Transport and Technical Services Department

JERSEY'S WASTE WATER STRATEGY

States of Jersey

Document Status: Version 10

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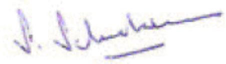
Approved By:	Selva Selvakumaran		29-07-13

JERSEY'S WASTE WATER STRATEGY

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1. Introduction

Jersey's Waste Water Strategy (WWS) describes, at a high level and in broad terms, the vision for ensuring that the collection, treatment and disposal of waste water across Jersey is in accordance with the future needs of the Island, whilst complying with legal obligations and States policies, up to and including 2035. The strategy for waste water was first drafted in 2009 and was known as the Liquid Waste Strategy at that time. Since then Transport and Technical Services (TTS) have undertaken a number of studies in order to develop the strategy. As the studies have been completed the strategy has been revised in line with the findings and this document represents the culmination of some four years work.

An effective, adequately-funded waste water service is required to help to maintain and improve public health, and preserve the environment of Jersey as a place to live, visit and invest in. This presents a number of challenges as restricted investment in the past means that existing assets are not adequate to address current and potential future customer expectations and regulatory requirements. Substantial investment is now required to implement a waste water service adequate for the demands of the 21st century. Development of the strategy for waste water has been progressed to identify a practical vision for the service improvements needed over the next 20 years and beyond.

This strategy will enable the Minister for Transport and Technical Services to fulfil his obligation to Islanders to prevent pollution and maintain public health by dealing safely and efficiently with waste water and allow the States of Jersey to plan essential investment while continuing to deliver the highest levels of customer service in a sustainable manner.

The strategy focuses on major challenges such as the effects of climate change, the impact of environmental legislation and the need for increased levels of investment to develop and maintain the assets. It also identifies business process changes to enable the States to meet its future operating constraints covering environmental, capital maintenance, population growth and operational budget.

In summary the Strategy includes:

- A review of current and future international environmental legislation, regulation and best practice that governs the strategy;
- Levels of service that TTS commits to deliver to the Island's population;
- The current status and issues with the sewerage system;
- The current status and issues with the waste water treatment system;
- The current status and issues with the waste water disposal system;
- Projected demand forecasts on the waste water system;
- The assessment of options for future sewage treatment; and
- A commitment to carry out further studies and also to adopt best practice asset management to ensure optimum delivery of services.

The Strategy is supported by, amongst others, the Bellozanne Sewage Treatment Works Feasibility Report (March 2013), Jersey Drainage Area Plan Needs Report (July 2012), Best Available Technology Report (May 2012), Bellozanne STW Operation Strategy (May 2011), STW Configuration and Locations Options Report (April 2010), Treatment Process Review (Sept 2009) and Bellozanne STW Master Plan (July 2009) discussion paper.

Waste Water key facts:

Population

- Resident population in the 2011 Census was **97,857**
- Resident population connected to the sewerage system (87%) **85,136 Approx.**
- Resident population served by private STW, septic tanks or tight tanks **12,721 Approx.**

Assets

- Main Sewage Treatment Works at Bellozanne
- Local package treatment plant at Bonne Nuit
- Number of foul pumping stations **110**
- Number of tidal surface water/storm pumping stations **6**
- Total length of foul sewers **297 km**
- Total length of combined sewers **23 km**
- Total length of surface water sewers **187 km**
- Total length of rising (pumped) mains is **64 km**
- 25,000m^3 storage tank (The Cavern) within St. Helier

1.1. The States Context: Jersey's Waste – Jersey's Responsibility

An effective waste water system is critical to the health of the Islanders and the economic viability and environmental sustainability of the Island.

Jersey is responsible for dealing with its own waste water. However, options are more limited than those of a larger country, and are governed by:

- What is reliable?
- What is affordable and realistic?
- What is available in the Island of Jersey?
- What is environmental best practice?

There are some critical factors to recognise when considering the challenges ahead:

- The potential health and environmental impacts of waste water collection, treatment and disposal are extremely important considerations in upgrades or selecting new facilities;
- Jersey has limited land and workforce resources which imposes some limitations on potential waste water treatment options;
- Reliability of disposal is important, as breakdown or capacity overload could result in unacceptable and potentially hazardous overflows of waste water; and
- The existing Sewage Treatment Works (STW) at Bellozanne which treats the majority of the Island's waste water is at the end of its original design life and now requires replacement despite ongoing capital maintenance. Due to design capacity limitations the STW is struggling to meet its discharge consent, which has a total nitrogen limit of 10mg/l when the population is greater than 100,000 or 15mg/l when the population is less than 100,000. The discharge consent

emulates the European Union's Urban Wastewater Treatment Directive for sensitive waters with regard to total nitrogen. However there is a question over whether the bay is deemed sensitive under the Urban Waste Water Treatment Directive. Studies of St Aubin's Bay are currently ongoing to determine the water body status under the Water Framework Directive. Looking more closely at the Bay as a receptor will determine the required sewage treatment standards.

There is increasing pressure on the Island's resources and it is therefore imperative that the States of Jersey address the crucial issues in a cohesive manner to facilitate an environmentally sustainable future as the Island grows and develops.

1.2 Development of the Strategy

This document is intended to outline the current status of the Waste Water Strategy and the way forward in developing Jersey's waste water service.

The strategy has been developed in line with the principles of reduce, manage and invest as presented in the Island Plan.

TTS, in conjunction with Grontmij, have been developing the strategy over the last four years. Grontmij is one of Europe's leading water consultants, specialising in the provision of consultancy services for the planning, management and delivery of water capital programmes.

To ensure the Waste Water Strategy is integrated with the future direction of States policies, consultation has been undertaken with the following States departments:

- Environmental Protection;
- Environmental Policy;
- Development Control;
- Building Control;
- Planning and Environment;
- Policy and Projects;
- Health Protection Services; and
- Community Health.

Since the WWS was first drafted in 2009, TTS has been developing the proposals to set priorities and appropriate budgets associated with the replacement of Bellozanne STW. In addition, the recent network model completed as part of the Jersey Drainage Area Plan Needs Report (July 2012) outlines the current issues associated with the sewerage network. The sewerage network model is currently available to assess the effects on the sewerage infrastructure of proposed future development in the Island and to identify the benefits of proposed future sewer upgrade schemes in order to address the current issues. The intention would be to develop these proposals to set priorities and appropriate budgets to ensure that the maximum benefit is gained from any expenditure with a view to improving the level of cost certainty.

2. A Strategy that Supports the States Legislation, Policy and Commitments

2.1. Legislation

Like any States Department, it is a fundamental requirement that the activities of TTS comply with all relevant legislation. TTS are required to comply with the Discharge Permit issued by the States Department of Environment for final effluent from Bellozanne STW entering St Aubin's Bay.

As well as the general Health and Safety requirements there are, in the field of waste water, the following key statutory requirements:

Water Pollution (Jersey) Law 2000 and subsequent revisions:

- Ensure activities do not cause pollution.
- Establish and issue discharge permits and ensure that no condition of a discharge permit is contravened.

Drainage (Jersey) Law 2005 and subsequent revisions:

- Establish and issue Trade Effluent Consents to foul sewer.
- Provide, maintain, improve and extend a system of public sewerage facilities so that Jersey is and continues to be effectively drained.
- Provide for the emptying of public sewers and deal with the contents by sewage disposal works or other means.

The effluent discharge from Bellozanne STW is regulated by the Water Pollution (Jersey) Law, 2000.

Planned legislation includes a possible new housing standard - Health and Safety (Dwellings) (Jersey) Law – which will strengthen groundwater protection measures to ensure safe drinking water. This is likely to lead to pressure for expansion of the sewerage network to reduce potential pollution risks from privately owned wastewater treatment plants and septic tanks. The Water Resources (Jersey) Law 2007 introduced legislation to protect the quantity and quality of inland water resources, and this may have the same effect, although it does not strictly refer to pollution risks.

In addition to the above legislation, Jersey's Public Health Service is normally informed of odour complaints (in accordance with the Statutory Nuisances (Jersey) Law 1999) and there has been a number of complaints received regarding the First Tower pumping station and Bellozanne STW.

2.2. States Policy

Although Jersey has particular constraints that limit the options for waste water management, the States has made strong commitments to dealing with waste water in the most environmentally sensitive manner. These commitments are defined in the following documents.

2.2.1. The Strategic Plan 2009-2014

The Strategic Plan 2009 – 2014 sets the overall direction for the Island.

In terms of waste water, the relevant priorities in the Strategic Plan 2009 – 2014 (listed numerically) are numbers 10 and 13:

> 10 "Maintain and develop the Island's infrastructure". In particular:
> - Ensure that infrastructure is fit for purpose, well maintained and sustainable for future generations
> - Ensure that waste disposal systems meet international standards to protect our health and environment.
>
> To achieve this, the States of Jersey will:
> - Develop funding mechanisms to address the backlog of deferred maintenance of sewers (and other infrastructure)
> - Develop investment/divestment plans to ensure the States property and infrastructure is properly maintained
> - Investigate alternative ways to fund and deliver key infrastructure services, such as disposing of liquid and inert waste
> - Invest in an improved solid and liquid waste infrastructure
> - Review the economic, environmental and social benefits from States-owned utilities
>
> 13 "Protect and enhance our natural and built environment". In particular:
> - Continue to protect the marine environment and coastal areas
> - Implement a range of measures to reduce pollution and to increase the environmental protection regime operating in the Island
> - Ensure environmental quality compliance with international standards

In addition, the need to maintain sewerage infrastructure and develop the WWS is identified separately as one of five key areas for developing long term resource initiatives.

2.2.2. Island Plan 2011

The Island Plan 2011 provides a framework of policies and proposals to guide land use planning decisions up to 2021. The Plan defines the development needs and policies for the Island, whilst promoting sustainability. The adoption and application of these principles and policies will provide a much more sound and sustainable basis for investment in the Island's infrastructure. In terms of waste water, the relevant policies in the Island Plan are listed below. Included among the key areas for focus over the lifetime of the plan is a major project for maintaining the Island's sewerage infrastructure for the treatment and disposal of the Island's waste water.

Key policies relating to waste water in the Island Plan 2011 are:

> **Policy NR 1 – Protection of Water Resources**
> Development that would have an unacceptable impact on the aquatic environment, including surface water and groundwater quality and quantity, will not be permitted. In particular, development proposals that rely on septic tanks, soakaways or private sewage treatment plants, as a means of foul waste disposal, will not be permitted except where they accord with Policy LWM 2 'Foul Sewerage Facilities'.

Policy LWM 1 – Liquid Waste Minimisation and New Development
In considering proposals for new development, the Minister for Planning and Environment will seek to encourage water management measures to minimise the volumes of sewage effluent that has to be managed.

Policy LWM 2 – Foul Sewerage Facilities
Development which results in the discharge of sewage effluent will not be permitted unless it provides a system of foul drainage that connects to the mains public foul sewer (to the satisfaction of the Minister for Planning and Environment in consultation with the Minister for Transport and Technical Services).

Policy LWM 3 - Surface water drainage facilities
The Minister for Planning and Environment will expect proposals for new development and redevelopment to incorporate Sustainable Drainage Systems (SUDs) into the overall design wherever practicable.

Further, the policy below relates directly to waste water treatment and disposal as follows:

Policy LWM 4 – Sewage Treatment Works and Sewerage Outfall
The Minister for Planning and Environment will support proposals for the development, enhancement and extension of the existing principal sewage treatment works, within the identified operational site for waste management at Bellozanne, provided the proposal complies with other relevant policies in this plan.

Proposals for a new / replacement principal sewage treatment site will be supported where it can be shown that:

- the development is more appropriate than accommodation at the existing site;
- the alternative site is suitable for the use and is demonstrably the best performing of the alternative locations reasonably available;
- the proposal is necessary to support planned population growth, or major new development, or a required improvement in effluent standards;
- there is a demonstrable gain in benefits sufficient to outweigh any potential harm arising from the proposal;
- the proposals are subject to a satisfactory Environmental Impact Assessment; and
- the proposals comply with other relevant policies in the plan.

The Minister will also support the construction of a longer sea outfall to replace or supplement the current short one, in combination with appropriate treatment at the existing principal sewage treatment works or any approved replacement works, provided the proposal complies with other relevant policies of this plan.

Policy LWM4 continued –

Any proposals for a new or extended sewage treatment works and/or a modified sea outfall will need to address satisfactorily the following health and environmental issues and must have:

- an acceptable health impact;
- an acceptable impact of discharges on the quality of sea water and marine or terrestrial habitats;
- no unacceptable risk of pollution;
- no significant unacceptable traffic impact (land and sea);
- an acceptable impact on local amenity, including no adverse levels of disturbance near the site or on routes to and from it, from noise, vibration, dust, fumes, gases, odour, illumination, litter or pests;
- satisfactorily dealt with other issues arising from the Health and Environmental Impact Assessment processes and from the aims of the Marine Protection Zone; and
- an acceptable visual impact.

For the avoidance of doubt, ultra-violet disinfection or an equivalent system will be required at all sewage treatment works so as to safeguard bacteriological quality for bathing and fisheries.

Regard will be made to constraints on the capacity of the existing Sewage Treatment Facility and Drainage System in consultation with the Minister for Transport and Technical Services.

Proposals for the development of land in the vicinity of the existing principal sewage treatment site, or any approved replacement site will only be permitted where they:

- will not prejudice or unduly restrict the permitted activities of the sewage treatment works; and
- are in accordance with other principles and policies of the Plan.

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- an acceptable impact of discharges on the quality of sea water and marine or terrestrial habitats;
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- will not prejudice or unduly restrict the permitted activities of the sewage treatment works; and
- are in accordance with other principles and policies of the Plan.

These policies identify the fact that without an adequate waste water collection, treatment and disposal system development will be constrained and this will affect the economic viability of the Island. The policies also identify that sufficient funding for expansion of the current infrastructure will have to be made available.

2.2.3. Strategic Plan 2012

The Strategic Plan 2012 'Inspiring Confidence in Jersey's Future' is a broad policy statement which consolidates the Strategic Plan 2009-2014 and the Island Plan 2011 to present the overall vision for the Island, primarily for the next three years but also for the future, by focusing on the key priorities that must be addressed by the government. This Strategic Plan is not specific to the WWS but it is important that the WWS is targeted so that the objectives of the Strategic Plan can be achieved without unreasonable constraint.

2.2.4. Department of the Environment for Jersey (the DPP – Diffuse Pollution Project)

The quality of Jersey's streams has improved in recent years: just under half of the Island's streams now have good or excellent biological water quality, compared to 1 in 5 ten years ago. However, despite these water quality improvements the Island still experiences elevated levels of nitrate in streams and groundwater compared to many other places in Europe.

As well as impacts on drinking water quality, excess nutrients in natural environmental waters have other unwanted consequences. These include growth of algal or bacterial populations leading to unsightly blooms, de-oxygenation of the water and harm to fish and other animals.

In order to reduce catchment based sources, a scheme has been designed by the Department of the Environment for Jersey (the DPP – Diffuse Pollution Project). This works in participation with stakeholders to identify and implement environmental best practice farming in Jersey in relation to nutrient and soil management to limit diffuse pollutant losses and bring about an improvement in water quality. The DPP has been in operation for two years and significant progress has been made in engaging with the farming community and encouraging changes in practice through dialogue and incentives.

2.3. States Commitment

Jersey, as a crown dependency, does not come under European Union (EU) jurisdiction. However in "2000 and Beyond" and in the Environmental Charter of 1996, the States made a commitment that Jersey law would require standards at least equivalent to those of the EU and, in the Strategic Plan 2009 - 2014, priorities 10 and 13 aim to meet international standards where practicable. The States is implementing components of international directives as part of best practice, but this is not policy linked.

In the field of waste water, international standards are generally defined by EU Directives. The key EU Directives applicable to this strategy are:

2.3.1. Bathing Waters Directive (76/160/EEC)

This places limits on microbiological and physicochemical parameters in bathing waters, with a view to protecting public health and the aquatic environment. EU Member States are required to identify bathing areas and to monitor water quality throughout the annual bathing season (mid May to September in the UK) in terms of the microbiological parameters which are:

- faecal coliforms;
- total coliforms;
- faecal streptococci;
- entero viruses; and
- salmonella.

The States of Jersey follows this directive as best practice, by monitoring 16 bathing water sites for a period of 20 weeks over the bathing season, for total coliforms, faecal coliforms and faecal streptococci. During the 2012 summer season all 16 of Jersey's sea waters passed the European Imperative Standard, whilst 12 out of the 16 further passed the stringent European Guide Standard.

All bathing waters tested pass imperative standards set in the current Bathing Waters Directive, while half passed the stringent guidelines standards.

A new Directive (2006/7/EC) repeals the 1976 Bathing Waters Directive, and is currently being implemented by EU Member States. It describes a tightening of standards and a change in water quality indicators. Classification of bathing waters by the following new microbiological parameters is required by 2015:

- intestinal enterococci;
- *escherichia coli*;
- cyanobacteria, macro-algae and marine phytoplankton, if profiling indicates proliferation of these organisms

2.3.2. Urban Wastewater Treatment Directive (91/271/EEC, and subsequent amendments)

This sets standards on treated waste water prior to being discharged. The limits are dependent on the population served by a STW and whether the receiving water is sensitive to nutrients within the discharged effluent. This assessment takes no account of the overall background level of nutrients in the receiving water, or the capacity of the specific water to deal with the nutrients. The final effluent from Bellozanne STW is discharged via an outfall into St Aubin's Bay near the First Tower area at a distance of 500m from the sea wall. The outfall also receives flow from the stream in Bellozanne Valley upstream of the STW.

Based on an initial water quality survey carried out by the Centre for Research into Environment and Health (CREH) on the Trophic Status of St Aubin's bay in 1997, it was noted that St. Aubin's bay displayed some evidence of eutrophication in the nearshore area and potential for eutrophication in the bay itself. The report also noted that the nutrient removal from the Bellozanne STW effluent would be a *prudent precautionary step*. However, the report identified the environmental status of St Aubin's bay as inconclusive based on the limited survey and noted that the time constraints necessitated by the decision timescales for infrastructure investment at Bellozanne STW had not allowed a protracted, but possibly more prudent, data acquisition.

The original study was inconclusive and further studies are being carried out in 2013 by Cascade Consulting on the status of St Aubin's Bay water body under the Water Framework Directive. The preliminary findings do not suggest the Bay should be classed as sensitive. If St Aubin's Bay is designated a 'sensitive water' then any discharge from Bellozanne STW should not exceed a total nitrogen limit of 10mg/l to comply with this Directive.

Other EU Directives conventions or policies relating to the environment include:

2.3.3. EU Shellfish Directive (2006/113/EEC)

This is designed to protect the aquatic habitat of bivalve and gastropod molluscs such as oysters, mussels and scallops, but does not cover crustaceans such as lobster and crab. Designated waters must comply with physical, chemical and microbiological water quality standards on both "mandatory" and "guideline" levels. In 2013 this Directive will be repealed by the Water Framework Directive, which will provide at least the same level of protection.

2.3.4. EU Freshwater Fish Directive (2006/44/EC)

This is concerned with the protection and improvement of fresh waters in order to support fish life, including coarse and game fisheries. Water quality standards and monitoring requirements are set for fresh waters. The majority of waste water discharges are to coastal waters, and these activities have minimal impact on freshwater quality. This Directive will be repealed by the Water Framework Directive in 2013.

2.3.5. Water Framework Directive (2000/60/EC)

This is the most extensive and important piece of water legislation to emerge from the European Union in the field of water quality. It requires that all inland and coastal waters achieve "good" status by 2015, and defines how this should be accomplished through the establishment of environmental objectives and ecological targets for surface waters. The Directive repeals the Shellfish and Freshwater Fisheries Directives (amongst others), but sets at least equivalent standards for these waters. The States is currently implementing a pilot scheme (DPP – Diffuse Pollution Project) in order to tackle catchment inputs of nitrogen, one of the key assessed risks to the Island's water not meeting good status.

It is considered that the discharges from the sewerage network including the STW do not affect water quality apart from the quality standards in St Aubin's Bay and so incorporation of this Directive into Jersey law should not impact on the Waste Water Strategy. Extension of the sewer network will help to achieve good ecological status.

2.3.6. The OSPAR Convention

The Convention for the Protection of the Marine Environment of the North East Atlantic, known as the OSPAR Convention, is the basis for various national laws and EU Directives governing the discharge of substances to the marine environment. While not a signatory of this convention, the States has committed to honour the fundamental principles and measures. This has been achieved by incorporating the key requirements of the convention into the Water Pollution (Jersey) Law 2000. The OSPAR Commission

1995 assessment did not identify the waters surrounding Jersey or the Normandy coast as problem areas for eutrophication, but did report evidence of eutrophication in neighbouring waters along the north Brittany coast. However, studies of St Aubin's Bay by the Centre for Research into Environment and Health in 1997 found the bay to be potentially eutrophic, although this has yet to be formally confirmed.

2.3.7. EU Directive on the Use of Sewage Sludge in Agriculture 1986 (86/278/EEC and subsequent amendments)

The objective of this Directive is to regulate the use of sewage sludge in agriculture to prevent harmful effects on soil, vegetation, animals and man, while encouraging its recycled use. Limits were set on the levels of heavy metals in soils. Untreated sludge was only to be applied to land in certain cases where the absence of any threat to human or animal health could be guaranteed.

A proposed revision to the Directive is due by 2013/14. It is likely that the revision will result in more stringent limits on the agricultural recycling of sewage sludge, including tightening of existing consent limits for potentially toxic elements, and limits on a range of other potentially harmful substances. This may constrain the agricultural sludge route for certain sludge types in the future. It should be noted that UK DEFRA's Code of Practice already sets consent limits significantly lower than the EU.

2.3.8. UK Sludge (Use in Agriculture) Regulations 1989 and UK DEFRA Code of Practice for Agriculture Use of Sewage Sludge 1996

The UK Sludge Regulations were introduced in 1989 to implement and reinforce the EU Directive on the use of sewage sludge in agriculture. Standards were subsequently tightened through the DEFRA Code of Practice for Agriculture Use of Sewage Sludge in response to pressure from the food industry. Untreated sludge could not be applied to agricultural land after December 2005, whether it was for food or non-food crops. The Code also requires formal monitoring of sludge and soil qualities / quantities and registry of the land to which the sludge is applied.

DEFRA is understood to be planning to introduce revised Regulations regarding sludge disposal to land in the near future, and have stated that the permitted concentrations of certain toxic substances will be reviewed. The probable implication of the revised Regulations is that formal quality targets will have to be set and monitored for the sludge at the various stages of treatment and disposal.

2.3.9. UK ADAS Sludge Matrix 2001

The ADAS Sludge matrix was a joint development between the UK water industry and the British Retail Consortium (representing the food industry) in response to public concerns about the safety of food and the increasing volumes of sludge being disposed to land. It represents the minimum sludge to land standards that the food industry would accept, which are:

Crop Group	Untreated Sludge	Conventionally Treated Sludge Note 1	Enhanced Treated Sludge Note 2
Fruit, vegetables, salad, & horticulture[3]	**Not allowed**	**Not allowed**	**Allowed** Note 4
Combinable & animal feed crops	**Not allowed**	**Allowed**	**Allowed**
Grass & Forage – grazed	**Not allowed**	**Not allowed** Note 5 & 6	**Allowed** Note 5
Grass & Forage - harvested	**Not allowed**	**Allowed** Note 5	**Allowed** Note 5

Note 1 - Conventionally treated sludge has been subjected to defined treatment processes and standards that ensure at least 99 per cent of pathogens have been destroyed.

Note 2 - Enhanced treated sludge has been subjected to defined treatment processes and standards that ensure virtually every pathogen (99.9999 per cent) which may be present in the original sludge has been destroyed.

Note 3 - For salads and vegetables, only with 30 and 12 month harvest intervals, respectively

Note 4 - Only with 10 month harvest interval.

Note 5 - No grazing for 3 weeks after sludge applied to land and harvest interval applies.

Note 6 - Deep injected or ploughed down only

2.3.10. The Basel Convention

This Convention requires signatories to handle and dispose of their waste in an 'environmentally sound manner'. In general terms this provides that jurisdictions should deal with their own wastes within their own boundaries unless it is 'not possible for them to do so'.

It seems unlikely that Jersey could argue that this exemption applies as Jersey has successfully dealt with its waste water for decades. However, the Waste Management (Jersey) Law 2005 allowed the Convention to be formally extended to the Island and permits the export of certain forms of hazardous waste that Jersey does not have the capacity to deal with. Export of waste water or the biosolids (sludge) from wastewater treatment is not considered to be exempt, except as a last resort.

2.3.11. EU Strategic Environmental Assessment Directive (2001/42/EC)

This Directive requires a formal strategic environmental assessment of certain plans and programmes which are likely to have significant effects on the environment.

Authorities which prepare and / or adopt a plan or programme that is subject to the Directive must prepare a report on its likely significant environmental effects, consult environmental authorities and the public, and take the report and the results of the consultation into account during the preparation process and before the plan or programme is adopted. They must also make information available on the plan or programme as adopted and how the environmental assessment was taken into account. Basic procedural and technical requirements are set out in the Directive, which Member States can choose to implement within their existing systems.

2.3.12 Future Environmental Legislation

No specific future environmental legislation has been allowed for, as currently foreseen legislation is not expected to have a significant impact on investment requirements.

3. International Best Practice

In developed countries worldwide it is considered best practice to provide a properly designed, constructed and maintained sewage collection system (generally piped) to convey foul sewage flows to a STW for appropriate treatment. Wherever possible, surface water run-off should be collected separately for discharge to appropriate water courses through surface water outfalls. New property developments are generally designed to not increase the rate of surface water run-off. There is also a growing awareness that water resource and waste water management should form part of an integrated approach.

The following sections provide a summary of International Best Practice associated with the sewerage catchment, STW treatment, water resources and waste water recycling, particularly in dealing with waste water in the most environmentally sensitive manner.

3.1. Sewerage Catchment

Sewerage is the name for the network of pipes and manholes that collects and transfers waste water to a STW. Sewerage systems are designed to flow by gravity to the STW where possible; otherwise the waste water flows by gravity to a low point for collection at a pumping station. Pumping stations consist of an underground collection chamber for the waste water and pumps which push the waste water uphill through a pipe called a rising main. The rising main usually discharges the waste water to a high point in the system where the waste water will then flow by gravity again downhill to the STW or the next pumping station.

There are two basic types of sewerage systems, combined and separate. Combined sewerage is common in older European towns and cities. Combined sewerage systems receive sewage flow from houses and also surface water runoff from roofs and paved areas during wet weather. This mixture of sewage and surface water runoff is collected together and drains to the STW for subsequent treatment. During wet weather there is a significant increase in flow to the STW due to the surface water run-off. Separate sewerage systems overcome the problems of fluctuations in the flow to the treatment works during wet weather. The sewage goes directly to the STW via one network of pipes (foul system) while the surface water runoff goes to the nearest watercourse via another system of pipes (surface water system). This results in a smaller volume and less variation in flow to the STW. There are benefits in reduced costs of pumping and treatment and also less risk of pollution and / or flooding due to overflows from the sewers. New developments should be served by separate sewerage systems.

It is deemed best practice to separate out the surface and foul flows in any collection system. However, the historical legacy is that combined systems were installed in many urban areas, which then required overflows to spill excess flows to watercourses during heavy rain. Such overflows may cause pollution on an intermittent basis.

The Jersey system has a higher percentage of separate sewers than many other water utilities in the UK, due to a continuous and extensive separation programme. This and the significant investment in storage facilities, particularly the Cavern, mean that the States collection system is close to best practice in terms of overflows. There may be a need to change the standards for prevention of property flooding from the sewer network as the English and Welsh industry is moving to design new sewers against storms that cause property flooding more frequently than once every 30 years whilst the TTS standard is currently once every 10 years. This should be reviewed once the actual risk of property flooding has been assessed from the recent modelling of the sewer network.

It is not economically feasible to construct a sewerage system with a capacity to cope with the most extreme weather events. Combined sewer overflows (CSOs) are structures that are designed to spill an excess mixture of untreated sewage and storm water from the sewer network to a nearby watercourse during heavy rainfall. These structures are located within combined sewerage systems, where the increased flow caused by the storm water runoff exceeds the sewerage system's capacity and the diluted waste water is forced to overflow through the CSO into streams and rivers. The capacity of a combined sewerage system is finite and therefore CSOs, which are the safety valves of the system, are inevitable. However, it is desirable to minimise discharges from CSOs because of the potential environmental impact.

It is preferable that sewers are built such that flows can reach their intended destination by means of gravity, i.e. flowing from a higher point to a lower point. Unfortunately land topography does not always allow for this and so sewers can lie very deep in places or that pumping systems have to be employed. Deep sewers are not only expensive to construct but having deep manholes presents additional, sometimes unacceptable, health and safety risks for maintenance. Pumping systems can generally use shallower sewers but the pumping stations can be expensive to build, operate and maintain. In Jersey, like many other places, this has been a problem in some locations and has meant that some properties are not able to economically connect to the public sewer system. Indeed, there are estimated to be over 450 private pumping stations (serving some 1200 properties), in addition to 116 public pumping stations in the Island, which serves as testament to that fact. Extended sewers and pumped systems can also lead to odour problems.

In other regions where the topography of the land negates the use of gravity systems, and pumping is undesirable, other methods are being utilised. A prime example of this is East Anglia where the land is generally very flat and gravity sewers are simply not an option in many locations. In these areas Anglian Water uses vacuum systems to convey waste water to its destination. These systems work by 'sucking' the effluent along the sewer network, which can be consequently laid at much shallower depths.

In addition to implementing a surface water separation programme, the States has implemented a policy whereby all new developments must have separate foul and surface water sewers. Where surface water is separate a number of methods can be engaged to deal with these flows and dispose of them in an environmentally sound manner.

Sustainable Urban Drainage Systems (SUDS) is an approach which is being adopted both in Jersey and internationally when managing surface water. There are a number of techniques that can be applied, some of which are intended to merely store or attenuate flows, and others, such as filtration drainage and reed beds, can provide a certain level of treatment before discharge. Such methods can deal with surface water both in terms of quantity and quality.

Where areas such as roads and car parks are being drained it is considered good practice to install oil interceptors to reduce the negative impact that hydrocarbons have on receiving waters. Indeed, some authorities demand that as a pre-requisite to planning permission, oil interceptors must be utilised. A basic tenet of SUDS is that post-development run-off must not exceed pre-development run-off levels in an effort to reduce the impact on the environment. This is the approach adopted by the States through the planning process.

The UK government is encouraging the implementation of Integrated Urban Drainage Management (IUDM), which is a joined-up approach to drainage management. The development and implementation of IUDM has the potential to reduce flood risk, improve water quality and improve water resources management. In addition it provides clarity in roles and responsibilities for the public.

The IUDM approach has been developed in recognition of two important aspects of flood risk management. Firstly, the mechanisms of flooding can be complex, with floodwater originating from a variety of sources and being transmitted via complex flood pathways to impact a wide range of locations. Secondly, the responsibilities for urban flood risk management fall across a range of diverse stakeholders, from individual property owners through to large public and private bodies. The main components of IUDM are:

- pluvial (surface water) and fluvial (river, stream) flooding;
- sewer flooding;
- groundwater rebound and flooding;
- impact from/on transport network; and
- Sustainable Urban Drainage Systems (SUDS).

IUDM emphasises the need for different authorities responsible for different parts of the drainage system to work together to assess and manage flood risk, taking a long term, strategic approach.

TTS is responsible for the sewer network, and pluvial and fluvial management. This level of responsibility is consistant with UK standards..

3.2. Treatment

The best location for a STW is entirely dependent on the specific location of the served catchment area including the population, topography, environment and the body of water that is to receive the treated effluent. The technology and level of treatment applied will again be dependent upon such factors, along with the underlying waste water legislation that will set out the quality standards for the final effluent and receiving waters.

3.2.1 Conventional Treatment

In general, waste water flows are first pre-treated through screening to remove solid waste and often de-gritted, before entering the treatment processes or entering pump systems that would be damaged. After this waste water is taken through a number of processes which include settlement and biological treatment. Detailed consideration of treatment processes applicable to Jersey has been covered by the 'Jersey Liquid Waste Strategy - Treatment Process Review' report (09/2009), 'Bellozanne STW Operation Strategy' report (03/2011) and the 'Best Available Technology' report (05/2012).

The level of required treatment is very much dependent on the nature of the receiving waters. Primary and secondary treatment is normally considered the minimum level of treatment for waste water before it can be discharged into a receiving water environment. The typical processes utilised for this treatment include the activated sludge plant which is a suspended-growth system, such systems can handle a mix of biomass and sewage while operating in a smaller space than fixed-film systems. Alternatively fixed-film growth systems such as surface aerated basins and filter beds can be used, these operate by waste water being passed onto biomass growing on suitable material. All these systems fundamentally involve processes that degrade the biological content of waste water.

Many developed countries now include tertiary treatment as a final stage to the treatment process in instances where the quality of the discharging watercourse is required to meet specific criteria, such as in bathing waters or nature reserves. This often takes the form of wetlands or lagoons where the biological quality of the water is further improved by natural processes. If nutrient loading has been identified as a potential issue then further nutrient removal systems are often put in place to prevent the excessive build up of nutrients that lead to algal blooms in receiving waters. When there is concern over the presence of harmful micro-organisms in the discharged water then disinfection processes such as ultraviolet or chlorination treatment of water can be utilised. The current plant at Bellozanne includes tertiary treatment by UV disinfection in order to improve bathing water quality.

As discussed in the 'Bellozanne STW Operation Strategy' report (05/2011) and the Best Available Technology' report (05/2012) the limited space available at the Bellozanne STW site means that the activated sludge process is considered to be the most suitable for Jersey, although other systems may offer acceptable solutions.

The choice of technology to be employed has been reviewed in the 'Best Available Technology' report (05/2012). Having examined the advantages and disadvantages of each process, the 'Best Available Technology' report concluded that the preferred treatment process is a conventional activated sludge system, with the flexibility for expansion capability on the site should an enhanced treatment standard be required in the future (including nitrification to the Urban Waste Water Treatment Directive standard for 'sensitive' waters).

It should be noted that as the discharge consent gets tighter the size and the costs of sewage treatment works increases in capital cost and usually in operating cost as well.

3.3. Water Resources and Wastewater Recycling

Encouraged by the Water Framework Directive, European best practice is now focussing on considering the full water cycle in a holistic, sustainable manner. This places increased emphasis on the need to reduce the flows and loads discharging into the sewerage network, whilst ensuring that sewerage discharges do not cause environmental pollution, particularly to drinking water sources. Jersey legislation provides the statutory basis for limiting pollution, however septic tanks and private STWs in the Island are considered to have a greater pollution risk compared against the discharges draining to Bellozanne STW via the sewer network.

Various sustainable water resource and waste water recycling technologies are outlined below, which have the potential to reduce the flows and loads discharging into the sewerage network.

Water re-use (where waste water is treated to extremely high standards and then used as a resource to be treated to potable standards) has been implemented in a number of countries including the UK, USA and Singapore. More widespread use is being considered in many other places, particularly as it is considered to be more cost effective than desalination of sea water. Water re-use can help to protect the environment by providing an alternative source of potable water to replace current abstractions which are causing environmental damage and as a source of additional water to meet population increases.

'Grey' water refers to waste water from all domestic sources, except toilets. Most grey water recycling systems collect this water, treat it to a desired level and use it on site for a range of uses, from toilet flushing to watering plants. This system is usually applied at a household scale and significantly reduces the quantity of waste water a household generates. Such systems are gaining popularity and acceptance especially in drought prone areas such as SE Australia, where reductions in the water demand and increased water use efficiency are vital in maintaining water resources.

Grey water recycling has been discussed as a popular approach to reducing water demand and waste in drought prone areas and as such is also a prominent topic on the international stage. However the implementation of such systems, especially in retrofitting large areas, leads to a decreased dilution of waste water flows and to a decreased dilution at treatment works which would need to be addressed through the treatment system.

Rainwater harvesting is another prominent topic on the international stage that is receiving particular attention in drought prone and conversely flood prone areas. Rainwater 'runoff' from impermeable surfaces in and around a property is collected via drainage systems and stored for use in a tank. This tank will usually incorporate a pre-filter system to stop pollution of the water by biological material. During wet seasons excessive rainfall can be stored, thus reducing the overall runoff within an area that leads to flooding. This water can then be stored for drier periods.

Rainwater and grey water recycling has never been used on a large scale in the UK and requires both public commitment and significant costs in modifying property drainage and the provision of tanks etc. However with the current trend towards building more eco-friendly and sustainable housing such, systems may gradually become more standard practice.

Integrating water resource management with waste water strategies may gradually become accepted practice, especially in areas where there is already an available water resource deficit. With Jersey already utilising desalination to supplement available freshwater resources and a forecasted increase in resident population then future Island planning should consider following such an integrated approach.

TTS has an interest in the above technologies and anticipates that their use will become more widespread in the future, particularly in cases where it would be expensive to connect properties to the sewerage system. They tend to lend themselves to new and smaller developments rather than being retrofitted to large urban areas. Therefore, whilst they may reduce the flows and loads to a treatment works, the flow reduction is unlikely to be significant in the short to medium term. However, over time, as the drive towards better environmental and sustainable solutions accelerates and future technological advances are developed, the accumulated reductions in flows and loads may have a beneficial impact on the treatment works in the future.

3.4. Community Awareness

When considering the public mindset with regard to the disposal of waste water there are two main elements to be taken into account. Firstly, the impacts that individuals and businesses have on the environment need to be reinforced in the mind of the public. Secondly, the concept of the 'Polluter Pays Principle' as enshrined in the Water Framework Directive should be considered.

Simple ideas like the use of dual-flushing toilet systems, which reduce volumes being discharged to the foul collection systems, can have a significant impact on how our resources are managed.

Businesses can be made more responsible for installing systems such as grease traps, to reduce the negative impacts of food waste on both the network and the treatment works. In the UK, under the Enhanced Capital Allowance scheme, there are tax breaks for companies who use water-saving technologies. Water metering is also a useful way of encouraging businesses and individuals to use the water resources in a more responsible manner, and thus reduce the volumes of waste water requiring treatment.

3.5 International Perspective - The Approach of Other Islands

Other Islands are facing the same challenges as Jersey in dealing with waste water. Relevant examples of the approach undertaken on other islands is summarised as follows.

3.5.1 States of Guernsey

The States of Guernsey has one main STW at Belle Greve that offers only preliminary treatment before discharging the Island's raw waste water into deep water through a long sea outfall. The treatment is simple maceration and grit removal, with no facility to remove bio-solids or disinfect the effluent.

The Belle Greve Wastewater Disposal Facility was commissioned in 1971 and directly or indirectly served 90% of the Island's population. The Belle Greve catchment has since been extended to serve 99.7% of the population, following the commissioning of the Creux Mahie transfer pumping station. The outstanding small catchment comprises approximately 70 houses at Fort George.

In 1997 the States of Guernsey resolved to introduce full sewage treatment within 5 – 10 years, however following a debate in 2012 the States of Guernsey have decided against installing 'full' treatment facilities. They are currently reported to be spending £11million on essential upgrades to Belle Greve Wastewater Disposal Facility.

3.5.2 Isle of Man

Similar to Jersey, the Isle of Man is independently governed by its own Parliament and is not part of the European Union. During the last 10 years the central strategy saw the development of a centralised treatment works discharging to watercourse. The IRIS Regional Sewage Treatment Strategy was recently approved and it is due be completed by 2014/15. The central strategy has been amended to include the development of the regional treatment strategy whereby smaller STWs treat those areas currently not connected to the main Meary Veg STW in Santon.

The basis of this amendment to the strategy was a reduced scheme completion time and provision of greater flexibility for the future treatment and disposal of sludge. They were also concerned over the failure to comply with bathing standards in North West England despite United Utilities spending over £200 million on long sea outfalls and secondary treatment.

The whole waste water system is owned, operated and maintained by the Department of Transport.

3.5.3 Isle of Wight

The Isle of Wight is part of the UK and is therefore subject to all relevant legislation. There were several local STWs across the Island, initially built with limited treatment processes and short sea outfalls that resulted in persistent failure to meet bathing water standards.

Southern Water took the economic decision to build one major STW and sludge treatment plant at Sandown, and then steadily de-commission the existing regional Works, except for a few small local sites serving discreet catchment areas. In 2009 the last remaining regional STW was decommissioned as Newport is now connected to Sandown Works.

The final effluent is discharged through a long sea outfall into the deep waters of the English Channel. To date, the new STW has performed to expectations and conformed to European Directives.

The entire Island's sludge is transported to Sandown to be digested, dried and then sold to farmers in cake and granular form.

3.6 Summary

As outlined above each island tends to have a different strategy for dealing with their own waste water. This is very much dependent on the island's constraints and existing infrastructure; however all the islands are generally continuing to upgrade and improve their treatment facilities in order to comply with current EU Directives and Legislation.

4. Existing Sewerage Catchment Review

This section summarises the history, current status and condition of the sewer network, pumping stations and combined sewer overflows, which have been taken into account as part of the development of the WWS. The sewage treatment works, sludge disposal and outfalls are considered separately in Section 5.

Currently the sewerage system in the Island works well during dry weather, with the pumping stations and gravity sewers having no hydraulic problems due to the dry weather flow (DWF). However, the system comes under pressure and fails in certain parts of the Island during wet weather, particularly given the high levels of surface water and seawater inflow and intrusion into the system.

4.1 Sewer Catchment

There are approximately 570km of sewers and pumping mains in Jersey. The sewerage system is a mixture of combined (foul and surface water) and separate foul and surface water systems. The combined sewers are generally concentrated in and around St. Helier where the sewers are older, with much of the rest of the Island served by newer separate systems. All new development now has to be served by separate sewers. Due to the topography of the Island, the system is heavily pumped with 116 public pumping stations across the Island which are operated and maintained by TTS. It is estimated that there are also over 450 private pumping stations in the Island.

Currently approximately 87% of the properties in the Island are connected to the sewerage system, with the remaining residential properties discharging into either septic tanks, tight tanks and private treatment plant facilities, which are emptied on a regular basis by tankers and discharged to Bellozanne STW. The majority of the system drains to Bellozanne STW in the south of the Island, while a small pocket of properties on the north of the Island are served by a small package plant at Bonne Nuit.

As part of the Waste Water Strategy development process, a Drainage Area Plan (DAP) Needs Report (07/2012) has been prepared to determine current issues and providing a basis for the future effective management of the sewage collection system. As part of this sewerage network model all asset condition surveys have been collated, including details such as stop / start levels in pumping stations. The model has identified current issues and deficiencies within the sewerage system.

The sewerage network model is currently available to assess the effects on the sewerage infrastructure of proposed future development in the Island and to identify the benefits of proposed future sewer upgrade schemes in order to address the current issues and prioritise future upgrades.

4.1.1 Sewerage Network

The original system of public sewers in St Helier was constructed in the latter part of the 19th century, and not without opposition, due to the cost of the work involved. The sewers were built of brickwork, and carried both foul sewage and surface water (combined system). These combined sewer systems discharged their contents to sea, through outfalls at the Weighbridge, Le Dicq, First Tower, and Beaumont, without any form of treatment.

This method of disposal continued until after the Second World War when, with tourism becoming a major factor in the Island's economy and the increasing use of the foreshore for recreational purposes, the Health Authorities became concerned about the risk of infection from sewage on the beaches and in the sea.

Recommendations were put before the States in 1950 to re-design and reconstruct the existing sewerage system to modern standards. This involved the construction of a Sewage Treatment Works in Bellozanne Valley, and a large pumping station at First Tower. Intercepting sewers were constructed to cut off the outfalls in St Aubin's Bay and other bays, and to convey the collected sewage to the First Tower Pumping Station to be pumped to Bellozanne for treatment. The Sewage Treatment Works was commissioned in 1959.

It was recognised that a large amount of surface water was entering the St Helier combined sewers from the brooks at Vallée des Vaux and Grands Vaux. In 1956, a large surface water sewer (1.8 metre diameter) was constructed from Town Mills to the Weighbridge, to collect the surface water from the two valleys. This sewer had to be constructed in a tunnel under Val Plaisant, New Street and Conway Street, and discharged the surface water to sea through the old granite outfall at the Albert Pier. The recent network model has confirmed that this surface water sewer is adequately sized for current and future predicted flows.

Over the years, the foul sewer system has been extended to many parts of the Island, requiring the construction of many pumping stations due to topography. A large proportion of the foul sewage from these areas has to pass through St Helier on its way to First Tower. Flows from areas north east of St Helier are pumped to Five Oaks. Flows from east of St Helier arrive at Le Dicq, and are pumped to the Weighbridge. The increased development and the extension of the sewer system obviously increased the loading on the St Helier sewers.

From 1950 to 1980, various new sewers were constructed in St Helier to rationalise the sewer system by separating surface water flows from foul sewage. In some areas new foul sewers were laid with the intention of later using some of the old brick sewers to carry the surface water. In other areas, total reconstruction was carried out by replacing the brick sewers with new twin pipe systems in order to separate flows.

4.1.1.1 Condition of the Sewerage Network Assets

The sewerage system has been categorised based on the consequence of sewer failure. Critical sewers are identified based on the cost to replace the sewer and the social / economic consequences of failure occurring such as pollution risk and traffic disruption during repair etc. Factors such as sewer depth, sewer diameter, ground conditions, and traffic routes determine the critical category of sewers, with category 'A' being the most critical and Category 'B' being of secondary importance.

Presently, 200km of sewers have been inspected by CCTV (closed circuit television), which equates to approximately 39% of the entire foul and surface water system.

Table 4.1.1 shows the breakdown of grades and categories for the sewer network derived from the inspections.

STRUCTURAL CONDITION GRADE	Category A	Category B	Non - Critical
1 (best)	1.6%	25.6%	43.0%
2	0.5%	2.5%	4.0%
3	0.5%	2.6%	4.7%
4	3.5%	2.5%	1.5%
5 (worse)	3.5%	2.5%	1.5%
Totals	**9.6%**	**35.7%**	**54.7%**

Table 4.1.1 – Grades and categories of the Sewer Network

The grading scale follows the WRc Sewer Rehabilitation Manual (4th edition) which classifies sewer condition according to the number of defects per metre identified by the CCTV survey. The condition grading scale aligns with the performance categories identified by the water industry regulator for England and Wales (Ofwat).

- Grade 1 - No concerns;
- Grade 2 - No threat to service but operating costs increasing;
- Grade 3 - Requiring capital maintenance on economic, health & safety grounds or third party initiated;
- Grade 4 - Requiring preventative capital maintenance; and
- Grade 5 - Requiring immediate capital maintenance.

It is assumed that un-surveyed sewers have the same mix of condition (asset profile) as those surveyed. On this basis it is estimated that a total of 76km of sewer are Grade 4 or 5 in the Island

4.1.1.2 Sewerage Network - Current Position and Issues

The following summarises the current position and issues with the sewer network identified by the recent sewerage network model, inspection of the assets and historical information.

1. Approximately 30 km of sewer is known to be in a poor condition. This is 15% of the 200 km of sewer that has been assessed. Assuming the un-assessed sewers are in the same condition, then there are approximately 76km of sewer in poor condition and requiring attention. In December 2012 a significant sewer failure occurred at Green Island, which involved the collapse of a 450mm diameter concrete pipe in a major road. Planned maintenance and replacement allows work to cause less disruption compared with emergency repairs.
2. The sewerage network model developed in 2012 identified nineteen locations where the foul / combined sewer system is predicted to flood in the Island. These tie up with known flooding locations but some are in fields, hence may not have been previously reported. The same locations flood for both a 1 in 10 year and 1 in 30 year rainfall event.

   The flooding identified near the Beaumont Sewage Pumping Station (SPS) is caused by lack of storage at the pumping station, as a result of the significant inflow and infiltration upstream of the SPS and in the trunk sewer upstream of First Tower SPS. During rainfall events First Tower acts as a flow limiter, passing only a fixed volume forward to Bellozanne STW so that the inlet works are not overloaded. Due to this control, flows in the sewer network back up to the Weighbridge Combined Sewer Overflow (CSO) in the east and back to Beaumont SPS in the west, which prevents the high level overflow bifurcation at Beaumont SPS from operating resulting in flooding upstream of Beaumont SPS. At the Weighbridge sewerage spills to the Cavern for storage but there is no storage or spill location at Beaumont SPS and hence flooding can occur. The provision of additional storage located upstream of Beaumont SPS would resolve the flooding upstream of Beaumont SPS, thus preventing the existing pumps from being overloaded due to this lack of storage.

3. There are known areas of significant network infiltration and seawater intrusion increasing the flows to be collected, pumped and treated. This has significant impacts throughout Jersey's waste water collection, treatment and disposal system where it causes capacity reduction resulting in increased levels of flooding and CSO discharges to sea, corrosion damage, excessive maintenance and odour. This was highlighted by flooding in February 2007, December 2010 and December 2012 / January 2013 during severe wet weather. These problems were caused by a combination of significant surface water cross connections / infiltration, poor sewer condition, high water table, prolonged rainfall and poor / blocked road drainage.
4. Historically, foul and surface water flooding has occurred in the north eastern part of St Helier town centre. The hydraulic model does not predict any flooding to occur in this area during either a 1 in 10 year design rainfall event or during a 1 in 30 year design rainfall event. Flooding is however predicted to occur in Ann Street ($73m^3$) and Hilary Street ($45m^3$) during a 10 year design rainfall event when 20% sediment is added to flat sewers in this area. This suggests that the observed flooding in this area could be attributable to an accumulation of sediment in the sewers in this area.
5. There are a number of sewers in the St Helier area that are laid flat and as a result of this an accumulation of sediment could occur in these areas. There are 39km of foul/ combined sewers in St Helier that do not have self-cleansing velocities during a 1 in 3 month design rainfall event, leading to possible septicity and subsequent problems with odour and concrete corrosion. Many of the low velocities modelled within St Helier have occurred as a result of the completed and planned sewerage separation schemes. To minimise the build-up of sediment and potential odour complaints in these sewers regular flushing of the sewers will be required.
6. Within St. Helier, infiltration is also a major issue due to the fact that the sewerage system is much older leading to high infiltration from ground water ingress. St Helier also has an extensive network of combined sewers which due to their nature take a large quantity of storm flows during wet weather. The recent hydraulic network model identified that parts of the system had infiltration levels up to 43% of the overall DWF. The majority of the infiltration flow arriving at Bellozanne STW is from the gravity system in St. Helier.

In line with the States Reduce, Manage and Invest philosophy, TTS is currently undertaking a programme of works to reduce the amount of surface water infiltration. Areas prone to seawater intrusion into the sewerage system have not been identified to date and further investigations will need to be undertaken before the next phase of works can take place.

4.1.2 Combined Sewer Overflows (CSOs)

There are eight CSOs in St. Helier. All overflows from the structures discharge to the sea via the surface water system through either the Marina outfall or Gloucester Street outfall. Following the completion of the Philip Street shaft and subsequent sewer separation scheme in St Helier, the King Street CSO will stop discharging to the bay. Instead the new Ann's Court CSO will discharge to the cavern, resulting in the Weighbridge CSO operating more frequently as the Cavern will fill slightly more quickly via this different source.

In the UK the CSO design standard is not set by a return period such as 1 in 10 years or 1 in 30 years but by the amenity value of the receiving water. A CSO must pass forward a specified flow (Formula A) before spilling, and all spills up to a 5 year return period have to be screened to reduce aesthetic impacts. The spill frequency objective is set to safeguard the quality of the receiving watercourse or water body.

The results of the recent sewage network modelling predict that an additional 20,255m^3 of flow would need to be stored in the system in order to prevent the Weighbridge CSO from spilling during a 1 in 10 year rainfall event. Provision of this additional storage is not considered reasonable or practical and the operation of the network is therefore being optimised for the existing assets.

There is no known existing aesthetic issue relating to the operation of the Weighbridge CSO, however, in order to reduce the impact of these more frequent spills, consideration will be given to installing a screen on the Weighbridge CSO.

The overflow settings associated with a number of the existing overflows in St Helier will be altered when the sewer separation scheme is completed. Currently the broad aim of TTS is to limit discharges from the overflows to storm events of one in 10 years return period, or greater.

The Philip Street Scheme will be constructed in two stages. The first phase involving the construction of the Philip Street shaft is currently under construction, with the second phase to separate foul and surface water upstream of Philip Street to follow on completion.

4.1.2.1 Condition of the Combined Sewer Overflows

The CSOs have not been graded in the same manner as the sewers and pumping stations, as a detailed survey of each CSO would require man entry into the confined space sewers. Several of the CSOs in St. Helier have only been constructed in the last few years so their condition is assumed to be good. Also, as the CSOs are all unscreened, there can be no issues with the condition and operation of mechanical or electrical components. For these reasons the overall condition of the CSOs is not considered to be an issue.

4.1.2.2 Combined Sewer Overflows - Current Position and Issues

The following summarises the current position and issues with the CSO's identified by the recent sewerage network model and historical information.

1. There are fourteen combined sewer overflows around the Island that are predicted by the sewage network model to operate on an annual basis, including overflows from pumping stations. Following the completion of the Philip Street shaft and sewer separation scheme there will be ten overflows that are predicted to operate during a 1 in 10 year rainfall event. These are at Weighbridge, La Greve de Lecq 2, Le Rivage, Maupertuis, Pontac, Rozel 1, St Brelade 1, St Ouen, Charing Cross and Fauvic. Given that these overflows are unscreened there is a risk of aesthetic effects.
2. The sewerage network model indicates that that only one overflow in the Gorey Bay area spills on a regular basis. This is the overflow upstream of Fauvic SPS. The site is deemed to spill an average of 14 times per year. Although the volumes of discharge are small it does not comply with the EU shellfish directive, given that 10 spills per year are allowed prior to non-compliance.

There is a history of pollution incidents due to overflows from the network; however this has significantly reduced over the past 20 years due to ongoing investment and improvements in operational procedures.

4.1.3 The Cavern

An important asset within the waste water network is the Cavern, a large underground storage facility constructed in the mid 1990's. The cavern is located in St Helier and can hold a total of 25,000m^3 during wet weather which limits overflow events to 1 in 10 years.

During Dry Weather Flow (DWF) conditions, the waste water flows from the Island drain to First Tower pumping station and are then pumped to the inlet works at Bellozanne STW. During large rainfall events, when the increased flows in the foul/combined sewers exceed the capacity of First Tower pumping station of 1,100 l/s, the flow backs up to the Weighbridge overflow in St. Helier and spills into the Cavern. When flows in the system return to DWF levels the contents of the Cavern are pumped back into the St. Helier gravity system and onto the STW via First Tower pumping station. When the Cavern becomes full, a penstock opens at the Weighbridge Overflow diverting excess flows to the Marina Outfall and then to the sea. If the outfall is tide-locked, the West of Albert pumping station pumps these flows to the sea.

4.1.3.1 Condition of the Cavern

The civil components of the Cavern storage facility are assumed to be in good condition because of its young age and the fact that it is an offline facility not used on a regular basis. The main consideration is therefore the mechanical and electrical components. The pumps which are used to drain the Cavern back into the gravity system were replaced in 2006 and are assumed to be in good condition.

4.1.4 Surface Water System

There are local discharges from the surface water network to watercourses (inland areas) and the sea (coastal areas). The surface water network within St Helier has two main outfalls at the Marina and Gloucester Street. All combined sewer overflows (CSOs) in St Helier discharge directly or indirectly to the sea.

The majority of pumping stations throughout the Island discharge into the surface water network. In the event that the pumps fail and / or the storage is overloaded then discharges occur from the pumping station or the lowest manhole cover on the local system.

There are also six tidal surface water pumping stations.

TTS is also responsible for a number of watercourses in the Island.

4.1.4.1 Surface Water System - Current Position and Issues

The recent sewage network model identified that three areas are at risk of surface water flooding at St Saviour, located north of St Helier, St Clement and Grouville. The flooding at St Aubin / St Brelade from the surface water system is caused during high tides when there is no outlet for the surface water system. There are minor remaining external flooding issues (gardens, accesses, roads, open spaces) associated with the watercourses at Millbrook and at St Peter's Valley during heavy rainfall. On occasion there have also been internal flooding issues at these properties.

4.1.5 Pumping Stations

The waste water pumping stations in the Island range in capacity from 1 l/s up to 1,100 l/s at First Tower. The more recent pumping stations across the Island have additional storage capacity usually in the form of an extra wet well. The 'wet well' storage capacity at larger pumping stations has been sized to provide either 24-hour or 36-hour Dry Weather Flow (DWF) storage (during storms this storage reserve is considerably reduced). Storage is provided at the pumping stations so as to allow time to respond to pump failures and to restrict discharges during storm events. Categorising the foul sewage pumping stations based on capacity gives the breakdown shown in Table 4.1.5.

Category	Capacity	Number
Small	< 10 l/s	70
Intermediate	10 – 50 l/s	26
Large	> 50 l/s	14
Total		**110**

Table 4.1.5 - Pumping Station Capacities

Eleven pumping stations have an emergency overflow facility so that in the event of a power failure (there are no emergency power facilities at the pumping stations) or an extreme rainfall event, where the storage capacity at the station is exceeded, flows can back up within the foul system and discharge via the surface water system. The majority of these emergency overflow facilities can be found at pumping stations on the east side of the Island.

4.1.5.1 Condition of the Pumping Stations

An assessment of pumping station condition has been undertaken assessing all civil, mechanical and electrical components of the stations. Physical data on the pumping stations together with photographic surveys have been used for grading each station based on the condition of the civil and Mechanical & Electrical (M&E) components.

The estimated proportion of pumping stations in each grade is shown in Figure 1 below. It can be seen that up to 75% of assets are in Grade 3 to 5, with 25% in Grades 4 & 5.

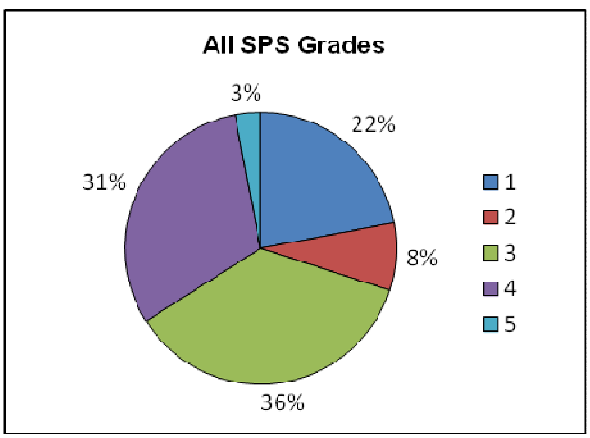


Figure 1 – Estimated Pumping Station Condition Grades

Figure 1 shows that the pumping stations are generally in poor condition with only 30% of the pumping stations being in good condition (grades 1 & 2). A significant percentage (70%) of the pumping stations is classified as grades 3, 4 or 5 (in need of capital maintenance).

Mechanical and electrical equipment is estimated as having a life of 15 years in Jersey and there has been limited investment recently, however further planned investment to replace the control panels and pumps, particularly at the larger pumping stations is planned over the next two years (See Sections 7.3.2 and 7.4.2 for further details of the planned investment).

4.1.5.2 Pumping Stations - Current Position and Issues

The following summarises the current position and issues with the pumping stations as identified during the recent sewage network modelling and historical information.

1. Approximately 70% of the 116 pump stations are in poor condition (grades 3, 4 and 5).
2. Of the 14 large pump stations (flow >50l/s), 9 are grade 4 and the remaining 5 are grade 3, hence all the large pumping stations are generally classified as being in a poor condition, requiring capital maintenance.
3. Of the 6 surface water pumping stations 2 are classed as a grade 5 condition, although these two pumping stations do have capital expenditure allocated for their upgrade.
4. The pumping stations generally cope well during dry weather conditions. However all of them suffer from surface water ingress to some extent and there are a number of pumping stations across the Island that are unable to deal with increased inflows and infiltration during wet weather. The recent sewage network model identified nine pumping stations that could cause surface level flooding upstream of the pumping stations as a result of having insufficient storage / pumping capacity. These are the pumping stations at Bashfords Nursery, Trinity, Le Rondin, Rue a la Dame / Highfield Vineries, Jersey Zoo, La Retraite / La Rue des Varvots, Becquet Vincent, La Frontiere and St. Brelade 1. However, during severe wet weather in December 2010 and December 2012 / January 2013 there were a number of other pumping stations where flooding occurred upstream of the pumping stations as a result of insufficient storage / pumping capacity. Preventing the amount of inflow and infiltration into the sewerage network will assist in reducing the amount of flooding upstream of the pumping stations.
5. A number of the pumping stations have a minimum of 24 hours storage (the strategic stations have 36 hours storage) based on one ‘Dry Weather Flow’ (DWF) from all properties, although sewage storage can be significantly less in wet weather due to surface water ingress. However, thirty nine pumping stations do not appear to meet UK design standards in terms of passing forward ‘Formula A’ flows or having 2 hours storage capacity at 3 DWF. It is generally accepted practice to require flows up to the equivalent of ‘Formula A’ to be passed forward to the treatment works and flows in excess of this can discharge to watercourse. Formula A normally equates to approximately seven times the value of the Dry Weather Flow.
6. Hydrogen sulphide (H_2S) caused by decaying organic matter (this occurs when sewage is retained in the network for long periods) is a problem at certain pumping stations, which causes odour problems in the vicinity of the pumping stations. Several pumping stations have had odour control units fitted to resolve the problem. At First Tower sewage pumping station the odour problems have been improved following the installation of a carbon filter unit. At Le Hocq, Pontac, Le Bourg and St Ouen biofilters have been installed, which have resolved the odour problems at these stations.

4.1.6 Rising Mains

There are approximately 64km of rising main in the sewer network, which includes 40km of uPVC pipe. This pipe material has been found to be susceptible to bursting elsewhere in the UK, particularly class B pipe laid in the 1970's and 80's. Bursts can cause significant pollution as well as leading to loss of service to customers and it is important to identify which rising mains are most at risk. TTS records show that approximately 7.5km of class B uPVC rising main is awaiting replacement as part of their ongoing programme.

5 Existing Waste Water Treatment & Disposal Review

This section summarises the history, current status and condition of the sewage treatment works, sludge disposal and outfalls, which have been taken into account as part of the development of the strategy.

5.1 Waste Water Treatment Facilities in Jersey

5.1.1 History

Up until the 1950s, untreated sewage was discharged directly onto beaches causing public health concerns. It was therefore decided that the system should be re-built to modern standards and that all sewage should be treated before being discharged to the sea.

Bellozanne Valley was an obvious choice for locating the treatment works as, at that time, it was a relatively remote area and was the natural centre of the Island's drainage system.

Bellozanne STW was opened in 1959 and designed to provide full treatment to produce an effluent to the standards of best practice at the time for a population of 57,000. This is the Island's main sewage treatment works. Through the years it has been continually improved and upgraded to take into account the significant increases in population, change in flows, increased environmental standards and more modern process technology.

In the early 1990s it became evident that the STW was required to be upgraded to increase its capacity and replace outdated equipment, with the existing activated sludge plant (ASP) coming to the end of its useful life, mainly due to the age of its mechanical and electrical equipment.

At this stage in 1997 a study on the trophic status of St Aubin's Bay was carried out by the Centre for Research into Environment and Health (CREH). The study noted that St. Aubin's bay displayed some evidence of eutrophication in the nearshore area and potential for eutrophication in the bay itself. The report also noted that the nutrient removal from the Bellozanne STW effluent would be a *prudent precautionary step*. However, the report identified that the environmental status of the St Aubin's bay as inconclusive based on the limited survey and noted that the time constraints necessitated by the decision timescales for infrastructure investment at Bellozanne STW had not allowed a protracted, but possibly more prudent, data acquisition.

On the basis of the CREH Report on the Trophic Status of St Aubin's Bay (November 1997), it was agreed that the planned upgrade of the ASP should include a nutrient removal process that would decrease the amount of nitrogen entering St Aubin's Bay. Prior to the full implementation of the Water Pollution (Jersey) Law, 2000 on the 27 November 2000, the Public Services Committee issued a Discharge Certificate for Bellozanne STW in favour of itself which stipulated a stringent effluent quality for total nitrogen of no more than 10mg/l for a population equivalent of more than 100,000 and no more than 15mg/l for a population equivalent of less than 100,000. The Discharge Certificate also contained a relaxed set of conditions until 31 December 2001 and was extended for additional periods of time during construction.

Due to the valley restricting available construction land, there was insufficient aeration volume to achieve nitrification / denitrification using the conventional activated sludge process as established in 1959. Instead, a new technique proposed by Degremont was used in providing a fixed film media within the aeration zones for organisms to grow and permit full nitrification / denitrification (enhanced activated sludge process). In addition, four new final settlement tanks were constructed for the enhanced process. At the time the new plant was installed, it was the only full scale example in Western Europe to use this new technique.

Unfortunately, repeat water quality studies conducted in 2007 showed no change in overall nitrogen levels, confirming this technology has proved to be unsuccessful with the STW failing the 10 mg/l Total Nitrogen consent on an average annual basis.

In the 1990s, the States of Jersey made the health and environmental decision to install Ultra-violet (UV) disinfection facilities prior to the final effluent's discharge through the outfall to reduce bacteria levels in the effluent. The UV disinfection at the STW was the first of its type in the British Isles. The UV plant was upgraded in 2003 with self-cleaning and more energy efficient units with applied dose monitoring facilities.

At present Bellozanne STW takes flow from a connected resident population of 85,000, which increases to a summer peak population of approximately 102,000. There are limited industrial discharges in the Island apart from a dairy and brewery; however, there are a large number of restaurants.

In 2003, a small package treatment plant was built at Bonne Nuit in the north of the Island to treat sewage from the local area, refer to Section 5.2 for details.

There are also a number of small private package treatment plants and septic tanks throughout the Island to treat effluent from properties which are not connected to the main sewers. These are discussed in Section 5.3.

5.1.2 Treatment and Disposal at Bellozanne STW

Bellozanne STW has performed exceptionally well over the 54 years that it has been in operation, maintaining a high level of treatment with the exception of struggling to meet the effluent Total Nitrogen Standard. The main reasons for the Bellozanne STW's current difficulty in meeting its consent conditions are:

- inadequate / outdated design;
- poor performance of the installed hybrid technology; and,
- variability of loading, particularly under high/ storm flow conditions.

A further environmental impact from the current works is the odour which can, on occasions, extend over a large residential area to the south.

Currently all waste water flows to the works receive some form of treatment. The current flow to full treatment (FFT) of 600 litres per second (l/s) receives preliminary treatment (screening and grit removal), primary treatment (settlement) and secondary treatment (activated sludge plant).

Storm overflows in the range 600l/s to 1100l/s receive preliminary treatment and primary settlement. All flows up to 1100l/s then combine to receive tertiary treatment in the form of UV disinfection before final effluent being discharged via the outfall into St Aubin's Bay near the First Tower area. This effluent is discharged to mean high water level with the outfall being exposed for long periods.

5.1.3 Condition of the Assets at Bellozanne STW

Due to their differing ages, the asset stock conditions across Bellozanne STW vary greatly. Much of the civil (concrete) asset stock is in a reasonable condition requiring ongoing capital maintenance, but many items of mechanical and electrical plant are in poor condition (Grades 4 and 5 using the UK Sewer Rehabilitation Manual grading). Key areas where capital maintenance investment is required in the short term include:

1. The activated sludge plant; and,
2. The sludge treatment plant.

Approximately 42% of the assets at Bellozanne STW are in poor condition as surveyed in 2008, particularly the activated sludge plant and the sludge treatment plant which requires immediate replacement. The construction of the new centralised sludge treatment facilities is currently underway.

5.1.4 Operational Issues at Bellozanne STW

The current sewage treatment works does not meet the consent standard required. The current works and problems encountered are described in the Bellozanne STW Operations Strategy Report (05/2011) and should be referred to for further details. A summary of the current key operational issues include:

- The design is outdated and does not meet the current standards.
- The activated sludge plant (ASP) is undersized for the population served.
- Hydraulic distribution to the final tanks is poor leading to uneven flow splitting and overloading of some tanks.
- Bellozanne STW treats almost the entire Island's waste water and discharges treated effluent into St Aubin's Bay. The STW is failing to meet its 10mg/l total nitrogen discharge limit.
- When trying to meet the required nitrogen consent limit, large amounts of oxygen must be used leading to excessive energy costs (large carbon footprint).
- The 2006 Revision to the European Union Bathing Water Framework Directive has tightened bacteriological standards and requires compliance by the end of the 2015 bathing season. Bellozanne STW requires improvement to the effluent solids quality and content to meet these standards.
- The ASP has problems with 'sewage foam', which contributes to compliance issues due to solids carry over in the effluent. The plant is not operating efficiently, because other parts of the treatment process have to be restricted to deal with the foaming problems.
- The foam formed in the ASP also has a knock on effect of causing foam in the digesters which needs to be carefully managed to prevent damage to the mixing compressors.
- The Bellozanne STW is nearing the end of its original design life and now requires replacement despite ongoing capital maintenance. Approximately 42% of the assets at Bellozanne STW are in poor condition as surveyed in 2008, particularly the ASP and the sludge treatment plant which requires immediate replacement. The construction of the new centralised sludge treatment facilities is currently underway.
- In 2010 the STW operated in storm conditions (overflow after screening and primary settlement) for periods totalling 130 days due to hydraulic and secondary

treatment capacity limitations. Increased full treatment capacity would reduce the number of events significantly or eliminate them.

- Bellozanne STW attracts regular odour complaints from a neighbour to the northwest and occasional complaints from the residential area to the south.
- The old Energy from Waste plant provided electrical power to Bellozanne STW and to First Tower pumping station but this supply has been discontinued. There is also a second main power line to Bellozanne STW and twin diesel standby generators. Additional works are ongoing to increase the robustness of the main power supply.
- Pressure for increases in population and connectivity to the network will further increase flows to the works, which is already above its treatment capacity due to process design capacity limitations and hydraulic restrictions.

5.1.5 Bellozanne STW Sludge Handling & Treatment Facilities

5.1.5.1 Handling & Treatment

Sludge is an unavoidable by-product of the waste water treatment process. It is important that continuous and appropriate routes for recycling and disposal are maintained to ensure that the environment and public health are not put at risk.

The sludge disposal strategy is well developed given that it is intrinsically linked to the centralised sludge treatment facilities currently being constructed at Bellozanne STW. Sludges from the Bonne Nuit STW, septic tanks, tight tanks and private treatment plant facilities are transported to Bellozanne STW for further treatment and ultimate disposal.

The sludge produced from the STW is first thickened and then pumped to anaerobic digesters where mesophilic digestion takes place; this is a natural process that encourages the breakdown of organic matter by bacteria in the absence of air. This process generates methane gas which is collected and used as an energy source to power other processes at the STW.

In order to create an enhanced sludge product suitable for use on land, it has been necessary to include sludge stabilisation as part of the centralised sludge treatment facilities. The use of imported lime for sludge stabilisation as at present will be replaced by a pasteurisation process. This is now much more common as a sludge treatment / stabilisation process than the use of lime due its reliability, reduced ongoing operational costs, reduced health and safety risks and odour reduction (no fishy smell).

The cake produced as part of the sludge stabilisation is then mostly transported and disposed to agricultural land for a charge, seasons and weather conditions permitting. If the disposal to land route is not available, the sludge is incinerated with energy recovery within the Energy from Waste plant.

The existing lime treated sludge meets the UK Department of Environment Food and Rural Affairs Code of Practice standards for enhanced treatment.

5.1.5.2 Sludge Disposal Routes and Standards

In 2012, the total sludge loads and disposal routes were:

- Lime treated sludge cake to land: 6,742m^3
- Lime treated sludge to incineration: 500m^3

Approximately 7,242m^3 of dry solids were therefore disposed of in that year.

Sludge cake can be applied to land except during wet weather winter periods. When the sludge cake cannot be applied to land and given the limited sludge cake storage facilities, there are periods when all the sludge cake has to be incinerated. The Energy from Waste plant at La Collette incorporates sludge handling facilities and has sufficient capacity to deal with sludge cake when the land recycling route is unavailable, however the Energy from Waste plant does struggles to meet production unless it is running on two streams.

Recent trials involving composting enhanced treated sludge with green waste have been successful and may be an additional outlet. In terms of sustainability the composting of enhanced treated pasteurised sludge would be the next best alternative if the land recycling route is not available, with incineration as a last resort.

The sludge is disposed to land in accordance with the UK Agricultural Development and Advisory Service (ADAS) matrix and additional supermarket protocols (please refer to Section 2.3 International Obligations). The approach taken in Jersey therefore complies with the practical application of UK legislation; however the UK quality monitoring processes are not relevant and are not followed in Jersey. Instead farmers sign documentation to confirm that no sludge has been applied in the previous year and quality records of fields are maintained. There is currently a land bank of approximately 1,000 verges suitable for sludge application, with scope for expansion to meet projected increases in sludge production. There is however, a threat that the recycling route to farmland is at risk due to potentially more stringent supermarket and legislative standards making land disposal unviable. Rags and grit screened from the sewage at Bellozanne STW are incinerated at the Energy from Waste plant.

The European Commission (EC) nitrates directive requires areas of land that drain into waters polluted by nitrates to be designated as Nitrate Vulnerable Zones (NVZs). Jersey is classed as being a Nitrate Vulnerable Zone.

5.2 Bonne Nuit STW

In 2003, a small package treatment plant was commissioned at Bonne Nuit on the north coast of the Island. It takes flows from a small catchment that includes 14 houses, 27 apartments, a hotel, a café and public toilets. The package plant consists of a primary settlement tank, a submerged aerated filter with associated settlement zone and a UV disinfection unit. There are no proposals to amend this arrangement as pumping sewage from Bonne Nuit to Bellozanne is not economically viable.

The final effluent leaves Bonne Nuit STW via an outfall that joins with a surface water pipe at the end of the harbour wall before discharging below the mean low water level at Bonne Nuit Bay. The condition of the outfall is not known but is assumed to be good.

5.2.1 Operational Issues at Bonne Nuit STW

Bonne Nuit STW has consistently performed better than its compliance levels, although since commissioning the filter media has been replaced and there are some issues with the air blowers and the control panel. The works to resolve these issues are planned for summer 2013. There would also be operational benefits in bringing the numerous small control panels around the site together into one Motor Control Centre.

Bonne Nuit STW had previously been the subject of odour complaints; however the recent installation of a carbon filter has proved to be very successful in eliminating odours from the works.

5.3 Septic Tanks and Tight Tanks

There are approximately 6,000 properties that are not connected to the main sewers. The sewage from these properties is generally either treated in septic tanks or collected in tight tanks. There are also a small number of private waste water treatment works. Septic tanks provide basic treatment in two stages:

1. Contaminants are removed from the sewage by either the settling of heavy particles to create a sludge layer at the bottom of the tank, or by floatation of materials less dense than water (e.g. oils and fats) to create a scum layer at the top of the tank. The remaining effluent in the middle discharges from the tank into local watercourses or a soakaway.
2. Organic matter in the sludge and scum layer is digested by bacteria, which prevents the excessive accumulation of sludge; consequently the average septic tank only needs to be emptied by a tanker 1-2 times per year. Issues such as insufficient maintenance, poor design and increasing groundwater levels, along with the rudimentary treatment process mean that many pollution incidents each year are caused by septic tanks.

Tight tanks are completely sealed tanks. These tanks reduce the Islands' ground and surface water pollution risk as there is no effluent discharged from the tanks. However the entire contents need to be frequently tankered away. Tight tanks are installed as a means of providing a sewerage service where a septic tank, or other solution, is not feasible. Where planning permission is granted for a development not connected to the sewer system, installation of a package treatment plant or tight tank will generally be required as ground conditions in Jersey do not favour septic tanks.

All the sludge from the septic tanks and the contents of tight tanks are collected by tanker and taken for treatment at Bellozanne STW. This is a service subsidised by the States.

Approximately 150 enquiries are received each year from septic tank and tight tank owners regarding connection to the main sewers.

5.4 Licensing of Discharges

Both the STW outfalls and the overflows from the pumping stations are covered by consents issued by the States Department of Environment. The performance of the STW outfalls is routinely monitored and reported to the Department of Environment. The operation of the overflows is reported to the Department of Environment, but no frequency of operation standard is set. It is noted that the Environment Agency in the mainland UK includes frequency of operation, volume of storage and other standards driven by environmental impact within its licensing of overflows and this is likely to become a requirement for any improvement works undertaken.

5.5 Other Issues

5.5.1 Odour

Bellozanne and Bonne Nuit STWs, and some of the pumping stations, have been the subject of odour complaints, although recent works at Bonne Nuit STW and some of the pumping stations have resolved these odour issues. To improve matters at Bellozanne STW, those process units which generate most odours, namely the digested sludge storage tanks, SAS and digester feed holding tank and the inlet works, have been enclosed and the air treated by way of odour control units. These works were implemented in 2008 but with limited success to date.

5.5.2 Bathing Water Directive Standards

Current water quality monitoring indicates that four bathing waters (at Victoria Pool, Rozel, Bonne Nuit and La Haule) did not meet the revised Bathing Waters Directive guide standard. All beaches passed the imperative standard.

6 Population Projections

6.1 Overview of Approach

The WWS incorporates current best practice, but recognises that the collection, treatment and disposal of waste water is a developing area and is subject to forecasted population increase. The following sections summarise the population projections for Jersey that were used for the Feasibility Report (March 2013).

The industry standard for developing population forecasts is to adopt a component-based approach either using census-based or policy-based forecasts. This approach has been adopted in the UK water industry for both water and wastewater supply-demand planning and further details can be found in the Environment Agency's Water Resource Planning Guidelines (Environment Agency, 2011) and UKWIR's Long Term/ Least Cost Planning for Wastewater Supply-Demand (07/RG/08/2).

The population projections presented in this Section are based on the States of Jersey Statistical Unit's model developed in 2009; the details of which can be found in the report entitled Jersey's Population Model. The review presented in this Section uses this as a basis of the revised forecast and makes adjustments for the following information which has become available while the WWS has been in development:

- States of Jersey Census Report 2011
- States of Jersey Island Plan 2011
- States of Jersey Annual Tourism Report 2010

These reports were used to carry out population assessments in May 2012. The results were reviewed in September 2012 when the report '2012 Jersey population projections' was issued by States of Jersey Statistics Unit. The methodology used is summarised in Section 6.6.

In June 2013 the Statistics Unit also released their final estimate for the Island's resident population at the end of 2012. The population was stated as 99,000 which was in line with the previous study's growth profile and therefore the design horizon population assessment has not been amended further.

6.2 Current Population

Population statistics from the 2011 Census, released by the States of Jersey Statistics Unit, indicate that the resident population in that year was 97,857. In 2010 Tourism brought in 556,860 visitors with a further 128,380 business and education related visitors, resulting in a total of 685,240 visitors for the year. The data showed that there is an approximate maximum tourist population of 14,900 at any given time, including children, and a registered bed stock of 11,900.

There is also a further seasonal increase in the population as a result of the influx of migrant workers and people 'visiting friends and relatives'. The Labour Market Report of 2011 identified an increase of 3,190 in total workforce during the summer. However, there is some uncertainty as to what proportion of this number are seasonal workers from outside the Island as opposed to residents who are already included in the population statistics. Data on numbers of migrant seasonal workers is not collected which gives rise to this uncertainty. By comparison, the 2010 Tourism Report identifies a seasonal increase of 1,503 in staff employed in the hospitality sector. When coupled with the observed figures for visiting friends and relatives (estimated as 2,746) the additional population from this sector is estimated to be 4,249.

6.3 Projected Resident Population

Population forecasts for Jersey, developed by the States of Jersey Statistics Unit, use a range of modelled scenarios based on different rates of fertility, mortality and net migration. Different scenarios of net inward migration are modelled which show increases in the number of economically active household heads. Increases of 150, 250, 325, and 650 household heads (hh) correspond to net total population increases, including dependants, of 320, 540, 700 and 1400 respectively.

It should be noted in reading the following paragraphs that the early predictions from the Statistic Units used change in household heads as the descriptor for each profile while more recent releases refer to net population change. This explains how, over the course of the discussion below, the design growth profile changes from +250(hh) to +500(net) with little change in the overall result. The change that does occur relates to refinements to the profiles made by the Statistical Unit over time.

The projections below use the 2011 census data as a starting point but then apply the population growth figures issued by the States of Jersey Statistics Unit in 2009 to forecast the population at regular intervals up to 2065. The population projections obtained using this methodology are summarised in Table 6.3a below. The States of Jersey had previously used the +150hh projection for planning purposes and so this line has been highlighted below.

	2011	2015	2020	2035	2065
Net NIL	97,857	97,857	97,857	95,757	80,757
+150hh	97,857	99,457	101,157	104,857	103,457
+200hh	97,857	99,957	102,157	107,957	111,057
+250hh	97,857	100,457	103,257	111,057	118,757
+325hh	97,857	101,257	104,957	115,657	130,257
+650hh	97,857	104,557	111,857	135,457	179,957

Table 6.3a - Projected resident populations based on 2009 growth figures from the States of Jersey Statistics Unit

The Jersey Island Plan 2011 identifies 4,625 new properties to be built between 2010 and 2020. On the basis of an occupancy rate of 2.3 this represents a population increase of 10,638 by 2020. Therefore the +150hh profile was taken and the growth up to 2020 replaced with the housing increase figures assuming linear growth. This gave the resident population profile as shown in Table 6.3b below.

	2011	2015	2020	2035	2065
Island Plan 2011	97,857	102,112	107,431	111,131	109,731

Table 6.3b - Design resident populations including new build housing

6.4 Projected Population including Visitors

Tourist numbers are difficult to forecast as they can be affected by a wide range of variables, most notably the state of the economy. Previous indications from First Research and past discussions with the Statistics Unit suggest no growth in the near future and, therefore, it is assumed that the tourist population will remain constant at

14,900 over the forecast horizon. Similarly, seasonal workers and visiting friends and relative numbers are assumed to remain constant at 4,249.

It should be noted that the 2011 Census was the first to include residents that were off-Island at the time. This has given rise to a step change in the population of some 6,000 people from predictions based on the 2001 Census as reported in the 2008 population update report. Given this step increase and the new build housing from the Island Plan the latest projection is significantly higher than the 2009 population model and it is therefore prudent to take the higher value for the purposes of flow forecasting.

Hence, the projected populations shown in Table 3.2 were uplifted to account for the tourists and workers and visiting friends and relatives by adding these numbers to the resident population for each year. This results in the maximum total population for Jersey as shown in Table 6.4.

	2011	2015	2020	2035	2065
Island Plan 2011	117,006	121,261	126,579	130,279	128,879

Table 6.4 – Estimated Maximum Island Population with new build housing

6.5 Population Connected to Bellozanne STW

As noted previously, it was assumed that approximately 87% of properties were connected to the sewerage system in 2008. A more detailed assessment of residential and commercial connectivity was undertaken by TTS in 2012 which suggested that the 'average' connectivity was 85.2%. However, it was noted that there are still a number of properties where the connectivity is unknown. Therefore, erring on the side of caution the assessment assumed the sewer connectivity at 87%.

A further 1400 properties are predicted to be connected to the network, over and above the expected population growth. This is primarily as a result of properties converting from septic and tight tanks for environmental reasons. For the purposes of this calculation it was assumed these connections will be at a constant rate. It was also assumed that visitor accommodation is connected to the sewerage system in the same proportion as domestic, i.e. 87%. This gave a connected population of 102,278 in 2011 and this figure was projected into the future by using the growth profiles established above. For comparison purposes all of the profiles are shown in Table 6.5.

	2011	2015	2020	2035	2065
Island Plan 2011	**102,278**	**107,152**	**113,238**	**118,125**	**116,725**
Net NIL	102,278	102,897	103,664	102,752	87,752
+150hh	102,278	104,497	106,964	111,852	110,452
+200hh	102,278	104,997	107,964	114,952	118,052
+250hh	102,278	105,497	109,064	**118,052**	125,752
+325hh	102,278	106,297	110,764	122,652	137,252
+650hh	102,278	109,597	117,664	142,452	186,952

Table 6.5 – May 2012 projected growth scenarios for population connected to Bellozanne STW

Based on the assumptions presented above, the average of the 2035 connected population results for the various Statistics Unit scenarios is 118,785. This was closest to the +250hh scenario and so the maximum population connected to Bellozanne STW in 2035 was taken as 118,000 in May/ June 2012.

This projection was based on 2007 population growth data from the Statistics Unit pending the new information which was to be released in September 2012. When this new data was released it showed a step change in the Statistics Unit model compared with the 2007 output and so a further review was carried out.

6.6 Review of 2012 Jersey Population Projections

6.6.1 Updated Scenarios (September 2012)

Based on the 2012 population growth data from the Statistics Unit, the connected population scenarios were recalculated as a sensitivity analysis and are presented in Table 6.6.1.

	2010	2020	2035	2065
Net +200	101,136	105,236	109,336	109,536
Net +350		106,836	113,836	120,936
Net +500		108,436	**118,336**	132,236

Table 6.6.1 – September 2012 projected growth scenarios for population connected to Bellozanne STW

The population projections from May 2012 gave an overall range of results that are consistent with the States of Jersey Statistics Unit projections of September 2012. The growth profile selected in May 2012 also falls well within what are considered to be the most likely outcomes using a Monte Carlo methodology.

The September 2012 profile was therefore based on a net +500 growth which gave a 2035 design population of 118,336. Note the change in descriptor from +250**hh** to **net** +500 as discussed above.

6.6.2 Additional Scenarios (January and June 2013)

The Statistics Unit released further population growth scenarios in January 2013. These considered higher growth than previous models following analysis of the most recent data. The latest population predictions under review are based on four different scenarios namely, net nil, net +350, net +700 and net +1000. The resident population figures from the potential Four Scenarios discussed by the Council of Ministers are as follows:

	2010	2020	2035	2065
Net + nil	97,100	99,000	99,200	90,400
Net +350		102,800	109,800	116,900
Net +700		106,600	120,300	143,300
Net +1000		109,900	129,400	166,000

Table 6.6.2a – Projected resident populations based on 2013 growth figures from the States of Jersey Statistics Unit

These were again converted to connected resident population using the same methodology as previously i.e. 87% connected plus 160head/year for new connections over twenty years.

The connected resident population was then converted to total population by adding 2009/10 figures for Tourists and Visiting Friends and Relatives. As noted above, the maximum visitor population at any time of 19,149 is not expected to change in the coming years. This is factored by 87% for connectivity as above, giving an additional 16,660 population in each case.

	2010	2020	2035	2065
Net + nil	101,136	104,390	106,164	95,308
Net +350		107,696	115,386	118,363
Net +700		111,002	124,521	141,331
Net +1000		113,873	132,438	161,080
Sept 2012 profile	101,136	108,436	**118,336**	132,236

Table 6.6.2b – Projected total connected populations based on 2013 growth figures from the States of Jersey Statistics Unit

The population projections issued after the original May 2012 prediction show that the original 118,000 design figure continues to sit in the middle of the various projection models. The selected forecast design connected population of 118,000 in 2035 is therefore still considered to be a reasonable design horizon. However, given the obvious uncertainty, it is considered advisable to provide flexibility in the design such that 118,000 is not an absolute limit but can be expanded with minimal cost in the future.

It is normal to allow for some contingency, or headroom, to allow for uncertainty in other factors aside from population. These tend to be, amongst other things, climate change, creep and future changes in law or planning policy. However, given that 118,000 is close to the average of the Statistical Unit forecasts (between 106,164 and 132,438) in 2035, and the flexibility of operation that will be designed in, it is considered unnecessary to allow for any further uncertainty.

The most recent data, released in June 2013, confirms the Statistics Unit’s estimate of the resident population at the end of 2012 as 99,000. This figure is consistent with the predicted growth profile between 2010 and 2015 which gave a population of 98,970 on a pro-rata basis. This gives confidence in the adopted model and in the design horizon selected.

The Bellozanne STW site appears to have space to accommodate future increases to the connected population of 118,000 by up to a further 20% for the ultimate scenario. The 2035 design population of 118,000 is still considered to be a reasonable horizon for the works. However, given that there is such a wide range of potential growth it is proposed that the design is completed using conservative parameters. This will mean that some structures are initially oversized but not to an extent that underloading causes performance issues at commissioning.

7 Identifying Sewerage Network Options 2013 - 2035

7.1 Introduction

The following sections summarise the requirements to address the key parameters associated with identifying the sewerage network options for capital maintenance and investment.

By defining levels of service across the investment period, a series of waste water options have been identified and evaluated for their capital cost. Clearly, investment will be required to new and existing infrastructure to comply with the policies and legislation summarised in Section 2.1.

7.2 Maintenance and Investment of the Waste Water System

7.2.1 Sewerage Network Capital Maintenance and Investment

As with the waste water treatment assets, capital maintenance expenditure is focussed on ensuring that the current condition grading of the asset stock does not deteriorate over the 20 year period of this strategy. The initial focus is on those sewers with a grade 4 or 5 asset condition to reduce infiltration and therefore maximise the useful capacity of the existing Bellozanne STW.

The projected level of investment is aimed at meeting current European and UK quality standards for river water quality and sewerage performance, and to maintain an asset stock in stable condition over the 5 to 10 year horizon.

Considering current data, Jersey has lower levels of service risk than the English and Welsh water utilities, but because of the incompleteness of the data in Jersey, it has been assumed that Jersey should follow the same approach.

The majority (62%) of the pumped rising mains in the Island are uPVC (approximately 40km), with a significant proportion of these (47% of the total) exceeding 25 years old. Subject to further detailed investigations, it is expected that significant investment in these assets would be required over the 20 year period of the strategy, particularly the initial 5 year period. Some classes of uPVC mains are particularly vulnerable to failure under repeated stress, such as that encountered in pumping installations. The highest risk is class B and there is an ongoing programme to replace pipes in this material with 7.5km remaining.

There are approximately 570km of surface water sewers, foul sewers, combined sewers and rising mains in Jersey. Additional data gathering and analysis is required to confirm the capital maintenance investment requirements, but based on UK practice it is expected that there would be a requirement for replacement / refurbishment of an average 3km per annum for gravity sewers and 1km per annum for rising mains. This equates to a perceived asset life of approximately 175 years for sewers and some 60 years for rising mains. This is consistent with the range of sewer renewal rates for the English and Welsh water utilities.

7.2.2 Pumping Stations Capital Maintenance and Investment

The current maintenance plans over the next two years include the replacement of 40 pumping station control panels and the replacement of the pumps at the majority of the larger pumping stations, along with the associated pipework, covers, valves and civil repairs. This will reduce the number of grade 4 pumping stations by 75% and the grade 3s by about 50%, hence this will significantly increase the proportion of sewage pumping stations classified as being in good condition (grades 1 and 2). Further capital maintenance will still be required throughout the strategy period to continue to upgrade the remaining pumping stations, besides further maintenance / replacement of the mechanical and electrical equipment at the end of the third quarter following the recent and ongoing pumping station improvement programme. This assumes that mechanical / electrical equipment has an asset life of 15 years (in line with experience in Jersey) and 60 years for civil works.

The asset refurbishment programme will be split roughly equally across the investment period (Years 6 to 20) as there are no asset conditions to make individual pumping station investment year specific (See Section 7.4 – Table 7.4 for the Summary of the Expenditure Profile).

7.2.3 Combined Sewer Overflows Capital Maintenance and Investment

Only minor capital maintenance investment is envisaged for the combined sewer overflows in St Helier, as they are primarily concrete structures of long asset life, however as mentioned previously, following the construction of the Philip Street shaft and sewer separation scheme the overflow settings associated with a number of the existing overflows in St Helier will be altered. Replacement of the mechanical assets (pumps) in the Cavern Storage facility has been assumed as being required in 2017 and 2027. The electrical assets (MCC panel) are in good condition and are envisaged to last longer than the 20 year strategy period, with only minor refurbishments, ICA upgrade etc.

7.2.4 Climate Change Investment

The potential for climate change impacts on the Jersey sewerage network has not been fully assessed. It has been assumed that in common with the southern part of England climate change will lead to increases in the magnitude of storm events within the Strategy period. This will increase the waste water flows to be handled by the network, the pumping stations, the overflows and the STW. In the absence of detailed modelling of the assets, a simple general allowance for upsizing the assets as they are maintained / renewed has been made of 5% of the projected maintenance cost.

7.3 Upgrading the Waste Water Catchment System

7.3.1 Sewer Network Upgrades

The St Helier sewerage system is considered to be able to accommodate projected development once planned surface water separation schemes have been completed. The existing shape of the strategic sewerage network draining to the First Tower Pumping Station has been assumed to remain the same and required upgrades to service development have been estimated. Further modelling works are currently being undertaken to determine the size of an online storage facility upstream of First Tower Pumping Station in order to address the flooding issues near the Beaumont Pumping Station caused by lack of capacity both potentially in the pumping station, as a result of the significant inflow and infiltration upstream of the pumping station, and in the trunk sewer upstream of First Tower Pumping Station.

A programme is currently being implemented to investigate, locate and resolve the infiltration / inflow problems across the Island. By using a combination of pumping station telemetry data and in-sewer flow monitors, a systematic investigation is being undertaken to identify the location and severity of the problem so that suitable remedial measures can be carried out. The infiltration into the sewerage network, and particularly that of sea water, must be addressed. This single issue has significant impacts throughout Jersey's waste water collection, treatment and disposal system where it causes under capacity, resulting in increased levels of flooding and CSO discharges to sea, damage, excess maintenance and odour problems.

Based on the population growth and spatial development for the projected 2035 population, an initial assessment has indicated that a substantial proportion of the existing sewerage network is already at capacity, mainly due to the significant amount of inflow and infiltration and therefore unless the amount of inflow and infiltration is substantially reduced into the sewer network, then the sewer network would require upgrading to cater for any development. It is possible to substantially reduce the cost of supporting development if it is concentrated in appropriate locations, for example, within existing developed areas. However, as detailed in the Island Plan 2011, the responsibility for the cost of making a connection and / or providing increased capacity in the public foul sewerage system and pumping stations, so as to accept any additional flow from the development, will rest with the developer.

It is proposed that the sewerage network be extended so that an additional 3% of existing properties could be connected to the public system, thus reducing potential pollution incidents caused by failure of septic tanks and tight tanks. However, until the inflow and infiltration into the network has been substantially reduced the level of flooding and CSO discharges to sea is potentially increased as a result of increasing the demand on a system (network and pumping stations) that is already known to fail at various locations during rainfall events. The inflow and infiltration reduction programme would also facilitate development opportunities and could be coordinated with the development programme to deliver the optimum benefits at least cost. The cost of the sewer extensions has been estimated at £42m giving an average cost of £30,000 per property for the additional 1,400 connections.

It is proposed that the network connections, surface water separation schemes and public contribution to new connections be reviewed over the business planning cycle to match Island priorities in terms of evolving development, environmental requirements and affordability.

Traditionally, sewer extensions and capacity increases have been provided by constructing additional sewers to connect to the trunk system that conveys flows to the Bellozanne STW. The exception is the successful implementation of the Bonne Nuit Scheme where new sewers were installed to convey sewage to a small local package treatment works rather than Bellozanne STW. This approach may be used again in the future if it is deemed uneconomic to connect a small, remote community to the Bellozanne catchment. There are drawbacks for operational and maintenance costs so this would be considered on a case by case basis.

No increase in the capacity of the surface water collection or disposal system has been included. It is assumed that any new development will be regulated through the planning process so as not to increase the rate of surface water runoff.

The proposed sewer network upgrade programme includes the following service improvements:

- construction of the Philip Street Shaft (currently under construction), completing the St Helier flood alleviation strategy;
- further surface water separation in St Helier to (i) provide capacity for future development; (ii) to reduce flows to treatment through surface and foul sewer separation; and, (iii) to further reduce the risk of CSO spills;

- upgrade sub-standard rising mains to reduce risk of bursts and subsequent pollution incidents; and
- repair or replace sewers known to be in poor condition to reduce infiltration and improve capacity at the STW.

7.3.2 Pumping Station Upgrades

Given the topography of the Island, additional pumping stations will be required as part of the sewer extensions programme due to the need to connect to the existing sewerage network. The capacities of the new pumping stations, both in terms of flow and storage volume would be compatible with the sewerage network capacity.

As mentioned previously there is ongoing investment to upgrade the existing pumping stations, particularly the larger pumping stations. This programme will continue to the smaller pumping stations in the future to further increase the proportion of pumping stations classified as being in good condition.

Some of the existing assets will be replaced / refurbished in order to meet a requirement to increase their capacity. This will also result in a reduction in capital maintenance requirements in the short to medium term. All existing pumping stations in the Island have been assumed as requiring some form of capital maintenance during the strategy period.

7.3.3 Combined Sewer Overflows Upgrades

It is assumed that there will be no increase in surface water runoff aside from the 7% increase in peak rainfall intensities caused by climate change. Except where noted elsewhere, it has been assumed that combined sewer overflows will not require upgrading as part of this Strategy.

7.4 Summary of Sewer Network Capital Expenditure

The capital expenditure profiles produced provide an indication of the required level of funding. The capital expenditure programme is shown in Table 7.4.

	Capital Expenditure by 5 year periods £m				**Total 20 year Capital £m**
	Year 1 - 5	**Year 6 - 10**	**Year 11 - 15**	**Year 16 - 20**	**Total**
Rising Mains (capital maintenance & new build)	£2.50	£2.50	£2.50	£2.50	£10.00
Sewers (capital maintenance/ surface water and seawater investigations and remedial works)	£23.31	£24.93	£3.53	£4.13	£55.90
Sewage Pumping Stations (capital maintenance)	£4.85	£3.63	£3.43	£3.63	£15.54
Sub Total	***£30.66***	***£31.06***	***£9.46***	***£10.26***	**£81.44**
Property Connections (to achieve 90% connection)	-	-	£21.00	£21.00	£42.00
General Management	£3.00	£2.60	£3.20	£2.40	£11.20
Total	**£33.66**	**£33.66**	**£33.66**	**£33.66**	**£134.64**

Note 1: Some elements, in particular, the phasing and capital maintenance elements are preliminary at this stage and will require further refining following completion of the surface water and seawater inflow and intrusion investigations and detailed analysis of the sewer hydraulic model.
Note 2: Rising main costs are based on replacement of 1km per year at £500/m (approx. current rate)
Note 3: Property Connections - Cost assumes connecting an additional 3% of properties. Number of properties in the Island is approximately 47,675 with 87% connectivity to the sewerage network. Additional 3% connectivity equates to approximately 1,400 properties at say £30k/ property. i.e. £42 million.

Table 7.4 – Sewer Network Capital Expenditure

As outlined in Table 7.4 it is likely that significant funding will be required to maintain or improve the current service levels and environmental status. In order to meet the priorities and achieve sustainable management of the waste water for the next 20 years, investment in the 5 yearly Infrastructure Capital Programme of approximately £135million or £6.75m per annum over the 20 year plan period will be required.

As noted previously following the recent completion of the sewerage network model a more detailed analysis of the sewerage network is required to prioritise future works and determine the associated costs. The inclusion of all site specific and project on-costs may mean that detailed analysis would indicate costs that could be in the order of 25% higher than those above.

8 Identifying Waste Water Treatment Options 2013 - 2035

8.1 Introduction

The following sections summarise the requirements to address the key parameters associated with identifying waste water treatment options.

The existing Bellozanne STW is undersized and at the end of its original design life. It does not consistently treat waste water to meet its effluent consent for Total Nitrogen and suffers from extensive biological foaming, a consequence of which is poor removal of suspended solids and lower bacteriological kill from the UV disinfection process. The situation will further deteriorate if the Island's population increases. As outlined previously a large number of the assets at Bellozanne STW are in poor condition and do not meet the current design standards. 'Do Nothing' has been discounted as an option at the outset.

Following discussions in June 2012, TTS and the Department of the Environment (DoE) have now come to a conclusion that the existing Bellozanne STW will never be able to achieve the required environmental standards for the current and future population until the works is replaced in its entirety.

Based on the past experience, further expenditure on major maintenance or upgrades to the existing assets is therefore effectively abortive as the treatment assets will remain sub-optimal in the short term and ultimately not be able lead to achieve the appropriate effluent quality standard. Therefore, the future investment has been based on the costs associated with the replacement of Bellozanne STW over the next 5 years, rather than continued maintenance to the existing works over the next 20 years.

There is potentially significant domestic development being considered by the States, with a forecast 2035 resident population of 130,279. The tourist population is currently not anticipated to increase above 15,000. Based on the current population connectivity of 87% of flows at Bellozanne STW, plus an allowance for future connectivity and the tourist population, the selected forecast design connected population is 118,000 in 2035. However, given the obvious uncertainty with such a wide range of potential growth it is proposed that the replacement of the STW is completed using conservative parameters. This will mean that some new structures are initially oversized but not to an extent that underloading causes performance issues.

For Bonne Nuit, it has been anticipated that replacement of the mechanical and electrical assets will initially be required some 20 years after commissioning of the plant, i.e. between 2023 and 2028, as part of the ongoing capital maintenance.

It is assumed that civils assets have a 60 year life while mechanical and electrical assets have a 15 year life. Provided that a new STW can be commissioned before 2020, theoretically, there should be minimal maintenance required for the new works in the remaining strategy period to 2035.

8.2 Levels of Investment

The proposed assumptions around levels of investment for the 2013 – 2035 strategy periods are as follows:

- A new STW will be constructed using conventional activated sludge plant with carbonaceous BOD removal, followed by monitoring of key water quality parameters in St Aubin's Bay for up to 5 years to confirm no deterioration or improvement to the current level of water quality as a result of the STW replacement.
- Provision will be made in the new STW design for potential population increases of up to 20% beyond the design horizon and to meet a tighter consent for effluent quality to avoid any deterioration of water quality in St Aubin's Bay.
- Ultra Violet disinfection tertiary treatment will be provided to all STW effluent discharges.
- Odour control will be provided to the treatment units that generate significant odour such as inlet works, sludge tanks and other units that are at risk of causing statutory nuisance.
- The flow to full treatment at the Bellozanne STW is assumed to increase from 600l/s to 830l/s with additional storm overflow storage facilities on site, which will eliminate the storm overflow events at the STW.

8.3 Sewage Treatment Works Options

The initial process options review to cover treatment works of varying magnitude was completed with a report entitled 'STW Treatment Process Review (Sept 2009)'. In consultation with the DoE, a further review was carried out in 2012 so as to ascertain what the options are surrounding the required discharge consent from the works and to determine the process options available to achieve these consents. Clearly the process design and selected technologies are largely driven by the consent standard required.

8.3.1 Process Options

The report entitled 'Bellozanne STW Best Available Technology Report (05/2012)' was completed to consider and recommend the most appropriate technology for the treatment of the Island's waste water, which included examining the advantages and disadvantages of each process.

The preferred treatment process regardless of consent standard required is the activated sludge process. This encompasses a variety of mechanisms and processes that use dissolved oxygen to promote the growth of biological floc. Activated sludge is a robust well known technology that is familiar to the operators at Bellozanne thus minimising any training that would be required. It also provides a high degree of flexibility of operation to allow for the variation in summer / winter influent conditions.

The Bellozanne STW Best Available Technology Report (05/2012) concluded that a conventional activated sludge process was the most appropriate technology. The level of treatment required will depend upon the assimilative capacity of the receiving waters. Based on the recent studies to date, St Aubin's Bay does not appear to be a sensitive water and therefore a conventional activated sludge plant with carbonaceous BOD removal would be appropriate.

Provision will be made in the new STW design for potential to meet a tighter consent for effluent quality. However, there will be more monitoring of St Aubin's Bay to establish the current quality of the waters. Therefore, the proposed layout at this stage makes provisions for adequate capacity in the design together with expansion capability on the site should an enhanced treatment standard be required in the future. The new STW will be designed to eliminate any overflows at the STW to St Aubin's Bay.

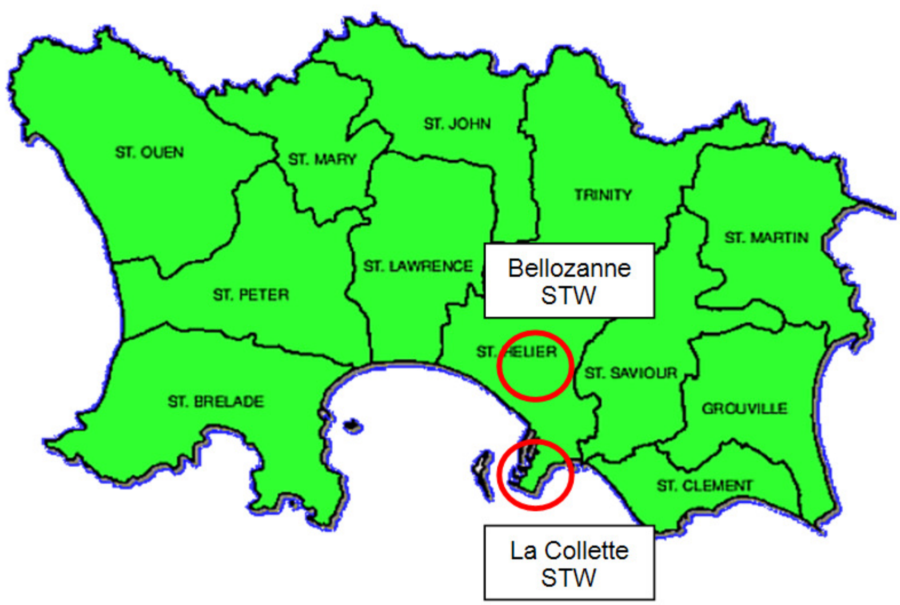
The evidence in St Aubin’s Bay is still being collected and the final results will have to be reviewed in conjunction with the Regulator as part of the ongoing discussions.

8.3.2 Potential Locations for new Sewage Treatment Works

The existing Bellozanne STW is severely constrained by the valley sides and extensions / modifications are difficult to accommodate. In addition to the relocation of the Energy from Waste plant, relocation of the Clinical Waste Incinerator and the Recycle Centre will free enough land to allow the phased replacement of the Bellozanne STW while it continues to remain in service.

‘STW Configuration and Locations Options Report (April 2010)’ addressed the potential locations for a new sewage treatment works. Options for providing the required treatment capacity on other sites have previously been considered and discounted on cost, including additional treatment facilities both on the south-west and south-east coast. These alternative sites were generally discounted due to the significant cost in revising the sewerage network to accommodate the location of a new treatment facility.

The majority of previously discounted options have not been reassessed for the WWS in 2013. However, the alternate location of La Collette, which was previously the second preferred option, has been revisited to ensure that no element or combination of elements in the costs is sufficient to change the preferred site. This comparison is detailed in Section 8.4.



8.3.3 Disposal Options

Outfalls to non-sensitive waters have to be of a length to ensure that effluent is diffused sufficiently at a location where no currents can bring it back to shore. Key elements of the outfall designs are:

- For Bellozanne, the existing outfall will be rehabilitated for its long term use together with the removal of any identified hydraulic restrictions.
- For the purpose of costing, it is assumed that a 2.5km outfall for La Collette is appropriate. It is assumed the receiving waters at this distance would be classed as non-sensitive, although this would be confirmed through detailed modelling.

As an alternative to the use of the existing outfall from Bellozanne STW to St Aubin's Bay, other potential final effluent discharge outfall locations to less nutrient sensitive waters in the north of the island such as Ronez Bay were considered. The total estimated cost for this option, including the associated pumping costs, is £35m which is substantially higher than the total estimated cost for upgrading and, if required in the future, extending the existing outfall at St Aubin's Bay. Such an option is therefore not considered as a viable option.

8.4 Evaluating the Options

Since the Jersey WWS was first prepared in 2009, TTS has been undertaking studies to develop it. There have been a number of previous issues of the WWS which have considered a wide range of options and only the highest ranked options from the original WWS have been updated and presented in Table 8.4.

The recent Bellozanne STW Feasibility Report (03/2013) has identified and appraised options to upgrade / replace the Bellozanne STW, to provide an efficient and reliable method of disposal, which allows for future changes in flows and loads. The feasibility report also includes a detailed assessment of the costs, cash flow profile and the preparation of a master plan for the development of the works.

The costs have been updated in line with the current estimates provided as part of the Bellozanne STW Feasibility Report and compared against the costs associated with a new works to replace Bellozanne STW at La Collette on the reclaimed land in St. Aubin's Bay.

The WWS is focussed on ensuring that statutory requirements and the Strategic Plan commitments are delivered in line with 'Best Available Technology Not Involving Excessive Costs' (BATNIEC) principles.

In accordance with UK best practice, costs have been divided into operational expenditure (OPEX) and capital expenditure (CAPEX). All CAPEX costs included in the Strategy are at 2012 prices. Costs / income associated with land purchase / disposal and site specific clearance are excluded from the evaluation.

All the options were initially evaluated according to their:

- Capital Expenditure (CAPEX);
- Environmental Impact Review;
- carbon footprint; and
- energy usage.

A summary of the outcomes of these assessments is given in Table 8.4.

	20 Year CAPEX	Environmental Impact Ranking & Score	STW Power (Million kWh per year)
Option 1: New La Collette STW to replace Bellozanne			
New STW at La Collette discharge into St Aubin's Bay	2nd £104M	2nd	Joint 1st 4.4
Option 2: Phased Replacement of Existing Bellozanne STW			
Phased replacement of Bellozanne discharging into St Aubin's Bay (no extension of the existing outfall)	1st £75M	1st	Joint 1st 4.4

Table 8.4 - Comparison of CAPEX and Environmental Assessment of the STW Options

8.4.1 Basis of the Phase 1 Environmental Impact Review

Environmental Impact Review (EIR) was carried out to consider the environmental impacts associated with the construction and operation of each option. A relative EIR was carried out initially. This ensured that environmental and sustainability considerations were evaluated as part of the selection process. The evaluation involved a screening exercise of all the options against the following common criteria:

- land take;
- resource use/ waste generation;
- proximity of STW to sources;
- energy usage;
- location / visual impacts;
- water quality;
- repairs and maintenance;
- transportation;
- nuisance; and
- archaeology.

Following this first phase assessment a more detailed second phase of environmental review was undertaken.

8.4.2 Basis of the Phase 2 Environmental Impact Review

The design options were assessed against the following 12 criteria. An environmental impact score was awarded for each of the 12 criteria on a scale of +5 (most positive environmental impact) to -5 (most negative environmental impact). A zero score encompasses meeting minimal legal requirements, minimal environmental damage and conferring minimal environmental benefits. The individual overall environmental impact score for each design option was summarised by totalling the awarded scores for each of the 12 assessment criteria.

Criteria	Objective
Biodiversity	To maintain and protect all statutorily designated environments (e.g. Ramsar sites) located in Jersey and surrounding waters and ensure sustainable management of non-designated environments and the ecological processes on which they depend.
Population	To improve the quality and capacity of the waste water treatment system to ensure sufficient capability is provided to meet the requirements of the anticipated future population growth.
Human Health	To achieve compliance with statutory bathing water quality targets, in addition to ensuring there are no measurable negative impacts upon human health, intake water quality at the desalination plant and local marine aquaculture associated with the method of sewage treatment.
Soil	To maximise re-use and regeneration of brownfield land and minimise disposal of waste to landfill during construction and operation.
Water	To ensure compliance with statutory water quality targets and minimise discharge of potential eutrophication forming effluent.
Air	To ensure compliance with local air quality targets and minimise release of air pollutants during construction and operation.
Climatic Factors	To provide a sustainable solution which addresses the causes of climate change by reducing energy consumption during waste water treatment and is resistant to the currently anticipated consequences of climate change.
Material Assets	To maximise material resource efficiency, including existing facilities and infrastructure, whilst sourcing additional raw materials from sustainable and ethical sources.
Nuisance	To minimise nuisance and disturbance to the local community, businesses and tourists during construction and operation.
Cultural	To maintain and protect identified and currently unidentified areas of cultural importance and heritage.
Landscape	To preserve and enhance statutory protected and important non-protected landscapes during construction and operation.
Inter-relationships	To implement environmental best practice throughout all stages of the project, including maximising opportunities for community and stakeholder involvement, to minimise potential for environmental incidents.

	Technical Score	Environmental Impact Ranking & Score
Option 1: New La Collette STW to replace Bellozanne		
New STW at La Collette discharge into St Aubin's Bay	+8	2nd
Option 2: Phased Replacement of Existing Bellozanne STW		
Phased replacement of Bellozanne discharging into St Aubin's Bay (no extension of the existing outfall)	+10	1st

Table 8.4.2 - Results of the Technical Phase 2 Environmental Impact Review (EIR) Scores

8.4.3 Basis of the more detailed financial modelling

The Net Present Cost (NPC) of a project is a summation of all costs: capital investment, operation and maintenance costs, replacement costs, energy costs any other costs etc. The NPC assessment covers a 20 year period with a discount factor of 6%.

The following elements are included in the analysis:

- Operating Expenditure (OPEX);
- Capital Expenditure (CAPEX); and
- Capital Maintenance Costs.

8.5 Summary of Net Present Cost Evaluation

A summary of the NPC estimates, which are over a 20 year planning horizon, is shown in Table 8.5.

	NPC
Option 1: New La Collette STW to replace Bellozanne STW	
New STW at La Collette discharge into St Aubin's Bay	£136M
Option 2: Phased Replacement of Bellozanne STW	
Phased replacement of Bellozanne discharging into St Aubin's Bay (no extension of the existing outfall)	£98M

Note 1: The NPCs are detailed in the 'Configuration and Options Report – Draft Issue 2, April 2010.
Note 2: The NPC assessment only includes capital and operating costs which vary between the options. They do not include complete capital and operating costs of operating the sewage service.

Table 8.5 – Summary of NPCs for selected Options

As shown in Table 8.5, Option 2 (Phased Replacement of Bellozanne STW at Bellozanne) has a lower NPC than Option 1 (New STW at La Collette). It should be noted that the capital and operating cost estimates used in the evaluation for the new STW at La Collette are appropriate for comparative purposes in line with the estimated costs for the replacement of Bellozanne STW. The Bellozanne STW replacement cost estimates were prepared as part of the Bellozanne STW Feasibility Report (03/2013).

8.6 Conclusions

Following completion of the earlier version of the Jersey WWS, it was determined that there were no merits in taking Option 1 (New STW at La Collette) forward because Option

2 (Phased Replacement of Bellozanne STW at Bellozanne) is the best performing option financially and environmentally. As a result the Bellozanne STW Feasibility Report was commissioned in order to outline the proposal for the new Bellozanne STW to replace the existing STW. This reassessment of the options has confirmed the conclusions reached previously.

Based on the latest CAPEX cost estimates, Environmental Review and NPC costs, Option 2 (Phased Replacement of Bellozanne STW at Bellozanne) remains the better performing option than Option 1 (New STW at La Collette).

The estimated total project cost for the replacement of the works at Bellozanne STW, including the relocation of the Clinical Waste Incinerator, is £75million, based on 2012 prices. A confidence level of plus or minus 15% can be expected at this stage. This estimate is based on the feasibility outline design work completed during the preparation of the Bellozanne STW Feasibility Report, with the new Bellozanne STW being designed and constructed as a conventional activated sludge plant with carbonaceous BOD removal to achieve a BOD / SS standard together with Ultra-violet disinfection of effluent.

The proposed Bellozanne STW replacement would also allow for any future expansion as dictated by future demand or if a tighter discharge consent is applied.

Assuming that St Aubin's Bay is confirmed as 'non-sensitive' and a conventional activated sludge plant with carbonaceous BOD removal to achieve a BOD/ SS standard is agreed with the Regulator, TTS is committed to monitor the performance of the new works to ensure it continues to meet the environmental requirements.

The future expansion may be completed in two phases to meet increasing demand or a tighter consent. The first expansion phase would provide additional conventional treatment capacity or allow for nitrification of the effluent. The second expansion phase would achieve a 'total nitrogen' standard i.e. nitrification of all ammonia followed by de-nitrification before discharge. To achieve a Total Nitrogen Standard the estimated total project cost for both expansion phases, including engineering and contingencies, is £30.8m based on 2012 prices.

9 Preferred Treatment Solution

9.1 Introduction

It should be noted that a future consent value for Bellozanne STW has not yet been confirmed with the Regulator as it is closely linked to completion of the studies on St Aubin's Bay. It is expected that the bay will be confirmed as 'non-sensitive' and the consent will include BOD / SS standard together with Ultra-violet disinfection standard for the effluent from Bellozanne STW.

The preferred treatment solution for Bellozanne STW is a conventional activated sludge plant with phased implementation of the sewage treatment facilities at the proposed Bellozanne STW operational site.

The Bellozanne STW Feasibility Report (03/2013) has been prepared which presents a plan for the replacement of the Bellozanne STW liquid stream and rehabilitation / partial replacement of the effluent outfall into St Aubin's Bay to meet the long term needs of the Island.

In order for the Bellozanne site to be viable in the long term, the report identified an operational location within the site with a view to ensuring that the current hydraulic and process constraints are eliminated. With these constraints in mind a potential site layout has been developed which would allow for a phased implementation of the replacement works. Based on the land available, future replacement works can be built within the boundary of the land already owned by the States, while the existing plant remains in service.

The site plan for the Bellozanne STW site has been developed based on the following considerations:

- compliance with EU UWWTD and Bathing Water Directive;
- proven treatment technology that can be managed effectively with local expertise;
- any upgrades to the sewage treatment works are compatible with the WWS;
- centralised sludge treatment and dewatering facilities, currently under construction;
- provisions for future expansion within the land owned by the States of Jersey;
- phased capital expenditure on the basis of an evidence-based effluent quality.

The new Bellozanne STW will be able to provide an efficient and effective operational site based on current design standards.

9.2 Proposed Site Layout

The proposed operational site layout as shown in Figure 9.2 below would allow for the maximum use of the existing facilities while the new facilities are brought into service as dictated by the demand. Works required in the short, medium and long terms can be optimised with minimal unnecessary expenditure.

The overall site layout makes provision for potential future secondary treatment upgrades such that the requirement for an additional ammonia standard or even total nitrogen standard can be incorporated. Furthermore, the proposals as shown would be able to cope with an increase in the flow and load by 20% beyond the design horizon scenario.

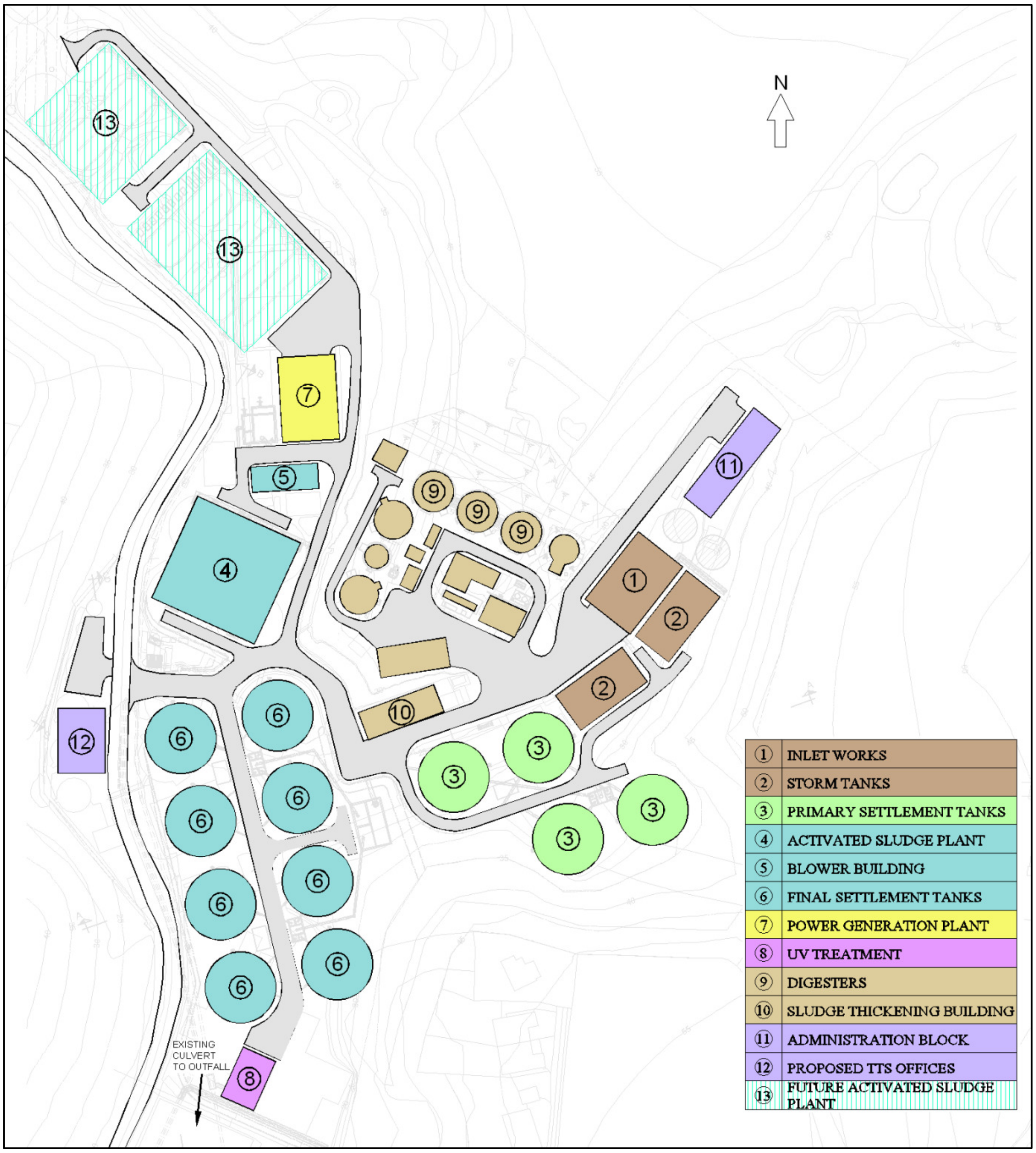


Figure 9.2 - Bellozanne STW Proposed Layout Including Growth Contingency

9.3 Programme for the Replacement of Bellozanne STW

The land available for the construction of the new STW, while keeping the existing STW in service in its entirety, is limited. The programme is therefore driven by sequencing work to minimise disruption to operations rather than minimising the overall duration.

In order to increase the footprint of the site, the existing wooded slopes surrounding sections of the STW will need to be excavated back and stabilised in advance of any new construction works. This excavation should allow the new STW to be sited within the existing boundaries and avoid the need for any land purchase or realignment of the main Bellozanne Valley Road.

The old Energy from Waste Plant on the site is currently being demolished under a separately funded project. All other buildings and structures will be demolished and removed to suit the phasing of the new STW and this work is therefore included in the new STW project.

As the existing works must remain in service at all times, the construction and commissioning of the new STW will be completed in two distinct phases in order to create the required space and to decommission the existing STW in stages without compromising the treatment capacity. However, it should be noted that some of the process units can be constructed under either Phase 1 or Phase 2 based on the funding availability although some of these elements will not be of use until Phase 2 is complete.

Phase 1 of construction of the new STW, following the Accommodation Works such as relocation of services, site remediation and hillside excavation, can be summarised as follows:

Phase 1

- Inlet Works, including screening and grit/ FOG removal
- Storm Tanks
- Primary Settlement Tanks
- Sludge Storage Tanks (replacement of existing)
- Administration Building

On successful commissioning of Phase 1, the existing Inlet Works, Sludge Storage Tanks and Primary Settlement Tanks and associated works will be demolished to make way for the remaining STW assets to be constructed under Phase 2 as follows:

Phase 2

- Activated Sludge Plant and associated works
- Final Settlement Tanks (if not constructed under Phase 1)
- UV Disinfection Plant (if not constructed under Phase 1)

If funding can be secured the detailed design and construction of the proposed works are expected to commence in 2014/ 2015 with completion in 2018.

Based on the feasibility design presented, it is recommended that the new Bellozanne STW is designed and constructed as a conventional activated sludge plant based on carbonaceous BOD removal to achieve a BOD / SS standard together with Ultra-violet disinfection of the effluent. The discharge standard may be altered in the future such that an additional ammonia standard or even a total nitrogen standard is required.

On commissioning of the new STW to replace the existing, it is proposed to monitor the key water quality parameters in St Aubin’s Bay for up to 5 years. In the event that there is a deterioration in water quality within the Bay as a result of the STW replacement, the works can be modified to achieve a higher standard of treatment, which includes both carbonaceous BOD removal and Nitrification (Ammonia) removal. To achieve a Nitrification (Ammonia) standard a further four lanes would be added to the activated sludge plant.

If following the upgrade of the works to achieve a Nitrification (Ammonia) removal standard there is further deterioration in water quality within St Aubin’s Bay or discharge standards change, the works may be modified further to achieve a Total Nitrogen (TN) removal standard of treatment. To achieve this higher standard a further three lanes (total seven additional over the original scheme) would be added to the activated sludge plant together with additional process modifications.

Figure 9.2 indicates the proposed site layout to construct a conventional activated sludge plant and identifies the areas for any future expansion of the Activated sludge plant as dictated by future demand or a tighter discharge consent.

In order to achieve a Total Nitrogen Standard the estimated total project cost for the future secondary treatment upgrades, including engineering and contingencies, is £30.8m based on 2012 prices.

In view of the uncertainty associated with the wide range of population growth scenarios under consideration, it is recommended to make provisions in the design for the future connected population to be up to 20% higher than the proposed 2035 design population of 118,000 such that only minor modification to the works will be required. Minor modifications would likely include increased blower capacity and changes to pump capacities. While the design horizon is considered to be reasonable it is based on a net population growth of +500 per annum and the Statistics Unit are currently considering scenarios with growth between nil and +1000. It is proposed that the design is completed on conservative parameters to achieve this flexibility rather than allowing for a higher population.

9.4 Sludge Treatment and Disposal

Sludge would continue to be digested, thickened and enhanced treated at Bellozanne STW, with as much as possible of the treated sludge being disposed to land. The most sustainable option is to recycle to agricultural land. However, to prevent over-nitrification in the winter (when plants do not grow and therefore do not take-up nitrogen), there will be times when it is not possible or appropriate to recycle to land. In this event the treated sludge will be disposed of at the Energy from Waste Plant at La Collette.

The existing anaerobic sludge digesters at Bellozanne are in critical condition, hence an improved sludge treatment facility is currently being constructed with planned completion by the end of 2014.

Recent trials involving composting enhanced treated sludge with green waste have been successful and may be an additional outlet. In terms of sustainability the composting of enhanced treated pasteurised sludge would be the next best alternative if the land recycling route is not available, with incineration as a last resort.

9.5 Effluent Outfall

The Bellozanne STW Feasibility Report (03/13) currently assumes that the extension of the outfall will not be required on the basis of assimilative capacity of the receiving waters resulting from evidence based policy to be agreed with the Environmental Regulator. Further data collection and water quality modelling at St Aubin's Bay will continue in 2013 / 2014 to demonstrate that the location of the outfall is suitable for the long term needs.

The condition survey and data collection to model the catchment and existing outfall will continue in order to determine the capacity and suitability for its continued use as an effluent outfall. Any required rehabilitation works and any hydraulic restrictions identified will be rectified as part of the proposed scheme to make the outfall viable for the long term needs.

The estimated cost to improve the aesthetics in terms of exposed effluent outfall pipe by the replacement of the exposed outfall and extension of the outfall to a point beyond the low water mark including engineering and contingencies is £4.0m based on 2012 prices. As the driver for an extension to the existing out is primarily 'aesthetics', any extension to the outfall is excluded in the new STW cost estimates in view of the current economic climate.

The Bellozanne STW is not the only discharge into St Aubin's Bay and many of the Island's streams also flow into the bay. These streams are monitored by the Environment Department and therefore it will be necessary to work closely to ensure that the recreational bathing waters are protected.

9.6 Discharge Consent Compliance Works

The existing activated sludge plant is undersized and the treated effluent does not comply with the total nitrogen discharge limit of 10mg/l (annual average).

Monitoring of the water quality at St Aubin's Bay will continue in 2013/2014 to determine an evidence based policy for an environmentally sustainable effluent discharge from Bellozanne STW. One of the most significant environmental benefits of the new STW development will be the elimination of storm overflow to St Aubin's Bay via the existing effluent outfall.

The treated effluent from the Bellozanne STW will be discharged to the sea via the existing outfall to St Aubin's Bay. To reflect the revised standard to a conventional activated sludge plant with carbonaceous BOD removal, the effluent quality requirements for the Bellozanne STW can be summarised as follows:

Suspended Solids	-	35mg/L
Biochemical Oxygen Demand (BOD_5)	-	25mg/L

This is a variation to the current discharge consent, hence further discussions and agreement must be reached with the Department of Environment at the earliest opportunity.

Ultra-violet (UV) disinfection of the effluent will be provided so as to safeguard bacteriological quality for bathing waters and shellfish beds. The consent standard for UV disinfection is currently based on the applied UV dose. However, should this change to an actual faecal coliform standard, and depending upon the actual standard applied, it is likely that the suspended solids concentration and particle distribution, even for a fully compliant effluent, would be too high to guarantee the faecal coliform kill required. Tertiary treatment via sand filters prior to the UV plant would then be required to ensure effluent compliance.

10 Strategy Review – The Way Forward

10.1 Asset Management

The Waste Water Service relies upon the assets (sewers, pumping stations, waste water treatment work etc.) that are used to deliver the service. Asset management as defined by the BSI Publicly Available Standard 55 (PAS55) is "The systematic and co-ordinated activities and practises through which an organisation optimally manages its assets and their associated performance, risks and expenditures over their lifecycle for the purpose of achieving its organisational strategic plan". Asset Management is increasingly seen as best practice by utilities and Government departments in the UK and internationally. The Waste Water Strategy is to have at its core the optimal management of the assets.

Historically, TTS asset management strategy has been based on replacing as many of the old assets or those causing operational problems as possible each year from the money allocated by the States, with little possible reference to the long term sustainability of this level of investment. This is similar to the approach in England and Wales pertaining prior to privatisation of the water industry. Since privatisation the approach has evolved. It started with 20 year asset management plans that identified the assets and their investment requirements. This was a major step forward from pre-privatisation as it ensured that all the assets were included and that the investment cycle was not constrained by the annual budget setting. However, it was initially done on a simple basis without detailed views of the asset lives and without an understanding of the link between customer service and the maintenance / improvement of the assets.

The Regulatory regime assumed that if customer service had been adequate in the past then no change in capital maintenance funding was required for the future. This did not take account of the assets deteriorating over time or of the asset inventories growing over time and changing in content as new types of plant to meet new quality standards were built.

It is accepted that the level of historical expenditure across the UK water utilities has been insufficient to maintain the asset stock in a sustainable condition and also that limited asset data and analysis has meant that it has not always been possible to target the limited funds in the best way.

To prioritise areas of funding TTS is continuing to condition grade their assets and their performance (against measures defined within the Strategy). This is to include completion of the CCTV programme for all category A and B sewers plus a representative sample of non-categorised sewers and the integration of all sewer network asset data onto InfoNET database.

The recently completed hydraulic model of the Island's sewer network together with spatial analysis of problems on the network is essential for planning and investing in the sewerage system.

The network model is now available to be used for the following tasks:

- assessment of the impact from new developments;
- inflow & Infiltration studies;
- CSO spill optimisation;
- Cavern storage optimisation;
- pumping station storage optimisation;

- planning and designing of capital schemes;
- emergency planning for operational incidents; and
- 'what if' scenarios.

10.2 Operational Aspects

Currently TTS operates a regular cleaning program in known trouble spots around Jersey to help maintain system capacity and avoid blockages. Continuation of this programme is considered essential.

Another problem affecting the sewers and the pumping stations is that of fats, oils and grease (FOG) from the many restaurants and hotels across Jersey. When not disposed of properly, these build up in the sewer system constricting flow, which can cause sewer blockages and increased sewer flooding during wet weather. It also interferes with treatment processes at the treatment works. To address this problem a FOG programme will be implemented to assist restaurants and other food service establishments with proper handling and disposal of their FOG. Initially this will involve visiting all the food service establishments (FSE) across the Island to check the proper sizing, installation, and maintenance of grease traps.

A best management practice guide will be developed for owners of FSE to prevent the discharge of FOG into sewers. Inspections will be carried out to ensure that the grease traps are properly installed, maintained, and operating effectively. Similar FOG programmes have been initiated by other water authorities around the world.

Surface water separation schemes in St. Helier will be continued to reduce the wet weather impact on the downstream system and on the treatment works. This will also result in a reduction in spill frequency and volume of spills to the Cavern.

A programme is currently being implemented to investigate, locate and resolve the infiltration / inflow problems across the Island. By using a combination of pumping station telemetry data and in-sewer flow monitors, a systematic investigation is being undertaken to identify the location and severity of the problem so that suitable remedial measures can be carried out. The infiltration into the sewerage network, and particularly that of sea water, must be addressed. This single issue has significant impacts throughout Jersey's waste water collection, treatment and disposal system where it causes under capacity, damage, excess maintenance and odour problems.

Energy efficiency should be an integral part of sewerage system operation. In water utilities across the world there is an increased awareness in the importance of saving energy and reducing daily operational costs. For example in view of the fact that the sewerage system in Jersey is heavily pumped there are operational strategies in place to improve system efficiency and reduce operating costs with any new upgrade. This includes selecting the most efficient pump, the use of variable speed drives on the pumps, one man lift access covers, self-cleaning pumping stations to reduce both cleaning and call out costs and intelligent control panels to allow the most flexible control possible etc.

10.3 Procurement Strategy

This Strategy envisages a significant increase in expenditure to both maintain the assets and to meet development requirements. There are projected peaks of expenditure to resolve the service problems, but long term maintenance programmes are projected to be higher than current levels.

Consideration will be given as to how this enlarged expenditure programme is procured. The programme has been in effect run on an annual basis as part of the States overall budget setting. The privatised English and Welsh companies have benefited from the ability to plan for longer periods and have mostly opted for long term (five years, or more) framework contracts, partnerships and alliances so as to optimise efficiency. The current programme in Jersey is based on the 5-year Infrastructure Capital Programme.

These arrangements invariably include setting and monitoring of target outputs and costs with sharing of risks / gains. The Jersey construction market may not be able to support some of these approaches for the Waste Water service on its own. There may be opportunities for integrating procurement across a number of the services provided by the States. This approach can be applied to the sewer and pumping station programmes, but not so easily to the one-off STW expenditure.

There is almost certainly benefit in monitoring unit costs and in setting target costs. It is recommended that the procurement strategy for the future programme be reviewed.

10.4 Future Efficiencies

The cost of providing the Waste Water Service in Jersey has been benchmarked against the English and Welsh water industry. This produces a simple view on the efficiency of the service and on its current level of capital expenditure. The strategy suggests that a significant increase in capital expenditure and maintenance is required to simply maintain the assets and a significant increase would be required to resolve the service issues and accommodate development.

It is difficult to assess a relative efficiency position for Jersey. Jersey is of a different scale to the English and Welsh water and sewerage companies and there are also a number of ‘special factors’ that will influence this, such as its Island location.

It is also noted that companies should be viewed in the light of their service delivery over time as well as their relative efficiencies. This is because they can under-spend on their capital maintenance and appear relatively efficient but this will be at risk of their service delivery deteriorating.

The scope for efficiency in Jersey is likely to be larger than in the UK companies and could be in excess of 3% p.a. for OPEX and 10% for CAPEX. A review of the business processes and the organisation is recommended before efficiency targets are set. Consideration may have to be given to achieving efficiency through integrated approaches with other States departments and / or potentially private sector companies. This will be reviewed as part of the Business Case development.

English and Welsh water companies report their capital expenditure requirements to Ofwat under four categories; these are:

- maintenance – e.g. expenditure to keep a sewage pumping station operational;
- improved service – e.g. expenditure to reduce a flooding design frequency (from 1 in 10 years to 1 in 30 years event);
- quality enhancement – e.g. expenditure to address changes in environmental legislation;
- new / increased demand – e.g. expenditure to address additional housing or increased growth.

10.5 Business Processes

Asset management is seen as best practice for asset intensive utilities such as water and wastewater companies. Asset management consists of an integrated set of processes and objectives that flow through the business. The Executive staff set the business risk policies, the service standards and objectives, and ‘owns’ the processes to deliver the objectives. Key elements are:

- clear service standards and targets with recording of incidents/service failures;
- asset inventory - complete, accurate and up-to-date;
- operation and maintenance targets aligned with investment targets;
- investment process driven by business risk and linked to business-as usual;
- tracking and targeting of costs;
- Value and Risk Management approaches built into the business processes;
- quality control built into the business processes;
- Continuous Improvement; and
- ensuring the organisational structure, processes and tools are appropriate to the particular business. Major benefits can be obtained without sophisticated tools and processes.

10.6 Performance Assessment

In order to provide an objective measure of Waste Management Services’ performance in the management and operation of the waste water collection, treatment and disposal facilities it is proposed to introduce an overall performance assessment. This will be based on best UK practice using applicable elements of the measures used by OFWAT and the Water Industry Commission for Scotland (WICS). Potential measures are:

Outputs

- Health and Safety Incidents;
- STW compliance;
- Category 1 , 2 and 3 pollution incidents;
- number of properties at risk of flooding (for defined storm);
- CSO overflows;
- odour complaints;
- asset condition (assessed on a 5 yearly basis); and
- number of properties connected to sewers.

Others

- operating expenditure per population equivalent;
- length of sewers replaced and renovated per annum;
- total flow rate of pumping stations renovated/annum; and
- number of pumping stations and sewers with increased capacity/annum.

11 Funding and Delivery of the Strategy

The funding, procurement and delivery of the Waste Water Strategy will require detailed consideration to ensure that the implemented service offers value for money over the 20 year period.

11.1 Potential Funding Sources

Potential funding sources include:

- direct taxation (as currently);
- borrowing
- infrastructure charges to be levied on Developers;
- direct customer billing for Sewerage and Drainage Services; or
- a combination of the above (potentially introduced in phases)

These will be investigated during the implementation of this Strategy with a view to adopting the best balance of charging sources for the States of Jersey.

11.2 Funding the Sewer Network Upgrade

TTS has recently secured additional funding in the form of the Infrastructure Capital Programme for asset replacement, which contributes towards the provision of funding for rising mains, sewers and pumping stations.

In order to meet the priorities and achieve sustainable management of the waste water for the next 20 years, investment in the infrastructure capital programme of approximately £135 million or £6.75m per annum over the 20 year plan period will be required to maintain or improve the levels of service and environmental status.

This works out at an average yearly cost per property of approximately £170, allowing for the projected development, but not assuming any commercial income.

The expenditure is a significant increase on recent levels, where the service provided has been funded directly from taxation.

11.3 Funding the Replacement of Bellozanne STW

To enable Bellozanne STW to be replaced in the shortest possible timescale, additional funding would need to be secured, which would be a significant addition to the current allocated Infrastructure Capital Programme funding over the next 5 years.

The estimated total project cost for the replacement of Bellozanne STW, including the relocation of the Clinical Waste Incinerator, is £75million, based on 2012 prices. This estimate is based on the feasibility outline design work completed to date, with the new Bellozanne STW being designed and constructed as a conventional activated sludge plant with carbonaceous BOD removal to achieve a BOD / SS standard together with Ultra-violet disinfection of the effluent.

The cost profile shall assume that expenditure for the replacement of Bellozanne STW will be spread throughout a 5 year period to allow sufficient time for approval of the strategy and activities such as planning, design and construction. There is also a need to tie-in with the relocation of the Clinical Waste Incinerator from Bellozanne which is programmed to be relocated to La Collette by the end of 2014 under this project.

This additional funding required for the new STW will either have to be funded by additional borrowing or direct taxation.

11.4 Scope of Programme Delivery

The overall scope of the proposed implementation can be adjusted flexibly according to the affordability of the programme. For example:

- Additional connections to the foul sewage system could be limited to the current 87% connection level, or increased to a level below the 90% connection level proposed in this Strategy. Based on the established priorities, the proposed spend profile assumes the surface water separation, and sewer maintenance and upgrades over the first 10 years, and the provision of additional property connections to the network over the last 10 years.
- In line with the Island Plan 2011 the responsibility and cost of making a new connection and / or providing increased capacity in the public foul sewerage systems and pumping stations cost, should be borne by the Developers.
- The progress towards achievement of foul and surface water separation could be slower than that proposed within this Strategy.
- Any changes to the envisaged programme could potentially increase the risk of asset failure and slower introduction of replacement assets may have associated environmental consent compliance issues. Slower phasing of investment would also have the effect of 'back-loading' the overall cost of the Strategy.

11.5 Delivery Mechanisms

The delivery of the strategy could be through a variety of means. For example:

- in-house Direct Service Organisation (for example, as currently delivered by Transport and Technical Services);
- a States-owned Trading Operation (for example, Jersey Fleet Management or Car Parking);
- a wholly States-owned Operating Company or Trust (for example, Jersey Harbours or Jersey Airport);
- a Joint Venture for a defined service delivery (for example, Jersey Family Nursing);
- a Private Public Partnership (for example, the Operating Finance Lease employed to fund Mourier House);
- A fully externalised service - either wholly or partly privately owned (for example, Jersey Electricity Company or Jersey Water).

Each of these delivery mechanisms has its own risks and opportunities. Based on the initial investigations during the development of the Waste Water Strategy, it is anticipated that the current delivery mechanism is expected to continue for the foreseeable future as it offers the best value for money in delivering the required level of service.

12 Recommendations

The WWS will enable the Minister for Transport and Technical Services to fulfil the obligation to Islanders to prevent pollution and maintain public health by dealing safely and efficiently with waste water.

The Strategic Plan 2009-2014 provides the high level direction for the Island's services and this will translate the following recommendations into detailed short, medium and long term delivery plans to ensure that clear strategies, action plans and success criteria are developed for each of the priorities. The WWS focuses on the principles of reduce, manage and invest as adopted by the Island Plan.

The Strategy aims to ensure:

- the Island's bathing water, aquaculture and natural environment is protected;
- Jersey's waste water is dealt with safely and efficiently and in accordance with international best practice and standards; and
- The system can meet the current and future needs of the Island.

Capital replacement and maintenance of the Island's main waste water assets will require investment over the next 20 years to allow the efficient collection, treatment and disposal of the Jersey's waste water to continue.

12.1 Waste Water Collection

In order to reduce the amount of water that flows into the sewerage network for treatment, TTS will prioritise work to reduce infiltration to sewers that are in poor condition. TTS will also continue their programme of separating the surface water (rainwater) from the foul water sewers. This will effectively increase the capacity of the system to carry foul waste water from new and existing properties and ensure that only foul waste water is treated by the STW at Bellozanne.

A parallel programme of work to specifically address seawater intrusion problems across the Island will be carried out. Seawater intrusion both reduces the capacity in the system and has an adverse effect on the treatment process.

Alternative sustainable techniques for reducing flows entering the STW at Bellozanne, such as Sustainable Urban Drainage Systems (SUDS), will be promoted for use on all new developments and as part of any programme to connect existing properties to the sewerage network. These store or attenuate flows and can provide a certain level of treatment for surface water before discharge. Through the planning process these advances in sustainable techniques will become accepted practice. The Minister for Planning and Environment, as part of the planning policy, now expects proposals for new development and redevelopment to incorporate Sustainable Drainage Systems (SUDs) into the overall design wherever practicable.

Consideration will be given to adopting an integrated water resource management strategy such as grey water and water recycling schemes. This type of approach requires public engagement and support and is likely to be phased in as the drive for better environmental and sustainable solutions accelerates.

All the above points will ultimately result in a reduction in flows at the treatment works, but any single point will be of limited benefit in the short term in isolation. From recent studies it is considered that many of the problems associated with lack of capacity in the sewer network could be reduced, and in many cases removed, if the locations of the worst infiltration can be determined and subsequent remedial measures carried out. This single issue has significant impacts throughout Jersey's waste water collection, treatment and disposal system, by affecting the capacity of the system this leads to increased levels of flooding and CSO discharges to sea, high levels of hydrogen sulphide which attacks pipes etc. causing corrosion, excess maintenance and odour problems.

To address the issues raised during the Drainage Area Plan Study (sewerage network model) an asset management plan to prioritise investment to upgrade and maintain the 116 pumping stations thus reducing the risks of flooding and the frequency of spills to sea.

Additional storage capacity will be provided for the west of the Island, likely to be in the vicinity of the existing Beaumont SPS. This will reduce the number of spills of diluted waste water from the network during storm events.

The existing network must be brought up to the required standard and once this has been achieved it can be expanded to include more properties in those areas where it is economically viable to do so.

The projected estimated costs over the next 10 years to investigate, locate and resolve the infiltration issues, replace and upgrade the existing sewer infrastructure including undertaking essential maintenance of the existing pumping stations and resolving the flooding issues is £67.5million, based on 2012 prices. This will be funded by the Infrastructure Capital Programme.

12.2 Waste Water Treatment

The existing STW at Bellozanne is over 54 years old and has been continually improved and upgraded to meet changing requirements and increased environmental standards. However, it is now under capacity, incapable of meeting one of the required regulatory standards and operating costs are high. The STW has reached the end of its useful life and it is not feasible to upgrade the existing assets further. A new STW is, therefore, the only viable option to meet the existing and future requirements. The key recommendations for Waste Water Treatment are:

- The new STW will be built on the existing Bellozanne site. This site has sufficient space to allow a phased replacement while keeping the old STW in operation and there will be no need for costly modifications to the existing sewerage network.

- Pending confirmation of the discharge consent conditions, sewage treatment will be based on the proven conventional activated sludge process with carbonaceous BOD removal. This technology is widely utilised in the industry, familiar to our operators and provides a high degree of flexibility to allow for the fluctuations in population and weather patterns in the future.

- Ultra-violet (UV) disinfection of the effluent will be provided so as to safeguard bacteriological quality for bathing waters and shellfish beds.

- The design horizon is for a connected population of 118,000 in 2035. The works will be designed to be easily expanded to take account of higher population growth or changing discharge consent conditions on the basis of water quality monitoring of St Aubin's Bay.

The new STW will provide essential increased capacity and improve reliability. With the provision of additional storage facilities at the STW, there will be no spills of untreated waste water from the STW and the risk of pollution to Jersey's coastal waters will be reduced to a minimum.

The estimated total project cost for the replacement of the works at Bellozanne STW, including the relocation of the Clinical Waste Incinerator, is £75million, based on 2012 prices. This additional funding required for the new STW will either have to be funded by additional borrowing or direct taxation.

The future expansion may be completed in two phases to meet increasing demand or a tighter consent. The first expansion phase would provide additional conventional treatment capacity or allow for nitrification of the effluent. The second expansion phase would achieve a 'total nitrogen' standard i.e. nitrification of all ammonia followed by de-nitrification before discharge.

The ongoing project to replace the sludge treatment facilities involves enhanced sludge treatment achieved by a pasteurisation process followed by anaerobic sludge digestion. Methane gas produced during the treatment process will be utilised for heating of the sludge and power generation to meet approximately a third of the power requirements for the new STW.

12.3 Effluent & Biosolids Disposal

The output from the new STW will continue to be in the form of treated waste water and biosolids.

The treated waste water from Bellozanne STW will be discharged to St Aubin's Bay via the existing outfall which will be suitably refurbished.

The standards for the discharge will be set by the Jersey Environmental Regulator based on the receiving water quality and in accordance with international best practice and standards.

An ongoing programme of monitoring in St Aubin's Bay will track the quality of the receiving water and if deterioration is identified as a result of the replacement of the STW then the STW will be upgraded to suit in stages.

The sludge as a by-product will be processed to produce methane gas for power generation and, following enhanced treatment, will be used as a fertiliser on farmland in accordance with the best practice and standards.

12.4 The Future

This strategy incorporates current best practice, but recognises that the collection, treatment and disposal of waste water is a developing area and is subject to steadily evolving legislation and forecasted population increase.

Through regular review, the strategy can therefore be developed to accommodate:

- future technological advances;
- future legislative and environmental requirements;
- future population changes; and
- future changes to level of service.

APPENDIX A – LIST OF SUPPLEMENTARY REPORTS

1. Bellozanne Master Plan for the STW (July 2009)
2. Bellozanne STW Treatment Process Review (Sept 2009)
3. STW Configuration and Locations Options Report (April 2010)
4. Bellozanne STW Operation Strategy (May 2011)
5. Bellozanne STW Best Available Technology Report (May 2012)
6. Jersey Drainage Area Plan Needs Report (July 2012)
7. Bellozanne STW Feasibility Report (March 2013)