States of Jersey

Sewage Treatment Works

Configuration and Location Options Report

April 2010

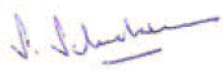
Prepared for:
States of Jersey
Transport and Technical Services
Waste Management Services
PO Box 412
States Offices
South Hill
St Helier
JE4 8UX

Prepared by:
Grontmij
Grove House
Mansion Gate Drive
Leeds
LS7 4DN

T +44 (0)113 262 0000
F +44 (0)113 262 0737
E jason.jones@grontmij.co.uk

Grontmij

www.grontmij.co.uk

Report Status:	Issue 2		
Job No:	100942		
	Name	**Signature**	**Date**
Prepared By:	Jason Jones / Jason Ball		26/04/10
Checked By:	Selva Selvakumaran		26/04/10
Approved By:	Chris Wotherspoon		26/04/10

EXECUTIVE SUMMARY

A Liquid Waste Strategy is currently being developed to identify the optimum approach for the provision of liquid waste services in Jersey for the next 20 years.

This report was originally prepared for the Project Board meeting on 15 September 2009 and was subsequently updated to include the final Environmental Impact Review (EIR). It summarises the results of work to identify a preferred location and treatment configuration for the long term treatment of liquid waste. It includes recommendations relating to the preferred arrangement and location of sewage treatment facilities for consideration by the Project Board.

Twelve options for a range of potential treatment works locations and configurations have been identified and evaluated on initial capital cost and environmental impact basis. The options are based on an estimated 2028 design population equivalent of 110,000 and compliance with Jersey law and international best practice legislation, such as the European Union 1991 Urban Wastewater Directive (UWWTD)[1] and 2006 Bathing Waters Directive[2].

The Wastewater Treatment Directive requires different levels of treatment depending on whether effluent is discharged to "sensitive" or "non-sensitive" water. St Aubin's Bay is likely to be a sensitive water and studies to determine this are in progress. Hence, options have been developed which include:

- Treatment of effluent to a level acceptable for discharge to non-sensitive ("deep") waters via a long sea outfall.

- Treatment to achieve an effluent quality acceptable for discharge to sensitive waters, with effluent discharged to St. Aubins Bay below Mean Lower Water Springs (MLWS) via a short sea outfall.

Based on the initial capital cost and environmental impact review, the following options have been analysed on a net present cost basis over a 20 year period using a 6% discount factor:

- **Option 6: New treatment works at the La Collette landfill site to replace Bellozanne**
  - 6i - discharge into deep water via a long sea outfall
  - 6ii - discharge into St Aubin's Bay

- **Option 7: New treatment works within the existing Bellozanne operational site**
  - 7i - discharge into deep water via a long sea outfall
  - 7ii - discharge into St Aubin's Bay

Options 7i and 7ii have lower whole life costs than Options 6i and 6ii, and have equal or better environmental rankings. Furthermore, Option 7 has been identified as the option that would best serve the strategic interests of the States of Jersey. Although the NPC analysis identifies that Options 7i and 7ii have the lowest costs, these are relatively close and it not possible to determine a single preferred option without more detailed analysis.

It is recommended that the Project Board confirms that a new activated sludge plant at Bellozanne is the preferred option and sanctions further work to: -

[1] EU Urban Wastewater Treatment Director (91/271/EEC).
[2] EU Bathing Waters Directive (2006/7/EC).

- Confirm a master plan for the development of Bellozanne STW;
- Confirm the appropriate level of treatment and effluent discharge location; and
- Develop cost estimates for budgeting purposes.

1 INTRODUCTION

Transportation and Technical Services (T&TS) currently operates two sewage treatment works (STWs). These are Bellozanne, which was opened in 1959 and is situated in Bellozanne Valley, and Bonne Nuit, a small package plant, which was commissioned in 2003. Bonne Nuit takes flows from the surrounding local area whilst Bellozanne takes all other effluent treated by T&TS. This includes the contents of private septic tanks and tight tanks, which are tankered to the site.

A Liquid Waste Strategy (LWS) is currently being developed. The objective is to identify the optimum approach for the provision of liquid waste services on the Island for the next 20 years, including the preferred arrangement and location of the sewage treatment facilities.

This report was originally prepared for the LWS Project Board meeting on 15 September 2009 and was subsequently updated to include the findings of the final Environmental Impact Review (EIR). It summarises the results of work to identify a preferred location and treatment configuration and includes recommendations for consideration by the Project Board.

In the preparation of the report, it has been assumed that effluent from Bonne Nuit and the surrounding area will continue to be treated at Bonne Nuit STW, although this would not have a material impact on the recommendations.

2 TYPE OF TREATMENT

The selection of the type of treatment process to be provided is covered in a separate report entitled "Treatment Process Review Report, Issue 02" of April 2010. This recommends activated sludge as the appropriate secondary treatment process and the assessments carried out as part of this study are on this basis.

It has been agreed that the LWS will be based on compliance with Jersey law and international best practice legislation. The key international best practice legislation associated with discharges of wastewater to marine environments are the European Union Urban Wastewater Directive (UWWTD) and Bathing Waters Directive. All options evaluated in this report allow compliance with these two directives.

The UWWTD requires different levels of treatment depending on whether effluent is discharged to "sensitive or non-sensitive" waters. Studies are currently ongoing to determine whether St. Aubin's Bay is sensitive. For the purposes of this report, it has been assumed that the Bay will be deemed to be "sensitive" and, therefore, any discharges will require a high level of removal of total nitrogen.

For options involving potential discharges of treated effluent to St. Aubin's Bay, the following two alternative approaches have been considered:

1. Treatment of effluent to a level acceptable for discharge to non-sensitive ("deep") waters via a long sea outfall.

2. Treatment to achieve an effluent quality acceptable for discharge to sensitive waters, with effluent discharged to St. Aubins Bay below Mean Lower Water Springs (MLWS) via a short sea outfall.

The choice of level of treatment and effluent disposal location can be emotive issues in terms of public perception. A summary of the strengths and weaknesses of the approaches is given in Figure 1.

Treatment Process	Strengths	Weaknesses
Conventional + discharge to deep water via a long sea outfall	• Reduced operational cost and complexity. • Reduced energy cost and carbon footprint. • Reduced risk of failure of EU Bathing Waters Direction should there be operational issues at the STW. • Reduced risk to the environment should the STW fail.	• Potential risk of currents bringing back non-compliant effluent to shore. • Additional potential construction difficulties (weather, ground conditions etc).
Full nitrifying + discharge to St Aubin's Bay	• Reduced nutrient load to St Aubin's Bay • May be seen by pressure groups as a more responsible solution.	• Bay may still fail nutrient level due to nutrients from other sources. • Greater operational complexity – more things to go wrong. • Increased energy costs and carbon footprint. • Additional sludge produced. • Potential construction difficulties (weather, ground conditions etc).

Figure 1 –Alternative Treatment Approaches for Compliance with the UWWTD

Disinfection of final effluent is unlikely to be required to meet the Bathing Water Directive for discharges to deep water. However, it is understood that there may be public perception issues if discharges are not disinfected. In addition, disinfection would provide a safety margin in the event of any process failures and it is allowed for in all options.

3 POTENTIAL SITE IDENTIFICATION

The capital cost of a STW is significantly influenced by factors such as:

- the type and level of treatment provided;
- the treatment capacity;
- the extent of sewerage network modifications to transfer flows to the works;
- the physical conditions at the site; and
- the extent of existing assets which are utilised.

The location of a STW impacts on capital costs to the extent that it influences the factors outlined above. Any measures to deal with specific site constraints are unlikely, however, to impact on capital costs to such an extent that they change the choice at a strategic level.

An initial site identification exercise was, therefore, carried out in conjunction with T&TS to identify potential configurations which would enable key cost drivers and other relevant factors to be evaluated. This took cognisance of the existing factors, particularly the sewerage system and population centres; these impact on the size of the works and the costs of modifications to the existing sewerage system.

Potential site locations were identified to give a range of different configurations and potential locations in different parts of the island to enable a holistic evaluation. This took into account financial and environmental factors. Where appropriate, sub-options for the discharge to St. Aubins Bay via a short or long sea outfall have been considered for each main option.

Configurations identified for evaluation are as follows:

Option 1: Existing Bellozanne STW with a new “side stream” plant on the site of the solid waste facilities at Bellozanne.

This option assumes that a new works would be built at Bellozanne in the area currently occupied by the existing Energy from Waste Plant (EfW) and the T&TS workshop. Its capacity would be sufficient to enable the existing plant to be down-rated to achieve the design consent. The existing plant would be refurbished, but not extended or replaced.

Option 2: Existing Bellozanne STW plus a new STW in the south-east of the island

This option assumes that a new works would be constructed towards the eastern edge of the urban area of St. Helier to treat flows from the south-east part of the island. The sewerage system would be amended so that flows to Le Dicq Pumping Station (PS) are transferred to the works. For the short sea outfall option, a portion of flows from Weighbridge would need to be pumped to the new works. The Population Equivalent (PE) at Bellozanne would be reduced to enable it to achieve its design consent, and the plant refurbished, but not extended.

For the purposes of this evaluation, it has been assumed that the new works would be buried below the existing FB Fields and Athletics Track, because the availability of land to construct an un-enclosed plant in the area is limited.

Option 3: Existing Bellozanne STW plus a STW in the south-west of the island

This option assumes that a new works would be constructed in the south-west of the island to treat flows from St Brelades and associated areas. Flows to Beaumont PS would be transferred to the works. For the short sea outfall option, a portion of flows arriving at First Tower PS would also be pumped to the new works. The PE at Bellozanne would be reduced to enable it to achieve its design consent and the plant refurbished, but not extended.

For the purposes of this evaluation, it has been assumed that the new works would be constructed in greenfield land in the area inland of Corbière Lighthouse, with flows transferred from Beaumont PS via a rising main laid predominantly in the disused railway track.

Option 4: Existing Bellozanne STW plus new STWs in the south-east and south-west of the island

The locations of the works are as per Options 2 and 3. The PE at Bellozanne would be reduced to enable it to achieve its design consent for discharge to St. Aubins Bay, with the remaining effluent treated at the south-east and south-west STWs.

Flows to the south-east works would be diverted from Le Dicq PS. Flows arriving at Beaumont PS would be pumped to the new works in the south-west with a portion of the remaining flows arriving at First Tower PS diverted to this works.

Option 5: New STWs in the south-east and south-west

This option assumes that new STWs would be constructed in the south-east and south-west of the island and Bellozanne would be abandoned.

Flows arriving at Le Dicq PS and a portion of the flow arriving at Weighbridge would be diverted to the south-east plant. Flows arriving at Beaumont PS and the remaining flows arriving at First Tower PS would be pumped to the south-west plant.

Option 6: New STW at La Collette landfill site

This option assumes that a new works would be constructed at La Collette landfill site and Bellozanne would be abandoned. The sewerage network would be modified such that flows from the west of the island would be pumped from First Tower PS to a new pumping station at Weighbridge. Flows from St. Helier and the east of the island, which currently gravitate from Weighbridge to First Tower PS, would be diverted to the new Weighbridge PS and all flows pumped to the new works.

Option 7: New STW at Bellozanne Operational Site

This option assumes that a new works would be constructed within the existing waste management operational area at Bellozanne. As space is limited, and there is a need to maintain treatment capability during construction, this option would involve phased development over a number of years. It would be necessary to remove part of the existing bank/ valley side in the north-eastern part of the site. This option requires no modifications to the existing sewerage network.

The configurations/ location options include a wide range of plant sizes, locations and site types, such as greenfield, buried in an urban area, existing brownfield and landfill site. Due to the topography of the island, the predominantly rural nature and concentration of the majority of the

population in the south of the island, it was considered that any works to the north or centre of the island would not be viable. Hence, no such locations were included.

It should be noted that the specific locations considered in the evaluation are large enough to accommodate the STW footprints and are in the vicinity of key points in the sewerage network. Use of the sites is not meant to indicate a particular preference/ endorsement of any site.

The indicative locations of the four sites used in evaluation are shown in Figure 2.

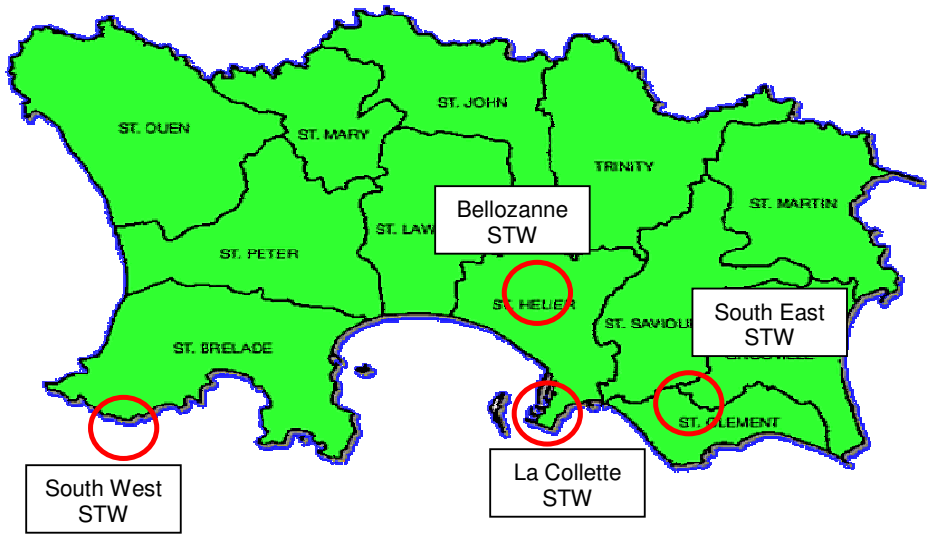


Figure 2 – Indicative STW Locations

As noted previously, where applicable, options with a potential discharge to St. Aubin's Bay have been evaluated on the basis of a long sea outfall with a level of treatment acceptable for discharge to non-sensitive waters (i) and with a level of treatment acceptable for discharge to sensitive waters, with discharge to St. Aubins Bay via or short outfall to MLWS (ii). This applies to Options 1, 2, 3, 6 and 7.

4 DESIGN BASIS

4.1 Population

The assessments are based on a total population of 110,000 and a design horizon of 2028. This allows for a net inward migration of 150 heads of household per year. Details of this build up are contained in Appendix A.

It has been assumed that the existing capacity of Bellozanne is a PE of 100,000 for discharge to non-sensitive waters and a PE of 60,000 for discharge to sensitive waters. This is based on process considerations.

4.2 Flows and Loads

The projected flows to the works have been calculated using the following formula:

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

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

The per capita water consumption is 150litres/head/day, which is consistent with the assumptions used in the Jersey Water's Water Resources Plan[3]. This is assumed not to vary significantly over the forecast horizon. Infiltration is assumed to be 0.3PG. Trade effluent flows are assumed to remain constant at 30l/s over the period.

BOD loads to the works have been assumed as 60g/head/day, which is in line with accepted practice.

4.3 Discharge Consent

An effluent discharge consent of 25mg/l BOD and 35mg/l SS has been assumed for all discharges to non-sensitive waters as defined by the UWWTD.

As stated in Section 2, studies are ongoing to determine whether St Aubin's Bay is a sensitive water and it has been assumed that any discharges to the Bay will be subject to a nitrogen limit. Thus the discharge consent would be 25mg/l BOD, 35mg/l SS and 10mg/l nitrogen. This would require an advanced level of treatment compared with discharge to non-sensitive waters but does not require a long sea outfall.

As noted previously, it has been assumed that all discharge consents would require the ultra-violet disinfection to achieve the requirements of the Bathing Waters Directive which will become applicable by 2015

[3] Telephone conversation with John Howard of Jersey Water

5 ASSESSMENT CRITERIA

To ensure a thorough assessment of relevant factors, the twelve options were evaluated according to their:

- 20 year capital cost (CAPEX);
- Relative environmental impact; and
- Energy usage.

In addition, a qualitative SWOT (Strength, Weaknesses, Opportunities, Threat) analysis was carried out to identify any non-tangible issues which may have a significant impact on selection. This SWOT analysis is included in Appendix B.

In carrying out the analysis, the following approach was taken:

- 20 year capital cost – Capital costs were prepared using a unit cost database which gives indicative non-site specific costs for a range of capacities. Site specific issues were used to inform any relevant revisions to the unit costs. The capital cost estimates are based on April 2010 prices and include an allowance for design and a 40% uplift to account for higher construction cost on Jersey compared to the UK mainland. Costs/ income associated with land purchase/ disposal and site specific clearance or the relocation of existing assets are excluded from the evaluation. The costs include an uplift of between 12 and 15% for feasibility, design and supervision, depending on the capital item.

- Environmental Impact Review (EIR) – To consider the environmental impacts associated with the construction and operation of each option, a relative EIR was carried out. 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
    - Archaeology

- Energy Usage – Operational electricity use has been estimated based on assumed average flows with a unit cost of 7.5p/kw/hr.

Following this first stage evaluation, a number of options were selected for further evaluation on a net present cost (NPC) basis.

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.

6 ASSESSMENT RESULTS

The results of the assessment are as shown in Figure 3.

Option	20 Year CAPEX[1]	Environmental Impact Ranking & Score[3]	STW Power (Million kWh per year)
Option 1: Bellozanne - extensions would be constructed as a side stream plant			
i) Bellozanne STW + additional new side stream plant discharge into deep water	4th £55M	4th -2	3rd 10.58
ii) Bellozanne STW + additional new side stream plant discharge into St Aubin's Bay	3rd £54M	Joint 1st +1	8th 11.93
Option 2: Bellozanne + new South East STW			
i) Bellozanne STW discharge into deep water + new South East STW discharge into deep water	Joint 8th £78M	Joint 9th -10	7th 11.67
ii) Bellozanne STW discharge into St Aubin's Bay + new South East STW discharge into deep water	10th £83M	Joint 7th -8	10th 12.84
Option 3: Bellozanne + new South West STW			
i) Bellozanne STW discharge into deep water + new South West STW discharge into deep water	7th £71M	Joint 9th -10	6th 11.51
ii) Bellozanne STW discharge into St Aubin's Bay + new South West STW discharge into deep water	Joint 8th £78M	Joint 7th -8	9th 12.40
Option 4: Bellozanne + new South East & South West STW			
Bellozanne STW discharge into St Aubin's Bay + new STW at South East discharge into deep water + new South West STW discharge into deep water	11th £118M[2]	12th -27	not updated
Option 5: New South East and South West STW			
New South East STW discharge into deep water + new South West STW discharge into deep water	12th £129M[2]	11th -20	not updated
Option 6: New La Collette STW to replace Bellozanne STW			
i) New STW at La Collette discharge into deep water	5th £66M	5th -3	1st 9.90
ii) New STW at La Collette discharge into St Aubin's Bay	6th £69M	6th -4	Joint 4th 10.74
Option 7: New STW within the existing Bellozanne Operational Site			
i) New STW at Bellozanne discharge into deep water	2nd £46M	3rd 0	2nd 10.56
ii) New STW at Bellozanne discharge into St Aubin's Bay	1st £43M	Joint 1st +1	Joint 4th 10.74

Note 1: The CAPEX includes costs to meet consent and levels of service.
Note 2: CAPEX options 4 and 5 are based on previous population estimates with "by inspection" adjustments to give a comparative basis.
Note 3: The Phase 1 environmental scoring is based on the report issued in November 2009.

Figure 3 - Evaluation Results

Options 6i, 6ii, 7i and 7ii were selected for NPC analysis as they had the lowest CAPEX (apart from Option 1i and 1ii) and the best environmental rankings. Options 1i and 1ii were not selected for NPC analysis as they would not address all of the existing operational issues; this is discussed further in Section 7.

The choice of Options 6i, 6ii, 7i and 7ii was approved by the Project Board on 15 September 2009.

The NPCs results are shown in Figure 4:

Option	NPC
Option 6: New La Collette STW to replace Bellozanne STW	
i) New STW at La Collette discharge into deep water	£68M
ii) New STW at La Collette discharge into St Aubin's Bay	£70M
Option 7: New STW within the existing Bellozanne Operational Site	
i) New STW at Bellozanne discharge into deep water	£45M
ii) New STW at Bellozanne discharge into St Aubin's Bay	£46M

Figure 4 – Net Present Cost Results

The NPCs results indicate that Options 7i and 7ii have lower whole life costs than Options 6i and 6ii.

Further details of the environmental impact review are included in the "Environmental Impact Review Phase 1 Report, Final Draft", of November 2009.

It should be noted that the capital cost estimates have been carried out to such a level that they are appropriate for comparative purposes, but more detailed analysis is required to develop cost estimates for budgeting purposes. 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.

7 DISCUSSION OF RESULTS

The key criteria for identification of the preferred configuration and location of a works are financial, environmental and operational. Energy usage is included in the environmental impact review and NPCs are, thus, encapsulated within these criteria.

From Section 6, Options 4 and 5 have the highest CAPEX figures and the worst environmental rankings and are, therefore, not considered to be appropriate.

Whilst Options 2i, 2ii, 3i and 3ii, have CAPEX figures of similar order to Options 6i and 6ii, they have worse environmental rankings. There is likely to be significant public objection to a new works in either of these areas. None of these options is therefore considered appropriate.

Whilst Options 1i and 1ii have the second lowest CAPEX, and lowest environmental rankings, they do not provide a long term sustainable operational solution for the following reasons:

- The extent of the existing site is limited.
- The existing health & safety, process and hydraulic issues at the site would not be fully addressed.
- The health & safety, process and hydraulic issues would be compounded with a new side stream plant.
- The option would be subject to a protracted timescale due to the need to wait until commissioning of the new EfW plant and clearance of the site (including relocation of the T&TS workshop and offices) before construction could commence.
- The option is likely to be subject to significant public opposition as the new facilities would be constructed closer to housing.
- Significant costs would result from site clearance and the relocation of the existing T&TS assets in the site; these costs are not included in the capital cost estimates.

Options 1i and 1ii are, therefore, not considered appropriate; this was approved by the Project Board on 15 September 2009.

Options 7i and 7ii have lower whole life costs than Options 6i and 6ii. The NPCs for Options 7i and 7ii are within the likely tolerance for this level of analysis and it is not possible to distinguish between them without more detailed analysis.

Based on the EIR Phase 1, Option 7 is the better performing option. Under the preliminary EIR Phase 2, the difference in unweighted scores between Options 7 and 6 reduces prior to consideration of strategically important issues for the States of Jersey. For example, Option 6 envisages the use of land at La Collette which could be potentially used for the East of Albert project. Hence, it was determined that there were no merits in taking Option 6 forward because Option 7 is the best performing option financially and is equal (unweighted) or better (weighted) environmentally.

CONCLUSIONS AND RECOMMENDATIONS

Of the options selected for NPC analysis, Options 7i and 7ii have lower whole life costs than Options 6i and 6ii, and have equal or better environmental rankings. In addition, La Collette need not be considered further because of the wider strategic interests of the States of Jersey, including the potential use of this land for the East of Albert project.

The analysis indicates that Options 7i and 7ii have similar NPCs but it is not possible to differentiate between the two at this stage.

It is, therefore, recommended that the Project Board confirms that a new activated sludge plant at Bellozanne is the preferred option and sanctions further work, with the design basis for the plant to be as set out in Section 4, to:

- Confirm the appropriate level of treatment and effluent discharge location;
- Confirm a master plan for the development of Bellozanne STW; and
- Develop cost estimates for budgeting purposes.

.

APPENDIX A - POPULATION

Population Projections

Current Population

Population statistics for 2008, released by the States of Jersey Statistics Unit, indicate that the resident population is 91,800[4]. 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[5], 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[6] 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.

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 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 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[7] 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.

[4] Jersey Population Update 2008, States of Jersey Statistical Unit - http://www.gov.je/NR/rdonlyres/105821C3-2A82-480F-A887-C1F4CFBA67FA/0/2008populationupdate.pdf
[5] Telephone conversations with First Research, 8th June 2009 and 28th August 2009
[6] Jersey Labour Market at 2008, States of Jersey – http://www.gov.je/NR/rdonlyres/E0C5C2FD-63CF-4102-B57D-257444377751/0/manpower2008dec.pdf
[7] First Research have been commissioned by States of Jersey to provide historical tourism data

Given the 2008 estimate is significantly higher than the latest population model[8], it would be prudent for the purposes of flow forecasting to take the higher value. Therefore, the projected populations shown in Table 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.

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 – Estimated Maximum Island Population

Approximately 92% of the population[9] are currently connected to the sewerage system. It is assumed (on the basis of an increase in property connectivity from 87% to 90%) that a further 1000 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 3. The 150 households' heads figure is used by States of Jersey for planning purposes.

Scenario	2008	2010	2015	2028	2035	2065
Net NIL	101,016	101,566	102,124	102,259	101,386	86,386
+150hh	101,016	101,806	103,964	109,279	110,726	109,326
+200hh	101,016	101,886	104,544	111,619	113,906	117,006
+250hh	101,016	101,966	105,124	113,999	117,086	124,786
+325hh	101,016	102,086	106,044	117,559	121,806	136,406
+650hh	101,016	102,646	109,904	132,759	142,166	186,666

Table 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. A 20% contingency results in a maximum population of some 132,000. This contingency, or headroom, allows for uncertainty in, amongst other things, climate change, creep[10] and future changes in law or planning policy.

[8] The Jersey Population Model, States of Jersey, 2009 - http://www.gov.je/NR/rdonlyres/E80D30B2-4582-4163-9B57-48AE4328B7CC/0/Populationmodel2009paper.pdf
[9] Email correspondence with Steve Fisher, 4th September 2009
[10] 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.

APPENDIX B – SWOT ANALYSIS

SWOT Analysis

#	WWTW Option	Strengths	Weakness	Opportunity	Threat
1 i)	Bellozanne Plant, carbonaceous, 4.5km sea outfall	• Established site • Low carbon footprint • No significant development of sewerage infrastructure needed • Perceived to be more politically acceptable at Bellozanne as there is no change in land use	• Ops difficulties during modification work • Transport to the new EfW plant. • Land space restrictions • Future expansion close to existing housing development • Current hydraulic and process constraints remain on existing works • Confined site by valley walls. Removal of hillside will be required • Requires relocation of other services (but unlikely to affect the LWS implementation programme) • Carbon impact of excavated material removal • Disposal of grit and screenings at La Collette • Contaminated land assessment will be required • Longer outfall length required for discharge of effluent	• Shorter Outfall • 5km Outfall cost may not need UV disinfectant	• Sea outfall insufficient • Sludge disposal to land uncertain • Required land not available in time • Nutrient influx from watercourses may still result in eutrophication within the Bay
1 ii)	Bellozanne Plant, nitrifying, 1.5km sea outfall	• As above + reduced nitrogen input into Bay	• As above	None	• As above + the reduction in treated nitrogen may be cancelled out by the increase in demand
2 i)	Bellozanne, carbon, 4.5km sea outfall + FB Fields, carbon, 5km sea outfall	• FB fields site frees St Helier sewer capacity • Population flexibility • Free up of Belloz. EfW land	• Ops difficulties during modification work • Need to transport raw sludge to Bellozanne • Transport to the new EfW plant. • FB Fields is buried & will be complex • Operations have to run 2 sites • Current hydraulic and process constraints remain on existing works	• Shorter (best case 2km) outfalls may be sufficient • 5km Outfall cost may not need UV disinfectant	• As for 1(ii) • Planning difficulties for FB Fields • Sludge disposal to land uncertain • Insufficient power supply to works • Access & tankering difficulties • Nutrient influx from watercourses may still result in eutrophication within the Bay • FB Fields close to Ramsar site and shellfish beds
2 ii)	Bellozanne, nitrify, 1.5km sea outfall + FB Fields, carbon, 5km sea outfall	• As above + reduced nitrogen input into Bay	• As above	• As above	• As above
3 i)	Bellozanne, carbon, 4.5km sea outfall + La Rosiere, carbon, 2km sea outfall	• Reduced consent risk at St Aubin's Bay • La Rosiere frees capacity in First Tower PS • Population flexibility • Free up of Belloz. EfW land	• Ops difficulties during modification work • Need to transport raw sludge to Bellozanne • Transport to the new EfW plant. • Operations have to run 2 sites • Current hydraulic and process constraints remain on existing works	• As above	• Consents not met • Planning difficulties for La Rosiere • Sludge disposal to land uncertain • Insufficient power supply to works • Access & tankering difficulties • Nutrient influx from watercourses may

					still result in eutrophication within the Bay
3 ii)	Bellozanne, nitrify, 1.5km sea outfall + La Rosiere, carbon, 2km outfall	• As above + reduced nitrogen input into Bay	• As above	• None	• As above
4	Bellozanne, nitrify, 1.5km sea outfall + FB Fields, carbon, 5km sea outfall + La Rosiere, carbon, 2km sea outfall	• Reduced consent risk at St Aubin's Bay • Freed capacity in St Helier system and at First Tower • Population flexibility • Free up of Belloz. EfW land	• As above • Operations have to run 3 sites • Current hydraulic and process constraints remain on existing works	• Shorter (best case 2km) Outfall cost may be sufficient • 5km Outfall cost may not need UV disinfectant	• Consents not met • Planning difficulties for 2 x new Works • Uncertain sludge land disposal • Insufficient power supply to works • Access & tankering difficulties • Outfall water too shallow • Cost risk on rising main to site • Nutrient influx from watercourses may still result in eutrophication within the Bay • FB Fields close to Ramsar site and shellfish beds
5	FB Fields, carbon, 5km sea outfall + La Rosiere, carbon, 2km sea outfall	• Complete new facilities • Reduced nutrient input into St Aubin's Bay • Freed capacity in St Helier sewer system • FB Fields land is cost free • Population flexibility • Freeing up of Bellozanne land Free up of Belloz. EFW land	• Need to transport grit & rags & sludge cake to the new EfW plant. • Need to tanker raw sludge from one of the new works • New FB Fields plant has to be buried with associated operational difficulties • Odour control issues • Operations have to run two distant sites	• Shorter (best case 2km) Outfall cost may be sufficient • 5km Outfall cost may not need UV disinfectant	• Consents not met • Planning difficulties for 2 x new Works • Uncertain sludge land disposal • Insufficient power supply to works • Access & tankering difficulties • Outfall water too shallow • Cost risk on rising main to site • Nutrient influx from watercourses may still result in eutrophication within the Bay • FB Fields close to Ramsar site and shellfish beds
6 i)	New La Collette, carbon, 2.5km sea outfall	• Complete new facility • Freeing capacity in the St Helier sewer system • Sufficient land available with potential for future expansion • No relocation of other services required • Shorter outfall length required to deep (non-sensitive) waters • Industrial area and away from housing • Disposal of grit and screenings at La Collette solid waste facilities	• Development of significant sewerage infrastructure needed (transfer flows to new site with Diversion sewers, P.S. & pumping mains) • Visual impact. (Gateway to Jersey impact) • Close to environmental and ecologically sensitive areas (Ramsar site and shellfish beds) • High carbon input of land reclamation • Potential risk – major solid waste and liquid waste assets all on one site • Needs contaminated land assessment • Special foundation requirement due to aggressive ground conditions. Saline intrusion.	• Potential synergy of EfW and treatment works resources (manpower; reduced rag and sludge transport costs; utilise power)	• More at risk from coastal flooding and climate change impacts (i.e. sea level rises). • Planning & Political – Sensitive post EfW • EIAs may be stringent based on the development of the EfW Plant • Public opinion (post EfW) to new development • Potential for protracted implementation of the LWS • Land may not be available in time • Nutrient influx from watercourses may still result in eutrophication within the Bay • Consents not met

6 ii)	New La Collette, nitrifying, 1.5km sea outfall	• As above + reduced nitrogen input to Bay	• As above	• As above	• As above
7 i)	Bellozanne, phased replacement, 4.5km outfall into deep water	• Established liquid waste & solids waste site • Sufficient land available within the operational site with potential for future expansion • Existing site 'hidden' by valley topography • Away from established housing development • Existing EfW Plant, Workshop & Offices do not need to be relocated for construction to start • Demolition of the existing EfW Plant can be delayed • Major solid waste and liquid waste assets on separate sites • Maximises the design life of existing assets. Tie-in with capital maintenance • No significant development of sewerage infrastructure needed • Current Bellozanne hydraulic and process constraints eliminated • Planning – compatible with the current land use • Perceived to be more politically acceptable at Bellozanne as there is no change in land use	• Confined site by valley walls. Removal of hillside will be required • Requires relocation of other services (but unlikely to affect the LWS implementation programme) • Carbon impact of excavated material removal • Sludge transfer to new EfW plant at La Collette for incineration when land disposal is not available. • Disposal of grit and screenings at La Collette • Contaminated land assessment will be required • Longer outfall length required for discharge of effluent	• Potential cost-neutral option for disposal of excavated rock. Potential for use at La Collette site. • EIAs may not be stringent as there is no change in land use • Timely programme for implementation of the LWS or less risk of changes to programme.	• Potential for piling requirements • Nutrient influx from watercourses may still result in eutrophication within the Bay • Consents not met
7 ii)	Bellozanne, phased replacement, 1.5km outfall into St Aubin's Bay	• As above + reduced nitrogen input into Bay	• As above (except for longer outfall)	• As above	• As above + the reduction in treated nitrogen may be cancelled out by the increase in demand