	<100	<10	10 (10)

In addition to the effluent, there are a number of other streams which discharge near to the beach. The investigative monitoring data indicates that these streams have coliform counts of a similar magnitude to the package plant effluent. Also, another line of evidence which would tend to reduce the relative contribution of the effluent coliforms to bathing beach failures is that the pathway from the discharge point to beach is quite long as there is a breakwater wall which prevents direct flow.

The increases in coliform counts at the beach are sporadic and may have multiple significant sources including wildlife and diffuse inputs from land drainage. As

mentioned elsewhere in this report, fully characterising the relative contribution of these sources to coliform counts at the bathing beach could require a number of intensive surveys including boat sampling to explore pathways of pollution under different conditions. It may be more efficient to begin by employing the microbial source tracking techniques described in Section 3.2.3 on bathing waters samples in order to provide evidence whether the pollution is largely of human origin.

3.6.4 Fire fighting foam contamination of the St Ouen's aquifers

The airport fire service has historically operated a fire training ground at the eastern end of the Airport site for more than 30 years. At the beginning of the 1990s, a new aircraft rig was set up which utilized pressurised kerosene. The fuel was sprayed over the rig and ignited to allow fire crews to practice. Aqueous film forming foam (AFFF) in water was used in these exercises to extinguish the flames. Any waste effluents, containing unspent fuel, burnt fuel products and foam chemicals, were disposed of to soakaway. In 1993, the use of fire fighting foam at the airport ceased when contamination of nearby groundwater supplies was identified. In January 1995, a programme of regular monitoring of streams and boreholes in the area of the airport and St Ouen's Bay was agreed. Ongoing monitoring of the St Ouen's Bay aquifers, by the Airport Authorities continues, with the results being provided to Environmental Protection and Health Protection for periodic review.

AFFF fire extinguishing fluids frequently contain perfluorinated chemicals, of which the most familiar and well studied is PFOS (perfluoro octane sulphonate). PFOS and some other perfluorinated chemicals are sometime referred to as 'eternal chemicals' due to their very long persistence in the environment.

PFOS has been internationally recognized as a priority pollutant and was identified as a substance potentially needing a national EQS for use within the Water Framework Directive. A draft UK EQS for PFOS was developed but this was then superseded by the inclusion of PFOS in the candidate list for a European wide EQS. Discussions are still ongoing within the EU to finalise which EQSs to take forward for implementation and there is also potential for new evidence to adjust the values of these standards. Although final EQS values are not yet agreed, it may still be useful to compare the monitoring data against the proposed annual average limit proposed for marine protection from chronic toxicity which is 0.023 µg l^{-1}. PFOS is now subject to stringent marketing and use restrictions and is effectively banned in most applications with use of PFOS containing fire fighting foams forbidden after 27 June 2011.

A spreadsheet of PFOS monitoring data from boreholes and other sites near the airport was made available for this report. Our attention was focused on those sampling points closest to the coast and those with the most complete data. The data from three sampling sites are examined for any evidence of trends and Figure 3.2 shows the location of these sampling points. Figures 3.3, 3.4 and 3.5 show the recorded concentrations of PFOS at these sites over time.

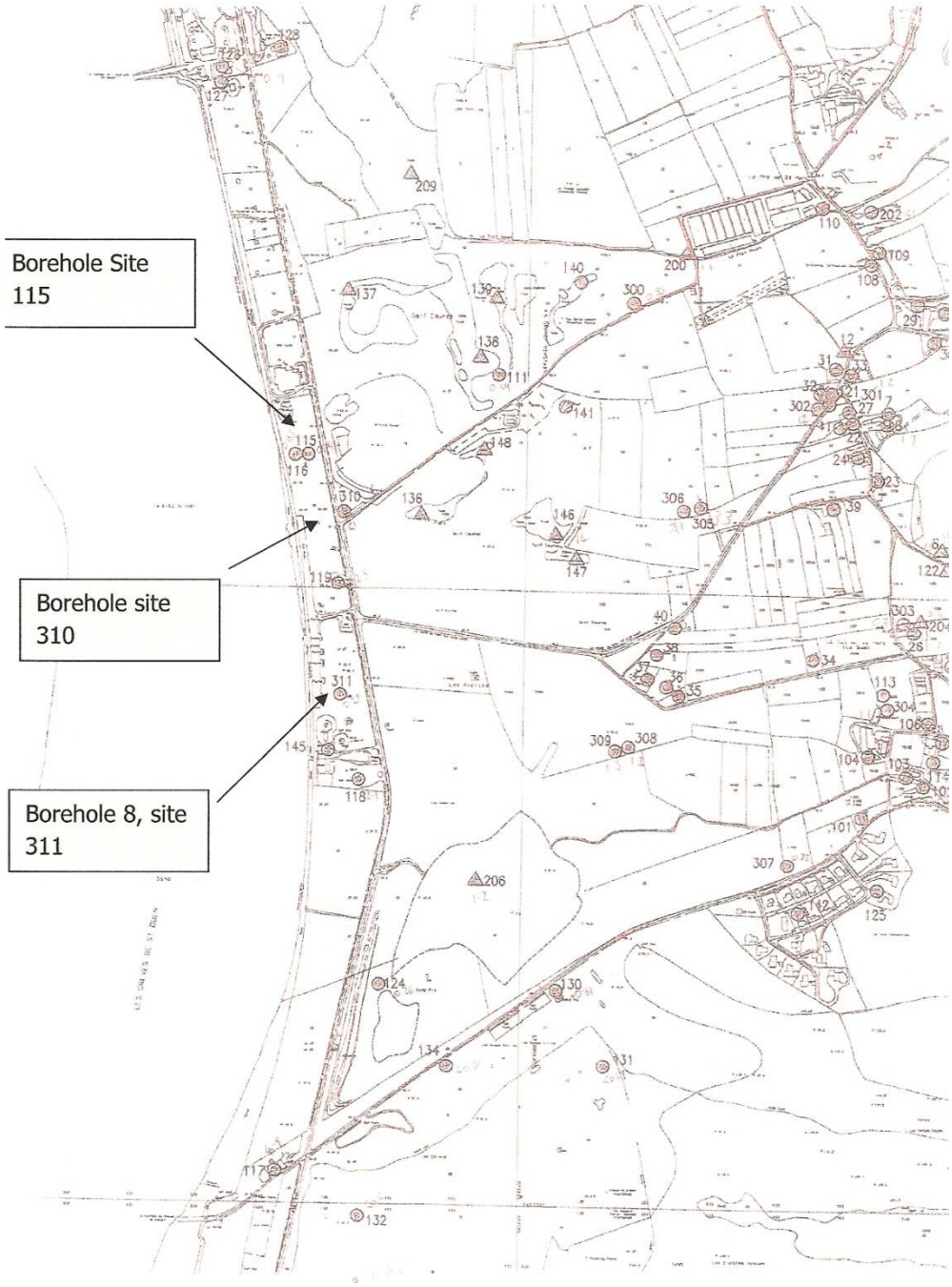

Figure 3.2 Map showing the location of the three near coast monitoring points used for trend analysis

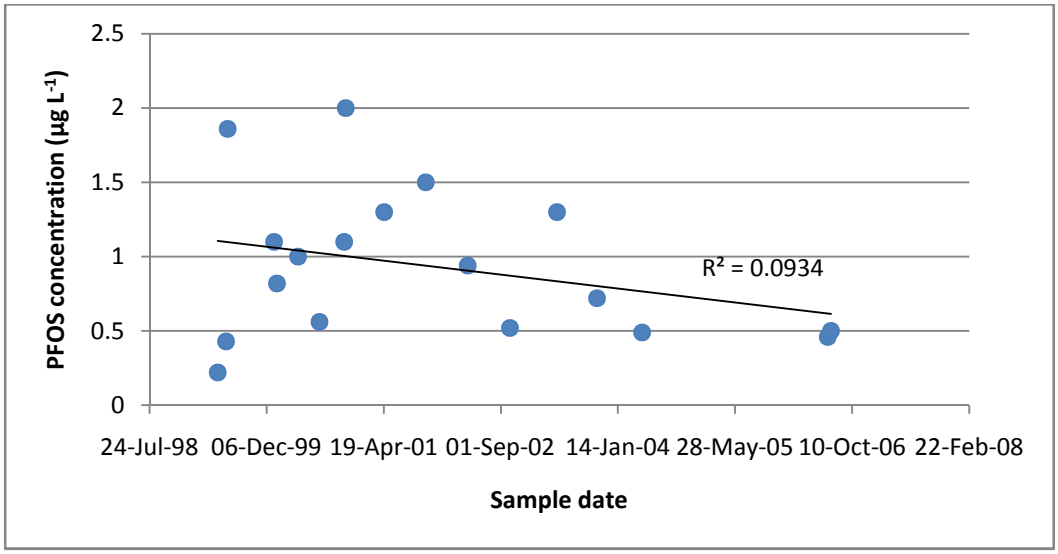

Figure 3.3 PFOS concentrations between 1999 and 2006 at site 115

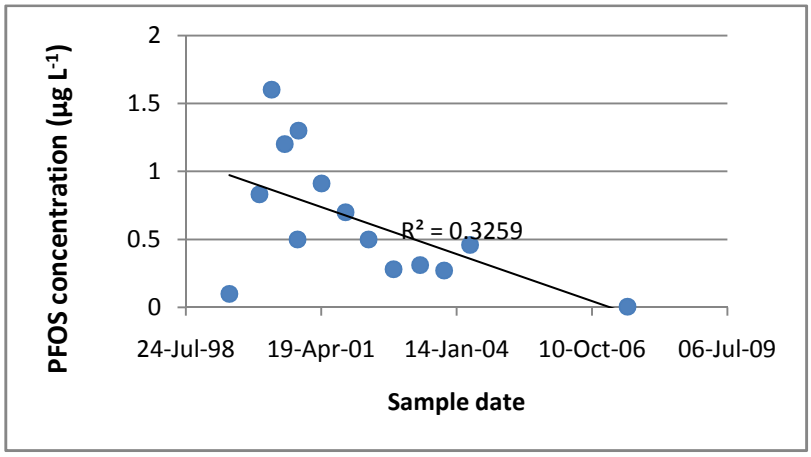

Figure 3.4 PFOS concentrations between 1999 and 2007 at site 310, BH8

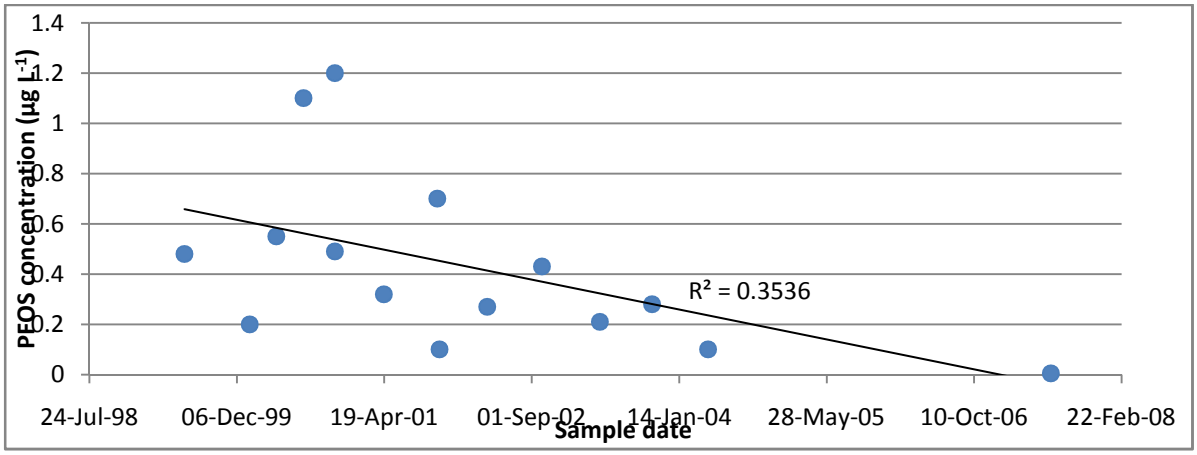

Figure 3.5 PFOS concentrations between 1999 and 2007 at site 311, BH9

There appears to be a downward trend in PFOS concentrations over time at sites 310 and 311 and a slight downward trend at site 115. However, there is a lot of variability in the data. It does appear that for the two sites sampled in 2007 these more recent samples did contain lower concentrations of PFOS.

All of the positive detections of PFOS at the coastal sites exceed the proposed long term marine EQS value. The limit of detection quoted for the analytical method (whilst good for PFOS) is also much higher than the potential EQS and so many of the samples quoted as 'less than' may also in reality have exceeded the EQS. However, this needs to be put into context of the massive dilution as contaminated groundwater is dispersed into the marine environment. A small amount of the contaminated water is fed to Bellozanne and the airport authorities are required to measure seaweed and shellfish in the vicinity of the outfall and none has been detected. The submission form EP does not state whether similar monitoring of biota is undertaken in St Ouen's Bay. If it is not, then obtaining such data should be a priority to allow comparisons against relevant standards.

4. CONCLUSIONS

A healthy marine environment is clearly very important to the social and economic wellbeing of the island. The waters and beaches around Jersey support a vibrant aquaculture and tourism industry and are home to sites of international environmental significance. The importance of the environment to Jersey understandably increases the concerns of stakeholders to potential impacts from any major developments or discharges on the coastline.

Much of the available resources for monitoring the marine environment are focussed on microbiological analysis. This is unsurprising given the health protection requirements for bathing waters and shellfish. However, the present arrangements for microbiological analysis do not provide sufficient capacity to allow the desired degree of reactive or investigative monitoring. The existing arrangements are a major limiting factor in meeting stakeholder expectations and the situation is unlikely to improve without a considerable increase in resources.

The aquaculture industry has expressed concerns about microbiological pollution and are clearly frustrated at what they believe is insufficient action by regulators to identify and fix sources of pollution. Environmental Protection works with the aquaculture industry and have launched a number of initiatives to engage with them. However, without significantly more resources to gather evidence on the sources and temporal variation of faecal pollution, the situation will not improve.

The available monitoring data do not indicate any urgent chemical issues using the parameters tested, although the scope of substances monitored is limited. There is a shortage of monitoring data for chemicals with bioaccumulation potential and endocrine disruptors which may have more subtle effects on the local ecosystems. For example, very few of the WFD priority lists of chemicals are monitored. Some limited and targeted risk-based monitoring for a few key chemicals would provide useful evidence from sites deemed to be potential sources. This is the approach adopted by the Environment Agency which has undertaken very limited surveys for new chemicals of concern.

From the evidence of the submissions and discussions with the various teams, it is clear that resources within Jersey's environmental regulatory functions are insufficient to meet the aspirations of stakeholders. The shortage of resources faced by Environmental Protection is mitigated by flexible working practices, adoption of a risk based approach, and the evident goodwill of team members, but the existing arrangements leave little room for extra workload or monitoring.

In the light of the economic importance of the shellfish and tourism industries it seems prudent to deliver a programme of marine environmental protection based on more evidence than is currently collected.

5. RECOMMENDATIONS

The following recommendations have been drawn from the evidence presented and discussed above, and from the previous experiences of other UK regulatory organisations.

- We recommend undertaking a risk-based assessment of the chemical contaminants most likely to be present in Jersey's waters, and the estimated reasonable worst case loads of these substances in the Bellozanne effluent and diffuse inputs from the La Collette reclamation site. This should not be a hazard assessment. This would deliver a clear list of potential contaminants of concern and evidence to support their selection. This exercise should then be followed up with limited, but targeted monitoring of effluents and sessile biota close to these sites.

- Having undertaken the above exercise, longer term monitoring can be refined and targeted to cover only key contaminants of concern, NOT all chemicals.

- The scope of marine chemical monitoring around Jersey should be reviewed to ensure that analytical data are compatible with EU regulatory requirements in order to allow effective comparison with international standards. This would deliver greater understanding of the status of waters, and provide confidence to those markets reliant upon Jersey's resources, such as shellfish and tourism.

- Additional resources and more flexible arrangements for aqueous microbiological sampling and testing on the island are essential to meet reactive monitoring demands and stakeholder expectations. A policy review of delivery capability for long term reactive monitoring is necessary.

- Structured microbiology monitoring surveys should be undertaken to characterise the sources and pathways of faecal pollution. These surveys will need to be significant in size and scope to be effective and will require external laboratory services.

- Monitoring data from sites of public interest such as Bellozanne should be more readily available. The establishment of public registers in a similar manner to the UK Environment Agency would help create a more informed dialogue with stakeholders and remove some of the prevailing suspicion.

6. ACKNOWLEDGMENTS

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APPENDIX 1

Potential changes and additions to the WFD priority list of pollutants

Substance	Current Status	Possible (new) status
Existing substances		
Trichlorobenzenes	Priority Substance	Priority Hazardous Substance
Di(2-ethylhexyl)phthalate (DEHP)	Priority Substance	Priority Hazardous Substance
Lead and its compounds	Priority Substance	Priority Hazardous Substance
Octylphenol	Priority Substance	Priority Hazardous Substance
Trifluralin	Priority Substance	Priority Hazardous Substance
Proposed new substances (red list)		
17 alpha-ethinylestradiol (EE2)	-	Priority Hazardous Substance
Aclonifen	-	Priority Hazardous Substance
Methyl 5-(2/4-dichlorophenoxy)-2-nitrobenzoate (Bifenox)	-	Priority Substance
Cyanides (free)	-	Priority Substance
Cybutryne (Irgarol ®)	-	Priority Substance
Cypermethrin	-	Priority Substance
Dichlorvos	-	Priority Hazardous Substance
Diclofenac	-	Priority Substance
Dicofol	-	Priority Hazardous Substance
Dioxins (2,3,7,8-Tetrachlorodibenzo-p dioxin, TCDD)	-	Priority Hazardous Substance
Heptachlor/ Heptachlor epoxide	-	Priority Hazardous Substance
1,2,5,6,9,10-Hexabromocyclododecane (HBCDD)/	-	Priority Hazardous Substance
Perfluroroctane sulfonic acid and its salts (PFOS)	-	Priority Hazardous Substance
Polychlorinated biphenyls (PCBs)	-	Priority Hazardous Substance
Quinoxyfen	-	Priority Hazardous Substance
Terbutryn	-	Priority Substance
17 beta-estradiol	-	Priority Hazardous Substance
Ibuprofen	-	Priority Substance