REPORT N^{O} 70019143/DS/AG

LA COLLETTE WASTE METALS FACILITY

RISK ASSESSMENT TO SUPPORT DRAINAGE TO SOAKAWAY

MARCH 2017

WSP | PARSONS BRINCKERHOFF

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States of Jersey Department for Infrastructure

Project no: 70019143
Date: March 2017

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1 EXECUTIVE SUMMARY

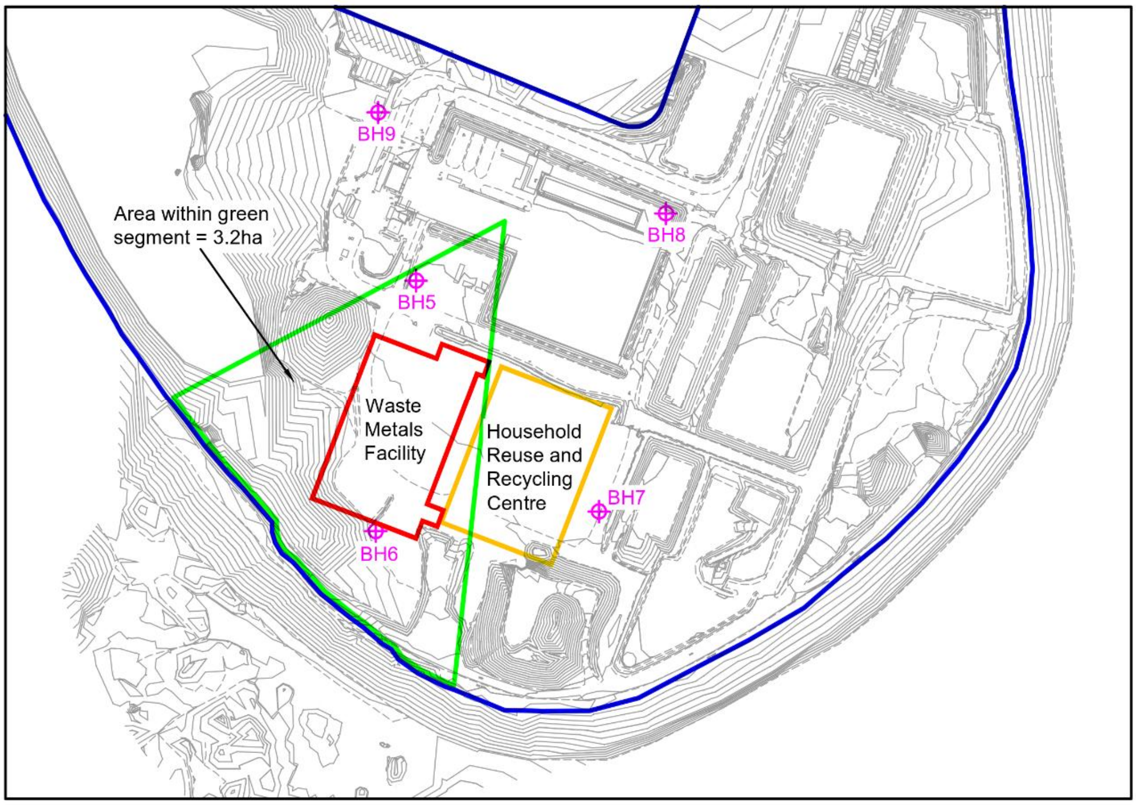
1.1 BACKGROUND

1.1.1 The following report has been prepared by WSP | Parsons Brinckerhoff on behalf of the States of Jersey, Department for Infrastructure (DFI). It presents a quantitative risk assessment to support the discharge of surface drainage to ground at the proposed waste metals recycling facility at La Collette, Jersey and forms Appendix 9.2 to the Environmental Statement of the Planning Application.

1.2 SITE LOCATION

1.2.1 The La Collette Phase 2 Reclamation Site is an area of 27.5 ha of reclaimed land to the south of St. Helier in Jersey on the eastern promontory of St. Aubin's Bay. The proposed waste metals facility ("the site") is located in the south of this area (Figure 1.1).

Figure 1.1 Proposed Site Location, showing Monitoring Boreholes



1.2.2 Construction of the outer La Collette Phase 2 breakwater commenced in the early 1990s and was completed in 1995. The sea protection berm forms a crescent shaped armoured rock embankment on its southern and western margins with a maximum elevation of 14-15m above Chart Datum (ACD). Planning permission for the infilling of the Phase 2 void was granted by the Planning and Environment Committee in September 1995. Infilling behind the breakwater has mainly been with inert construction, demolition and excavation waste onto a substrate of sandy clay and gravel, overlying granite bedrock.

1.2.3 The marine waters adjacent to the south and east of La Collette are designated under the RAMSAR Convention and form part of the South East Coast of Jersey RAMSAR, which covers 3,210.5ha. It is one of the largest intertidal reef sites in Europe and extends from St. Helier to Gorey Harbour on the east coast [1]. St Aubin's Bay, to the west, lies outside the designation.

1.3 PROPOSALS

1.3.1 The proposals are to relocate the existing scrap metal recycling facilities at Bellozanne to a new, purpose-built facility at La Collette. The new facilities will cover approximately 0.81ha in the south of La Collette, adjacent to the newly opened Household Reuse and Recycling Centre, as shown in Figure 1.1. This area is currently being reclaimed with inert materials.

1.3.2 The proposals are to create a modern, contained processing facility that will operate strictly in accordance with approved procedures and practices as formalised within a Working Plan and Waste Management Licence. The design includes for containment of surface drainage from roofs and hardstand areas by a sealed (i.e. positive) drainage system, which will pass through an oil-water separator before discharging to ground, under consent.

1.4 REGULATORY CONTEXT

1.4.1 In accordance with current Regulatory Guidance, it is necessary for DFI to demonstrate that the proposed discharge of surface water to ground will not cause any unacceptable risks to the surrounding water environment and, in particular the South East Coast of Jersey RAMSAR.

1.4.2 The States of Jersey (SoJ) is not part of the United Kingdom and therefore not subject to UK legislation. In the absence of local statute, however, SoJ often draws on the experience gained in the UK and wider European Union to inform local regulation, where appropriate.

[1] JNCC, 2008. Information Sheet on Ramsar wetlands (RIS). Ramsar Information Sheet: UK23001. South East Coast of Jersey, Channel Islands.

2 SITE LAYOUT AND OPERATIONS

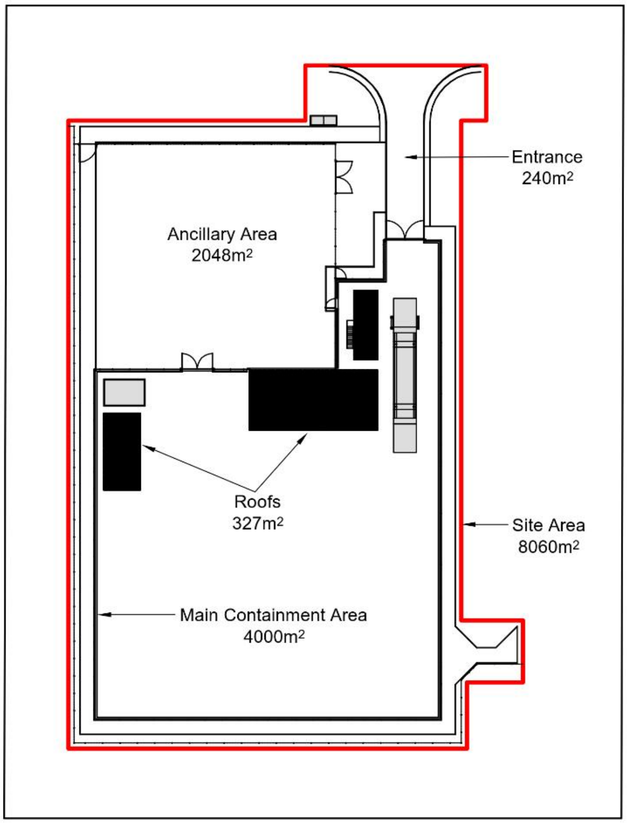
2.1 LAYOUT

2.1.1 A detailed account or the proposed site infrastructure and operations is provided in Appendix 9.1[2] to which reference should be made, however a summary is provided below.

2.1.2 The site layout comprises three main areas, illustrated in Figure 2.1:

- A northern 'ancillary area' comprising soft finishing and the site entrance, covering 2288m^2, of which 240m^2 will be metalled;
- The main containment area, formed of concrete hardstanding, covering the remainder of the site, an area of 4000m^2; and
- Ancillary buildings, including offices and a roofed process area, situated within the main part of the site. The total area of roofs is 327m^2.

Figure 2.1 Proposed Layout Showing Contributory Areas



[2] WSP | Parsons Brinckerhoff, 2017. La Collette Waste Metals Facility. Surface Water Contamination Containment Strategy, March 2017.

2.1.3 The operations that will take place on the main containment area include:

- Receipt, storage and grading of ferrous and non-ferrous waste metals;
- Cutting, baling and shearing of materials;
- Receipt and storage of cooling appliances;
- Receipt and storage of WEEE, (commercial and large domestic electrical appliances); and
- Loading of materials for transport by road and sea for further processing.

2.1.4 Runoff from these operations is the subject of this report.

2.1.5 More hazardous operations will take place under cover and include:

- Receipt and storage of hazardous materials;
- Depollution of end of life vehicles;
- Storage and sales of car parts for re-use;
- Receipt and storage of batteries (dry and lead acid).

2.1.6 Any liquids generated within the covered areas, will be contained within the buildings and not enter the main surface water drainage system that is the subject of this assessment. For this reason it does not form part of this report and will not be considered further.

2.1.7 Details of the proposed site drainage infrastructure proposed at the site are included in Appendix 9.1 of the Environmental Statement.

3 RISK ASSESSMENT

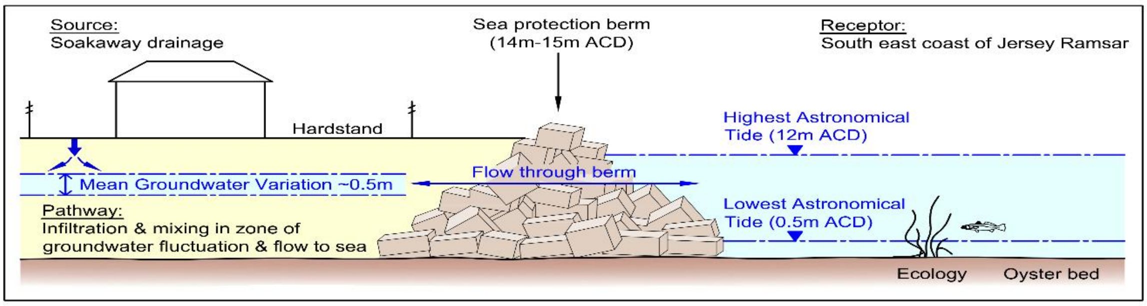
3.1 METHODOLOGY

3.1.1 It is commonly accepted practice that risk assessments follow a 'source-pathway-receptor' approach where a source is linked to receptor by a pathway [3].

- The **source** is the what might cause harm, in this case the discharge of site drainage;
- A **pathway** is a mechanism that links the source and receptor. There may be several pathways linking a particular source and receptor. In this instance, however, the pathway is the movement of drainage into the ground, its infiltration and mixing with the water table beneath the site and its migration to the marine waters outside the sea protection berm. The pathway includes any attenuation mechanisms that may operate, such as dilution and sorption.
- The **receptor** is the marine waters outside the breakwater, including the East Coast of Jersey RAMSAR and St Aubin's Bay.

3.1.2 The relationships between sources and receptors are often illustrated using a conceptual site model (CSM). A CSM illustrating the processes in operation at the site is shown in Figure 3.1.

Figure 3.1 Conceptual Site Model for La Collette



3.1.3 The following presents a quantitative risk assessment based on water quality information obtained at the existing facility at Bellozanne between July and October 2016.

3.2 ANALYSIS OF THE SOURCE TERM

3.2.1 The source term (i.e. the site drainage) is a complex variable with related volumetric and quality considerations. As a consequence, this assessment takes a simplified and, conservative, approach to the water quality leaving the site, based on analysis of the water quality at Bellozanne. In order to provide context, the main considerations are discussed briefly below.

RUNOFF VOLUME CONSIDERATIONS

3.2.2 The amount of drainage generated from an impermeable area is a function of three main variables, the storm intensity, duration and return period (probability of occurrence). For any given return period, the highest intensity storms have the shortest durations and therefore tend to produce the highest instantaneous rates of runoff (i.e. flow). Longer duration storms have lower

[3] Environment Agency, December 2011. Horizontal Guidance Note H1 – Annex J 3: Additional Guidance for Hydrogeological Risk Assessments for Landfills and the Derivation of Groundwater Control Levels and Compliance Limits. Version 2.1.

storm intensities but tend to deposit higher cumulative amounts of precipitation and therefore produce greater runoff volumes.

3.2.3 The 30 year mean annual rainfall recorded at Jersey Airport (1982-2010) is 866mm [4]. On average, there are 176.3 rainy days per year, with the mean probability of rainfall between 31.9% in July and 64% in November [5].

3.3 RUNOFF QUALITY CONSIDERATIONS

3.3.1 Research on UK roads [6] has demonstrated that the quality of runoff varies with time. The poorest quality discharges tend to occur in the 'first flush' of water from the pavement, with a gradual improvement thereafter. It has also been demonstrated that there is also a relationship with antecedent conditions, longer periods without rainfall tending to produce poorer quality run-off once rain does fall.

3.3.2 As a consequence, longer duration storms, which produce the largest volume of runoff, will produce better quality runoff towards the end of the storm, than at the beginning.

MONITORING AT BELLOZANNE

3.3.3 The quality of runoff from the current operations at Bellozanne is considered to be a reasonable analogue for the quality likely to be experienced at the site, albeit a conservative one. Obtaining 'real-time' water quality data during storm conditions was not possible and as a consequence, monitoring was limited to sampling of standing water from within the drainage system. This is not a particular drawback as the water analysis obtained can be used as a proxy for the quality of the 'first flush' likely to be discharged from the oil-water interceptor at the site during a rainfall event.

3.3.4 The drainage system at Bellozanne routes runoff from the hardstanding to a series of four precast concrete ring manhole chambers, which act as an oil-water separator. Sampling of the water present within the final chamber, immediately prior to the outflow, was undertaken by WSP | Parsons Brinckerhoff on four occasions between early July and late October 2016 when discharge was not occurring. Laboratory analysis was for a range of determinands, including:

- indicator parameters, such as pH, conductivity, ammoniacal nitrogen, sulphate, nitrate etc;
- transition metals, which were analysed for both 'total' and 'soluble' fractions to provide an indication of the proportion adsorbed to particulate matter;
- volatile and semi-volatile hydrocarbon species, including BTEX (benzene, toluene, ethylbenzene xylenes), PAH (polycyclic aromatic hydrocarbons) and PCBs (not detected).

3.3.5 The results obtained are summarised in Table 3.1, which compares the findings with the water quality standards that apply to the coastal waters in Jersey [7,8]. The date of the last occasion when the chambers were cleaned, prior to the sampling, is shown to provide an indication of whether there was an obvious relationship with the observed water quality. The shaded cells highlight which parameters exceeded the local water quality standards on which occasions to demonstrate the contaminants of concern (CoC) and the attenuation factors that would be required to reduce the maximum recorded concentrations to below the relevant standards.

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[4] Source: UK Met Office, 30 year mean annual rainfall at Jersey Airport (80m AOD)
[5] http://www.world-climates.com/city-climate-jersey-uk-europe/ downloaded 15th March 2017
[6] On behalf of the UK Department of Transport, now Highways England
[7] Capita Symonds (2011). La Collette Waste Management Facility – Operational Water Monitoring Plan. Report to States of Jersey Transport and Technical Services, November 2011.
[8] Cascade (2015). Strategic review of the water quality monitoring programme for La Collette waste facility. Report to States of Jersey. Final Report, 19 June 2015.

Table 3.1: Summary of Water Quality Monitoring Undertaken at Bellozanne, July – October 2016

Monitoring Date			05/07/2014	14/09/2016	20/09/2016	21/10/2016		
Determinand	**Units**	**La Collette Compliance Standard [1]**	**Interceptor last cleaned**	**14/09/2016**	**14/09/2016**	**07/10/2016**	**Maximum value**	**Attenuation factor for max conc [2]**
pH	pH Units	-	6.18	6.79	5.79	6.71	6.79	
Nitrate	mg/l	50	<0.3	<0.3	<0.3	1.38	1.38	0.03
Ammoniacal N	mg/l	-	<0.2	8.36	1.64	2.7	8.36	
Free Ammonia (calc)	mg/l	0.021	<0.0001	0.017	0.0003	0.0046	0.017	0.81
Chloride	mg/l	250	NT	31.4	70.2	112	112	0.45
Sulphate	mg/l	250	46.9	81.6	128	194	194	0.78
Total Hardness, as $CaCO_3$ unfiltered	µg/l	-	NT	102000	202000	253000	253000	
Soluble (Filtered) Metals								
Arsenic	µg/l	25	1.05	1.36	1.64	1.47	1.64	0.07
Cadmium	µg/l	2.5	0.148	0.328	<0.08	<0.08	0.328	0.13
Chromium	µg/l	15	6.17	2.57	2.17	1.71	6.17	0.41
Copper	µg/l	5	16.6	27.2	6.76	5.77	27.2	**5.44**
Iron	mg/l	1	NT	0.415	0.607	3.24	3.24	**3.24**
Manganese	mg/l	0.5	NT	0.08	0.116	0.535	0.535	1.07
Lead	µg/l	25	9.35	14.2	2.11	2.37	14.2	0.57
Mercury	µg/l	0.3	<0.01	0.0118	<0.01	<0.01	0.0118	0.04
Nickel	µg/l	30	12.5	16.2	25.4	56.3	56.3	**1.88**
Vanadium	µg/l	100	1.06	<1.3	1.92	1.4	1.92	0.02
Zinc	µg/l	40	468	549	35.1	111	549	**13.73**
Total (Unfiltered) Metals								
Arsenic	µg/l	25	NT	5.55	4.16	3.6	5.55	See footnote [2]
Cadmium	µg/l	2.5	<0.5	<0.5	<0.5	1.68	1.68	
Chromium	µg/l	15	NT	6.92	12	13.4	13.4	
Copper	µg/l	5	NT	68.4	143	128	143	
Iron	mg/l	1	NT	NT	NT	10.8	10.8	
Lead	µg/l	25	NT	36.6	145	112	145	
Mercury	µg/l	0.3	0.0666	0.0938	0.137	0.134	0.137	
Nickel	µg/l	30	NT	19.8	34.8	60.2	60.2	
Vanadium	µg/l	100	NT	<8	<8	<8	<8	
Zinc	µg/l	40	NT	831	1650	2030	2030	
Volatile Organic Compounds (VOCs)								
Benzene	µg/l	30,300	15.2	NT	<1	<1	15.2	
Toluene	µg/l	40,400	1770	NT	12	13	1770	0.04
Ethylbenzene	µg/l	*30*	454	NT	5.77	6.46	454	**15.13**
Xylene	µg/l	30,300	2928	NT	36.4	53.6	2928	0.10
Mineral oils	µg/l	600	12000	NT	7280	9300	12000	**20.00**
Polyaromatic Hydrocarbons (PAHs)								
Naphthalene	µg/l	5200	23.4	3.12	2.69	7.89	23.4	0.00
Benzo-a-pyrene	µg/l	0.3	NT	0.058	0.154	0.077	0.154	0.51
Anthracene	µg/l	0.02	NT	0.712	0.116	0.080	0.712	**35.60**
PAH sum of 4	µg/l	0.1	NT	0.501	0.7791	0.359	0.7791	**7.79**

[1] As reported by Cascade (2015) in the report 'Strategic review of the water quality monitoring programme for La Collette waste facility,' Ref 8.
[2] Attenuation Factors in bold type show main Contaminants of Concern (CoC). Not shown for total 'metals' as ground will filter out particulates
Shaded cells show exceedances of the La Collette Compliance Standard
NT - Not Tested

3.3.6 The results indicate that the runoff from Bellozanne, as indicated by the quality in the final chamber, immediately prior to discharge, was characterised by dissolved hydrocarbons and metals, particularly copper, iron, nickel and zinc.

3.3.7 In the following analysis, the maximum recorded concentrations of soluble metals are used as an analogue for the quality of the 'first flush' discharge to ground at La Collette, as the ground can be expected to filter out any turbidity and associated adsorbed species. It should be noted that the presence of hydrocarbons tends to produce anoxic conditions in the water, which increases the solubility of some metals, particularly copper and iron.

3.4 ANALYSIS OF THE RECEPTOR TERM

3.4.1 The receptor is the marine water outside the sea protection berm. The allowable concentrations of parameters within the marine waters are indicated by the coastal waters compliance standards for La Collette [9], which are shown in Table 3.1. These standards represent the parameter concentrations accepted by SoJ for the protection of the marine waters, including their dependent ecosystems.

3.5 ANALYSIS OF THE PATHWAY TERM

3.5.1 Once discharged, the drainage will infiltrate the unsaturated soils directly beneath the site, with movement mainly vertically downward until the water table is encountered. Once at the water table, the discharge will mix with groundwater beneath the site and move through the subsurface soil matrix in a predominantly lateral direction along the prevailing hydraulic gradient, eventually to flow through the sea protection berm and enter the marine waters. In practice this is likely to be radially in all directions away from the soakaway.

3.5.2 It is possible, owing to the aerobic nature of the unsaturated zone and the composition of the subsurface, that a measure of attenuation by redox reactions will occur during this process. Owing to the proximity of the marine waters, however, these processes are not included in the following analysis, in which attenuation is limited to the dilution afforded by the tidal variation that takes place beneath the site footprint.

3.5.3 As part of the investigations for the Household Reuse and Recycling centre, the variation of groundwater levels in the vicinity of the site was monitored continuously using pressure transducers and dataloggers over a three week period, including two Spring tidal cycles, between 8th April and 1st May 2014 [10]. The monitoring locations included the tidal range within the marine waters immediately outside the sea protection berm, water levels immediately inside the berm and five groundwater monitoring boreholes (BH5 - BH9 inclusive)[11]. The nearest boreholes to the site footprint are boreholes BH5, BH6 and BH7, the locations of which are shown on Figure 1.1.

3.5.4 The monitored tidal variations, relative to Chart Datum (CD) are shown on Figure 3.2 and summarised in Table 3.2.

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[9] Cascade, 2015 *op. cit.*

[10] Parsons Brinckerhoff, 2015. Phase II Intrusive Investigation and Risk Assessment Report, Proposed Recycling Park, La Collette, St Helier, Jersey. Report to States of Jersey (Issue 2), January 2015.

[11] Op. cit. Drawing No. 28606A/701 (12.6.14).

Figure 3.2 Summary of Groundater Level Monitoring, 8th April – 1st May, 2014

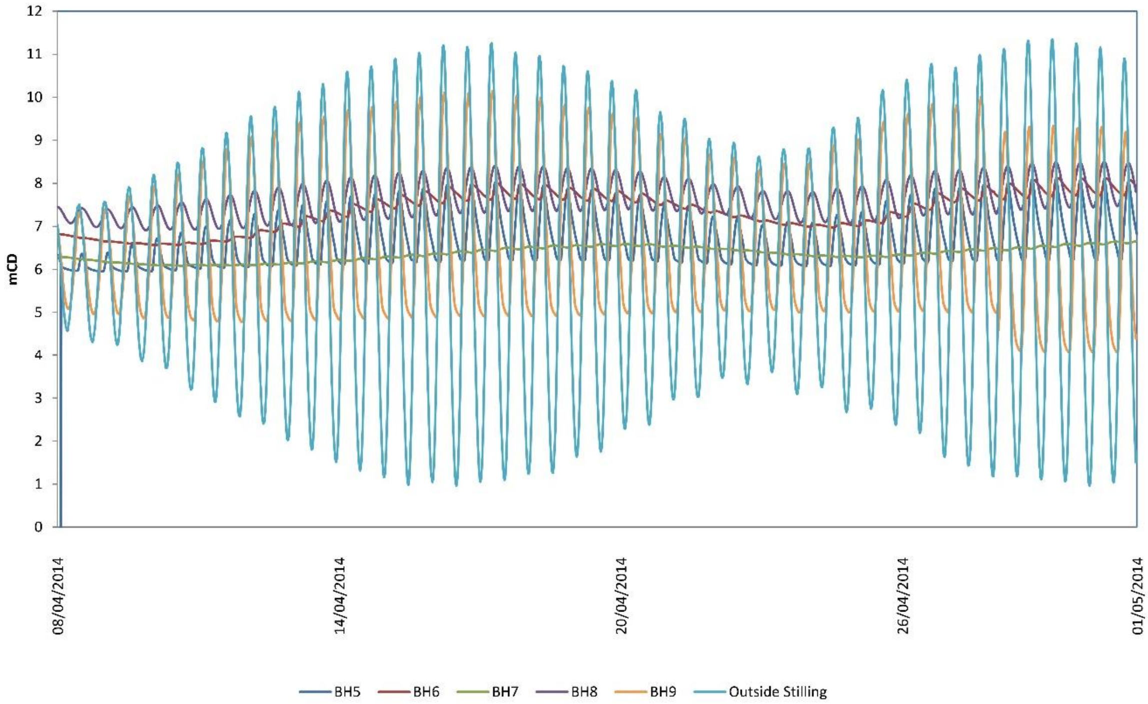

Table 3.2: Summary of Groundwater Monitoring Undertaken April-May, 2014

Borehole	Max WL (RCD)	Min WL (RCD)	Max Variation (m)	Est. Mean Tidal Range (m)	Comments
BH5	8.121	5.953	2.17	1.25	Lags marine water by <1hr
BH6	8.122	6.563	1.56	0.235	Lags by 5-6 tidal cycles on falling limb
BH7	6.661	6.080	0.58	0.0375	Lags by 5-6 tidal cycles on falling limb
BH8	8.498	6.909	1.59	0.8	Lags by 2 cycles on falling limb
BH9	10.152	4.061	6.09	4.05	In phase
Inside Berm	10.187	1.317	8.87	-	Lags by a few minutes – datalogger dried at low water
Outside Berm	11.351	0.963	10.39	7.1	

3.5.5 The data show a reduction in observed tidal oscillation inland from the sea protection berm, as is commonly witnessed, with local variations reflecting the differing ground conditions and placement used during the land reclamation. The smallest mean variations were observed in boreholes BH6 and BH7, where the observed lowest part of the oscillation due to tidal influence lags behind that of the marine waters by approximately six tidal cycles. This is attributed to a general lower permeability of backfill in these locations and provides an indication of the time for porewater within the subsurface to respond to the variation in seawater levels outside the sea protection berm.

3.5.6 For the purposes of this assessment, a mean tidal variation of 0.5m is taken beneath the site, based upon the data observed at boreholes BH5, BH6 and BH7.

4 CALCULATIONS

4.1 INTRODUCTION

4.1.1 The calculations below present a conservative, 'reasonable worst case' assessment. This is based on a simple mixing model where attenuation of the site discharge occurs solely by dilution within porewater directly beneath the site footprint, caused by the twice daily rise and fall of the water table in response to the tidal variation. The resultant concentrations within the porewater beneath the site are then compared with the attenuation that would be required for the porewater to meet the La Collette marine water standards. This approach is advantageous, in that it simplifies the complexities caused by the differing ground conditions and hydraulic responses. In order to avoid over-conservatism, however, the results need to be considered in the context of the simplifying assumptions on which the calculations are based. Importantly, the assessment does not consider the reduction in concentration of the source term that will follow the 'first flush' of runoff by assuming that the discharge quality remains constant throughout the duration of a storm.

4.1.2 The calculations presented represent steady-state conditions and are based on the mean daily volume of water likely to be generated by the site during 'average' meteorological conditions. A sensitivity analysis is included that varies key parameters, in particular the area over which dilution occurs, to account for more likely conditions.

ATTENUATION FACTORS

4.1.3 Table 3.1 shows the maximum recorded parameter concentrations from the four monitoring rounds at Bellozanne. It also shows the compliance standards for La Collette and the attenuation factor that would be required to reduce these concentrations to an acceptable magnitude, i.e. to at or below the relevant local compliance standard.

4.1.4 Comparison of the maximum recorded soluble concentrations of transition metals with the La Collette standards suggests that soluble zinc is the most sensitive metal parameter, requiring attenuation by 13.7 times to reduce its maximum recorded concentration to below the required standards. The PAH anthracene, however, appears to be the most sensitive parameter overall, requiring attenuation of the maximum recorded concentration by 35.6 times.

4.2 AVERAGE CONDITIONS

ASSUMPTIONS – REASONABLE WORST CASE

4.2.1 The assumptions that are made are:

- 866mm rainfall over 176.3 days, i.e. mean rainfall on rainfall days 4.91mm/day (paragraph 3.2.3);
- 95% runoff from areas of hardstanding, including the main containment area (4000m^2), roads (240m^2) and roofs (327m^2) 0.81 ha less soft cover (paragraphs 1.3.1 and 2.1.2);
- 95% infiltration on areas of soft finishing (2048m^2, paragraph 2.1.2);
- Runoff from roofed areas and soft standing not impacted;
- Attenuation by two tidal cycles, creating a mean tidal variation of 0.5m from beneath site footprint only (paragraph 3.5.6);
- Effective porosity in subsurface granular soils of between 20-35%, with a likely value of 25%;

- Total mixing and discharge with 24 hours only within the zone of groundwater variation; porewater in the reclaimed ground below the lowest recorded water level is excluded;
- Discharge quality is represented by the maximum recorded concentrations of parameters at Bellozanne;
- No treatment of dissolved phase hydrocarbons by oleophilic membrane prior to discharge;
- No source depletion with storm duration;
- No attenuation in site soils.

RESULTS

4.2.2 The results are:

Discharge	$= 0.95 \times 4.91 \times 10^{-3} \times (4000 + 240 - 327)$	$= 18.25 m^3/day$
Clean infiltration	$= 0.95 \times 4.91 \times 10^{-3} \times (0.81 \times 10^4 - 3913)$	$= 19.53 m^3/day$
Dilution beneath site	$= 0.81 \times 10^4 \times 0.5 \times 0.25 \times 2$	$= 2025\ m^3/day$
Attenuation factor	= (2025 + 19.53) / 18.25	= 112

4.2.3 The results indicate that dilution in the groundwater present beneath the site footprint will provide more than sufficient attenuation to reduce the maximum recorded concentrations within the discharge to below the required standards that apply within the marine waters surrounding La Collette. The minimum factor of safety in the above example that would apply would be for anthracene, requiring an attenuation factor of 35.6, and is about 3.1.

4.3 SENSITIVITY ANALYSIS

4.3.1 Three parameters were varied during sensitivity analysis:

- Varying the effective porosity between 20% and 35% – this had the effect of altering the calculated attenuation factor for the reasonable worst case to between 89.6 and 156.8;
- Varying the tidal range between 0.04m and 1.25m – this had the effect of altering the calculated attenuation factor for the reasonable worst case to between 8.96 and 280;
- Varying the contributory area to reflect the segment of La Collette over which infiltration is more likely to occur, estimated at 3.2ha discussed below.

4.3.2 In practice, as the infiltration is likely to move radially in all directions beneath the site (see paragraph 3.5.1), it will be subject to greater attenuation over a much wider area than just the site footprint, assumed above. An estimate of the segment of land likely to cause dilution beneath the site is outlined in green on Figure 1.1 and covers 3.2 ha.

4.3.3 The calculations are:

Discharge	$= 0.95 \times 4.91 \times 10^{-3} \times 3913$	$= 18.25\ m^3/day$
Clean infiltration	$= 0.95 \times 4.91 \times 10^{-3} \times (3.2 \times 10^4 - 3913)$	$= 131.01 m^3/day$
Dilution beneath site	$= 3.2 \times 10^4 \times 0.5 \times 0.25 \times 2$	$= 8000\ m^3/day$
Attenuation factor	= (8000 + 131) / 18.25	= 445.5

4.3.4 This has the effect of increasing the factor of safety on the most sensitive parameter, anthracene, to 12.5 and represents a 'more likely conservative case.'

4.4 IMPLICATIONS FOR DISCHARGE MANAGEMENT

IMPACT ON MARINE WATERS SURROUNDING LA COLLETTE

4.4.1 If discharged to ground, all parameters likely to be present within the discharge will have reduced to below the relevant standards applicable to the marine waters before the discharge water enters the seawater immediately adjacent to the headland of La Collette.

4.4.2 The 'reasonable worst case' assessment demonstrates that the likely attenuation in the zone of water table fluctuation present beneath the site footprint, assuming a constant discharge quality, will be over 100 times. As the discharge is likely to move radially in all directions from the point of discharge, however, attenuation is likely to take place over a much wider area. The 'more likely conservative case' represents a more realistic assessment of the attenuation and suggests an attenuation factor of at least 445 times, again assuming a constant discharge quality. The factors of safety on the most sensitive discharge parameter identified, anthracene, are between approximately 3 and 12.5 times. The implications of these attenuation factors upon the maximum concentrations recorded at Bellozanne are summarised in Table 4.1.

Table 4.1 Calculated Quality of Discharge Prior to entry into Marine Waters

Determinand	Units	La Collette Compliance Standard [1]	Max Recorded Conc'n	Resultant Concentrations (µg/l)	
				Reasonable Worst Case: AF = 112	More Likely Conservative Case: AF = 445
pH	pH Units	-	6.79		
Nitrate	mg/l	50	1.38		
Ammoniacal N	mg/l	-	8.36	0.075	0.024
Chloride	mg/l	250	112		
Sulphate	mg/l	250	194		
Soluble Metals					
Arsenic	µg/l	25	1.64	0.0146	0.0037
Cadmium	µg/l	2.5	0.328	0.0029	0.0007
Chromium	µg/l	15	6.17	0.0551	0.0139
Copper	µg/l	5	27.2	0.2429	0.0611
Iron	mg/l	1	3.24	0.0289	0.0073
Manganese	mg/l	0.5	0.535	0.0048	0.0012
Lead	µg/l	25	14.2	0.1268	0.0319
Mercury	µg/l	0.3	0.0118	0.0001	0.00003
Nickel	µg/l	30	56.3	0.5027	0.1265
Vanadium	µg/l	100	1.92	0.0171	0.0043
Zinc	µg/l	40	54.9	0.4902	0.1234
Volatile Organic Compounds (VOCs)					
Benzene	µg/l	30,300	15.2	0.14	0.034
Toluene	µg/l	40,400	1770	15.8	15.8
Ethylbenzene	µg/l	454	454	4.05	1.02
Xylene	µg/l	30,300	2928	26.14	6.58
Mineral oils	µg/l	600	12000	100	27.0
Polyaromatic Hydrocarbons (PAHs)					
Naphthalene	µg/l	5200	23.4	0.21	0.053
Benzo-a-pyrene	µg/l	0.3	0.154	0.0014	0.00035
Anthracene	µg/l	0.02	0.712	0.0064	0.0016
PAH sum of 4	µg/l	0.1	0.7791	0.007	0.0018

4.4.3 In practice, the attenuation afforded by the unsaturated zone beneath the site will be greater than the calculations demonstrate because of the assumptions underlying the assessment, particularly that of a constant discharge quality.

CUMULATIVE IMPACTS

4.4.1 The 'reasonable worst case assessment' presented only examines water incident on and present within the zone of water table fluctuation beneath the proposed footprint of the proposed waste metals facility. As a result, the results presented are independent of the implications of adjacent areas of development on the headland.

4.4.2 Furthermore, as the drainage from the existing operations at Bellozanne already enters St Aubin's Bay, the proposed discharge represents a neutral impact in terms of contaminant loadings on the marine waters.

4.5 DISCHARGE CONSENT

4.5.1 It is intended that the applicant will apply the Environment Department for a surface water Discharge Consent to formalise disposal of surface water by soakaway at the site. The applicant will seek to agree consent limits for key parameters (that will ensure that discharge from the site will not result in contamination of the coastal waters adjacent to the headland. The consent will be bespoke to the site and on the assumption that operations will be undertaken in compliance with the Waste Management Licence and the containment strategy and associated infrastructure set out in Appendix 9.1 of the Environmental Statement.

4.5.2 Once granted, compliance with the consent will be monitored through regular water quality sampling undertaken at a point to be agreed with the Environment Department, prior to discharge to the soakaway. The frequency of monitoring will be agreed with the applicant through the granting of Waste Management Licence and/or the Discharge Consent.

4.5.3 Table 4.2 below includes details of several extant consents granted by the UK Environment Agency for waste metals processing sites in England that undertake similar operations to those proposed at La Collette.

Table 4.2 Precedent Discharge Consents for UK Waste Metals Processing Sites

Location	Outfall Receptor	Key Discharge Conditions
Tilbury	Soakaway/ Groundwater	No poisonous, noxious or polluting matter
		No solid matter
		No visible oil or grease
		10mg/l hydrocarbons
		Monitoring from sampling point
Newhaven	Rive Ouse	Trade effluent consisting of site drainage
		No other specific condition
Newmarket	Newmarket No 1 Drain	No visible signs of oil and grease
		50mg/l suspended solids
		5mg/l hydrocarbons
		10µg/l cadmium
		500µg/l copper
		2500µg/l lead
		2000µg/l zinc
Sharpness	Severn Estuary	No visible oils
		Interceptor, adequately maintained
		No discharge injurious to flora/fauna
Gloucester	Hempsted Brook	pH between 6 and 9
		250mg/l suspended solids
		5mg/l hydrocarbons

4.5.4 The above table shows that there is significant variation in the details of consents granted across the UK, depending upon the date on which the consent was granted (and prevailing environmental legislation and policies at the time) and the sensitivity of the receiving water body. Notwithstanding, it can be seen that precedent sites for waste metals sites generally seek to control and monitor:

- Suspended Solids
- Hydrocarbons
- Discharges that are 'injurious to flora and fauna'.

4.5.5 The findings of the assessment can be used to develop preliminary discharge consent conditions to apply at the point of discharge to the ground. The assessment demonstrates that an attenuation factor of between one and two orders of magnitude could be applied with confidence to the local marine water standards. Preliminary discharge consent parameters are summarised in Table 4.2, together with an explanation and justification for their use.

Table 4.3 Preliminary Discharge Consent Standards Proposed for the Waste Metals Recycling Facility

Parameter	Units	Concentration	Justification
pH	(pH units)	6-9	Standard condition
Suspended solids	(mg/l)	-	Not required due to filtering capacity of ground
Oils / grease		None visible	Standard condition – easier to regulate than 0.6mg/l
Copper (soluble)	µg/l	100	20x existing marine standard – leaves FoS of between 5.6 and 22.3 x to achieve current standard
Iron (soluble)	mg/l	10	Conservative - 10x existing marine standard
Nickel (soluble)	µg/l	300	Conservative - 10x existing marine standard
Zinc (soluble)	µg/l	400	Conservative - 10x existing marine standard
Benzene	µg/l	150	Slightly <10x existing marine standard
Anthracene	µg/l	1	50x existing marine standard – to be included with sum of 4 PAH outlined below
PAH (sum of 4)	µg/l	1	Conservative - 10x existing marine standard

5 SUMMARY AND CONCLUSIONS

5.1.1 The quantified risk assessment presented in this report demonstrates that the dilution caused by tidal oscillation within the reclaimed ground beneath the footprint of the site is able to attenuate concentrations of the likely contaminants of concern present in the discharge to below the local compliance standards before the discharged water enters the sensitive marine waters outside la Collette.

5.1.2 The calculations that form the basis of the assessment are based upon a simplified mixing model, which uses a series of assumptions to simplify the complexity of the natural environment. As a consequence, the assessment presented is conservative and overestimates the potential impact of the proposed discharge to ground. The attenuation factors and factors of safety that are reported are therefore underestimates of those that will operate in reality. Notwithstanding, they are a reasonable basis for the setting of the provisional discharge consent parameters that are presented.