States of Jersey

Liquid Waste Strategy

Bellozanne STW Master Plan

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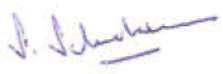
Checked By:	Jason Ball	pp 	13/07/09
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EXECUTIVE SUMMARY

The States of Jersey commissioned a Liquid Waste Strategy, the objective of which was to identify any necessary upgrades to wastewater collection, treatment and disposal facilities. This is to ensure that operational practices and procedures are in accordance with best practice.

The current sewage treatment facilities at Bellozanne suffer from a number of operational problems and the works does not meet its current discharge consent. In addition, there are environmental and health & safety concerns. Investigations have been undertaken to improve the performance of the facilities and works have been constructed to reduce the odour problems, albeit with limited success. The resident population is predicted to increase in the future, together with an increase in the number of properties connected to the main sewerage system; such factors will exacerbate the current problems. Whilst EU legislation is not applicable to Jersey, it is the benchmark, and the Urban Wastewater Treatment Directive imposes a tighter discharge standard than the current one. Hence, there is a need to identify and appraise options to upgrade the sewage treatment works, and the outfall arrangements, to provide an efficient and reliable method of disposal, which allows for future changes in flows and loads.

The draft Liquid Waste Strategy appraised a number of treatment and disposal options at Bellozanne and other locations. Following consultation with key stakeholders and some further studies and investigations, Bellozanne has been highlighted as the most suitable site for a sewage treatment works. In addition, a further option was identified over and above those in the draft Liquid Waste Strategy. This comprises an upgrade of the existing works to provide a conventional activated sludge plant and to discharge the final effluent to non sensitive waters by way of a long sea outfall. The sludge treatment and disposal facilities are to be improved in accordance with previous studies.

This Master Plan principally deals with this further option and sets out the necessary short, medium and long term works.

The waste recycling and the clinical waste incinerator at Bellozanne are due to be relocated and this area could be utilised for sewage treatment facilities. Additional space could be gained by excavating the valley sides and some high ground with the removal of the house and effluent storage reservoir. Hence, the upgraded works would fit within the boundary of land already owned by the States and the key treatment stages as required could be constructed to the east of the existing plant. The principal benefits of this further option are that construction would be simpler, and hence less expensive, and the existing or upgraded treatment processes could remain in operation during construction, which is preferred for operational reasons.

A study of the environmental impacts of the sea outfall is underway. An Environmental Impact Assessment will need to commence shortly given that its duration will be some 18 months.

Subject to approval of the Project Board, this further option will be assessed on a whole life cost basis to determine its cost effectiveness and the spend profile to provide what is an integral part of the draft Liquid Waste Strategy.

1 INTRODUCTION

This report presents a Master Plan for the development of the Bellozanne Sewage Treatment Works (STW). It should be read in conjunction with the latest draft (January 2009) of the Liquid Waste Strategy (LWS), which provides the overall direction for sewerage and sewage treatment facilities in Jersey.

The LWS was prepared by Grontmij and will be subject to further stakeholder consultation and approval by the States of Jersey. The issues raised at the stakeholder workshop on 12 February 2009 will be incorporated into the final version of the LWS. This Master Plan deals primarily with the issues that are relevant to the STW and takes account of information that has become available since that time.

1.1 Background

The States of Jersey commissioned Grontmij to prepare a LWS, the objective of which was to identify any necessary upgrades to wastewater collection, treatment and disposal facilities. This is to ensure that operational practices and procedures across Jersey up to and including 2028 are in accordance with current and future international regulations, and best practice.

Key stakeholders have been involved in the development of the LWS. The stakeholders were in general agreement with the approach outlined at the workshop in February and suggested a number of areas for further development; refer to notes of the workshop, which are included in Appendix A.

The favoured treatment options highlighted in the draft LWS can be summarised as follows:

Selected Options
Option 1
(i) Bellozanne STW + new side stream plant with discharge into deep water via a long sea outfall
(ii) Bellozanne STW + new side stream plant with discharge into St Aubin's Bay via an extended short sea outfall
Option 6
(i) Relocate STW to La Collette and discharge into deep water via a long sea outfall
(ii) Relocate STW to La Collette and discharge into St Aubin's Bay via an extended short sea outfall

Financial analyses indicate that the whole life costs for treatment at Bellozanne or La Collette are within 10% of each. Option (i), remaining at Bellozanne and discharging effluent via a long sea outfall, has marginally the lowest whole life cost.

Two of the main issues highlighted during the workshop were the location of the STW and the level of treatment to be provided. With regard to the latter, if the effluent is discharged to nitrogen sensitive waters, a higher level of treatment would be required. Bellozanne was also highlighted at the workshop as the more suitable of the sites and a further option (Option 7) was identified. This comprises an upgrade at Bellozanne to provide a conventional activated sludge plant and to discharge the effluent to non sensitive waters via a long sea outfall. The upgraded works could fit within the land already owned by the States and the key treatment stages as required could be

constructed to the east of the existing plant. The benefits of this are that construction would be simpler and the existing or upgraded treatment processes could remain in operation during construction. The will result in an efficient and effective site for the provision of sewage treatment.

1.2 Purpose

Grontmij have prepared this Master Plan document for Option 7 and it deals with the proposed works at Bellozanne and the options for the outfall. It considers work which will be required in the short, medium and long term. There is a need to make best use of those existing assets which are in good condition and minimise any unnecessary expenditure. The works should be designed to accommodate future flows of sewage and changes in the discharge regulations.

The States of Jersey are currently consulting on a draft Island Plan in which the future plans for the Island's waste management strategy to 2035 are set out. Integration of the Island Plan with this Master Plan and the LWS and is essential to ensure an efficient and coherent vision for the development of Bellozanne STW.

2 JERSEY AND WASTEWATER

Jersey is responsible for dealing with its own waste. However, options are more limited and are governed by:

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

There is increasing pressure on the Island's resources, which will be exacerbated by climate change. It is, therefore, imperative that the States of Jersey address such issues in a coherent manner to allow sustainable growth and development.

2.1 Wastewater

Currently 87%[1] of the existing residential properties are connected into the sewerage system; the remaining properties discharge into private STWs, septic tanks or tight tanks. The majority of the sewerage system drains to Bellozanne STW in the south of the Island; a small number of properties on the north of the Island are served by a packaged treatment plant at Bonne Nuit.

2.1.1 Physical Catchment

Jersey comprises numerous small sub-catchments, most of which form rivers that flow from north to south. Having a fairly centralised main treatment facility, flows of sewage are delivered by way of a mixture of gravity sewers and rising mains.

Figure 2.1 - Aerial View of Jersey showing approximate location of Bellozanne STW

[1] Telephone conversation with Steve Bohea (T&TS), 25th June 2009.

2.1.2 Sewerage System

The sewerage systems are a mixture of combined and separate systems. Because of its age, the combined sewers are generally concentrated in and around St. Helier; the remainder of the Island is principally served by separate systems. There are 103 sewage pumping stations, which are operated and maintained by Transport & Technical Services (T&TS).

2.1.3 Treatment Works

Up until the 1950s, untreated sewage was discharged directly onto the beaches, with obvious concerns for public health. Having decided that treatment was required Bellozanne was an obvious choice because, at that time, it was relatively remote and the natural centre of the drainage system.

Bellozanne STW was commissioned in 1959 and designed to provide full treatment for a population of 57,000 and produce an effluent to Royal Commission standards. It has been improved and upgraded to take account of changes in flows, higher environmental standards and improved process technology. Presently, it treats flows from a resident population of 78,950[2] and a summer peak of approximately 94,428.

The Discharge Permit (DC2999/07/01), which comes under the Water Pollution (Jersey) Law, 2000, requires the annual average total nitrogen concentration to be less than 10mg/l and suspended solids less than 35mg/l (on a 95 percentile basis).

2.1.4 Disposal System

The final effluent from the works is discharged via an outfall into St Aubin's Bay near the First Tower area. The effluent is discharged to mean high water level, whereas best practice in the UK is to discharge beyond this to avoid the outfall being exposed for long periods. In the 1990s, T&TS made the decision to install UV disinfection at the works to reduce bacteria levels in the effluent; this was the first of its type in the British Isles.

2.2 Population Projections

2.2.1 Current Population

Population statistics for 2008, released by the States of Jersey Statistics Unit, indicate that the resident population is 91,800[3]. Tourism brings in a further 375,900 visitors per annum. With a maximum available adult bed space of 12,700, this equates to an approximate maximum tourist population of 15,000[4], including children.

There is also a further increase in the seasonal population as a result of the influx of workers and visiting friends and relatives. The Labour Market Report of 2008[5] identified an increase of 3000 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.

[2] Based on Jersey Population Update 2008, States of Jersey Statistical Unit - http://www.gov.je/NR/rdonlyres/105821C3-2A82-480F-A887-C1F4CFBA67FA/0/2008populationupdate.pdf
[3] Jersey Population Update 2008, States of Jersey Statistical Unit - http://www.gov.je/NR/rdonlyres/105821C3-2A82-480F-A887-C1F4CFBA67FA/0/2008populationupdate.pdf
[4] Telephone conversation with First Research, 8th June 2009
[5] Jersey Labour Market at 2008, States of Jersey – http://www.gov.je/NR/rdonlyres/E0C5C2FD-63CF-4102-B57D-257444377751/0/manpower2008dec.pdf

2.2.2 Projected 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 correspond to total population increases, including dependants, of 320, 540, 700 and 1400 respectively.

The projections are based on the 2001 census data, aged to 2005, and forecast at regular intervals up to 2065. The most recent population projections under the different migration scenarios are summarised in Table 2.1. The population for 2008 is in the range 88,880 to 90,500, depending on the migration scenario. This is less than the current provisional 2008 population of 91,800.

Scenario	2005	2008 (Interpolated)	2010	2015	2028 (Interpolated)	2035	2065
Net NIL	88,400	88,880	89,200	89,200	87,940	87,100	72,100
+150hh	88,400	89,240	89,800	91,400	95,320	96,800	95,400
+200hh	88,400	89,360	90,000	92,100	97,780	100,100	103,200
+250hh	88,400	89,480	90,200	92,800	100,280	103,400	111,100
+325hh	88,400	89,660	90,500	93,900	104,020	108,300	122,900
+650hh	88,400	90,500	91,900	98,600	120,060	129,500	174,000

Table 2.1 - Projected populations from the States of Jersey Statistical Unit

Tourist numbers are difficult to forecast as they can be affected by a wide range of variables, most notably the state of the economy. Indications from First Research[6] are of no growth in the near future and, therefore, it is assumed that the tourist population will remain constant at 15,000 over the forecast horizon. Similarly, due to a lack of information, workers and visiting friends and relative numbers are assumed to remain constant at 3,000.

Given the 2008 estimate is significantly higher than the latest population model[7], it would be prudent for the purposes of flow forecasting to take the higher value. Therefore, the projected populations shown in Table 2.1 should be uplifted to account for the current 2008 population estimate; the figures for tourists and workers and visiting friends and relatives should be added. This results in the maximum total population for Jersey as shown in Table 2.2.

[6] First Research have been commissioned by States of Jersey to provide historical tourism data
[7] The Jersey Population Model, States of Jersey, 2009 - http://www.gov.je/NR/rdonlyres/E80D30B2-4582-4163-9B57-48AE4328B7CC/0/Populationmodel2009paper.pdf

Scenario	2008	2010	2015	2028	2035	2065
Net NIL	109,800	110,120	110,120	108,860	108,020	93,020
+150hh	109,800	110,360	111,960	115,880	117,360	115,960
+200hh	109,800	110,440	112,540	118,220	120,540	123,640
+250hh	109,800	110,520	113,120	120,600	123,720	131,420
+325hh	109,800	110,640	114,040	124,160	128,440	143,040
+650hh	109,800	111,200	117,900	139,360	148,800	193,300

Table 2.2 – Estimated Maximum Island Population

As noted previously, approximately 87% of properties were connected to the sewerage system in 2008. It is assumed a further 1400 properties will be connected by 2028, over and above the expected population growth. This is primarily as a result of properties converting from septic and tight tanks for environmental reasons. The maximum population projection for Bellozanne STW is shown in Table 2.3. The 150 households' heads figure is used by States of Jersey for planning purposes.

Scenario	2008	2010	2015	2028 (Interpolated)	2035	2065
Net NIL	95,526	96,168	96,949	97,643	96,756	81,756
+150hh	95,526	96,408	98,789	104,663	106,096	104,696
+200hh	95,526	96,488	99,369	107,003	109,276	112,376
+250hh	95,526	96,568	99,949	109,383	112,456	120,156
+325hh	95,526	96,688	100,869	112,943	117,176	131,776
+650hh	95,526	97,248	104,729	128,143	137,536	182,036

Table 2.3 – Projected populations connected to Bellozanne STW

For the purposes of this study, it is assumed that the maximum population connected to Bellozanne STW in 2028 will be 110,000. This is approximately the average of the connected population and the total island population at 2028, namely 104,663 and 115,880. A 20% contingency results in a maximum population of 132,000. This contingency, or headroom, allows for uncertainty in, amongst other things, climate change, creep[8] and future changes in law or planning policy.

The figures in Table 2.3 assume an average connectivity to Bellozanne of 87% in 2008. At the time of writing, further information is awaited from T&TS on the distribution of connectivity across the Island. This, together with parish-based household forecasts provided by the States of Jersey Statistical Unit, will enable a more accurate forecast of population growth by area to be made in the future.

2.3 Wastewater Flow and Load

2.3.1 Current Flow and Load

The existing works is designed with a flow to full treatment (FFT) of 600l/s.

[8] Creep is defined as the impermeable area from developments at the sub-property (e.g. paving over gardens) which delivers additional surface water load to a network.

Table 2.4 shows the range of flows which enters the works from the sewerage system over the period 2005 to 2008. The data is also presented in Figure 2.2. As would be expected, peak storm flows show a significant correlation with rainfall.

Month	Mean Flow(l/s)	Max Flow(l/s)	Min Flow(l/s)
January	379	754	268
February	391	846	255
March	388	603	269
April	336	570	263
May	358	758	258
June	346	685	264
July	349	667	247
August	323	731	247
September	307	556	239
October	314	515	227
November	355	666	231
December	406	924	226

Table 2.4 –Influent Statistics for Bellozanne STW

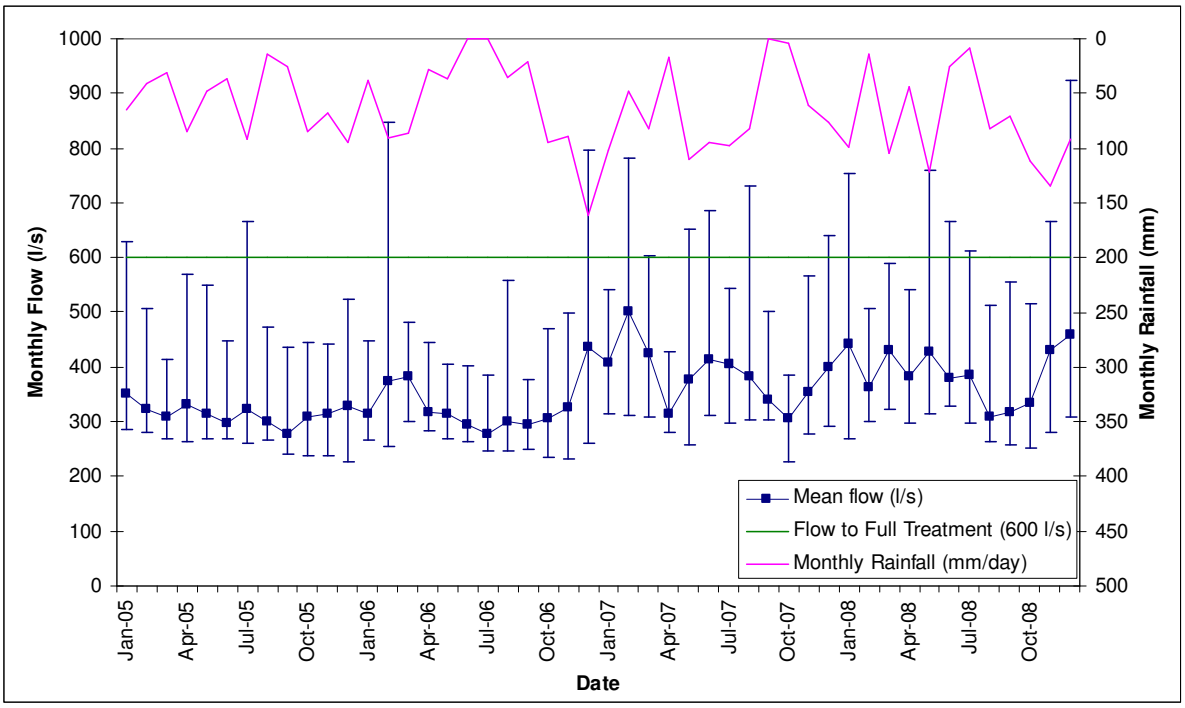


Figure 2.2 – Variation in Bellozanne STW inlet flows from 2005 to 2008

Infiltration into the sewerage system is assumed to be 56l/s, which is based on minimum recorded night time flows at Bellozanne.

From information provided by T&TS, the sum of all currently permitted trade effluent discharges is 30l/s.

The concentration of sewage entering the works is recorded by States of Jersey and is presented in Table 2.5 over the period 2007 to 2009.

	Average	Maximum	Minimum
BOD (mg/l)	148	457	25
SS (mg/l)	217	874	4
pH	8	9	7
Total Nitrogen (mg/l)	55	143	15

Table 2.5 – Sewage concentration for Bellozanne STW for 2007 to 2009

2.3.2 Projected Flows

The projected flows to Bellozanne are calculated using the following formula:

$$DWF\ (m^3/day) = PG + I + E$$

where: P = population connected to the STW
G = Per capita water consumption (litres/head/day)
I = Infiltration to sewer (m^3/day)
E = trade effluent to STW (m^3/day)

The per capita water consumption (G) is 150litres/head/day, which is consistent with the assumptions used in the Jersey Water's Water Resources Plan[9]. This is assumed not to vary significantly over the forecast horizon. Infiltration is assumed to increase in proportion to the population at a rate of 0.3ΔP.G. Trade effluent flows are assumed to remain constant at 30 l/s over the period.

The projected DWF figures for Bellozanne STW are shown in Table 2.6. With reference to Table 2.4, the figure for 2008 corresponds well to the minimum flows recorded at the works.

Year	Maximum Population Connected to Sewer System	DWF (l/s)
2008	95526	252
2028	104663	268
2035	106096	270
2065	104696	268

Table 2.6 – Projected flows

[9] Telephone conversation with John Howard of Jersey Water (date tbc)

2.4 Regulatory Requirements

It is a fundamental requirement that the activities of T&TS comply with all relevant legislation. As well as the general health and safety requirements, the following key statutory requirements are applicable in Jersey:

Water Pollution (Jersey) Law 2000:

- Ensure activities do not cause pollution.
- Ensure that no condition of a discharge permit is contravened.

Drainage (Jersey) Law 2005:

- 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.

Jersey is a crown dependency and is not part of the EU. 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 (Commitment 4) to meet where possible international standards.

In the field of liquid waste, international standards are generally defined by EU Directives; the key ones are dealt with in the following paragraphs:

2.4.1 Bathing Waters Directive (76/160/EEC)

This places limits on microbiological parameters in bathing waters with a view to protecting public health and the aquatic environment. The States are required to identify bathing areas and to monitor water quality throughout the bathing season. The microbiological parameters are:

- Faecal coliforms;
- Total coliforms;
- Faecal streptococci; and,
- Salmonella.

The standards for bathing waters are shown in Table 2.7.

Parameter	**Mandatory** (95% of samples)	**Guideline** (80% of samples)
Total coliforms	10,000 per 100ml	500 per 100ml
Faecal coliforms	2000 per 100ml	100 per 100ml
Streptococci		100 per 100ml

Table 2.7 – Existing Mandatory (Imperative) and Guideline Microbiological Standards

The revised Bathing Water Directive (BWD; 2006/7/EC) has led to a tightening of standards (Table 2.8). All bathing beaches on the Island currently comply with the tightened standards apart from that in the immediate vicinity of the outfall in St Aubin's Bay.

Parameter	Excellent	Good	Sufficient
Intestinal Enterococci Cfu/100ml	100*	200*	185**
E.Coli Cfu/100ml	250*	500*	500**

* 95%ile **90%ile based on log10 normal probability density function

Table 2.8 –Microbiological standards for the Revised BWD

2.4.2 Urban Wastewater Treatment Directive (UWWTD; 91/271/EEC)

This sets standards for treated sewage prior to being discharged. The limits are dependent on the population served and whether the receiving water is sensitive to nutrients. It takes no account of the overall level of nutrients in the receiving water and the capacity of the receiving water to deal with the nutrients.

Due to the size of Bellozanne STW and the fact that St Aubin's Bay has been identified as a "sensitive water" at risk of eutrophication, the discharge from Bellozanne should not exceed a total nitrogen limit of 10mg/l. The works is struggling to meet its current consent and the Environment Department is likely to adopt a precautionary approach and identify St Aubin's Bay as a 'sensitive' water; this has yet to be confirmed.

2.4.3 Water Framework Directive

This is the most extensive and important piece of legislation to emerge from the EU for the water environment. It requires that all inland and coastal waters achieve "good" environmental 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, but sets at least equivalent standards for such waters. The States are currently implementing a pilot scheme in order to tackle catchment inputs of nitrogen, one of the key assessed risks to the Island's water not meeting good status.

3 BELLOZANNE TREATMENT PLANT ASSESSMENT

This section describes the current issues at Bellozanne STW and the work undertaken following the stakeholder workshop.

3.1 Existing Facilities and Operation

Bellozanne is an activated sludge plant (ASP) with 4 anaerobic digesters for sludge treatment. Other sludge and waste management facilities include a sludge drier, waste processing and sorting area, an incinerator for municipal solid waste and clinical waste incinerator.

All flows of sewage receive some form of treatment. Grease removal tanks in the inlet works remove fats, oils and grease using dissolved air flotation. Flows up to 600l/s receive preliminary, primary and secondary treatment. Storm flows receive preliminary and primary settlement. All flows combine to receive tertiary treatment in the form of UV disinfection before being discharged into St. Aubin's Bay.

3.1.1 STW - Current Asset Condition and Operational Issues

Current key operational issues are:

- The hydraulic distribution to the final tanks is poor, leading to unequal flow splitting and overloading of some tanks;
- The works is unable to meet the 10mg/l total nitrogen discharge limit required by the UWWTD.
- In attempting to meet the 10mg/l nitrogen limit, large amounts of oxygen would be required leading to excessive energy costs and health & safety issues. The process also has the side effect of creating 'sewage foam' in the plant that is detrimental to environmental compliance.

The condition of the assets varies greatly due to their differing ages. Much of the civil (concrete) asset stock is in a good condition, but many items of mechanical and electrical plant are condition grade 4 (requiring preventative capital maintenance) or 5 (requiring immediate capital maintenance).

Key areas where capital maintenance investment is required in the short term include:

- The activated sludge plant; and,
- The sludge treatment plant.

3.1.2 Odour Issues

Bellozanne has been the subject of odour complaints. To improve matters, those process units which generate most odours, namely the primary sludge storage tanks, return liquor holding tank and the inlet works, have been enclosed and the air is treated by way of odour control units. These works were implemented in 2008 but with limited success to date.

Odour control facilities are generally required in order to avoid public nuisance with a site boundary odour limit of $5ou_E/m^3$ (European Odour Unit per m^3). Further measures will be implemented.

3.1.3 Capacity Analysis

Based on the performance of the works and an evaluation of the processes, it has been determined that the existing works can be converted to a conventional activated sludge plant. This would be part of a medium term strategy to meet the effluent quality requirements.

In the UK, 3DWF is normally taken as flow to full treatment (FFT). The current FFT is approximately 680 l/s as a result of the capacity limitation of the activated sludge process. However, a higher figure of 780l/s is an aspiration by T&TS. The peak flows to the works is approximately 1100l/s and the existing inlet works and primary settlements tanks are designed treat this flow with the exception of the inlet screens. However, these additional capacities cannot be utilised due the potential for premature overflow at the downstream of the primary settlement tanks.

3.1.4 Effluent Disposal System and St. Aubin's Bay Water Quality

In the early 1990s it became evident that the STW was required to be upgraded to increase its capacity and replace outdated equipment. Subsequently, it was agreed that the planned upgrade should also include a nutrient removal process that would decrease the amount of nitrogen entering St Aubin's Bay.

The upgrade was completed in 2002. However, the modified plant did not meet the nitrogen output levels that had been agreed. As a result, a relaxed standard of 20mg/l total nitrogen was requested and agreed.

During the first half of 2006, additional works were carried out to reduce the amount of total nitrogen in the effluent. The works proved to have an immediate beneficial effect and the total nitrogen was reduced, but not to a level to meet the requirements of the Discharge Permit. T&TS have been issued with two formal warnings from the Environment Department related to effluent breaching the consent of 10mg/l total nitrogen.

T&TS has continued its efforts to improve the performance of the works, together with monitoring of the water quality in St Aubin's Bay. Further works are being undertaken as part of the short term strategy (2009 to 2013).

The effluent is currently discharged via a short sea outfall at the mid tide mark. The Centre for Research into Environment and Health (CREH) has recently completed investigations into the level of nutrients in St Aubin's Bay from the watercourses and the STW. The draft report published in January 2008[10] states that the 2007 mean Dissolved Available Inorganic Nitrogen (DAIN) from the STW is 24.8mg/l. Comparison of the total flux budget for DAIN reveals that effluent from the STW accounted for less than 65% of the total DAIN load which enters the bay. Total discharge from watercourses accounted for 56% of flow, compared to 44% from the effluent.

Findings from a eutrophication study of St Aubin's Bay in 1997 by CREH[11] found the bay to be potentially eutrophic. The findings are being updated in 2009.

[10] Nutrient flux source apportionment for St Aubin's Bay, draft Report to States of Jersey, January 2008, CREH
[11] Trophic Status of St. Aubin's Bay, Report to States of Jersey, November 1997, CREH

3.1.5 Sludge Handling and Disposal

The sludge handling process is summarised in Figure 3.1. The surplus sludge is thickened and pumped to the sludge 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. The process generates methane gas which is used as an energy source for other processes at the works. The digestion process does not achieve a high enough temperature to reduce E. coli to within EU limits and enhanced treatment is required.

The digested sludge is treated by centrifuging and either dried to form a pellet product or limed to form a cake. These are then generally transported and disposed to land, depending on the season and weather conditions. If the land route is not available, the sludge is incinerated, in a mixture with municipal solids, in the Energy from Waste (EfW) plant.

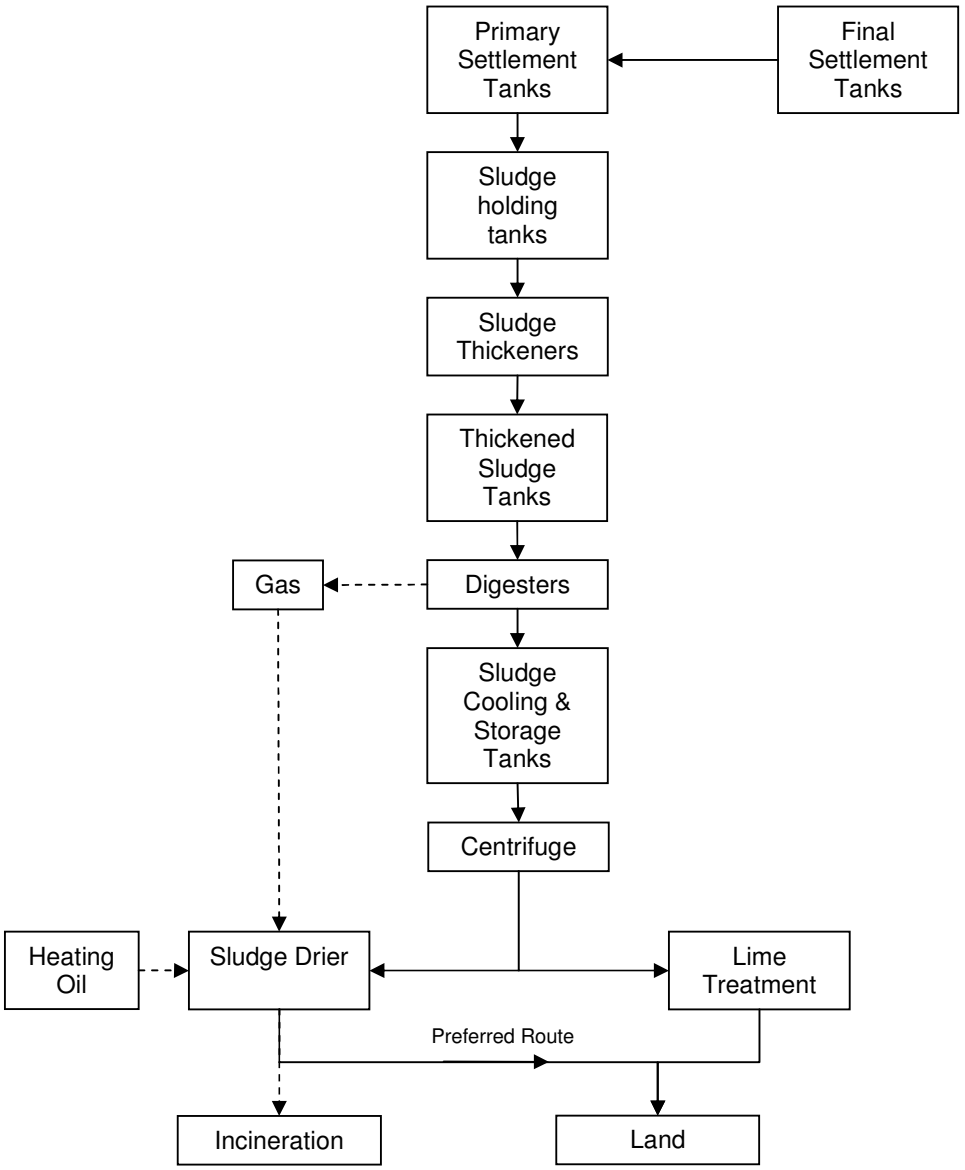


Figure 3.1 - Flow Schematic of Sludge Handling and Treatment Stages at Bellozanne

The lime treated cake cannot be stored and is normally disposed to farmland within 24 hours of production. Occasional attempts have been made to incinerate non-limed sludge cake but these have tended to cause problems with the incinerator. Both the thermally dried and the lime treated sludge meet the Code of Practice standards for enhanced treatment.

The sludge drier has been in operation for over 15 years without major maintenance. This has lead to a number of potentially catastrophic failures. A new EfW plant will be commissioned at La Collette by July 2011 and will have a sludge injection facility. This means it is only necessary to extend the operating life of the sludge drier to provide a strategic backup prior to the commissioning of the EfW plant. However, due to the current condition of the sludge drier, investment in excess of £1m would be required.

The Report entitled *"Feasibility Study on Refurbishment/Replacement of Existing Sludge Digestion Plant" (October 2008)* recommends that new digesters would be more economic but the space required would not be available until early 2013, following commissioning of the new EfW plant.

3.1.6 Energy from Waste Plant

The EfW plant currently provides electricity to Bellozanne STW and to First Tower Pumping Station. The present EfW plant was commissioned in 1979, but is now outdated and under capacity.

The 2002 Island Plan identified and safeguarded a site at the existing waste management complex in Bellozanne for a replacement EfW plant. However, in June 2006, the States approved a new location for the plant at La Collette. Outline planning permission for the plant followed in October 2007 and in July 2008, the States approved detailed proposals and authorised the Minister for T&TS to accept the tender from the preferred bidder. The external design of the plant was approved in October 2008 and infrastructure work started in early 2009. The EfW plant is expected to come on stream by July 2011.

3.2 Site Constraints

The existing Bellozanne site is severely constrained by the valley sides and extensions/modifications are difficult to accommodate. The relocation of the EfW plant, the workshop and offices will free up land to accommodate a new side-stream treatment process. It will also be necessary to win some land from the valley sides.

3.3 Summary of Current Issues and Work to Date

Following the workshop in February 2009 regarding the LWS, the key stakeholders, including staff of T&TS, Planning, Environment and Public Health, have been consulted as part of the development of the Master Plan. The following activities have also been undertaken:

- Review of operational issues
- Investigation of investment requirements in the short term for the activated sludge plant, sludge treatment plant and sludge thickening and dewatering facilities
- Review of odour control
- Review of capacity

- Review of effluent disposal options
- Overview of the programme for EfW plant
- Review of site constraints and potential for future expansion

4 DEVLOPMENT OPTION FOR BELLOZANNE

To meet the levels of service identified in the draft LWS, the key parameters considered in the development of Bellozanne STW are as follows:

- Process treatment;
- Potential layout;
- Effluent disposal; and
- Sludge treatment facilities.

The works is currently failing to achieve its consent with regard to total nitrogen and suspended solids, and measures are being undertaken to improve this. A higher level of treatment is required as the effluent is currently discharged to St Aubin's Bay, which is deemed to be 'sensitive' to nitrogen.

With Option 1, as presented in the draft LWS, the existing STW would remain in operation in the long term and a side-stream STW would be constructed to complement the treatment provided. However, the process and hydraulic constraints would continue and there is no provision for replacement of the existing STW when the treatment units are no longer fit for purpose. In order for the site to be viable in the long term, it will be necessary to eliminate the current hydraulic and process constraints as part of a phased replacement process. Option 1 requires the relocation of the workshop, the car parking facilities and some of the offices to facilitate the construction of the side-stream plant.

The Master Plan takes into account the following matters:

- Compliance with the UWWT and Bathing Water Directives
- Proven treatment technology that can be managed effectively with local expertise
- Discharge of effluent to less sensitive receiving waters
- Upgrades to the sewage treatment works that are compatible with the LWS
- Centralised sludge treatment and dewatering facilities
- Provisions for future expansion in the land owned by the States of Jersey
- Phased capital expenditure

Based on the above, a conventional sewage treatment with long sea outfall to discharge into deep water (Option 7) is considered to be realistic. The following sections outline the developing Master Plan.

Option 7 provides an opportunity to resolve the hydraulic and process issues and replace the existing STW in phases as and when the treatment units are no longer fit for purpose. Based on a preliminary review, the existing treatment units will be replaced in the following order over the long term:

1. Sludge treatment facilities
2. Conversion of the existing nitrifying – denitrifying ASP to a conventional carbonaceous ASP (thereby eliminating process constraints but requiring the construction of long sea outfall)
3. Inlet works (thereby eliminating hydraulic constraints of the existing STW)

4. Primary settlement tanks
5. Aeration tanks
6. Final settlement tanks
7. UV disinfection

4.1 Bellozanne STW

4.1.1 Existing Sewage Treatment Facilities

The ASP is undersized and would not achieve the 10mg/l total nitrogen limit. It would produce a good quality effluent in terms of BOD and SS, were it not for the filamentous organisms and foam which cause compliance issues due to solids carry over in the final effluent.

T&TS has been involved in investigations and upgrades to improve the performance of the ASP. Currently the activities are focussed on how to:-

a) Eradicate the filaments for improved settleability and overcome foaming problems.

Note: The selector zone needs to be modified / renewed to improve the sludge characteristics, as measured by SSVI[12]. This will permit the plant to run at higher mixed liquor solids and overcome the foaming problems.

b) Establish the mixed liquor recycles for effective denitrification.

Note: The ASP is currently operating without mixed liquor recycle to minimise the foam generated. Every time the mixed liquor return pumps are switched on, the filament problem is made worse, there are associated foam problems and the process becomes unstable.

c) Provide baffles in the anoxic zones to improve the plug flow arrangements and reduce short circuiting in the lanes.

d) Provide standby Return Activated Sludge (RAS) pump(s) with associated pipework to improve the security of the system, as well as providing for process variations.

e) Identify the process options (alternative to Meteor and Pegasor pellets) for the short to medium term, with a view to providing a robust system for better reliability.

Note: The original pellets in Lane 3 have been replaced with Meteor ones, which have not proved to be suitable for a fine bubble diffuser system because no biological film has grown on them. If the Meteor pellets are replaced with Pegasor ones imported from Japan in a phased manner as proposed by T&TS, full nitrification may be restored at significant cost (approximately £2m over a 2 year period) but no performance guarantees would be provided by the media supplier. Because there have been problems with pellet loss into the final effluent, there will probably be a need to top up the pellets in a few years time.

f) Investigate the use of a carbon source in the anoxic zone to improve denitrification

The current status of the investigations can be summarised as follows:

[12] Settled Sludge Volume Index as a measure of settleability

1) The works performance has been reviewed over recent years using available data, to highlight process plant performance and any shortfalls. The review will act as a benchmark for future improvements.

2) Designs for the modifications to the selector and anoxic zones have been completed for the 3 lanes. Modifications in Lanes 2 & 3 have been completed and commissioned. Modifications in Lane 1 are currently underway and all 3 lanes are expected to be in operation by end of July 2009.

3) Hypochlorite solution addition to the works liquor returns to ensure filaments are removed. This should be a short term measure until the sludge characteristics improve.

4) It is proposed to introduce a RAS bypass around the selector to bypass between 50 and 80% of the RAS to the front of the anoxic zone. As the existing RAS pumping station does not have standby capacity, it is proposed to construct a submersible RAS pumping station.

5) The proposed RAS pumps would deliver RAS directly to the downstream end of the selector tank and, when necessary, act as standby to the existing screw pumps in the event of one of them being out of service.

6) The proposed RAS pumps would operate on a variable speed duty/assist basis, with each provisionally sized to deliver 200l/s. This additional maximum flow of 400l/s would satisfy the process requirements and provide an adequate standby facility for the screw pumps (design duty 325l/s each). It is proposed that an actuated valve off-take from the new pipe to the existing RAS channel would allow flows from the wet well direct to the upstream end of the selector tank.

7) The design of the proposed RAS pumping station and selector by-pass pipework should be completed by the end of June 2009 and it is expected to be commissioned by mid September 2009. Trials to determine optimum levels are expected to last until mid November 2009.

8) Investigations commenced in early June 2009 to identify the process options (alternative to Meteor and Pegasor pellets) for the short to medium term, with a view to providing a more robust system. Recommendations are expected by early August 2009.

9) With improved settleability, the mixed liquor solids would be increased to improve nitrification and establish mixed liquor recycling on completion of the RAS by-pass trials.

10) Further studies will continue by adding a carbon source to the front of one of the anoxic zones (glycerol or acetate) to improve denitrification in the lane. The glycerol/acetate dose should be increased until maximum nitrate removal is achieved. The other anoxic lanes will act as a control in this study.

11) During the investigations, samples of final effluent would be taken for bacteriological parameters so that any improvement in performance can be monitored. This will require a review of previous bacteriological data for the final effluent.

12) The works performance has always been affected by the limited hydraulic gradient. Flow distribution at each stage of the process is unsatisfactory and an initial review indicates that only limited improvements can be made without significant capital and operational expenditure.

13) It has been identified that there are no viable denitrification plants that can guarantee the reduction in total nitrogen required by the Discharge Permit without very significant costs and the importation of large quantities of methanol. There is also the increased risk of seaweed proliferation in St Aubin's Bay.

14) Odour control facilities will be provided in order to avoid public nuisance with a site boundary odour limit of $5ou_E/m^3$.

4.1.2 Effluent Quality

Under Option 7, the effluent from the Bellozanne would be discharged to the sea via an outfall of length to be determined by further study and marine and hydraulic modelling. The proposed effluent quality requirements for the works, subject to the approval of the Environment Department, can be summarised as follows:

Suspended Solids	-	35mg/l
BOD_5	-	25mg/l

Ultra-violet disinfection will be provided to safeguard the bacteriological quality for bathing waters and shellfish beds.

4.1.3 Potential Site Layout

Option 7 would utilise the current waste processing and sorting area, the clinical waste incinerator area and parts of the existing works. The waste recycling and the clinical waste incinerator are due to be relocated. The potential layout is shown in Figure 4.1. However, the final site layout will depend upon the treatment process selected and any developments in the individual process units that could make the land use more effective.

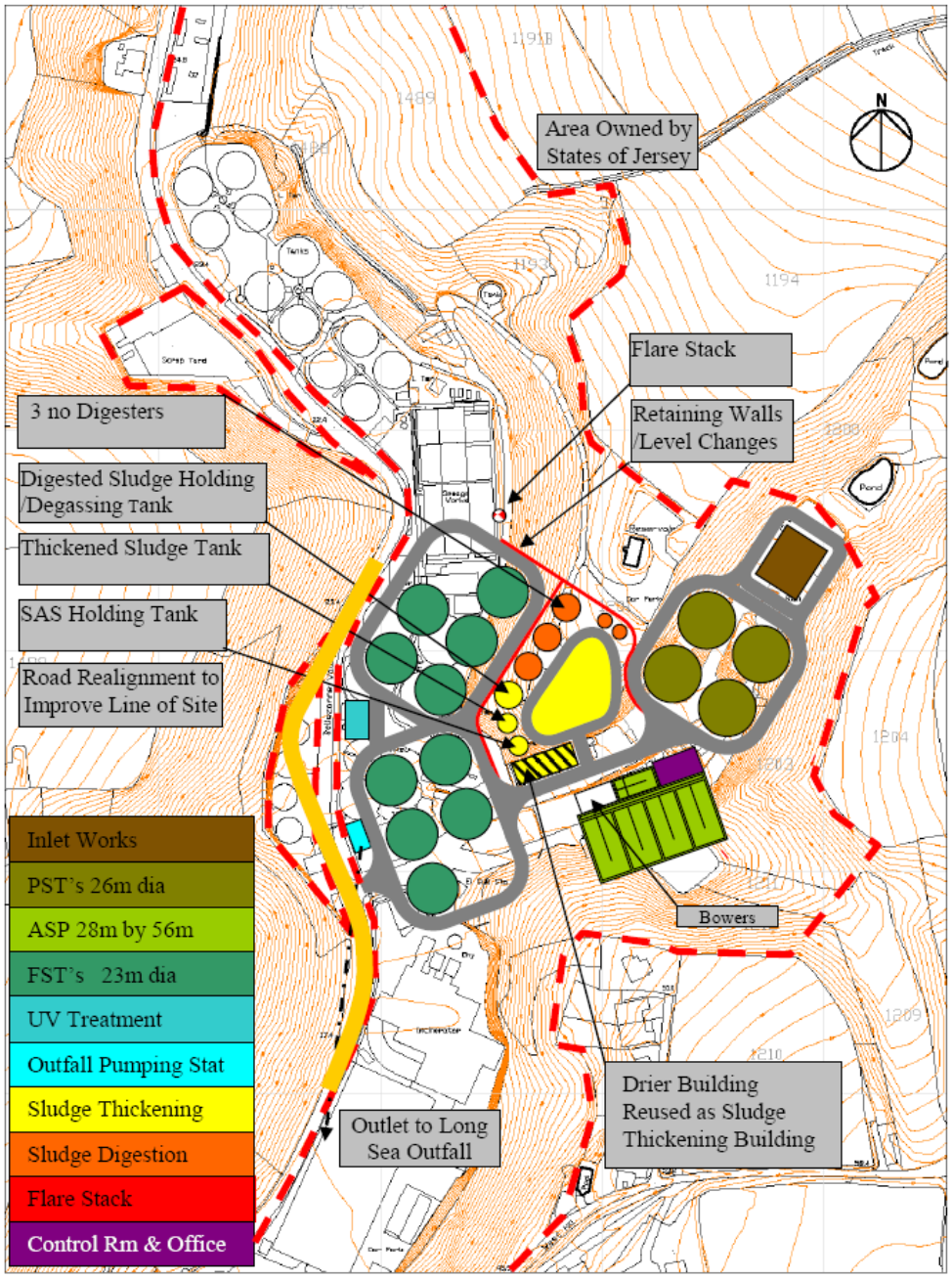


Figure 4.1 - Bellozanne STW Potential Layout

Land availability to accommodate elevated levels for future growth (up to 132,000 population) is highlighted in Figure 4.2. The Waste Management Services' operational site and the proposed limit of Bellozanne STW are shown on Figure 4.3. The disused power station area will be designated for the effluent / washwater pumping station and future UV disinfection building.

At the time of construction of the long sea outfall, an outfall pumping station may be required to pump the treated effluent at high tide levels. The existing outfall pipe will be checked for its structural integrity as part of the long sea outfall.

The First Tower Sewage Pumping Station and the pumping main would be upgraded to discharge to the proposed inlet works. The additional hydraulic head would allow for improvements at the treatment works in the short to medium term.

To construct the sludge treatment facilities, it will be necessary to remove the high area of ground to the north of the sludge drier building. This would also involve demolition of the house in the site as well as the effluent storage reservoir, which may either be relocated or replaced with a washwater pumping station.

It is imperative that the enabling works for the sludge treatment facilities are implemented without delay. These issues were discussed with staff of the Waste Management Services Directorate on 5 June 2009.

It should also be noted that a Report entitled "*Site Safety Audit of the Bellozanne STW"* carried out by Health, Safety and Engineering Consultants Limited (HSEC) in November 2002 identifies a number of health & safety issues that need to be addressed in the short term. These include traffic improvements and removal of the occupants of the house on site.

4.1.4 Land Availability

Although the existing site is constrained by the valley, there is sufficient land owned by the States of Jersey for potential future needs. The waste recycling and the clinical waste incinerator are due to be relocated and this area could be utilised for sewage treatment facilities.

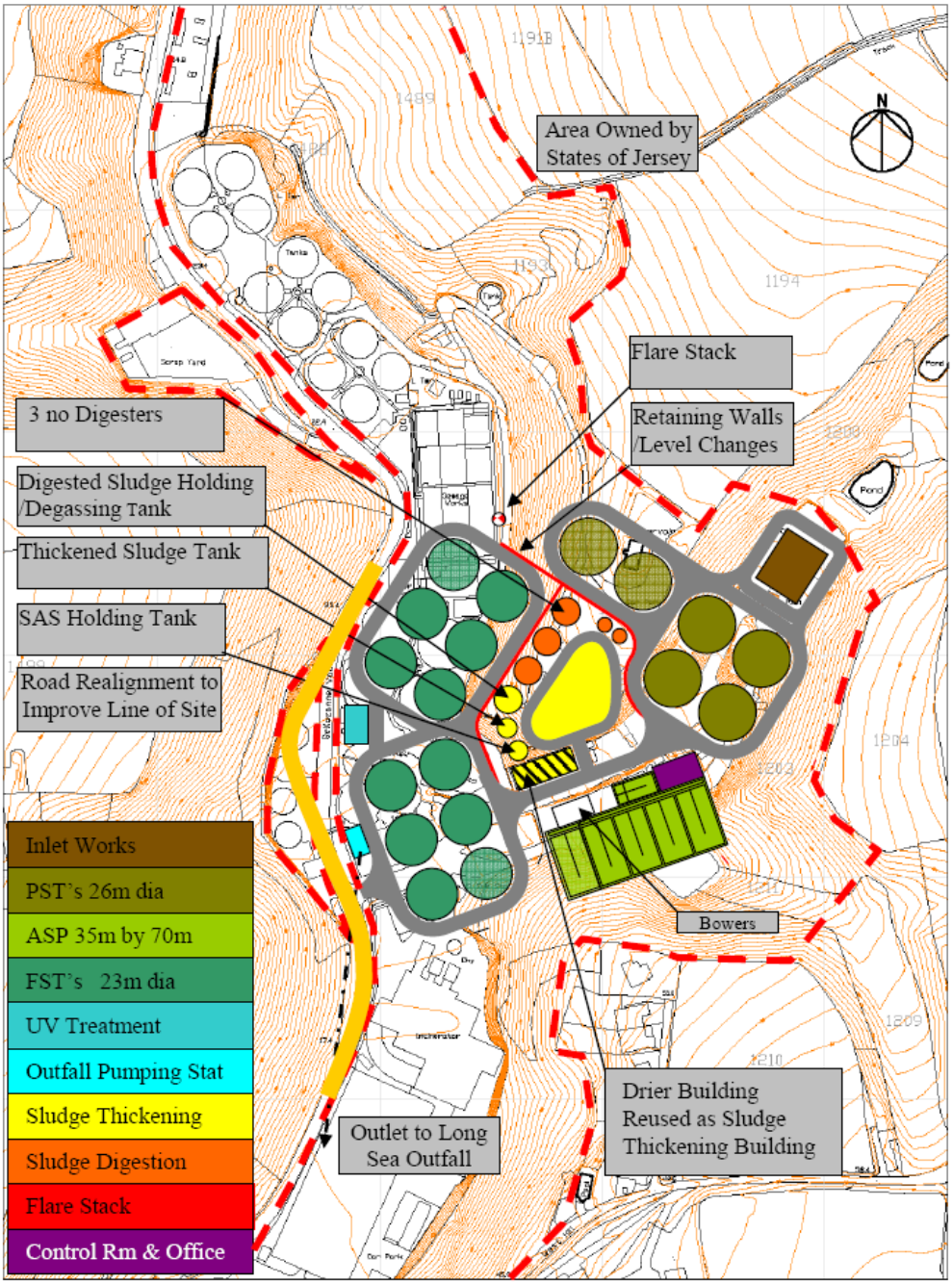


Figure 4.2 - Bellozanne STW Potential Layout Including Growth Contingency

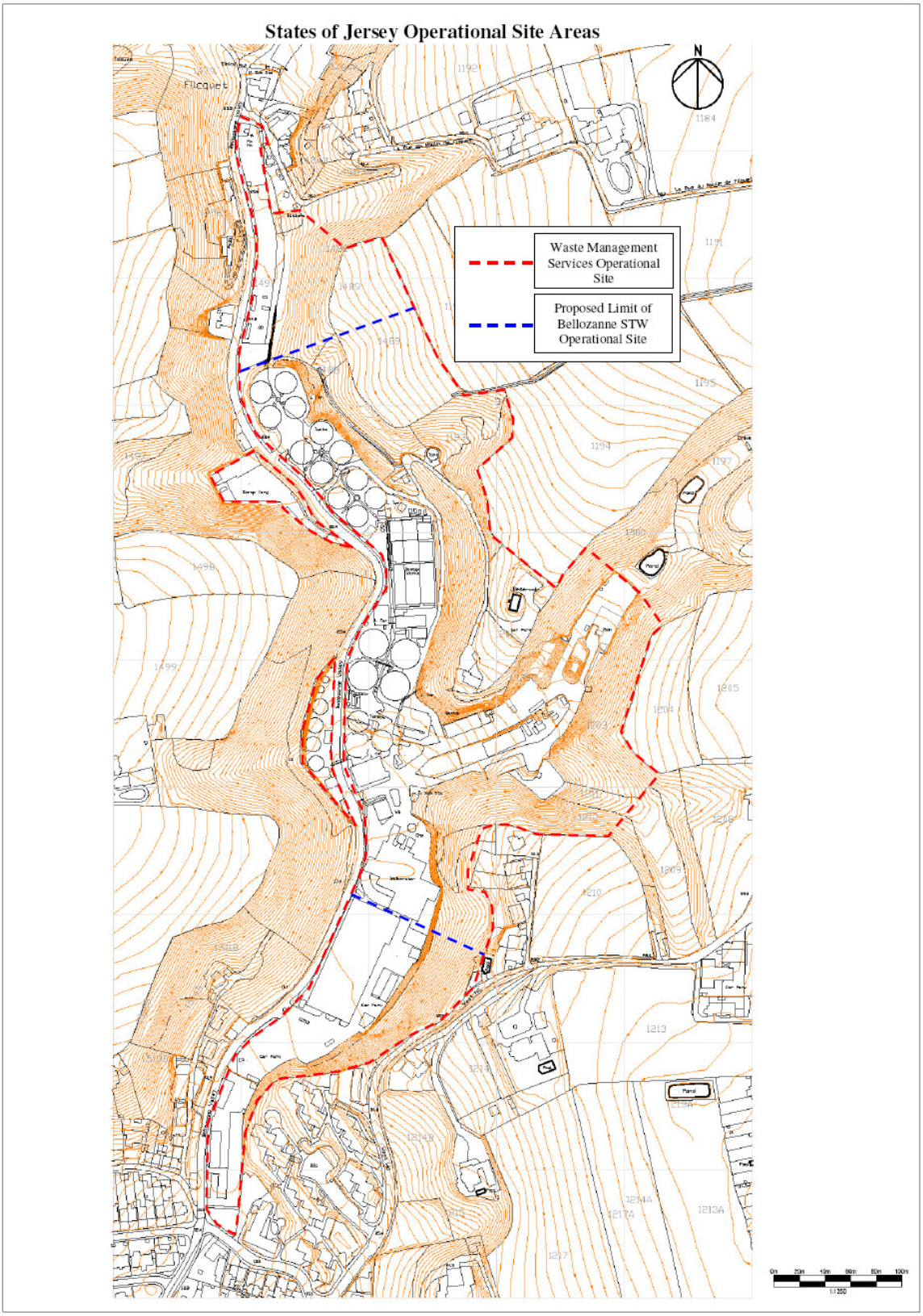


Figure 4.3 - States of Jersey Operational Site Areas

It will be necessary to remove parts of the existing hillside and reuse the material for construction. Environmental Impact Assessments (EIA) will not be necessary as previous ones have been undertaken by T&TS. Contaminated land assessments will, however, be carried out prior to construction when the areas have been cleared.

The soils and rock will be stored at another site for recycling and potential re-use of the materials has been identified for further investigation. There will be an associated impact from these activities and this will be assessed at a later stage.

4.2 Sea Outfall

A desk study has been completed to determine potential locations for the outfall, taking into account the quality of the effluent and the dilution and dispersion capacity of the receiving waters. Additional works including hydrographic survey, water quality surveys and water quality modelling have been recommended with a view to reaching an agreement Regulatory Standards based on assimilative capacity of the preferred outfall location. These additional works are expected to be completed by December 2010. Subsequently, Planning and Environmental Impact Assessment (EIA) will be followed by design of outfall for tendering by end of 2012 and construction in Year 2013 and Year 2014..

The desk study utilised a marine model of the bay and the waters surrounding the Island, and data from previous studies on nutrient levels.

The States of Jersey Planning & Environment Department have advised that an EIA will be required for the sea outfall. The EIA process, including public consultation, is likely to take up to 18 months. As part of this, it is likely that the marine model will be developed further to consider chemical and biological impacts, as well as microbiological impacts. Impacts on microbiological behaviour are not considered in the completed study because UV treatment is to be provided.

The desk study has identified optimum discharge locations that need to be confirmed through a more detailed study as follows:

Hydrographic Survey: Consisting of bathymetric survey to confirm accuracy of the Admiralty Chart, deployment of recording current meters to validate model predictions and drogue and/ or dye release from proposed outfall location to validate solute transport model.

Water Quality Survey: Consisting of microbiological sampling and analysis to ascertain pollution sources and microbial decay rates in the ambient waters prior to modelling. Nutrient (nitrate, phosphate, chlorophyll, BOD) sampling will also be included. The sampling programme would allow for sampling all river discharges and coastal waters at probably fortnightly intervals, and within the bay area over the course of at least one spring & neap tide.

Modelling: Consisting of both microbial fate and transport model and a eutrophication model and calibrated to impact of existing and potential outfall locations.

Environmental Impact Assessment (EIA): Including but not necessarily limited to assessments for Marine Archaeology, Bio-diversity, Flora & Fauna, Crustaceans, Shipping, Oil Cargo, etc. and preparation of Scoping Report and EIA Document.

4.3 Sludge Treatment Facilities

The principal concerns associated with the existing sludge treatment facilities are the condition of the facilities, associated risks and consequences of failure. Surveys have identified poor asset conditions with the mechanical and electrical systems operating beyond their asset life and the steel tanks have reached their design life.

The "Feasibility Study on Refurbishment/Replacement of Existing Sludge Digestion Plant" (October 2008) identified the need for the replacement of digesters. The "Digester System Condition Survey Report" (July 2009) has identified significant health & safety concerns, based on a limited survey of Digester No. 2. The survey identified significant corrosion of the digester was identified and, where severe corrosion was present, the remaining 'intact' steel could be less than 2.5mm in thickness (determined by the lower end limits of instrumentation). The steel in the uppermost 600mm of the digester tank and all roof members suffered from severe corrosion. It is also worth noting the following concerns with regards to the existing sludge treatment facilities:

- Gasholders are undersized. High refurbishment costs. Need to be replaced.
- Waste gas burner does not comply with Codes and is in close proximity to gas holders.
- All M&E equipment and gas piping system require replacement.
- The general state of electrical equipment, instrumentation and infra-structure reflects its age, and are obsolete. Replacements are required.
- Needs intensive maintenance to extend the life of the plant.
- Annual O&M costs up to 3 times of comparative new digesters.
- Risks and consequences of failure will continue to remain with any refurbishment options.

The existing sludge (drum) thickeners are located adjacent to the Bellozanne Valley Road and are a significant source of odour. The operation capacities of the 2 existing drum thickeners have also been identified as inadequate and O&M costs are extremely high due to poor quality material of construction and the use of potable water in significant quantities. The existing centrifuge unit used for sludge dewatering unit is currently located outside the Sludge Drier Building and only a boxed spare is available.

With regards to the Sludge Thickening and Dewatering, it was proposed and agreed that they would be housed in the current Sludge Drier Building, subsequent to the removal of the existing equipment. The reasons for the selection of the Sludge Drier Building for the purposes of sludge thickening and sludge dewatering can be summarised as follows:

- Sludge drier has been in operation for over 15 years.
- A series of potentially catastrophic failures have resulted in the past.
- Investment required in order to make the system viable is in excess of £1m.
- The building is suitable for sludge thickening & dewatering facilities.
- Additional area needed for sludge cake storage could be made available.
- Additional area required lime storage tanks could be made available.
- Existing disused power station building was discounted due to inadequate space, lack of sludge cake storage, operational constraints, and traffic and H&S issues.
- The existing sewage treatment works site does not have adequate for a new building.

It is imperative that the required improvements to sludge treatment processes are implemented with a view to reduce the annual O&M costs and increase biogas production and utilisation.

A site survey was carried out in March 2009 to assess sludge treatment, including a visual inspection of the digester and ancillary equipment. The Operation and Maintenance Manuals were reviewed. Operation records were taken for detailed study, where available. Subsequently, a full asset condition survey was carried out in April 2009. The Report entitled "*Digester System Condition Survey Report" (July 2009)* has identified health & safety concerns. It is proposed that only the immediate concerns are dealt with in the short term. Only 3 of the 4 digesters would be required to be upgraded and maintained in service to provide adequate sludge treatment capacity. The fourth one can be abandoned, provided that a new digester is brought into service by early 2012.

In accordance with the concept agreed with T&TS, the primary sludge will be settled in primary tanks with Surplus Activated Sludge (SAS) being diverted to separate storage tanks. SAS will be thickened by a duty drum thickener, whilst primary sludge will be thickened by a separate drum thickener, if required. A common standby drum thickener will also be provided. Thickened sludge will be stored and transferred to the sludge digesters. If the primary sludge can be thickened satisfactorily, it will be fed directly to the sludge digesters.

The digested sludge will be dewatered by centrifuges (2 existing and 1 new) which will be located together with the three drum thickeners. Polymer dosing will be made available upstream of the drum thickeners and centrifuges. Lime dosing will be made available either upstream or downstream of the centrifuges.

Based on the initial assessment for sludge thickening and dewatering, as outlined in the Report '*Feasibility Study on Refurbishment/Replacement of Existing Sludge Digestion Plant' (October 2008)*, additional requirements have also been identified for the sludge thickening / dewatering facilities.

In line with the proposal for centralised sludge treatment facilities, it is proposed that the sludge drier building is modified to house the sludge thickening and dewatering facilities. Options are being reviewed to house the centrifuges and pre-digestion drum thickeners on an elevated platform and using part of the building to handle the dewatered sludge. Lime and poly dosing units could be installed within the same building. An additional sludge storage area will be made available adjacent to the sludge drier building for emergency storage in the event that suitable disposal method cannot be utilised.

4.4 Carbon Impacts

Carbon footprint calculations were carried out to rank the options. The carbon impact per kWh of electricity has been revised by States of Jersey and the LWS needs to be revised in line with this. A preliminary assessment suggests the ranking of the options is not expected to change.

Previous calculations did not include construction and various other operational factors that would also generate carbon, as outlined in the UKWIR methodology[13]. This will be the responsibility of T&TS and when a more detailed programme has been outlined, this element will be included in the overall carbon footprint calculations.

[13] *States of Jersey Liquid Waste Strategy, Carbon Footprinting*, Grontmij, 2008

4.5 Critical Factors

4.5.1 Sludge Treatment

It will be necessary to proceed with the enabling works at the earliest opportunity so that the sludge treatment and dewatering facilities can be constructed on programme.

4.5.2 Land Requirement

Costs for the removal of the existing high ground will depend on market conditions for the use of rock as construction material and further investigations will be required. Potential re-use of rock has been identified for further investigation.

4.5.3 Reliability

The current programme to upgrade the assets with condition grades 4 and 5 will substantially increase the reliability of the plant in the short term. Expansion of the plant to deal with higher flows and ensure a more effective and efficient treatment process will provide long term reliability.

4.5.4 Operation during Construction

No impacts on the continued operation of the existing plant will result during the construction process. The process will essentially be built 'off-stream' as required. However, part of the upgrades and replacement of pumping main will need to be coordinated so as to not affect the sewerage system.

The timing of the relocation of the waste recycling facility and the clinical waste incinerator may affect construction. However, the relocation of the EfW plant will not affect the proposed works.

4.5.5 Tourism

Tourism is a vital component of Jersey's economy and the timing of the construction programme will be assessed for potential negative impacts. The greatest wider impacts are likely to be from construction traffic. Local impacts will include increased traffic, construction noise and air pollution. Construction of the outfall will be the most visible operation and the timing and programme for this must be carefully considered. Consultation with stakeholders and local residents will thus form a key input to the construction programme.

4.5.6 Planning and Regulation

All the proposed works will be constructed within land owned by the States of Jersey and land issues are not anticipated. Planning approval is not likely to be unduly delayed but approval for the outfall is likely to take approximately 18 months.

Although T&TS are implementing measures to improve the effluent quality, there is a risk of prosecution by the Environment Department. Construction of the outfall at the earliest opportunity would reduce this risk, subject to a revised discharge consent being agreed by the Environment Department.

The States of Jersey are currently considering how to implement the Water Framework Directive and Bathing Water Directives. They are not obliged to implement this legislation but have committed to integrate them with Island policy.

4.5.7 Assessment of Existing Infrastructure

The conditions of the existing outfall and the pumping main from the First Tower Pumping Station need to be investigated to determine their suitability for use. Some service diversions may also be required.

4.5.8 Nitrate and Eutrophication Study Results

Two studies are underway that may influence how the UWWTD impacts on the discharge of effluent into St Aubin's Bay. A catchment study initiated by the Environment Department is underway to assess the impact of farming on diffuse nitrate sources. A eutrophication study is also underway to assess the status of the bay and determine whether the current precautionary status of 'sensitive' is legitimate. The findings from these studies will inform the decision making process regarding discharge permits and environmental regulation surrounding the bay.

4.5.9 Environmental Impact Assessment

Construction waste management will also have to be considered, along with the potential impact on the Port Ramsar and oyster bed sites.

Due to the nature of the current land use on the operational site, a contaminated land assessment will be required.

4.5.10 Climate Change

Climate change scenarios for the Channel Islands are described in the Met Office report[14]. The relevant findings of the report are;

- Sea level rises are predicted due to the thermal expansion of the ocean. For the Channel Islands the lower and higher estimates are 9 and 69cm respectively for the 2080s.
- Minimum and maximum daily temperatures are set to rise, especially in summer.
- The probability of increased daily precipitation is set to increase. However, summer precipitation is set to decrease, up to 60% on average under high emissions scenarios. Increases in winter precipitation are not as marked.

This report published results from a regional climate model at the 25km scale needed to show the BIC islands as the UKCIP02 scenarios did not have sufficient resolution. The latest UKCIP09 climate predictions were released in June 09 and provide predictions at a 25km resolution and are thus suitable for use in the Channel Islands.

The climatic impacts could significantly affect the assets, especially under high emissions scenarios. Lower summer rainfall could result in less dilution and thus higher concentrations of pollutants entering the works. Sea level rise would not have a direct negative impact on the outfall but the predicted increases in sea temperature could impact negatively on eutrophication within the bay. An assessment of climate change impacts on the proposed outfall location was requested by the Environment Department. A qualitative assessment of climate change impacts has been incorporated in the outfall desk study.

[14] Scenarios of climate change for islands within the BIC region, Met Office Hadley Centre, July 2003

4.5.11 Jersey Water's 25 Year Water Resource Plan

Jersey Water (JW) is currently developing a 25 year water resource plan that will have potential impacts on the volume of wastewater generated. Initial discussions with Jonathan Howard of JW indicate that there will be no significant variation in per capita consumption up to the 2035 horizon. However, in the long term, a comprehensive programme of installing water meters may reduce consumption. Integration with the measures to be outlined in the JW plan will be the responsibility of T&TS.

4.6 Option 7 Summary

The advantages and disadvantages of Option 7 are summarised as follows:

Treatment Process	Advantages	Disadvantages
Conventional ASP + Long Sea Outfall	• Compatible with the land use • Compliance with statutory requirements • Conversion of the treatment process to Conventional ASP with a Long Sea Outfall resulting in operational stability and reliability • Improved Health & Safety • Reduced operational & maintenance costs • Reduced energy cost and carbon footprint • Reduced risk to the sensitive St Aubin's Bay environment • Process and hydraulic constraints eliminated • Phased capital expenditure with unnecessary expenditure minimised • Provide value for money by phasing of capital maintenance to tie-in with replacement works • Relocation of Energy from Waste Plant (Incinerator) by 2012 with the Clinical Waste Incinerator reaching the end of its design life • Workshop does not need to be relocated • Maximised use of existing assets • Designated area for sewage sludge treatment • Potential changes in future land use • Away from residential area • Reduced odour as a result of state-of-the-art facilities • Improved traffic flow and site security as	• Potential risk of currents bringing back effluent to shore • Potential construction difficulties (weather, ground conditions etc) • First Tower Sewage Pumping Station and pumping main need to be upgraded • Removal of some high ground for the construction of the Sludge Treatment facilities • Need for contaminated land assessment

Treatment Process	Advantages	Disadvantages
	a result of the designated isolated area for the sewage treatment works	

The advantages and disadvantages for Options 1 to 6 are covered in the draft LWS.

5 FINANCIAL APPRAISAL

The proposed option will be evaluated and compared with others highlighted in the draft LWS, taking account of:

- Capital expenditure (CAPEX)
- Whole life costs
- Carbon footprint;
- Energy usage. and
- Environmental impact

6 OTHER ASPECTS

6.1 Asset Management

A study is underway for T&TS Waste Management to benchmark their existing business procedures and organisational structure against international best practice, including UK PAS55 2008 Asset Management and the OFWAT 2008 AMPAP (Asset Management Planning Assessment Process). This will form part of the wider LWS. The report on the benchmarking is due to be issued by end of July 2009.

6.2 Funding the Strategy

The LWS will identify the likely funding requirements based on the defined levels of service.

There are various approaches that the States can take to fund the work, including:

- Direct Taxation;
- Infrastructure Charges to be levied on developers; and/or
- Creation of a State owned Corporation with separate billing.

The above options will be considered further as part of the LWS. It should be noted that the 'DRAINAGE (JERSEY) LAW 2005' is currently in place and makes provisions for a sewerage charge.

6.3 Corporate Strategy

The optimum corporate structure to deliver the LWS will require further consideration. Options to be considered include the existing one, a Trading Account, merger with Jersey New Waterworks and a private company.

7 PROGRAMME

A copy of the programme for the LWS is shown in Figure 6.1 and the programme for the short term strategy is shown in Figure 6.2.

The current upgrades to reduce foaming and improve sludge settleability are expected to be completed by November 2009. Additional works will follow on, including the addition of a carbon source to the front of one of the anoxic zones to improve denitrification.

A desk study is underway to determine potential locations for the outfall, taking into account the quality of the effluent and the dilution and dispersion capacity of the receiving waters. This study is expected to be completed by early August 2009.

The proposed sludge thickening and dewatering facilities, which are to be installed in the Sludge Drier Building, are anticipated to commence in March 2010 and be commissioned by August 2010.

The enabling works to facilitate the construction of sludge treatment facilities and sludge storage area are required to be completed by December 2009. The expenditure profile is currently being developed for the upgrading / replacement of the sludge treatment facilities. Only the immediate health & safety concerns identified in '*Digester System Condition Survey Report' (May 2009)* will be dealt with at present. Cost savings are anticipated as a result of phasing the capital maintenance to tie-in with replacement works. The programme assumes that the expenditure for the sludge treatment facilities can be spread through the planning period to 2013.

Further investigations will be required to produce an expenditure profile for Option 7. The earliest date for construction of the long sea outfall is late 2011. Phased implementation of the sewage treatment facilities will be a key element. The profiles will assume that expenditure can be spread throughout the planning period to allow sufficient time for approval of the strategy, planning, design and construction, and to tie-in with the relocation of the waste recycling facilities and the clinical waste incinerator.

Suggested key actions and timescales to move forward with the Master Plan and the LWS, are as follows:

- May – June 2009 — Preparation and submission of the Bellozanne STW Master Plan and discussions with the key stakeholders.
- Mid July 2009 — PT meeting to agree the Master Plan.
- End of July 2009 — PB meeting for formal approval of the Master Plan and the way forward for the LWS.
- July – October 2009 — LWS Report / Strategic Direction Statement in the format approved by the PB, together with costing of options.
- November – December 2009 — Finalise the LWS / Strategic Direction Statement.
- January – February 2010 — Public consultation based on Strategic Direction Statement.

• March 2010	Update the LWS following public consultation.
• April 2010	Lodge and debate LWS by Council of Ministers.
• June 2010 – April 2012	Development and Approval of Funding and Corporate Strategies

8 SUMMARY AND RECOMMENDATIONS

Engagement with the key stakeholders will continue as part of the development of the LWS. The Master Plan concentrates on the strategic development and implementation of the LWS and will be used to facilitate further consultation.

There is a need to focus on what has to be done in the short term and implementation of the LWS. It is also imperative that any work in the short term is compatible with the long term strategy to avoid any unnecessary expenditure.

It is proposed that the Project Team (PT) meets in July 2009 to discuss the Master Plan in order to:

- agree the upgrade works at Bellozanne STW;
- agree on the inclusion of Option 7 as part of the LWS;
- agree the short term strategy ;
- reach a consensus on the approach to LWS; and,
- make recommendations to the Project Board (PB).

The PB will be required to meet by the end of July 2009 to consider the proposals by the PT.

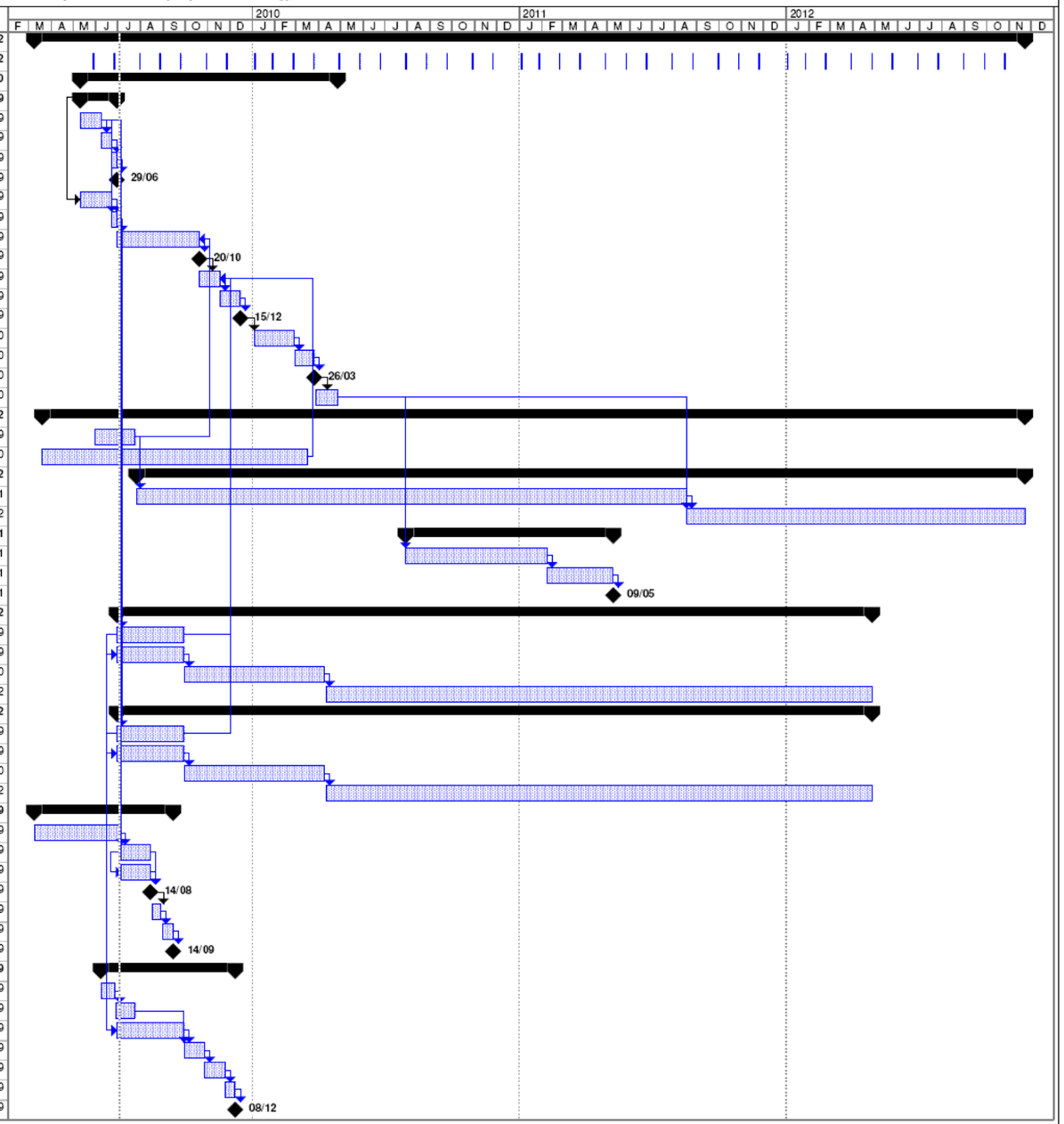
Approval of the Master Plan by the PB will allow T&TS to proceed with the required short to medium term measures without further delay.

Option 7 is defined as 'Replacement of Bellozanne STW as a Conventional Activated Sludge Plant together with a Long Sea Outfall. This will allow for phased implementation of the sewage treatment facilities when the current units are no longer fit for purpose.

The Draft LWS has been provided to the Scrutiny Team to *"Check and challenge all assumptions and data, then provide a framework for the presentation, consultation, funding and ratification of the strategy at political and public level".* The Master Plan, once approved by the PB, will be provided to the Scrutiny Team and discussions will continue with a view to incorporating Option 7 concluding the LWS.

Project: States of Jersey Liquid Waste Strategy

ID	Task Name	Duration	Start	Finish
1	**Jersey Liquid Waste strategy Programme**	**941 days**	**Mon 09/03/09**	**Thu 22/11/12**
2	**Programme Review Meetings**	**867 days**	**Fri 29/05/09**	**Fri 26/10/12**
45	**Jersey Liquid Waste Strategy (LWS)**	**242 days**	**Mon 11/05/09**	**Tue 27/04/10**
46	**Master Plan for Bellozanne WWTW Site**	**35 days**	**Mon 11/05/09**	**Mon 29/06/09**
47	Master Plan for Bellozanne WWTW Site	20 days	Mon 11/05/09	Mon 08/06/09
48	Consultation with Stakeholders on Master Plan	10 days	Tue 09/06/09	Mon 22/06/09
49	Revise Master Plan	5 days	Tue 23/06/09	Mon 29/06/09
50	Submit Master Plan for Bellozanne WWTW Site	0 days	Mon 29/06/09	Mon 29/06/09
51	Consolidate Draft Strategy Position	30 days	Mon 11/05/09	Mon 22/06/09
52	Agree Preferred Option with the Stakeholders	5 days	Tue 23/06/09	Mon 29/06/09
53	Confirm Data & Update Draft LWS (Format to Confirmed by SoJ)	80 days	Tue 30/06/09	Tue 20/10/09
54	Submit Final Draft LWS to T&TS	0 days	Tue 20/10/09	Tue 20/10/09
55	Final Draft LWS Review by Stakeholders	20 days	Wed 21/10/09	Tue 17/11/09
56	Finalise LWS	20 days	Wed 18/11/09	Tue 15/12/09
57	Submit LWS	0 days	Tue 15/12/09	Tue 15/12/09
58	Public Consultation	40 days	Mon 04/01/10	Fri 26/02/10
59	Update LWS	20 days	Mon 01/03/10	Fri 26/03/10
60	Submit Agreed LWS	0 days	Fri 26/03/10	Fri 26/03/10
61	Lodge & Debate Strategy	20 days	Mon 29/03/10	Tue 27/04/10
62	**Wastewater Treatment Works & Network**	**932 days**	**Fri 20/03/09**	**Thu 22/11/12**
63	Desk Study of Outfall Options (Limited Modelling)	40 days	Mon 01/06/09	Fri 24/07/09
64	Sewer Network Analysis & Options	248 days	Fri 20/03/09	Wed 17/03/10
65	**Long Sea Outfall & Pumping Station**	**845 days**	**Mon 27/07/09**	**Thu 22/11/12**
66	Planning / Environmental Assessment / Design	104 wks	Mon 27/07/09	Wed 17/08/11
67	Tendering & Construction	65 wks	Thu 18/08/11	Thu 22/11/12
68	**Wastewater Treatment Works - Phase 1**	**195 days**	**Fri 30/07/10**	**Mon 09/05/11**
69	Preliminary Design for Planning Approval	26 wks	Fri 30/07/10	Mon 07/02/11
70	Planning Approval Process	13 wks	Tue 08/02/11	Mon 09/05/11
71	Outline Planning Permission	0 days	Mon 09/05/11	Mon 09/05/11
72	**Funding**	**715 days**	**Tue 30/06/09**	**Fri 27/04/12**
73	Initial Appraisal of Funding Options	13 wks	Tue 30/06/09	Tue 29/09/09
74	Consultation with SoJ	13 wks	Tue 30/06/09	Tue 29/09/09
75	Detailed Funding Options & Proposed Model	26 wks	Wed 30/09/09	Fri 09/04/10
76	Legislative Process	104 wks	Mon 12/04/10	Fri 27/04/12
77	**Organisation**	**715 days**	**Tue 30/06/09**	**Fri 27/04/12**
78	Initial Appraisal of Organisation Options	13 wks	Tue 30/06/09	Tue 29/09/09
79	Consultation with SoJ	13 wks	Tue 30/06/09	Tue 29/09/09
80	Detailed Review of Organisation Options	26 wks	Wed 30/09/09	Fri 09/04/10
81	Legislative Process	104 wks	Mon 12/04/10	Fri 27/04/12
82	**Short Term Strategy (STS)**	**131 days**	**Mon 09/03/09**	**Mon 14/09/09**
83	Feasibility Studies	81 days	Mon 09/03/09	Fri 03/07/09
84	Develop STS for Bellozanne WwTW	30 days	Mon 06/07/09	Fri 14/08/09
85	Develop Capital Investment Profile	30 days	Mon 06/07/09	Fri 14/08/09
86	Submit STS for Review by T&TS	0 days	Fri 14/08/09	Fri 14/08/09
87	Review of STS by T&TS	10 days	Mon 17/08/09	Fri 28/08/09
88	Update Short Term Strategy	10 days	Tue 01/09/09	Mon 14/09/09
89	Submit Short Term Strategy for Implementation	0 days	Mon 14/09/09	Mon 14/09/09
90	**Asset Management**	**131 days**	**Mon 08/06/09**	**Tue 08/12/09**
91	Benchmarking of T&TS Against PAS 55	15 days	Mon 08/06/09	Fri 26/06/09
92	Initial Report on Key Processes & Options	20 days	Mon 29/06/09	Fri 24/07/09
93	Coordination of Appraisal of Organisation / Funding Options	13 wks	Tue 30/06/09	Tue 29/09/09
94	Final Report on Key Processes & Options	20 days	Wed 30/09/09	Tue 27/10/09
95	Review of Final Report by T&TS	20 days	Wed 28/10/09	Tue 24/11/09
96	Update Report	10 days	Wed 25/11/09	Tue 08/12/09
97	Submission of Final Report	0 days	Tue 08/12/09	Tue 08/12/09



Project: States of Jersey Liquid Waste
Date: Fri 03/07/09

Task — Progress — Summary — External Tasks — Deadline
Split — Milestone — Project Summary — External Milestone

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Figure 6.1 – Liquid Waste Strategy Programme at 14th May 2009

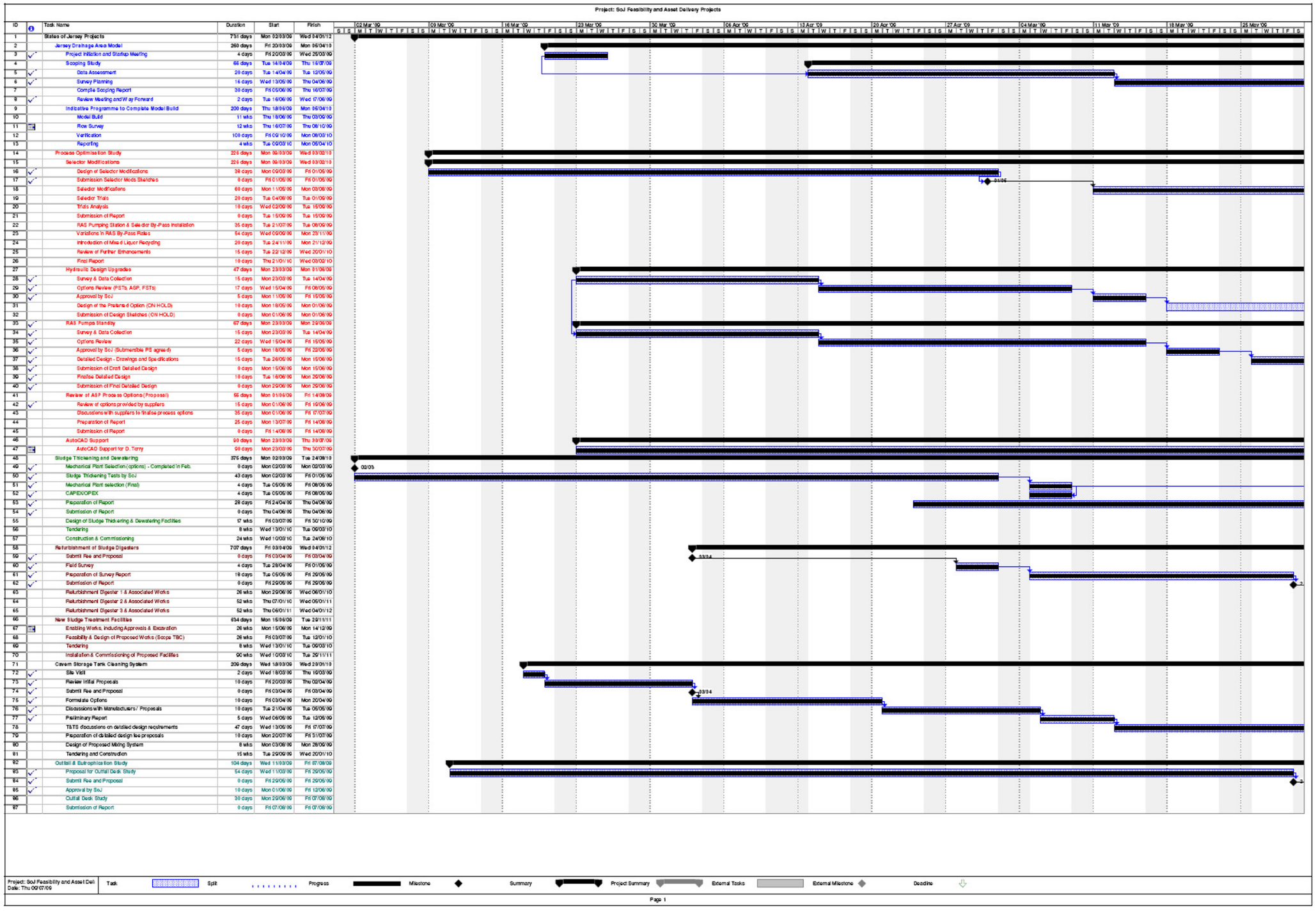

Figure 6.2 – Short Term Strategy Programme at 6th July 2009 – Page 1 of 11

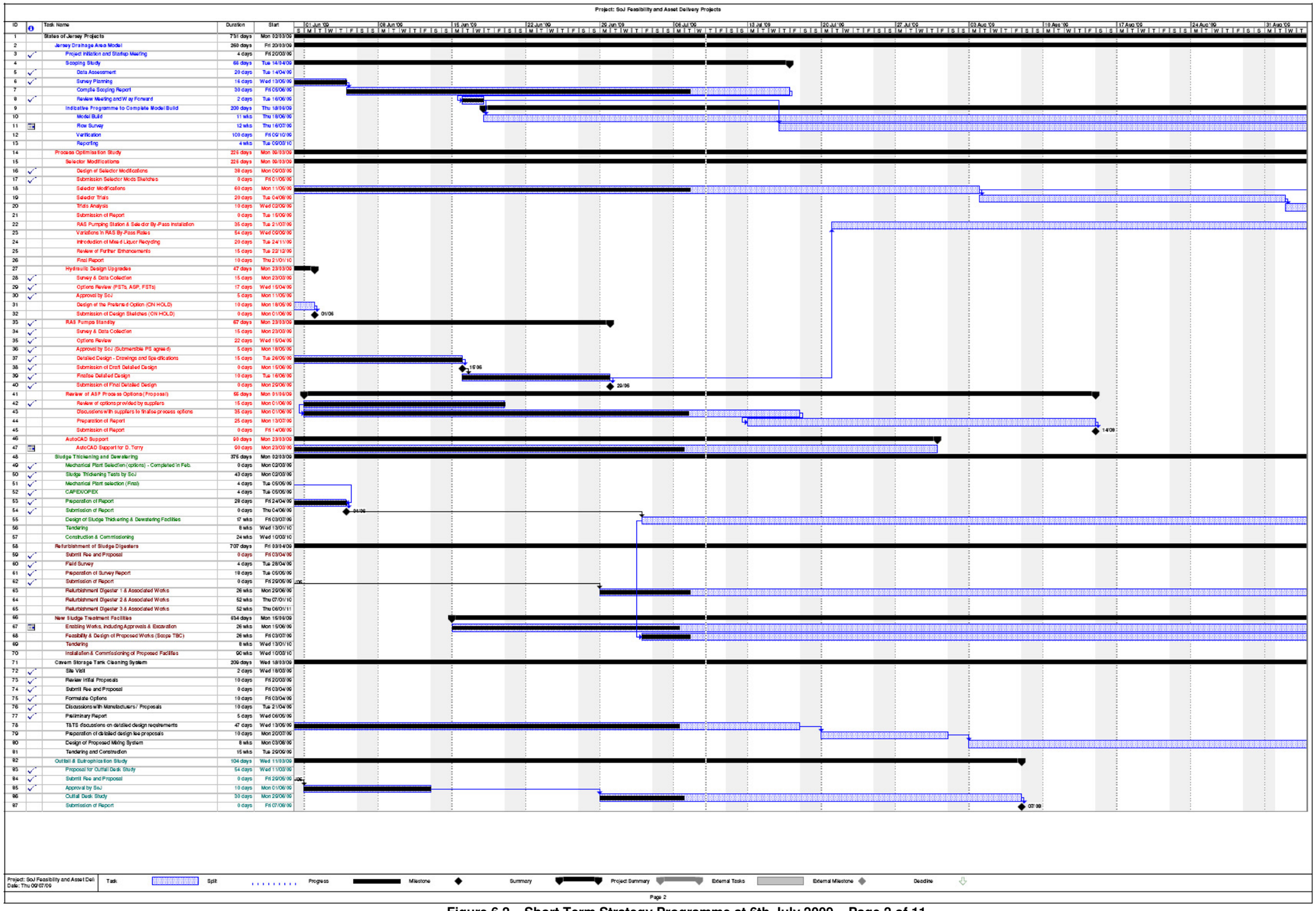

Figure 6.2 – Short Term Strategy Programme at 6th July 2009 – Page 2 of 11

APPENDIX A

MINUTES FROM THE LIQUID WASTE STRATEGY WORKSHOP

12TH FEB 2009

States of Jersey
Liquid Waste Strategy Workshop

12th February 2009

Prepared for:

Prepared by:
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Report Status: First Draft

Job No: P0000314010

	Name	Signature	Date
Prepared By:	Neil Gelston		24th February 2009
Checked By:			
Approved By:			

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1 INTRODUCTION

The purpose of the workshop was; to present for discussion the draft States of Jersey Liquid Waste Strategy Report (circulated in advance); to engage all principal Stakeholders in advancing and finalising the strategy; and to capture potential strategic issues or concerns.

As a starting point, the scene was set by an opening message by John Richardson in which he emphasised the practical impact of the current wider economic situation upon proposed strategic development and implementation. There was likely to be a dip in island growth and a period of no growth. He suggested that the strategy could be broken into 5 year elements. In addition to a summary of the background to the development and need for the Liquid Waste Strategy (LWS), he urged the workshop to provide an important catalyst to galvanise the direction and pace of the strategic decision making and implementation process.

The desired main outputs from the workshop included;

- Confirmed Stakeholder buy-in and commitment to the Strategy
- Identified Key responsibilities, inputs and ownerships
- Agreed decisions and captured items for further action
- Agreed communication and technical resolution approach

2 APPROACH

The workshop format was based on a programme combining short presentation of key elements of the LWS Report, with facilitated discussions and group working concentrated on four critical decision topics. These were;

- Levels of Service – Baseline Information & Changes in Levels of Service
- Customer Population Assumptions
- Assets Provision – Key decision points
- Strategic options for sludge e.g. Sludge disposal to land

The attendees were first of all invited to put forward brief post-it notes stating their own particular priority concerns and issues which they sought to be addressed or resolved during the workshop.

The workshop concluded by capturing views and proposals for taking the strategy proposal forward with optimum success.

3 OUTPUTS

3.1.1 Concerns and Issues

The main concerns and needs of the participants and their departments in terms of proposed LWS Document, and desired outputs from this joint workshop were captured and collated under following groups of criteria:

1. High level Government Policy and Strategic Planning
2. Baseline assumptions and information
3. Technical questions / concerns
4. Financial aspects / options

These not only embraced each of the key discussion topics programmed but highlighted a wide range of concerns, questions and follow-up actions. These are shown below following editing to take account of recurring or closely similar items from the participants. For brevity, certain discussion responses are shown in brackets alongside the basic comments raised by attendees.

Policy and Planning

- Caution with respect to making too many assumptions at current stage
- Concerns regarding some WWTW location options e.g. areas of high quality countryside potentially conflicting with presumption against development
- Environmental impact needed in detail before deciding site location
- Surface Water inundation of sewer system from private land/sources (Compliance with Drainage Law)
- Level of existing sewer maintenance / expenditure
- Proposals / Policy for new connection of existing properties to public sewer system (compulsory connections, payment for grouped connections, better use of Planning Obligations to fund increase in connections)
- Linkage with Jersey Water's 25 year water resource plan (e.g. water re-use)
- Difficulty in enforcing separation of foul and surface water connections
- Charging disincentives to new connections

Assumptions & Information

- Population figures not up to date. (Latest view on growth might be around 200 economically active heads of household p.a.). Action noted to check with Jersey Statistics dept.
- Tourist projections (to be checked with the Jersey Statistics dept).
- Trade load assumptions (to be checked).
- Future housing development spread too simplistic. (Action noted to check Transport section assumptions).
- Population spread across Island (to be agreed)
- Incomplete sewer network records
- Future housing development locations unknown
- Basis of Climate Change assumptions – Nadley (BIC) Report
- Basis of Water Consumption/Use data
- Site of existing Energy from Waste plant likely to be available for construction of a new sidestream WWTW in 2013. (Noted that the construction of new Energy from Waste plant was under review although contract had been signed).
- Complaints about smell from the composting currently undertaken on the La Collette site.

Technical Resolution/Assurance/Design Q's

- Discharge consent of Wastewater Treatment Works effluent / Total Nitrogen Limit of 10 mg/L or higher?
- Comparative benefits of short or long sea outfall options
- Locations of outfalls
- Risks of plant failures and impact on receiving waters e.g. east coast shellfish farming
- Integrity of existing foul and surface water sewer infrastructure
- Surface water ingress resolution
- Options for increased storage capacity on sewer network
- Modelling of dispersion / tidal effects of sea outfalls on bathing water quality and oyster beds
- Clarification of UV treatment application (during Winter)

- Basis of assumed Flow to Full Treatment

Financial aspects

- Asset Investment categorisation e.g. Capital Maintenance, Supply / Demand, Environmental Regulations, Better Services
- Effect of service procurement on selected options
- Costs / Benefits justification model needed.
- Affordability against timeline in current financial climate

3.1.2 Amendments Modifications to Draft LWS Report

It was agreed that a number of questions and issues raised and clarifying suggestions will be incorporated in a further draft of the presented report, as follows;

- Additional capital maintenance expenditure?
  - Provide additional breakdown
  - Clarify what 'the asset stock will be maintained at a similar existing state' means and option/consequences of not maintaining
- Flooding – insurer issues?
  - "Sewer flooding" & specific sites
  - More surface water run-off (from farm sheetings)
- Odour minimisation at WWTW and:
  - Other odour sources
  - Link with DEFRA code of practice (UKWIR Odour Minimisation Guidelines)
  - other potential solutions
- Emphasise other treatment options; similar levels of performance apart from nitrification (& also meeting other consents)
- Add 'appropriate treatment to avoid eutrophication' rather than specifying a Total Nitrogen Level of 10mg/L
- Is Flow to Full Treatment (FFT) of 3DWF appropriate? Need to state why this is the right level. Check with quality requirements.
- Pollution problems to groundwater
  - Other pollution issues
  - Granville Bay
  - Sustainability
- In view of the economic downturn, there should be some focus in phased capital expenditure with emphasis on what has to be done in the short term. Possibly look at 0 – 5 Year Plan, 5 – 10 Year Plan etc.
- Short term expenditure to be compatible with the long term strategy.
- Need for disinfection during winter months.
- Impact of Water Conservation on future expansion (reduced hydraulic load but the same organic load).
- Reword Levels of Service items.
- Identify requirements for Capital Maintenance, Supply / Demand, Environmental Regulations & Better Services in the cost estimates so that the expenditure can be categorised for the public.
- Consider 'Do Nothing' and 'Capital Maintenance Only' for options.
- More clearly Identify La Collette as a potential site for future WWTW.
- Clarify how the strong case for replacing Bellozanne WWTW has been arrived at.

- Clearly deal with issues likely to be raised by public e.g. local treatment, composting, SUDS and Potential for use of Grey water. (Possible link to an initial Strategic Direction Statement which sets the Service Targets before detailing the recommended solution).
- Possible link to water supply desalination plant?
- Clarify the basis for Carbon footprint assessment

3.1.3 Group Discussion Information Capture

During the course of the day all participants of the event contributed to discussion regarding the comparison between the two alternative sites considered (Bellozanne and La Collette) and the sea outfall type (long or short). The outcome of such discussion is detailed in Tables 3.1 and 3.2 below.

STW Sites

Bellozanne (existing site)		La Collette (new site)	
Positives	Negatives	Positives	Negatives
Established site use	Extremely confined site	No space constraints	Close to Port Ramsar
No changes to sewer network	Treatment standards will drop during construction	Low land value	Closer to Oyster beds
Politically acceptable?	Old plant will always have some odour problems?	Industrial area and away from housing	Eggs in one basket – risk
Effluent mixes with surface water?	Topography of St. Aubin's Bay?	Utilise power of Energy from Waste (EfW)	Public opinion (post EfW)
Planning approval process easier	Energy intensive	RAG and sludge disposal	Visual impact
	Electricity cost will be higher (peak demand)	All new plant (increased life)	Gateway to Jersey impact
	New plant will be nearer population	Releases Bellozanne site for housing	Loss of industrial land
	Overlooked by existing housing	Smaller carbon footprint	Infrastructure works to existing network
	Displacement of existing infrastructure	Safer option (construction and effluent)	Pipeline and P.S
	Limited site capacity	Can use conventional technology	Sensitive waters
	Sludge Transfer to new EfW plant at La Collette	Synergy with EfW?	
		Land value at Bellozanne	

Table 3.1 – WWTW Site Comparison

Note: No real views were expressed on relative cost-benefits.

Sea Outfall Options

Long		Short	
Positives	Negatives	Positives	Negatives
Perception?	Perception?	Best effluent quality	Treatment more costly
Better dispersion	Construction costs	Pumping cost	More sensitive area
	Maintenance costs		Higher risk process
Long term asset	Pumping cost		More maintenance
Less sensitive to future land use	Shipping hazard		More biosolids to dispose of
In failure mode less risk	Construction risk		Higher treatment costs

Long		Short	
Positives	Negatives	Positives	Negatives
	Greater risk to Port		More STW infrastructure
	Risk to Ramsar and oysters		
	Pumping surface water and effluent		
	Modelling must be correct		

Table 3.2 –Outfall Length Comparison

Note: Consensus was leaning towards a Long Sea Outfall solution subject to further dispersion and environmental impact studies.

4 OBSERVATIONS / RECOMMENDATIONS

During the course of the day there were several pertinent points raised, which are particularly worthy of serious further consideration, as they have potential to become blockers to successful adoption and progress of the LWS proposal.

- Key aims of workshop were largely achieved in stakeholder engagement and improved understanding of issues and consequences
- Broad range of personal /dept. concerns queries were captured with notable convergence of priorities appearing
- In addition to the four agenda topics of discussion, higher level policy and strategic planning issues were identified and raised in terms of decisions impact
- Useful points for clarification or additional information were identified for improved draft of Liquid Waste Strategy Report
- Workshop follow-up actions and owners were identified

Challenges to progress the Strategy proposal centred on gaining Ministerial consensus and support, including:

- Need for strong emphasis on promoting a clear set of options with associated long term measurable benefits.
- Concept of Policy, Strategy, and Contract Specification / Programme terminology are perhaps not as well understood across stakeholder and public audience as could be – needs clear explanation of nature and purpose. (Expectations were for a defined solution to be proposed and for there to have been enough feasibility done in advance to support the proposed solution).
- Programme Management principle of ‘staged sign – offs’ is agreed as a critical concept to be included.
- Green Paper approach is seen as important pre-cursor to detail strategy submission?
- Initial Strategic Direction Statement to set the Service Targets before detailing the recommended solution?
- Funding at Government level requires to be addressed – potential blocker

- Sludge Strategy – interdependence with other government land use initiatives is critical for optioneering.
- Likely questions/challenges from the public such as re-use should be dealt with clearly in the strategy.
- Short term expenditure is to be reviewed for compatibility with the long term strategy.

5 NEXT STEPS

Proposed Actions

Core Strategy Area	Key Action	Priority	Owner	Date Req'd By	Progress Status	Comments / Issues
Levels of Service	Receiving Water Design Parameters	High	Grontmij			Captured in Section 3 above
	Development locations	High	J. Richardson			Captured in Section 3
	No. of existing properties to be connected to sewers system	Medium	D Berry			
	Environmental issues update requested from stakeholders	High	All stakeholders			
	Obtain information on pollution incidents from non-connected properties. Granville Bay issue.		Grontmij / D Berry			
Population / Flow	Industrial flows/changes	High	All to advise known plans/projects			
	Confirm latest views on population and tourist projections	High	Grontmij			
Options	Clarify the case for replacing Bellozanne STW		Grontmij			
	Clarify how proposal arrived at for La Collette		Grontmij			
STW Location	Overall Island Plan / timing / public information / Strategic Plan. Alternative land use for La Collette site.	High	Client to resolve			
Island Plan	Island Plan to be amended to show the potential options for the STW location.	High	Client to resolve			
	La Collette to be registered as soon as possible as a possible location of	High	Client to resolve			

Core Strategy Area	Key Action	Priority	Owner	Date Req'd By	Progress Status	Comments / Issues
	STW site.					
Island Policy	Connection to sewer system - requires potential decision. Study / information on priority assessment of properties to connect.	Medium	Duncan Berry			
	Strategy - Develop Green Paper	High	John Rogers			
	Check climate change British Islands Council figures or South West or UKCIP		Grontmij			
	Obtain Bellozanne & La Collette land value costs	High	Duncan Berry			
	Implement water quality modelling of St Aubin's Bay		TBC			Specification must confirm/reject risk of eutrophication and meet the quality standards for locations of long / short outfalls.
	Long sea outfall study		TBC			See above
	More detailed cost estimates ('feasibility') for Bellozanne and La Collette		Grontmij			To be carried out before Strategic Decision requested
	The basis for the Carbon impact assessment to be agreed with L. Maris.		Grontmij			Jersey's nuclear based energy has low carbon impact
	The basis for the SEA assessments to be agreed with L. Magris		Grontmij			
Sludge	Liaise with the Environmental team re the WFD and the application of sludge. GIS mapping layers being developed		D Berry & Grontmij			

Table 5.1 – Action Log