Great Keppel Island Resort EIS For GKI Resort Pty Ltd

Waste Management Report

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Great Keppel Island Resort EIS Revision B

Waste Management Report

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EXECUTIVE SUMMARY

This Report has been prepared by Opus International Consultants ('Opus') on behalf of GKI Resort Pty Ltd to provide an overview of waste management issues and strategies associated with the Great Keppel Island (GKI) Revitalisation Plan. This Report has been prepared to address section 3.9 of the "Terms of Reference for EIS – Great Keppel Island Resort Project" issued by the Queensland Coordinator-General and relevant requirements of the "Guidelines for an Environmental Impact Statement for the Great Keppel Island Tourism and Marina Development, Queensland" issued by the Australian Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) in conjunction with the Great Barrier Reef Marine Park Authority.

The GKI Resort Revitalisation Plan proposes to create a low rise, eco-tourism resort on Great Keppel Island, incorporating a new 250 suite, 4 or 5 star resort hotel at Fisherman's Beach; a new 250 berth, all-weather safe access marina facility at Putney Beach including a retail village; an 18-hole championship golf course; a new runway and airport terminal; 750 eco-tourism villas; 300 eco-tourism apartments; staff accommodation and sporting fields. As part of the GKI Resort Revitalisation Plan, a new GKI Research Centre and Biodiversity Conservation Fund (BCF) will be established, the original Leeke's Homestead will be restored and a significant proportion of the Island will be protected for conservation.

Approximately 685 full time, part time and casual staff will be employed by the resort once fully operational.

Great Keppel Island is the largest island in the Keppel Island Group and is located approximately 12 km off the coast of Yeppoon on the Central Queensland coast. GKI is included within the Rockhampton Regional Council local government area. Until recently the Island has been occupied by a number of different commercial accommodation facilities ranging from camping ground style accommodation to resort level accommodation. The original GKI Resort was the main tourism resort located on the Island and comprised 190 guest rooms. These facilities were closed in early 2008. The Island is currently occupied by two backpackers' facilities, 10 residential properties and 10 commercial premises. Access to the Island is currently via ferry and cruise ship services from the Rosslyn Bay / Keppel Bay Marina on the mainland.

A range of wastes will be generated during the demolition, construction and operational phases of the GKI Resort Revitalisation Plan. Key components of the waste stream generated during operation of the resort will comprise paper, food waste and packaging (plastics, glass, cans all recyclable) consistent with domestic and commercial waste sources. During demolition and construction, concrete, bricks and pavers, and timber are expected to comprise the dominant sources of waste. For the purposes of developing a waste management strategy for the GKI Resort Revitalisation Plan, estimates of the anticipated volume of waste generated by the GKI Resort Revitalisation Plan have been made with reference to waste data from the former GKI resort and a review of available literature.

A strategy for managing wastes generated during all phases of the proposed GKI Resort Revitalisation Plan has been developed in accordance with the principles of the waste management hierarchy specified in the *Environmental Protection (Waste Management) Policy 2000.* This strategy focuses on avoiding waste generation during construction and operation wherever possible, through



implementation of procurement policies, planning and scheduling, training and awareness, and specific work practices. Reducing the total volume of waste generated by the GKI Resort Revitalisation Plan, and in particular the volume of waste requiring disposal, is an essential component of this Project. As well as the environmental and social benefits of reducing waste, there is also an economic imperative given the high costs, to both the proponent and Council, associated with transporting and disposing of Island-generated waste on the mainland.

A range of wastes will also be reused on the Island, including but not limited to, salvaging of demolition materials for reuse in construction (eg. concrete recycling via crushing), salvaging of other construction wastes, and composting of food and other organic wastes, including biosolids for reuse as soil conditioner on the Island during operation. Waste collection and storage practices will also be implemented to enable effective and efficient collection of recyclables, which will be transported to recycling facilities on the mainland. Wastewater will be treated to a standard that will enable use of recycled water for irrigation of the golf course, landscaped areas and potentially for toilet flushing. It is estimated that these procedures will reduce the volume of waste requiring disposal during operation of the resort to approximately 8-25% of total waste generated.

During construction of the resort, bulk bins for storage of segregated wastes and recyclables will be provided within the construction compound. These bins will be emptied as required (approximately weekly) by arranging for collection by an appropriately licensed commercial waste contractor. Waste collection vehicles will travel to and from the Island on the barge services, with trips scheduled in conjunction with the delivery of materials to minimise barge movements.

To service the operation of the resort, a waste transfer station will be established within the industrial compound on the Island. Wheelie bins will be collected from around the Island by the resort operator using a utility / tractor trailer before being emptied into bulk bins within the compound. It is anticipated this will occur at least weekly during normal operation, increasing to twice weekly or more during peak periods. Separate wheelie bins and bulk bins will be provided for collection of general waste and recyclable materials. A small stationary compactor, bin press or similar will be installed to reduce the volume of waste requiring transfer to the mainland to reduce transport frequency and cost, and reduce pressure on the capacity of Council's landfill facilities. Composting facilities will also be provided within the industrial compound for processing of food waste and other organics, including biosolids into soil conditioner.

The waste transfer station and associated areas for storage and handling of bulk waste materials, are to be located with appropriate setbacks to environmentally sensitive areas, existing residential properties and tourist accommodation. Appropriate containment and drainage systems are to be installed for waste storage and handling areas to prevent the release of contaminants to receiving environments.

A commercial waste contractor holding the appropriate licence under the *Environmental Protection Act 1994* will be engaged to collect bulk bins containing general waste and recyclable wastes from the Island, and to transport these materials to appropriately licensed disposal and recycling facilities on the mainland. It is anticipated that the majority of general and recyclable waste removed from the Island will be transported to Rockhampton Regional Council's Yeppoon Waste Management Facility, which provides facilities for recycling a range of materials as well as landfill for disposal. Waste collection



vehicles will travel to and from the Island via the regular barge service at least weekly or more frequently as required during peak periods.

A range of environmental controls and mitigation measures are proposed to minimise potential risks to the environment associated with waste management practices for the GKI Resort Revitalisation Plan. These measures include regular monitoring and inspections, tracking of wastes, and regular audits of waste streams to identify opportunities for increased reuse and recycling, and improved waste management practices. Engineering and procedural controls, such as construction of bunded containment areas, covering bins and stockpiles likely to generate odour or litter, and aeration of composting materials have also been proposed to minimise the potential environmental impacts of waste management.

A number of environmentally relevant activities as defined in schedule 1 of the *Environmental Protection Regulation 2008* have been identified as potentially being associated with the proposed waste management strategy, including ERA 63 – Sewerage treatment, ERA 53 – Composting and soil conditioner manufacturing and possibly ERA 62 – Waste transfer station operation and ERA 33 – Crushing, milling, grinding or screening. Approvals will be required under the *Environmental Protection Act 1994* to operate these ERAs on the Island.

Although this waste management strategy deals specifically with wastes generated by GKI resort activities proposed under the GKI Resort Revitalisation Plan, an opportunity may exist for existing residential and commercial properties on the Island to utilise the waste collection and storage facilities established as part of the GKI Resort Revitalisation Plan subject to further negotiation and agreement between the relevant parties.

A consolidated approach to waste management on GKI will provide a range of benefits including:

- Reducing costs to Rockhampton Regional Council due to the inefficiency of providing current waste management services to the Island;
- Increasing opportunities for implementation of reuse and recycling initiatives, which are currently not available to Island residents; and
- Improving facilities for storage and handling of wastes on the Island to reduce potential environmental impacts and public health risks, including:
 - Safer transfer of waste onto vessels for transport to mainland by construction of the new marina;
 - Providing greater separation of waste material being transferred to the mainland from other passengers travelling to and from the Island; and
 - Upgrade of existing collection and storage facilities on the Island to improve containment of potential contaminants.

For these reasons, it is considered that the GKI Resort Revitalisation Plan provides an opportunity to improve current waste management practices on the Island for the benefit of the environment, as well as Island residents and visitors.



1. INTRODUCTION

This Report has been prepared by Opus International Consultants ('Opus') on behalf of GKI Resort Pty Ltd to provide an overview of waste management issues and strategies associated with the Great Keppel Island (GKI) Resort Revitalisation Plan. The contents of this Report are to be included as part of the overall Environmental Impact Statement (EIS) prepared for the GKI Resort Revitalisation Plan.

1.1 **PROJECT OVERVIEW**

The GKI Resort Revitalisation Plan (refer to **Appendix A – GKI Resort Revitalisation Plan**) proposes to create a low rise, eco-tourism resort on Great Keppel Island.

The proposal involves:

- Demolition of the old resort and construction of a new 4 or 5 star resort hotel at Fisherman's Beach comprising 250 suites and day spa;
- Dredging activities for construction of the marina and re-nourishment of Putney Beach using dredge spoil;
- A new all-weather safe access marina facility at Putney Beach comprising 250 berths, a ferry terminal, emergency services facilities, yacht club, and dry dock storage;
- A retail village with a mix of cafes, restaurants and clothing shops around the marina;
- An 18-hole golf course, designed by Greg Norman Golf Course Design and including club house, integrated with essential habitats and ecological corridors, and located on previously disturbed grazing lands;
- New runway and airport facilities;
- 750 eco-tourism villas incorporating sustainable building design, rooftop solar panels and water tanks;
- 300 eco-tourism apartments incorporating sustainable building design, rooftop solar panels and water tanks;
- Installation of power, water and telecommunications connections between the Island and mainland;
- Associated service facilities and utilities (waste collection area, fire-fighting and emergency services hub, fuel, solar, wastewater treatment plant etc), including 200 bed staff accommodation facilities;
- Establishment of the GKI Research Centre and Biodiversity Conservation Fund (BCF) which will aim to deliver a better understanding of the surrounding marine and terrestrial environments and to actively undertake conservation works to enhance the natural environment;
- A new sports oval which can be used by resort guests and other GKI residents and visitors; and
- Restoration of the original Leeke's Homestead.

It is envisaged that approximately 685 full time, part time and casual staff will be required once the resort is fully operational. Most operational staff will work standard shift hours and will be sourced from



the Capricorn Region. The majority of staff will travel to the Island via ferry for each shift, before returning home to the mainland after their shifts. Up to approximately 200 staff may be accommodated in the new staff accommodation to be provided on the Island as part of the GKI Resort Revitalisation Plan.

The GKI Resort Revitalisation Plan will be constructed in stages, with Stage 1 involving construction of the Fishermans Beach hotel and day spa, the marina facility including retail precinct, one hundred and fifty (150) apartments and internal infrastructure (power, water, sewerage, roads). It is expected that Stage 1 will take approximately 18 months to construct at a cost of around \$150 million. Completion of the GKI Resort Revitalisation Plan is expected to take 12 years, finishing around 2023.

Construction workers will be ferried to and from the Island where possible and practical. It is envisaged that rooms at the old resort as well as other accommodation options on the Island will be utilised to provide accommodation on the Island for some construction workers.

Table 1 provides a summary of expected number of staff and visitors, and average occupancy for the resort during operation as derived from the report entitled "Forecast Economic Impacts - Proposed Revitalisation of Great Keppel Island", dated June 2011 prepared by Foresight Partners Pty Ltd. This data has been used to estimate the average volume of waste generated during operation of the resort as presented in section 5 of this report

Forecast Persons	Units	Avg. Annual Occupancy Rate	Persons / Occupied Unit	Total Number of Person per Annum	Average Number of Persons per Day
Hotel Rooms	250	65%	2.2	130,488	358
Villas	750	50%	2.5	342,187	938
Apartments	300	50%	2.5	136,875	375
Marina Berths	250	20%	2.2	40,150	110
Day Visitors	N/A	N/A	N/A	36,500	100
Staff Accommodation	200	95%	1.5	95,760	262
Staff Commuting	N/A	N/A	N/A	48,000	131
Annual Total				829,960	2,274

Table 1: Estimated Average Number of Persons on Great Keppel Island

1.2 LOCALITY OVERVIEW

Great Keppel Island is located approximately 12 km off the coast of Yeppoon on the Central Queensland coast. GKI is included within the Rockhampton Regional Council local government area.

GKI is the largest island in the Keppel Island Group, which comprises a group of sixteen islands, including North Keppel Island, Corroboree Island, Pumpkin Island, Miall Island, Middle Island, Barren Island, Halfway Island, and Humpy Island. Apart from GKI and Pumpkin Island, all of the other Keppel Islands are designated National Parks.

The proposed Revitalisation Plan applies to the areas of GKI that are leased by GKI Resort Pty Ltd, which covers an area of approximately 900 hectares consisting of multiple land tenures. The GKI Resort Revitalisation Plan also includes Unallocated State Land to be developed for the marina and areas to accommodate utility service connections between GKI and the mainland.



There are seventeen beaches on GKI and its natural environment offers a wide range of activities including swimming, diving, snorkelling and bushwalking.

1.3 CURRENT AND PREVIOUS DEVELOPMENT

Until recently the Island has been occupied by a number of different commercial accommodation facilities ranging from camping ground style accommodation to resort level accommodation. The original GKI Resort was the main tourism resort located on the Island and comprised 190 guest rooms. These facilities were closed in early 2008.

The Island is currently occupied by two backpackers' facilities, ten residential properties and ten commercial premises. Access to the Island is currently via ferry and cruise ship services from the Rosslyn Bay / Keppel Bay Marina on the mainland.

In the 1990s when the former GKI Resort was operating, the average daily population on the Island (staff, residents, overnight and day visitors) was approximately 765 persons while the maximum possible daily population was approximately 2,600 persons (Foresight Partners, 2011). The peak daily population for the Island during operation of the former resort (ie. 2,600 persons) is therefore comparable with the anticipated average daily population projected for the revitalised resort (ie. 2,274 persons) (Foresight Partners, 2011).

1.4 SCOPE AND OBJECTIVES

The purpose of this Report is to outline a strategy to manage the handling, storage and disposal of waste materials generated during demolition, construction and operation of the resort to ensure no adverse impacts on surrounding environments and communities. Specifically, the waste management strategy for the GKI Resort Revitalisation Plan aims to:

- Minimise the total volume of waste produced and the volume of waste disposed to landfill during the construction and operation of the GKI Resort Revitalisation Plan, by:
 - Employing waste avoidance and reduction strategies throughout construction and operation to eliminate waste at the source;
 - o Maximising the reuse and recycling of waste materials produced on site;
- Ensure the handling, storage and transportation of wastes during construction and operation of the GKI Resort Revitalisation Plan does not adversely impact on the natural environment or communities on and off the Island;
- Continually improve the process for managing wastes generated by the GKI Resort Revitalisation Plan by conducting regular waste audits to evaluate waste streams and practices, and to identify new ways to reduce, reuse or recycle wastes and to prevent environmental harm.

This Report has been prepared to address part B, section 3.9 of the "Terms of Reference for EIS – Great Keppel Island Resort Project" issued by the Queensland Coordinator-General and dated June 2011, which requires the following issues to be considered in the Environmental Impact Statement (EIS):



3.9 Waste

3.9.1 Existing waste generation and management

This section should estimate existing waste generation and describe the current waste management practices on Great Keppel Island, including solid, liquid and hazardous waste streams.

3.9.2 Potential impacts and mitigation measures

3.9.2.1 Waste generation

The EIS should identify and describe all sources, likely volumes and quality (where applicable) of waste associated with construction, operation and decommissioning of all aspects of the project. This section should describe:

- waste generated by delivery of material to site(s).
- all chemical and mechanical processes conducted on the construction sites that produce waste.
- the amount and characteristics of solid and liquid waste produced on-site by the project, including the percentage of waste that would be suitable for reuse, recycling or recovery.
- hazardous materials to be stored and/or used on-site, including environmental toxicity data and biodegradability.

3.9.2.2 Waste management

Having regard for best practice waste management strategies and the Environmental Protection (Waste) Policy 2000 and the Environmental Protection (Waste) Regulation 2000, this section should assess the potential impact of all wastes generated during construction and operation and provide details of each waste in terms of:

- reducing waste generation and optimising resource recovery.
- the options available (both on and off-site) for avoidance/minimisation, recycling, reuse and recovery (including any potential 'waste to energy' opportunities). Details on natural resource use efficiency (e.g. energy and water), co-generation of power and byproduct reuse (as shown in a material/energy flow analysis) are required.
- market demand for recyclable waste (where appropriate).
- operational handling and fate of all wastes including storage. The percentage of total waste that will be diverted from landfill for reuse, recycling or recovery should be specified.
- on-site treatment methods proposed for any wastes.
- methods of disposal (including the need to transport wastes off-site for disposal) proposed to be used for any trade wastes, liquid wastes and solid wastes.
- the potential level of impact on environmental values.
- measures to ensure stability of the waste storage areas and impoundments.
- methods to prevent, seepage and contamination of groundwater from stockpiles and/or storage areas and impoundments.
- measures to minimize attraction of vermin, insects and pests.
- the decommissioning of the construction site.

The Report also addresses relevant requirements of the "Guidelines for an Environmental Impact Statement for the Great Keppel Island Tourism and Marina Development, Queensland" issued by the Australian Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) in conjunction with the Great Barrier Reef Marine Park Authority.



2. CURRENT AND HISTORICAL WASTE MANAGEMENT PRACTICES

2.1 DURING RESORT OPERATION

From about the year 2000 until closure of the resort in 2008, Cleanaway (now Transpacific Cleanaway) was responsible for the collection of general waste from the Island, and transport of these wastes to the mainland for disposal at Council's landfill facilities. During this period, information provided by Mr Peter Lewis, Cleanaway Area Manager, indicates that an average of 90 m³ (30 x 3m³) bins were removed from the Island on a weekly basis.

Of the thirty (30) bins removed from the Island each week, one (1) bin contained recyclable glass and one (1) bin contained recyclable cans were transported to recycling facilities on the mainland. The remaining twenty-eight (28) bins contained general waste and were transported to Council's landfill for disposal. This indicates a low level of recycling activity in the previous operation.

Based on an approximate weight of 0.131 t/m³ for un-compacted general waste (Birdsey, 2001), this equates to approximately 11 tonnes of general waste, 0.39 tonnes of recyclable glass and 0.39 tonnes of recyclable cans being removed from Island weekly assuming each of the skips was full prior to removal. This volume of waste was being generated by the resort as well as the 25 residential properties on the Island and excludes green waste, which it is understood was being deposited in the abandoned quarry (Lot 8 on SP129154) (refer to **Appendix D – Location of Existing & Former Waste Facilities on GKI**).

During the period between about 2000 and 2008, Cleanaway has advised that a maximum of forty (40) skip bins were stored on the Island at the 'bin bank', which was located on leasehold land (Lot 45 on LN2763) leased by GKI Resort Pty Ltd and situated near the works compound (refer to **Appendix D** – **Location of Existing & Former Waste Facilities on GKI**). Forty (40) skip bins were also stored on the mainland at Yeppoon. A transport ferry would depart from Yeppoon on a twice weekly basis, each time carrying on average fifteen (15) empty bins to the Island while returning with fifteen (15) full bins. Prior to the bulk bins being collected by Cleanaway, the operator of the resort would collect wheelie bins located around the resort using a tractor and trailer and empty the contents of the wheelie bins into the bulk bins stored at the 'bin bank'.

Prior to 2000, the previous resort manager, Mr Cleary, has suggested that the abandoned quarry (Lot 8 on SP129154) was used as a landfill site for disposal of all waste generated by the resort and Island residents (refer to **Appendix D – Location of Existing & Former Waste Facilities on GKI**). It is understood that the Resort was primarily responsible for operation and management of the landfill site. No records have been found of any permits or licences being held for the operation of a landfill on the Island. Further details on the status of this land are contained in Section 3.2.6 – Land Contamination of the EIS.

Mr Cleary has indicated that some recycling was undertaken at the resort, with bottles and cans separated at the source and diverted to recycling facilities. Cardboard and green waste were diverted to a shredder and composted along with waste activated sludge from the sewage treatment plant. The



composted waste was disposed of into a worm farm during this period (Qantec McWilliam Consulting Engineers, 1995).

2.2 POST RESORT CLOSURE

Since closure of the former GKI Resort in 2008, Rockhampton Regional Council has been responsible for management of GKI's solid waste. Council currently operates the Keppel Island Waste Management Facility on the Island. This facility comprises a bin station located within the former resort depot compound (Lot 45 on LN2763) (refer to **Location of Existing & Former Waste Facilities on GKI**). Facilities for collection of general household waste only are available at the bin station. This means that recyclable materials are no longer separated as occurred during operation of the resort and are included with the general waste.

Information provided by Rockhampton Regional Council's Strategic Manager of Waste Services, Mr Craig Dunglison indicates that approximately 25 x 240L wheelie bins are currently being collected from the Island's residents on a weekly basis at a cost of approximately \$500 / trip to Council. The general waste is disposed of into a standard 240L wheelie bin at each residential property. It is understood that these wheelie bins are then placed on Fisherman's Beach for collection on a weekly basis.

The wheelie bins are loaded onto the Freedom Fast Cats ferry service for transport to the mainland. Fresh wheelie bins are brought over on the ferry to replace the filled bins taken back to the mainland for emptying. The bins are then emptied into skips located at Freedom Fast Cat's mainland facility. From here the skips are collected by Rockhampton Regional Council and transported for disposal at a Council operated landfill. Waste estimation figures provided by Freedom Fast Cats indicate that the weight of waste removed from the Island ranges from 720 kilograms - 2.4 tonnes per month, depending on Island occupancy and activities.

The current process of transporting general waste via a passenger ferry is not considered desirable due to the potential health risks, while Council also considers the process to be undesirable due to the costs imposed on the Council.

According to Mr Christie, the abandoned quarry located on the Island is also still used for all green waste disposal, however the worm farm that was used during operation of the former GKI Resort is understood to no longer be in use.



3. WASTE MANAGEMENT REQUIREMENTS

3.1 LEGISLATIVE REQUIREMENTS

The *Environmental Protection Act 1994* (EP Act), which is administered by the Department of Environment and Resource Management (DERM), was established with the purpose "to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development)."

The EP Act utilises a number of mechanisms to achieve its objectives. These include:

- creating a general environmental duty,
- licensing environmentally relevant activities (ERAs); and
- issuing environmental protection policies.

3.1.1 General Environmental Duty

All persons involved in this Project are subject to a general environmental duty of care under sections 319 and 320 of the EP Act. Section 319 of the Act, which conveys the general environmental duty, states that a person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm.

Furthermore, section 320 of the Act requires than if any person, while carrying out an activity, becomes aware that serious or material environmental harm is caused or threatened by any person's act or omission in carrying out the activity, they must as soon as reasonably practicable after becoming aware of the event, notify their employer or give written notice to the administering authority of the event, its nature and the circumstances in which it happened.

3.1.2 Environmentally Relevant Activities

Environmentally relevant activities are defined in schedule 2 of the *Environmental Protection Regulation* 2008. It is an offence to conduct an ERA without:

- A current development approval authorising the activity to be undertaken on the premises; and
- A current registration certificate authorising the person to undertake an ERA on the premises.

A number of waste-related environmentally relevant activities are defined in the *Environmental Protection Regulation 2008.* A summary of these ERAs along with an assessment of the relevance of each ERA to the GKI Resort Revitalisation Plan is provided in **Appendix B - Summary of Waste Related ERAs**.

3.1.3 Environmental Protection Policies

The Environmental Protection (Waste Management) Policy 2000 and the Environmental Protection (Waste Management) Regulation 2000 are the primary legislative instruments governing waste management in Queensland.



Environmental Protection (Waste Management) Policy 2000

The *Environmental Protection (Waste Management) Policy 2000* (EPP (Waste)) sets the following three main principles for waste management:

- 1. The "polluter pays principle" all costs associated with waste management should, where possible, be borne by the waste generator.
- 2. The "user pays principle" all costs associated with the use of a resource should, where possible, be included in the price of goods and services developed from that resource.
- 3. The "Product stewardship principle" the producer or importer of a product should take all reasonable steps to minimise environmental harm from the production, use and disposal of the product.

The EPP (Waste) also provides for the preparation of waste management programs to minimise waste generation, promote the efficient use of non-renewable resources and promote the use of waste as a resource in order to achieve the objectives of the EP Act. Waste management programs are to be prepared in accordance with the waste management hierarchy also outlined in the EPP (Waste).

The waste management hierarchy specifies the preferred order of adoption of various waste management practices, with priority to be given to practices that achieve the best environmental outcome. The waste management hierarchy is illustrated in **Figure 1** below:



Figure 1: Waste Management Hierarchy

An overview of how the principles of the waste management hierarchy shall be applied to demolition, construction and operational phases of the proposed GKI Resort Revitalisation Plan is provided in section 3.2 below.



Environmental Protection (Waste Management) Regulation 2000

The *Environmental Protection (Waste Management) Regulation 2000* (EPR (Waste Management)) contains specific provisions dealing with the following:

- Requirements for the storage, handling, transportation and disposal of various types of waste including general waste, industrial waste, clinical waste etc;
- Waste-related offences for littering, waste dumping, unlawful disposal of hypodermic needles and unlawful activities at waste facilities;
- A waste tracking system that collects data on waste generation, transportation and disposal within Queensland and interstate;
- A procedure for approval of wastes for beneficial reuse; and
- Design rules for waste storage, handling and transportation equipment.

Procedures for the storage, handling, transportation and disposal of wastes generated during the demolition, construction and operational phases of the proposed GKI Resort Revitalisation Plan, have been developed in accordance with the requirements of the EPR (Waste Management) (refer to sections 4 and 5).

The EPR (Waste Management) requires the tracking of all "trackable wastes" as specified in schedule 1 of the Regulation. The waste tracking system enables regulatory authorities to track waste from the place of generation to the place of storage, recycling, treatment or disposal. The objectives of waste tracking are to ensure that all parties involved with the management of the waste take a responsible attitude towards this management and to ensure that the waste is transported and managed appropriately so as to prevent environmental harm.

Waste generators, transporters and receivers all have a responsibility to provide information to DERM about the transport of trackable waste by paper or electronic systems. Part 4 of the EPR (Waste Management) specifies the requirements for transportation and handling of trackable waste. In accordance with these requirements, the 'generator' must give the following information to the 'transporter':

- The generator's
 - \circ $\,$ Name, address, local government area and contact details; or
 - Generator identification number;
- The name, address and contact details of the person to whom the waste is to be transported;
- The day and time the generator gives the waste to the transporter for transporting;
- The load number;
- For a load of waste transported to a receiver outside Queensland-the consignment number for the load;
- If the waste is dangerous goods-the type and number of containers in which the waste is contained;
 - The following details of the waste:
 - The type of waste
 - The amount, expressed as a stated number of kilograms or litres



- o Its physical nature (solid, liquid, paste or gas)
- o Its waste code
- o If the waste is dangerous goods
 - Its UN number
 - Its packing group designator
 - Its dangerous goods class and any subsidiary risk
- o The waste origin code for the activity that generated the waste/

The generator must record and must give to the administering authority, the following information:

- The information mentioned above;
- The transporter's name, address and contact details;
- The transporter's environmental authority number or registration certificate number; and
- If the vehicle used to transport the waste is a motor vehicle, its registration number.

3.2 QUEENSLAND'S WASTE REDUCTION & RECYCLING STRATEGY

In addition to current legislative requirements, consideration has been given to *Queensland's Waste Reduction and Recycling Strategy 2010-2020* (DERM, 2010) in developing the waste management strategy for the GKI Resort Revitalisation Plan. This Strategy is a 10-year plan to achieve the state government's vision of a low-waste Queensland and has the following broad goals:

- Reduce waste;
- Optimise recovery and recycling; and
- Develop sustainable waste industries and jobs.

To achieve these goals the Strategy outlines a five-part approach:

- 1. Identifying clear targets and priority products and sectors.
- 2. Setting a price signal by introducing a waste disposal levy.
- 3. Creating stronger regulation by reforming the current legislative framework.
- 4. Establishing new programs and investment strategies.
- 5. Partnering for change by establishing effective partnerships between state government, industry, local government and the community.

The targets for reducing waste specified in the Strategy include:

- Reduce waste to landfill by 50%;
- Reduce landfill gas emissions by 50%;
- Increase the recovery and recycling of resources across all waste streams;
- Reduce generation of waste; and
- Reduce the total amount of, and environmental impacts from, litter and illegal dumping.

The waste management strategy for GKI as outlined in this report is considered to be consistent with the objectives of *Queensland's Waste Reduction and Recycling Strategy 2010-2020* and will contribute to achievement of the specified targets by improving upon current waste management practices on the



Island, including through providing enhanced opportunities for reuse and recycling of wastes, which are currently all disposed to landfill and by closure of former landfill operations on the Island. In addition to this, the waste management strategy for GKI is strongly aligned with the waste management hierarchy as described in the following section.

3.3 WASTE MANAGEMENT HIERARCHY

The following section provides an overview of how the principles of the waste management hierarchy shall be applied to demolition, construction and operational phases of the proposed GKI Resort Revitalisation Plan.

3.3.1 Waste Avoidance

Waste avoidance relates to strategies that prevent the generation of waste or reduce the amount of waste generated. It is the most preferred waste management strategy as it significantly reduces the environmental risks as well as the social and economic costs associated with subsequent storage, handling, transportation and disposal of wastes.

The generation of waste can be avoided by undertaking the following.

- Input substitution;
- Increasing efficiency in the use of raw materials, energy, water or land;
- Process redesign;
- Product redesign;
- Improved maintenance and operation of equipment; and
- Closed-loop recycling reclaiming, from a production process, a material that would otherwise be disposed of as a waste and using it as an input in the same production process.

Opportunities to implement waste avoidance practices as part of the GKI Resort Revitalisation Plan, include:

- Implementing purchasing policies that focus on selection of materials and resources with less
 packaging and therefore less potential waste content, including encouraging bulk purchasing of
 materials;
- Use of e-marketing and information materials as opposed to paper-based materials where possible;
- Purchasing potentially reusable or recyclable materials where possible, and preferably materials derived from renewable sources and produced with a low embodied energy content;
- Purchasing materials or resources that not only generate less waste, but generate less harmful wastes (eg. purchasing of biodegradable, low phosphorous cleaning products);
- Management of estimating and ordering during construction and operation to ensure that only the minimum amount of materials required are purchased and delivered to the Island. As well



as reducing the volume of waste generated, this practice will also achieve cost savings for the Project. For example, having materials cut to size at the factory to reduce waste from on-site cutting;

- Effectively tracking material ordering, delivery, placement and use of materials to ensure all available materials are utilised prior to ordering additional materials;
- Implementation of supplier and service provider contracts that focus on environmental performance, such as "just in time" ordering of construction materials and supplies, reduction in packaging materials;
- Ensuring project design avoids unnecessary waste generation during construction. For example:
 - Planning and staging works to balance cut and fill requirements;
 - Ensuring appropriate staging and storage of stripped topsoil (as well as cleared and mulched vegetation) to ensure viability of this material for reuse in landscaping works; and
 - Designing buildings to minimise waste, including by use of pre-fabricated elements and components where possible, employing modular construction-based techniques and designing for deconstruction rather than demolition at the end of building life;
- Providing appropriate training to staff to ensure they are aware of the environmental risks and costs associated with inappropriate waste management, and understand the opportunities to reduce waste generation through their specific tasks;
- Ensuring all plant and equipment is effectively maintained and operated to reduce excess generation of waste;
- Installing water efficient fixtures and fittings to reduce the volume of wastewater generated;
- Installing appropriate infrastructure to ensure that excess energy generated by the proposed solar panels is not wasted and can be stored for reuse on the Island or returned to the mainland electricity grid;
- Returning any excess materials, packaging (eg. timber pallets) and used chemical containers to the supplier (where practical);
- Ensuring adequate and appropriate storage areas are available for the temporary storage of resources and materials that may be reused or recycled; and
- Establishing procedures for assessing waste streams for potential reuse or recycling prior to transport to an approved disposal facility, including undertaking regular waste audits, and staff and visitor awareness programs.

3.3.2 Waste Reuse

Waste reuse involves the reuse of waste without first processing or substantially changing the form of the material.

Opportunities to implement waste reuse practices as part of the GKI Resort Revitalisation Plan include:



- Reusing storage containers and pallets;
- Promoting the use of container return programs such as the delivery of materials on crates that are then returned to the manufacturer for reuse;
- Salvaging and reusing building materials derived from demolition of the existing resort, including crushing concrete, bricks and pavers, for reuse as road base, drainage and scour protection, and salvaging suitable timber and steel for framework, etc;
- Salvaging and reusing building materials derived from the construction process such as timber for concrete formwork, scrap steel and off-cuts, pallets, plastics, paper and cardboard and oils;
- Mulching of cleared vegetation and other organic waste for reuse in landscaping works on the Island, and where possible, salvaging of suitable timber for reuse in building construction on the Island or for commercial sale;
- Stripping and appropriately storing topsoil for reuse in landscaping works on the Island;
- Providing appropriate facilities to collect food waste and other organic wastes generated during operation of the GKI Resort Revitalisation Plan, for composting and reuse of composted material in landscaping on the Island; and
- Stabilisation and processing of biosolids from the sewage treatment plant on the Island for reuse as soil conditioner on the golf course and other landscaped areas.

3.3.3 Waste Recycling

Waste recycling refers to the reprocessing of waste materials to produce new products.

Opportunities to implement waste recycling practices as part of the GKI Resort Revitalisation Plan include:

- Treating wastewater to a suitable quality to enable use of recycled water for toilet flushing, and irrigation of the golf course and other landscaped areas on the Island;
- Collecting and segregating building wastes such as timber for concrete formwork, scrap steel and off-cuts, pallets, plastics, paper and cardboard and oils, and transferring to licensed recycling facilities on the mainland;
- Providing appropriate facilities to collect and segregate recyclable materials such as plastic bottles, aluminium and steel cans, glass, paper and cardboard, etc generated during operation of the resort, and transferring to licensed recycling facilities on the mainland;
- Implementing purchasing policies that give priority to purchasing of recycled materials or materials containing recycled content based on performance and pricing, to minimise impacts on virgin resources and to contribute to increasing the demand for recycled materials that will support the commercial viability of recycling activities;
- Providing regular awareness training and information to staff and visitors to encourage recycling of materials;
- Installing readily identifiable and conveniently located collection bins for recycled materials around the resort, including use of colour-coding and labels to assist visitors and staff in utilising the correct bin; and



• Ensuring sufficient number and appropriate types of recycling collection facilities are available, including undertaking regular audits to ensure adequacy of facilities provided.

Preliminary discussions with Rockhampton Regional Council have indicated that significant demand exists within the region for recyclable materials, particularly in terms of common domestic recyclables (eg. aluminium and steel cans, paper and plastics) but also in terms of recyclable construction wastes such as timber and steel. Rockhampton Regional Council, in conjunction with neighbouring local authorities, currently has a regional contract with AMCOR to supply a broad range of recyclable materials collected at Council's waste management facilities. In this regard, discussions with Council have indicated that there is a price benefit to Council under this contract to provide an increased amount of recyclable material. As such, Council has suggested that it would be supportive of accepting recyclable materials from GKI at its facilities, particularly where such materials are pre-segregated.

3.3.4 Energy Recovery

This practice involves recovering and using energy generated from waste.

Opportunities to implement energy recovery practices as part of the GKI Resort Revitalisation Plan are limited. Although technologies exist to recover energy from waste through incineration or gasification, these technologies have relatively high capital costs. Furthermore, such systems typically do not deal well with variable moisture content and composition of feedstock, which is an issue for GKI given the relatively small quantities of waste generated, would require the use of a broad range of feedstock material to make the system viable. Incineration also has the potential to release various pollutants to the air and is generally inconsistent with the 'clean' and 'green' image promoted by the GKI Resort Revitalisation Plan.

Similarly, the establishment of landfill for putrescible waste on the Island and extraction of methane gas for electricity generation is also not considered appropriate due to the relatively high capital costs, small quantities of putrescible waste generated, environmentally sensitive nature of the Island, limited land availability and proximity of sensitive receivers.

Given the relatively small scale of the sewage treatment plant and highly variable loads associated with variable occupancy rates, energy recovery from methane generated by the sewage treatment process is also considered to be unfeasible at this time.

Small-scale production of biodiesel from green and organic waste for use in vehicles operated by the GKI resort may comprise an energy recovery option for future investigation once more accurate data relating to the composition and volumes of suitable organic source materials generated on the Island are known.

3.3.5 Waste Disposal

Waste disposal refers to the final deposit of waste when the material is of no further use. This may involve disposal to landfill or thermal destruction (ie. incineration). Disposal is considered the least preferred option for the management of waste but when required, it is important to select a method of disposal that causes the least harm to the environment.



The disposal or incineration of wastes on the Island is generally not considered a viable option for the GKI Resort Revitalisation Plan due to the environmentally sensitive nature of the Island and surrounding areas. Although incineration of wastes provides opportunities for energy recovery as described above, incineration is not considered to be a feasible option as it is a relatively expensive option for treating wastes and is inconsistent with the 'clean' and 'green' image being promoted by the GKI Resort Revitalisation Plan. Similarly, operation of a landfill on GKI is not considered an appropriate option due to the environmental risks associated with contaminated leachate potentially entering groundwater and surface water, potential odour nuisance issues and relatively high costs associated with establishing and managing a landfill. Accordingly, no disposal or incineration of solid wastes will occur on the Island. Historical landfill facilities will be decommissioned in accordance with recommendations from contaminated site investigations undertaken for the GKI Resort Revitalisation Plan.

Some discharge of excess treated wastewater via ocean outfall may occur during periods of prolonged wet weather when demand for recycled water for irrigation is not sufficient to utilise all wastewater generated by the resort. In this case, wastewater will be treated prior to disposal to meet the quality standards specified by the Great Barrier Reef Marine Park Authority. Further details on proposed wastewater management on the Island, including reuse of recycled water for irrigation and toilet flushing, and discharge of excess treated wastewater via ocean outfall are contained in the Water Cycle Management Report prepared by Opus International Consultants.

All solid wastes that cannot be reused or recycled as described above, will be collected and stored in designated facilities on the Island, prior to transport and disposal on the mainland. Details of proposed waste collection, storage and handling procedures are detailed in sections 4 and 5. GKI Resort Pty Ltd will engage the services of a commercial waste transporter licensed in accordance with the requirements of the *Environmental Protection Act 1994* to transport wastes to the mainland. It is anticipated that a waste collection vehicle will travel to GKI once or twice a week via the regular ferry service. The waste collection vehicle will load wastes from bulk bins contained in the designated waste collection area before returning to the mainland via the ferry service on the same day. It is envisaged that bulk recycling bins will be collected via a waste collection vehicle travelling to and from the mainland once a week or as required.

Wastes will be disposed of at a Council-managed landfill facility licensed under the *Environmental Protection Act 1994.* Rockhampton Regional Council currently operates three (3) landfill sites, including:

- Lakes Creek Road Waste Management Facility;
- Gracemere Waste Management Facility; and
- Yeppoon Waste Management Facility.

The location of Council's waste management facilities is shown in Figure 2.

Discussions with Council's Strategic Manager of Waste Services, Mr Craig Dunglison, have confirmed that solid waste collected from GKI is currently disposed of at the Lakes Creek Road Waste Management Facility. However, Mr Dunglison also confirmed that the Lakes Creek Road Waste



Management Facility, which commenced operation in 1983, is due to cease operation as a sanitary landfill site in 2013 at which time it will commence operation as a waste transfer station.

Information derived from Council's website indicates that all three (3) existing landfill sites could be filled to capacity by early 2015 and Council has therefore commenced a landfill investigation process to identify a suitable new site to dispose of the City's waste (RRC, 2011). At this stage, the location of any new landfill site has not yet been announced. It is also unknown whether the considerable volumes of waste generated during the recent floods have shortened the timeframe for the Lakes Creek Road Waste Management Facility to reach capacity.



Figure 2: Location of Rockhampton Regional Council Waste Management Facilities

Despite issues surrounding the capacity of Council's existing landfill sites, Mr Dunglison has confirmed that Council has a responsibility to its ratepayers to provide waste management services and that Council will receive any solid waste generated by the proposed GKI Resort. Waste from GKI will be transported directly to the Yeppoon Waste Management Facility, located on the corner of Neils Road and Yeppoon Road, Yeppoon. This facility is able to accept the following items:



- Recyclable items glass, cardboard, paper, plastic, aluminium cans;
- Motor oils;
- Tyres;
- Batteries;
- Drums;
- Construction and demolition waste;
- General household waste; and
- Green waste.

This facility is also able to accept a range of hazardous wastes subject to prior approval from Council and compliance with limitations specified in Council's environmental licence. In particular, Council has indicated that this facility can accept asbestos material that may be derived from demolition of the existing resort provided this material is packaged and sealed in accordance with the relevant Australian Standards.

Given the limited capacity currently available at Council's mainland landfill sites, Council's Strategic Manager of Waste Services has confirmed that Council would support any efforts by the GKI Resort to reduce waste generated by the facility and particularly the reduction of waste requiring disposal at Council's waste management facilities. In order to achieve this, while also reducing the costs associated with transporting wastes, reuse and recycling of wastes on the Island will be maximised as described above. In addition, it is proposed that solid waste material intended for disposal on the mainland will undergo some minor treatment on the Island to reduce the volume of waste material prior to transfer to the mainland. This will include compaction of general waste using a small stationary refuse compactor, bin press or similar installed within the industrial compound. Compacted waste will then be enclosed into container for transport to the mainland to minimise shipping costs and frequency.



4. WASTE MANAGEMENT – CONSTRUCTION PHASE

4.1 WASTE GENERATION

Wastes generated during the demolition and construction phases of the project will primarily be derived from:

- Demolition of existing resort buildings and associated infrastructure (eg. roof sheeting and guttering, concrete, timber and steel framework and cladding, pipework, bricks, tiles and pavers);
- Ground preparation works (eg. cleared vegetation);
- Delivery of materials to the Island (eg. packaging, pellets, storage containers);
- Building and construction materials (eg. off cuts of timber, plastics, steel and concrete);
- Building and construction processes (eg. sawdust and filings from timber and steel cutting and grinding, cement slurries and paint sludges (if producing painted concrete products) from concrete batching); and
- Activities of construction workers, including general refuse (eg. food wrappings and scraps) and wastewater from site amenities.

A summary of wastes likely to be generated during the demolition and construction phase of the GKI Resort Revitalisation Plan is provided in **Table 2** along with estimated volumes and proposed methods for managing each of these wastes.

Estimates of demolition waste volumes are based on an assessment undertaken for this Project by Turner & Townsend and contained in their report 'Volumes of materials movements for proposed developments Great Keppel Island (June 2011)'. Turner & Townsend (2011) have estimated that demolition of the existing resort and associated infrastructure will generate approximately 10,301m³ of waste material, including:

- Concrete 4,747m³
- Timber & Plasterboard 2,645m³
- Glass 37m³
- Roof Metal 1,033m³
- Hardware and Pipes 500m³
- Furniture and Whitegoods 1,340m³

In addition, in calculating the amount of construction materials needing to be transported to the Island, Turner & Townsend (2011) allowed for 10% wastage of construction materials. On this basis, the following estimates of construction wastes have been derived:

- Concrete 11,301m³
- Timber & Plasterboard 8,575m³
- Glass 84m³
- Roof Metal 1,212m³
- Hardware and Pipes 748m³
- Furniture and Whitegoods 1,281m³
- Floor Finishes (Tiles & Carpets) 225m³



Reference has also been made to average composition data for demolition and construction (residential / commercial) in Queensland derived from "Construction and Demolition Waste: Waste Management and Resource Use Opportunities" published by the Queensland Environmental Protection Agency (EPA) in July 2002. This data is illustrated in **Figures 3 and 4**.



Figure 3: Average Composition of Demolition Waste in Queensland



Figure 4: Average Composition of Construction (Residential / Commercial) Waste in Queensland

In comparison to the data presented in **Figures 3 and 4**, Turner & Townsend (2011) identified only those construction materials that would require transport to the Island and therefore did not account for earthen spoil and green waste, which already exist on the Island. Taking this into consideration, the proportional composition of demolition and construction waste materials estimated by Turner & Townsend (2011) is comparable to the figures derived from the study by the former Queensland EPA. As such, the estimates provided by Turner & Townsend (2011) have been adopted as the basis for the



estimated waste volumes in **Table 2**, while other waste streams not accounted for by Turner & Townsend (2011) have been derived based on the proportions in **Figures 3 and 4** (eg. cardboard / paper packaging) except where indicated.

Waste Type	Approximate Quantity	Waste Storage	Waste Management Method	Frequency of Collection
Fill and soil (not contaminated)	Cut and fill activities will be minimised and balanced such that no surplus fill or soil will require removal from the Island.	Dedicated stockpile sites will be established for each stage of construction. Sites will be located with appropriate setbacks to watercourses, overland flow paths and residential dwellings.	Topsoil stripped and stored for reuse in landscaping works. Cut material will be reused for filling during construction on the Island.	As required.
Fill and soil (contaminated)	Refer to Section 3.2.6 – Land Contamination of the EIS.	Refer to contaminated site investigation report.	Refer to contaminated site investigation report.	Refer to contaminated site investigation report.
Cleared vegetation	Total for Construction = 180 to 300 hectares ¹	Dedicated green waste storage bay within construction compound.	Where practicable, felled timber of commercial quality will be salvaged and used in construction or transported to mainland sawmills for reuse. Other cleared vegetation will be mulched or chipped, and reused in landscape and rehabilitation works.	Weekly during construction
Timber	Total for Demolition = 1,860m ³ (approx) Total for Construction = 4,764m ³ (approx)	Dedicated storage bay within construction compound.	Timber salvaged from demolition of existing resort buildings or off cuts during construction will be reused in construction where possible. Otherwise, timber waste will be transported to the mainland for recycling where facilities exist, or disposal at Council's Yeppoon Waste Management Facility (landfill).	Weekly during construction

Table 2: Summary of Waste Generation and Management for Construction Phase



Waste Type	Approximate Quantity	Waste Storage	Waste Management Method	Frequency of Collection
Scrap metal	TotalforDemolition=1,033m³ (approx)TotalforConstruction=1,212m³ (approx)	Metal recycling skip bin in construction site compound.	Collected and transported to mainland for recycling.	Weekly during construction
Concrete, bricks, tile and rubble	Total for Demolition = 4,747m ³ (approx) Total for Construction = 11,301m ³ (approx)	Dedicated storage bay within the construction compound.	Concrete will be assessed for suitability and where practical, crushed on site (eg. using a mobile crushing plant) for use in road base or drainage on the Island. Concrete crushing activities will require approval under the EP Act for ERA 33 – Crushing, milling, grinding or screening. Other waste disposed to Council's Yeppoon Waste Management Facility (landfill).	Weekly during construction
Plasterboard	Total for Demolition = 784m ³ (approx) Total for Construction = 3,811m ³ (approx)	Dedicated construction waste skip bin within the construction compound.	Collected and returned to supplier (where possible) (eg. Boral Plasterboard offers a potential for product take-back for recycling into new plasterboard products or soil conditioner (gypsum used to treat problems such as transient salinity and as a clay breaker) (Boral Limited, 2011)). Where reuse and recycling options not available, disposal to Council's Yeppoon Waste Management Facility (landfill).	Weekly during construction
Packaging wastes – cardboard / paper and plastics.	Total for Construction = 3,500m ³ (approx)	Separate skip bins provided for cardboard / paper and plastics within the construction compound.	Transported to recycling facilities on the mainland, with some plastics disposed to Council's Yeppoon Waste Management Facility (landfill).	Weekly during construction



Waste Type	Approximate Quantity	Waste Storage	Waste Management Method	Frequency of Collection
Glass	Total for Demolition = 37m ³ (approx) Total for Construction =	Dedicated skip bin within the construction compound.	Transported to recycling facilities on the mainland.	Weekly during construction
Food and other organic waste ²	Average of 140 kg/day	Dedicated general waste skip bins within the construction compound.	Once composting facilities are established on the Island, construction food waste and organics will be collected for composting and reuse. Prior to the establishment of composting facilities on the Island, construction food waste and other putrescible organic waste will be transported for disposal at Council's Yeppoon Waste Management Facility (landfill).	Twice weekly during construction
Diesel and other fuels, oils, hydraulic fluids etc ³	Servicing = 1,050L/month (approx)	Bunded drum store within construction compound.	Collected, transported and recycled by a Fuel Recycling Contractor on mainland.	Monthly during construction
Asbestos	As identified	Asbestos material to be appropriately bagged by a licensed asbestos removal contractor.	"Supervised special burial" at an appropriately licensed landfill site on the mainland.	As required.
Wastewater	200L/person/day	Processed via re- commissioning of existing STP until new plant is constructed and operational in initial phases of the GKI Resort Revitalisation Plan. Existing and proposed STPs will require approval under the EP Act for ERA 63 – Sewage treatment.	Reuse in irrigation or discharge via existing ocean outfall in accordance with approval conditions.	Continuous

1.

Estimated area of vegetation clearing provided by CEPLA (2011) including remnant and non-remnant vegetation. Estimated based on average food waste per person from residential / commercial activities in Appendix C, assuming an average of 220 construction workers. 2.

3. Estimated based on monthly servicing of approximately 7 vehicles / machinery and approximately 150L/vehicle of replacement fuel, oil and other fluids.



The construction period is expected to extend over approximately 12 years until about 2023. As such, there will be some overlap between construction and operation of the resort during which time a range of both construction wastes and operational wastes will be generated. Due to the ongoing need for maintenance and refurbishment of resort facilities, construction type wastes as described in this section will be generated over the life of the GKI Resort Revitalisation Plan, albeit in much reduced quantities and as a lesser proportion of total wastes after the initial 12 year construction period ends.

Following completion of construction works, decommissioning of construction areas will occur progressively and will also generate a range of wastes. These wastes will be managed in accordance with the waste management principles for similar types of wastes derived from demolition and construction and in accordance with the waste management hierarchy. For example, the following wastes are anticipated to be generated during decommissioning of construction areas:

- All components of concrete batching and crushing plants will be dismantled and returned to the mainland for reuse. Excess materials that cannot be beneficially used on the Island will also be transported to the mainland for use in other construction projects;
- Concrete and asphalt hardstand within lay down areas and construction compounds will be ripped up and reused in works on the Island or returned to the mainland for recycling or disposal. These areas will then be stabilised through revegetation;
- Buildings used for site offices and amenities etc, will be dismantled and / or relocated to the
 permanent facilities maintenance compound on the Island or to the mainland for reuse or
 recycling;
- Security fencing around lay down areas and construction compounds shall be dismantled and returned to the mainland for recycling;
- All excess hazardous materials shall be transferred to the permanent facilities maintenance compound on the Island for use in resort maintenance activities or otherwise removed from the Island for reuse or recycling; and
- Any soils contaminated during construction shall be remediated or removed from the Island for disposal at approved facilities on the mainland.

4.2 ROUTINE PROCEDURES

4.2.1 Waste Minimisation

The following measures shall be implemented to minimise waste generation and reduce waste disposal during construction:

- Where practicable, construction shall include the use of modular components, purchase of materials cut to standard sizes or pre-fabricated materials to reduce the need for off-cuts;
- Selection of materials for building construction shall seek to maximise the use of renewable or recyclable components, subject to compliance with the relevant building standards specified in the Building Code of Australia and relevant Australian Standards;



- Purchasing policies shall be implemented to focus on selection of materials and resources with less packaging, including use of bulk purchasing, and potentially reusable or recyclable materials;
- Plastic waste will be kept to a minimum with alternatives to plastic being a selection criterion for suppliers delivering materials for construction. For example, metal strapping may be used instead of plastic wrapping or shrink wrap. Any plastic waste generated will be recycled, where possible;
- Contracts for builders and suppliers shall include an environmental performance component. Contractors and suppliers shall be required to pre-qualify for tendering based on environmental performance and consideration of potential environmental impact of supplying the materials or goods. Builders and suppliers shall also be required to identify the source of the material or goods, seek to provide alternatives, provide options for pre-fabrication, minimise packaging materials and access to "just in time" ordering;
- Construction project management shall ensure that works scheduling and organising trades, material delivery and placement, construction compound layout and organisation can contribute to effective reuse and minimisation of wastes, including effectively tracking materials to ensure all available materials are utilised prior to ordering additional materials;
- Life cycle analysis shall be undertaken for building materials etc to ensure waste generation is minimised over the full life of the GKI Resort Revitalisation Plan;
- Construction site disturbance shall be limited to minimise unnecessary excavation and removal of vegetation. It is anticipated that a neutral surplus of fill will result. If however there is surplus fill, it will be used for topsoil during landscaping. Landscaping for the GKI Resort Revitalisation Plan will utilise mulch from the vegetation removed during site preparation for construction activities;
- Stripping and storage of topsoil shall be managed to maintain viability of this material for reuse in landscaping;
- Separate skip bins shall be provided within the construction compound to facilitate waste segregation and maximise economic reuse and recycling. A sufficient number and appropriate types of bins shall be provided and labelled to assist with correct use;
- Storage of fuel for refuelling of equipment during construction on the Island shall be kept to a
 minimum. Storage and handling of fuels shall comply with AS1940 2004: The storage and
 handling of flammable and combustible liquids. Where possible, a proportion of the fuel used in
 the construction vehicles, plant and equipment shall include renewable fuels and/or ethanol
 based fuel;
- Any construction waste that cannot be recycled or reused and requires disposal, will be transported to a Council operated landfill facility on the mainland. A waste acceptance agreement must be sought from the Manager of the landfill prior to dispatch of waste from the Island;



- All wastes transported off the Island, must be transported by a licensed waste transporter under the EP Act and shall be covered or otherwise secured to prevent litter generation;
- If wastes suitable for reuse cannot be reused on site, off site reuse options will be investigated. A number of waste asset databases exist for contractors to list wastes available for reuse so other contractors can use them. Where possible, arrangements shall be made for excess materials or packaging to be returned to the supplier; and
- No waste materials shall be buried or burnt on the Island.

4.2.2 Waste Collection

Construction and demolition wastes will be collected and temporarily stored in bulk bins within the construction compound on the Island, prior to being collected and transported to the mainland by an appropriately licensed waste contractor for recycling or disposal at approved facilities.

All construction and demolition waste materials shall be assessed for the ability to be reused or recycled to minimise the volume of waste requiring disposal. Separate waste bins shall be provided to enable efficient separation of waste materials, including designated waste storage bins for separation of:

- 1. Domestic waste generated by staff and contractors;
- 2. Recyclable wastes paper and cardboard, timber, glass, metals and plastic (separate bins for each); and
- 3. Non-recyclable waste for disposal.

Waste storage bins shall be colour coded and/or labelled for separation of wastes into categories using the labelling system specified in Australian Standard *AS4123.7 – 2006 Mobile waste containers Part 7: Colours, markings and designation requirements.*

Smaller bins shall be provided in convenient and accessible locations relative to construction work areas and shall be emptied regularly into bulk storage bins provided within the construction compound.

Large items of waste that do not fit into bins provided, shall be removed from the Island as soon as possible and shall not be allowed to accumulate on the Island.

Timber pallets and packaging material shall be stored within the construction compound and returned to the suppliers at the time of the next delivery.

All potentially hazardous wastes (eg. waste oils, batteries, fuels and chemical wastes etc) shall be stored in separate containers located within a bunded and roofed hardstand area. No hazardous substances shall be placed in general waste bins or recyclable bins.

Liquid wastes are not permitted to be disposed of to landfill and must therefore not be placed in waste storage bins. Waste materials such as paints, concrete, plaster etc shall be allowed to dry before being placed in the appropriate waste storage container. Although not anticipated to be generated in large



quantities, any liquid wastes shall be transported by a licensed contractor to appropriate facilities on the mainland. No liquid wastes shall be disposed of into the sewerage treatment plant on the Island.

Waste storage containers and storage of bulk materials (eg. stripped topsoil and mulched vegetation), shall be:

- Located at least 50 metres from any natural watercourse, including coastal waters;
- Located outside of any overland flow paths;
- Provided with appropriate erosion and sediment control measures;
- Stockpiles of topsoil shall be no greater than 2 metres high and shall be stored for no longer than 6 months to maintain viability;
- Separated from existing residential properties or tourist accommodation to prevent odour and dust nuisance;
- Storage containers for potentially putrescible wastes (eg. food waste, other organics) or wastes with potential to generate windblown litter (eg. paper and plastics) shall be covered at all times; and
- Stockpiles of topsoil shall be covered if not intended to be used within 6 weeks.

4.2.3 Waste Transportation

The majority of wastes that cannot be reused or recycled on the Island will be transported to Rockhampton Regional Council's Yeppoon Waste Management Facility (Landfill). The location of Council's existing waste management facilities is shown on **Figure 2**.

Wastes will be collected from the Island by a commercial waste contractor licensed to transport waste under the *Environmental Protection Act 1994*. Waste collection vehicles will travel to and from the Island by a barge, which will also be utilised to deliver construction materials to the Island. Construction works shall be programmed to minimise barge movements by scheduling the removal of waste materials on barges returning to the mainland after completing delivery of construction materials.

All waste collection vehicles entering and leaving the Island must be clean and loads securely stowed, and covered where practicable.

Wastes will only to be transported to recycling or disposal facilities licensed for the particular waste stream(s).

All outgoing wastes from the Island will be transported by appropriately licensed waste transporters and will be accompanied by relevant waste tracking documentation.

4.2.4 Waste Disposal

No construction wastes shall be disposed of by burial or incineration on the Island.



All waste that cannot be reused in construction, will be transported to recycling facilities on the mainland or delivered for disposal at Rockhampton Regional Council's Yeppoon Waste Management Facility (Landfill) (refer to **Figure 2**). This facility is able to accept the following items:

- Recyclable items glass, cardboard, paper, plastic, aluminium cans;
- Motor oils;
- Tyres;
- Batteries;
- Drums;
- Construction and demolition waste;
- General household waste; and
- Green waste.

This facility is also able to accept a range of hazardous wastes subject to prior approval from Council and compliance with limitations specified in Council's environmental licence. In particular, Council has indicated that this facility can accept asbestos material that may be derived from demolition of the existing resort provided this material is packaged and sealed in accordance with the relevant Australian Standards.

Alternatively there are licensed waste collectors in the region that can collect, segregate and recycle most waste streams generated during construction of the proposed GKI Resort Revitalisation Plan.

4.3 ENVIRONMENTAL CONTROLS

4.3.1 Litter Control

The following measures shall be implemented to minimise litter generation during construction:

- Daily inspections of all waste storage areas shall be undertaken by the Principal Contractor or appointed representative, and shall include:
 - Review bin capacity to determine if additional waste collection services are required and provide additional bins where necessary to prevent overflowing;
 - General walkover of construction areas to identify evidence of litter and poor housekeeping practices and instruct clean-up of work areas if litter is observed;
- Bulk items that cannot fit within waste collection containers shall be stored within the construction compound and removed as soon as possible;
- Waste collection containers shall be removed regularly and no less than once a week during construction;
- Waste receptacles provided for the storage of paper and plastics will be covered to prevent wind-blown litter; and
- All waste transported on and off the Island will be covered, where practicable.

4.3.2 Odour and Dust Control

The following measures shall be implemented to minimise odour and dust generation and prevent environmental nuisance as a result of waste storage and transportation activities:


- Waste receptacles and storage bins for organic and food wastes will be covered;
- No bulk storage of food or other putrescible wastes shall occur within 50 metres of existing residential properties or tourist accommodation;
- Waste, particularly putrescible waste, shall be removed from the site regularly and no less frequently than weekly;
- Potentially contaminated stormwater captured in bunded areas used for waste storage will be assessed and disposed to appropriate facilities of as soon as practicable; and
- All vehicles entering and leaving the Island must be clean and loads securely stowed, and covered where practicable.

4.3.3 Pest and Vermin Control

The following measures shall be implemented to prevent attracting pests, vermin and disease vectors to waste storage facilities:

- Waste receptacles and storage bins for organic and food wastes will be covered;
- No pooling or ponding will be allowed to occur around storage areas;
- Where necessary, pest control shall be undertaken to control or prevent pest outbreaks; and
- All construction personnel, including contractors and sub-contractors, shall be provided with training in waste management procedures and good house-keeping practices as part of their site induction.

4.3.4 Stormwater Management

The following measures shall be implemented to prevent contamination of stormwater as a result of waste storage and transportation activities:

- All potentially hazardous wastes (eg. waste oils, batteries, fuels and chemical wastes etc) shall be stored in separate containers located within a bunded and roofed hardstand area;
- A spill response procedure shall be established and implemented, and appropriate clean up equipment / materials shall be provided where any construction activities or waste storage activities are undertaken to prevent the contamination of stormwater;
- Any stormwater captured within bunded areas used for the storage and / handling of wastes or other hazardous materials shall be pump-out and disposed of at an appropriately licensed facility; and
- Regular inspections shall be undertaken for stormwater drainage systems in areas used for the storage or handling of wastes and other hazardous materials to ensure all drains are free of litter and operating at optimum efficiency.

4.3.5 Construction Environmental Management Plan

A site-specific Construction Environmental Management Plan (CEMP) shall be developed prior to construction works commencing on site. Development of the waste management component of the



CEMP shall be consistent with the waste minimisation and management principles contained in this document and should consider the following issues as a minimum:

- Address waste reduction at source (e.g. orders to size, purchases in bulk);
- Encourage trials into alternative sustainable packaging techniques (eg, metal strapping in preference to shrink wrap, paper packaging as opposed to plastic, and shredded paper as opposed to foam);
- Use of reusable delivery and storage containers where possible;
- Efficient ordering systems to ensure minimal wastage; and
- Purchase of recycled products where viable and recycle, where possible.

4.4 MONITORING AND REPORTING

4.4.1 Inspections

Daily inspections of construction areas shall be undertaken during construction works to identify waste management issues and results recorded in an appropriate site inspection register / checklist.

4.4.2 Records

General Waste Records

Contractors shall maintain records of all construction waste streams, including keeping records of all waste disposal (date, location, volume, type, etc) during their contract.

Trackable Wastes

Records of all "trackable wastes" as specified in schedule 1 of the EPR (Waste Management) that are generated during construction activities will be recorded and maintained in accordance with the requirements of the EPR (Waste Management).

During the construction phase, the Principal Contractor will be the 'generator' for reporting purposes.

4.4.3 Incidents and Complaints

All environmental incidents, including complaints relating to waste management which have the potential to cause environmental harm must be reported to DERM in accordance with section 320 of the *Environmental Protection Act 1994*. Details of all complaints or environmental incidents relating to waste management shall be recorded in an appropriate environmental incident / complaint register.

All complaints or environmental incidents shall be investigated and corrective actions implemented to prevent recurrence. Corrective measures may include provision of additional waste containers or an increase in the frequency of waste collection. If a spillage or dispersal of waste causes contamination on the Island, the area affected by the spillage shall be immediately remediated and contamination reported to the relevant authorities.



4.5 TRAINING AND AWARENESS

All construction personnel, including contractors and sub-contractors, shall be provided with training in waste management issues as part of their site induction.

Training shall address the following:

- Relevant policies and legal requirements;
- Potential impacts of waste spillage and dispersal, particularly in relation to the environmental values of the area;
- Procedures for storage and handling of waste materials, including correct separation and appropriate disposal of waste materials;
- Procedures for responding to a complaint or incident involving waste; and
- Roles and responsibilities of all parties.



5. WASTE MANAGEMENT - OPERATIONAL PHASE

This section relates specifically to management of wastes generated by GKI resort activities proposed under the GKI Resort Revitalisation Plan. At present, approximately ten (10) residential properties and ten (10) commercial activities exist on the Island that do not form part of the GKI Resort Revitalisation Plan. The current method of waste collection and transport for these properties is highly inefficient and represents a high cost to the Rockhampton Regional Council as described in section 2. The current system also provides minimal opportunities for implementation of reuse and recycling initiatives compared to the strategies proposed for the GKI Resort Revitalisation Plan.

As such, an opportunity may exist for existing residential and commercial properties on the Island to utilise the waste collection and storage facilities established as part of the GKI Resort Revitalisation Plan subject to further negotiation and agreement between the relevant parties. As the volume of waste generated by the small number of properties on the Island not included in the GKI Resort Revitalisation Plan is expected to represent only a small proportion relative to waste generated by the resort, the inclusion of these waste streams should this occur, is not anticipated to significantly impact on the waste management strategies recommended in this section.

5.1 WASTE GENERATION

In order to determine the likely volume and composition of waste generated by the proposed Great Keppel Island Resort, consideration has been given to available data relating to waste generation associated with the former resort as well as available literature including waste characterisation data for Queensland and the hospitality industry.

5.1.1 Waste Estimation

As described in section 2.1.1, it has been estimated based on information provided by the previous waste contractor servicing the resort, that approximately 11 tonnes of general waste, 0.39 tonnes of recyclable glass and 0.39 tonnes of recyclable cans was being generated by the former GKI Island Resort weekly.

Assuming an average daily population on the Island of approximately 765 including staff, overnight and day visitors as derived from Foresight Partners Pty Ltd's report entitled "Forecast Economic Impacts – Proposed Revitalisation of Great Keppel Island" dated March 2011, this equates to approximately 2.2kg of waste being generated per person per day.

A summary of a literature review undertaken to assist in determining the likely volume of waste generated during operation of the GKI Resort Revitalisation Plan is provided in **Appendix C** – **Summary Literature Review for Estimation of Operational Waste Generation**.

Based on this literature review, it was determined that adoption of a waste generation rate of 2.2kg/person/day (excluding green waste) as derived from waste data for the previous resort, provides a conservative estimate of waste likely to be generated by the revitalised resort. Estimates of green waste and hazardous waste generation have been made based on reference to data from Queensland waste characterisation studies as described in **Appendix C – Summary Literature Review for Estimation of Operational Waste Generation**. In addition, information derived from the literature



review suggests that the key components of the waste stream generated during operation of the resort will comprise paper, food waste and packaging (plastics, glass, cans all recyclable) consistent with domestic and commercial waste sources.

Reference to the Water Cycle Management Report (Opus International Consultants, 2011) prepared for the GKI Resort Revitalisation Plan, indicates an average for the Project of 2,845 equivalent persons. Based on a biosolids generation rate of approximately 20kg of dry solids per equivalent person per year (EPA, 2002), it is estimated that the sewage treatment plant on the Island may produce up to 57 tonnes of biosolids per year.

On this basis, a summary of wastes likely to be generated during operation of the GKI resort, including estimated volumes and proposed methods for managing each of these wastes is provided in **Table 3**. Actual quantities will vary through the life of the GKI Resort Revitalisation Plan particularly as emphasis shifts from construction/demolition to operation. Implementation of regular waste auditing as part of resort operations as proposed in section 5.4.1, will track quantities and allow handling methods to be refined over the life of the resort.

Based on current estimates of waste generation and proposed waste management methods, it is estimated that only about 8-25% of waste generated will comprise materials not able to be reused or recycled. Such wastes include domestic and general waste, and a proportion of food waste collected from individual guest rooms and villas, and some hazardous wastes as described in **Table 3**.

Waste Type	Approximate Quantity	Waste Storage	Waste Management Method	Frequency of Collection (During normal operation)
Domestic and general waste	0.4-1.2 tonnes per day	Individual general waste bins at each villa / room and wheelie bins at various commercial and tourist sites around the Island. Bulk bins within facilities maintenance compound.	To be collected and transported to Yeppoon Waste Management Facility (Landfill) by a licensed waste contractor.	Twice weekly
Organic and Food Waste	Food Waste = 0.6 – 1.5 tonnes per day Other Organics = 0.7 – 1.1 tonnes per day.	Food waste generated within villas / hotel rooms, and general tourist areas collected in general waste bins. Separate wheelie bins provided for collection of food waste at commercial food preparation.	Food waste (villas / hotel rooms / general tourist areas) - as per general waste. Food waste (commercial food preparation) composted and reused as soil conditioner on the Island.	Twice weekly

Table 3: Summary of Waste Generation and Management for Operation Phase



Waste Type	Approximate Quantity	Waste Storage	Waste Management Method	Frequency of Collection (During normal operation)
Green Waste	0.8 tonnes per day	Mulched or chipped and stored in designated area within facilities maintenance compound. A proportion may also be included as feedstock for composting.	Reuse as mulch in landscaping areas on the Island.	As required by gardens maintenance.
Metals	0.3 tonnes per day	Separate recycling bins at each villa / room and recycling wheelie bins at various commercial and tourist sites around the Island. Bulk bins within facilities maintenance compound.	To be collected and transported to the recycling facilities on the mainland.	Weekly
Plastics	0.3 – 0.4 tonnes per day	Separate recycling bins at each villa / room and recycling wheelie bins at various commercial and tourist sites around the Island. Bulk bins within facilities maintenance compound.	To be collected and transported to the recycling facilities on the mainland.	Weekly
Glass	0.3 – 0.4 tonnes per day	Separate recycling bins at each villa / room and recycling wheelie bins at various commercial and tourist sites around the Island. Bulk bins within facilities maintenance compound.	To be collected and transported to the recycling facilities on the mainland.	Weekly



Waste Type	Approximate Quantity	Waste Storage	Waste Management Method	Frequency of Collection (During normal operation)
Paper and cardboard	1.0 to 2.0 tonnes per day	Separate recycling bins at each villa / room and recycling wheelie bins at various commercial and tourist sites around the Island. Bulk bins within facilities maintenance compound.	To be collected and transported to the recycling facilities on the mainland.	Weekly
Biosolids from sewage treatment process	0.16 tonnes per day	Storage in bunded hardstand drying areas within facilities maintenance compound.	To be stabilised and treated (eg. composted) for reuse as soil conditioner on the Island.	As required by STP operations.
Hazardous and other chemicals	0.01 tonnes per day	Storage in bunded hardstand areas within facilities maintenance compound.	Any spillage / leaks of chemicals or fuels to be contained within bunded area and pumped out for disposal at licensed facilities on the mainland. Waste oil to be transported for recycling on the mainland where facilities exist.	As required.
Electrical and electronic equipment (e-waste)	Not known	Dedicated e-waste bin at a central location on the Island.	Recycled off the Island by a licensed waste contractor.	As required.

5.2 ROUTINE PROCEDURES

5.2.1 Waste Minimisation

The following measures shall be implemented during operation of the GKI Resort Revitalisation Plan to minimise waste disposed to landfill:

• An annual waste audit shall be undertaken to audit progress towards waste reduction, recycling and reuse objectives, and to enable identification of new opportunities for improved waste management;



- Purchasing policies shall be developed and implemented to give preference to:
 - Selection of materials and resources with less packaging, including encouraging bulk purchasing of materials;
 - Purchasing potentially reusable or recyclable materials where possible, and preferably materials derived from renewable sources and produced with a low embodied energy content;
 - Purchasing materials or resources that not only generate less waste, but generate less harmful wastes (eg. purchasing of biodegradable, low phosphorous cleaning products);
- Procurement shall be managed to ensure that only the minimum amount of materials required are purchased and delivered to the Island, including effectively tracking material ordering, delivery, placement and use of materials to ensure all available materials are utilised prior to ordering additional materials;
- Preference will be given to the use of electronic marketing and other information materials to reduce the amount of paper waste generated;
- Regular training shall be provided to staff to ensure they are aware of the environmental risks and costs associated with inappropriate waste management, and understand the opportunities to reduce waste generation through their specific tasks;
- Regular awareness programs shall be provided to visitors to educate them on correct recycling
 procedures and the impacts of inappropriate waste management on the environment, including
 impacts on native flora and fauna of the Great Barrier Reef;
- All plant and equipment shall be regularly maintained and operated efficiently to reduce excess generation of waste;
- Water efficient fixtures and fittings shall be installed throughout the resort to reduce the volume of wastewater generated;
- Sufficient solar panels shall be installed to generate electricity for the resort and ancillary activities, with excess energy stored for reuse on the Island or returned to the mainland electricity grid;
- Adequate area shall be provided within the facilities maintenance compound to enable the separation and storage of different waste streams for efficient recycling and reuse;
- Where available, suppliers providing container return programs will be utilised;
- Easily identifiable and conveniently located collection bins for recycled materials will be
 provided throughout the resort, including use of colour-coding and labels to assist visitors and
 staff in utilising the correct bin. For example, each hotel room / villa shall be provided with
 separate bins for general waste and mixed recyclables. Separate wheelie bins for general
 waste and recyclable materials shall be provided in convenient locations throughout tourist and
 commercial areas of the resort. Information will be provided to visitors on correct recycling
 procedures to encourage separation of recyclables at the source;
- Commercial food preparation areas within the resort will be provided with separate bins for the collection of food waste, which will be composted for use as a soil conditioner in landscaping



areas around the resort. Food waste generated within hotel rooms / villas will be managed via the general waste stream due to the small quantities involved and the difficulties involved in separation at this source; and

- Composting and / or vermiculture facilities will be established on the Island to process food and other organic wastes;
- Green waste from maintenance of the golf course and landscaped areas associated with the resort, including grass clippings, prunings, etc shall be collected and processed for reuse in landscaping. Processing may be limited to grinding or chipping of branches to produce mulch cover material, while green wastes containing leaves and grass clippings etc will be used as feedstock into composting activities.
- Biosolids from the sewerage treatment plant on the Island will be stabilised and processed to reduce levels of pathogens etc prior to being reused as soil conditioner on the golf course and other landscaped areas; and
- Wastewater shall be treated at the on-site sewerage treatment plant to an appropriate standard that will enable use of recycled water for toilet flushing, and irrigation of the golf course and other landscaped areas on the Island.

5.2.2 Waste Collection

General Waste and Recyclables

General waste and mixed recyclable bins from each hotel room / villa shall be collected and deposited into separate wheelie bins as part of standard room cleaning activities, with the wheelie bins stored within the cleaner's facilities. Separate wheelie bins for general waste and recyclable materials shall be provided in convenient locations throughout tourist and commercial areas of the resort, as well as at commercial premises around the resort.

Wheelie bins containing general waste and mixed recyclables shall be collected from around the resort by the resort operator at least twice a week or on an as needs basis to prevent overflowing. Wheelie bins shall be transferred to the bulk waste storage area within the facilities maintenance compound where the contents will be transferred to separate bulk skip bins for recyclable and non-recyclable wastes. This process is similar to that used by the former resort.

Hazardous Waste

Although likely to be generated only in small quantities mainly through facilities maintenance activities, all hazardous wastes shall be collected separately and transferred to the facilities maintenance compound for storage in designated areas. Storage and handling of hazardous wastes, including batteries, waste oil, chemicals etc will be in accordance with AS1940:2004, including ensuring such wastes are contained within a roofed and bunded area able to contain the contents of stored materials in the event of a spill or leak. Appropriate spill kits should be kept in readily accessible locations in close proximity to areas used for the storage or handling of hazardous wastes, to enable the immediate clean up of any spills or leaks. Hazardous wastes shall be collected on an as needs basis.

E-Waste

A dedicated e-waste bin will be provided at a central location on the Island. E-waste will be transported to recycling facilities on the mainland as required.



Food Wastes

Separate bins provided at commercial food preparation areas for separate collection of food wastes, will be collected from around the resort by the resort operator at least twice per week during normal periods, increasing to every second day during peak periods or on an as needs basis to prevent overflowing and odour issues. These bins will be transferred to composting facilities at the facilities maintenance compound, with the composted material then stored for later use as a soil conditioner in landscaping areas around the resort. Food waste generated within hotel rooms / villas will be managed via the general waste stream due to the small quantities involved and the difficulties involved in separation at this source.

Green Waste

Green waste collected during garden maintenance activities will be transferred to stockpiles / bulk containers located within the facilities maintenance compound where it will be stored until processed to produce materials for use in landscaping works. A proportion of green waste, including branches and other prunings, will be chipped and used for cover material, while remaining green waste will be used as feedstock for composting with other organic wastes (eg. food waste, biosolids).

Stockpiles of green waste prior to and post-processing shall be located in designated storage areas that are well-separated from existing residential and tourist areas, waterways and overland flow paths. Stockpiles shall be mechanically aerated on a regular basis to reduce potential for spontaneous combustion.

Biosolids

Biosolids from sewage treatment processes can contain useful quantities of organic matter and nutrients (eg. nitrogen, phosphorous, potassium) that can be applied for beneficial reuse as a soil conditioner. Given that the sources of wastewater treated by the GKI sewerage treatment will largely be derived from tourist accommodation and commercial activities, with minimal industrial wastes, the level of heavy metal contaminants in biosolids will be relatively low making it suitable as a soil conditioner.

Prior to reuse as a soil conditioner, biosolids generated from treatment of sewage must be stabilised to destroy pathogenic organisms, minimise odour and reduce vector attracting potential. As the volume of soil conditioner likely to be generated by the sewerage treatment plant on the Island is likely to exceed 20 tonnes a year, this activity will likely comprise an environmentally relevant activity (ie. ERA 53) requiring approval under the *Environmental Protection Act 1994*.

Biosolids generated from sewage processing will be stored within a designated drying area within the sewerage treatment plant compound, which shall be well-separated from existing residential and tourist areas. The drying area shall comprise a hardstand area provided with appropriate containment and drainage systems to prevent the release of contaminants to surrounding soils, surface or groundwater. Biosolids will be dried for sufficient time to achieve a moisture content suitable for use as feedstock in composting activities.



5.2.3 Waste Treatment

Composting

Composting facilities shall comprise a level area (<3%) located within the facilities management compound that is well-separated from existing residential and tourist areas. Areas used for feedstock holding and composting shall comprise a hardstand surface (eg. asphalt, concrete) with adequate manoeuvring area for operation of loading / handling equipment. Composting facilities will require connection to water supply for feedstock mix and electricity supply (eg. for aeration equipment), and a stormwater containment and drainage system designed to prevent the release of contaminants to the environment. Composting activities shall be managed to prevent odour generation through regular mechanical aeration and screening of feedstock.

A range of methods and equipment are available for the treatment of organic wastes to produce composted material suitable for reuse as soil conditioner. Although organic waste will constitute a significant component of waste generated by the GKI Resort Revitalisation Plan, the actual quantities generated will be relatively small. As such, a system that enables composting of a range of feedstock is recommended. Compared to establishment of multiple composting systems, a single system will likely have reduced capital costs, enable more efficient operation and maintenance, and potentially require less land for establishment.

Given the relatively limited area available for development on the Island, the significant environmental values of the area and the presence of a number of sensitive receivers, consideration should be given to composting systems that require less space and effectively contain odours. The exact composting system used shall be confirmed at the detailed design stage, however one option available comprises the AgBag environmental compost system developed by Sweden-based CompoNordic AB. This type of system can be used to compost a range of organic waste streams including, food waste, cardboard, sewage sludge etc and enables small batches of material to be composted on a continual basis. Mature compost is produced within approximately 3 to 4 months.

Operation of the AgBag system essentially involves loading feedstock pre-mixed to the required compost recipe and moisture content, into a hopper with a hydraulic ram that then pushes the feedstock through a series of EcoPODs (ie. recycled plastic tunnels). The manufacturer of the AgBag system suggests that the system potentially requires 3 times less area than conventional windrows, while also being fully contained to reduce potential dust emissions associated with windrows. As the composting material is contained within the EcoPODs, the risk of stormwater contamination, leachate, odour emissions, and attraction of vermin and pests are also reduced.

Compaction

It is proposed that solid waste material intended for disposal or recycling on the mainland will undergo some minor treatment on the Island to reduce the volume of waste material prior to transfer to the mainland. This will include compaction of waste using a small stationary refuse compactor, bin press or similar installed within the facilities maintenance compound. Compacted waste will then be enclosed into containers for transport to the mainland to minimise shipping costs and frequency. A range of waste compactors are available on the market with a small stationary compactor or bin press system likely to be most efficient for the requirements of the GKI Resort Revitalisation Plan. Consideration may also be given to the installation of balers / shredders to enable more efficient storage, handling and transportation of cardboard materials sent to the mainland for recycling.



5.2.4 Waste Transportation

The majority of wastes that cannot be reused or recycled on the Island will be transported to Rockhampton Regional Council's Yeppoon Waste Management Facility (Landfill) (refer to **Figure 2**). This will include recyclable and non-recyclable general waste, and hazardous wastes.

The resort operator shall collect wheelie bins from around the Island and transport to the facilities maintenance compound using a utility or tractor / trailer, before emptying the contents into bulk bins. Wastes will be collected from the Island by a commercial waste contractor licensed to transport waste under the *Environmental Protection Act 1994*. Waste collection vehicles will travel to and from the Island by barge. Waste collection vehicles shall collect bulk bins contained within the facilities maintenance compound.

The resort operator shall ensure there are no unnecessary obstructions to waste and recycling collection vehicles on the Island. The bulk waste skip bins shall be positioned so that the waste collection vehicles have unimpeded access to the waste skip bins. The collection shall be approximately once per week during normal trading, possibly increasing to twice a week during peak periods.

All waste collection vehicles arriving on and leaving the Island must be clean and loads securely stowed, and covered where practicable.

Wastes will only be transported to recycling or disposal facilities licensed for the particular waste stream(s).

5.2.5 Waste Disposal

No solid or liquid wastes shall be burned or buried on the Island.

No liquid wastes other than sewage and approved trade wastes (eg. from laundry and kitchen facilities) shall be discharged into the sewerage treatment plant on the Island. Other liquid wastes, that may include for example waste / out of date chemical products or spillage of hazardous substances contained in bunded areas, shall be collected in appropriate storage containers prior to removal to the mainland for disposal at appropriately licensed facilities.

All waste that cannot be reused on the Island, will be transported to the mainland for recycling or disposal at Rockhampton Regional Council's Yeppoon Waste Management Facility (Landfill) (refer to **Figure 2**). This facility is able to accept recyclable and non-recyclable waste streams including the following items:

- Recyclable items glass, cardboard, paper, plastic, aluminium cans;
- Motor oils;
- Tyres;
- Batteries;
- Drums;
- Construction and demolition waste;
- General household waste; and
- Green waste.



This facility is also able to accept a range of hazardous wastes subject to prior approval from Council and compliance with limitations specified in Council's environmental licence.

Alternatively there are licensed waste collectors in the region that can collect, segregate and recycle most waste streams generated during construction of the proposed GKI Resort Revitalisation Plan.

5.3 ENVIRONMENTAL CONTROLS

5.3.1 Litter Control

The following measures shall be implemented to minimise litter generation during operation of the resort:

- Daily inspections of all waste storage areas shall be undertaken by the Resort Operator or appointed representative, and shall include:
 - Review bin capacity to determine if additional waste collection services are required and provide additional bins where necessary to prevent overflowing;
 - General walkover of resort areas to identify evidence of litter and poor house-keeping practices and request clean-up activities if litter is observed;
- Bulk items that cannot fit within waste collection containers shall be stored within the facilities maintenance compound and removed as soon as possible;
- Waste collection containers shall be collected regularly to prevent overflowing;
- Waste receptacles provided for the storage of paper and plastics will be covered to prevent wind-blown litter; and
- All waste transported on and off the Island will be covered, where practicable.

5.3.2 Odour and Dust Control

The following measures shall be implemented to minimise odour and dust generation and prevent environmental nuisance as a result of waste storage and transportation activities:

- Waste receptacles and storage bins for organic and food wastes will be covered;
- No bulk storage of food or other putrescible wastes shall occur within 50 metres of existing residential or tourist areas;
- No biosolids storage shall occur within 200 metres of existing residential or tourist areas, and biosolids shall be appropriately stabilised to reduce pathogens and odour potential prior to reuse in landscaping;
- Composting activities shall be managed to prevent odour generation through regular mechanical aeration and screening of feedstock, and / or use of composting systems incorporating odour containment / aeration systems; and



• Mulching and chipping of green wastes should not be undertaken during windy conditions or in close proximity to residential or tourist areas that may be impacted by dust and other particulates.

5.3.3 Pest and Vermin Control

The following measures shall be implemented to prevent attracting pests, vermin and disease vectors to waste storage facilities:

- Waste receptacles and storage bins for organic and food wastes will be covered;
- No pooling or ponding will be allowed to occur around storage areas;
- Where necessary, pest control shall be undertaken to control or prevent pest outbreaks; and
- All staff, including contractors, working on the Island shall be provided with training in waste management procedures and good house-keeping practices as part of their site induction.

5.3.4 Stormwater Management

The following measures shall be implemented to prevent contamination of stormwater as a result of waste storage and transportation activities:

- All potentially hazardous wastes (eg. waste oils, batteries, fuels and chemical wastes etc) shall be stored in separate containers located within a bunded and roofed hardstand area;
- A spill response procedure shall be established and implemented, and appropriate clean up equipment / materials shall be provided where any waste storage activities are undertaken to prevent the contamination of stormwater;
- Any stormwater captured within bunded areas used for the storage and / handling of wastes or other hazardous materials shall be pumped out and disposed of at an appropriately licensed facility on the mainland; and
- Regular inspections shall be undertaken for stormwater drainage systems in areas used for the storage or handling of wastes and other hazardous materials to ensure all drains are free of litter and operating at optimum efficiency.

5.4 MONITORING AND REPORTING

5.4.1 Inspections and Audits

The Resort Operator shall undertake regular inspections of resort areas to identify waste management issues and results shall be recorded in an appropriate site inspection register / checklist. Inspections shall include as a minimum, the inspection requirements outlined in section 5.3 above.

In addition, a waste audit shall be conducted when the GKI Resort Revitalisation Plan is operational and when each new stage of the GKI Resort Revitalisation Plan becomes operational. The purpose of the waste audit will be to identify:

• Types and volumes of wastes generated;



- Further opportunities for waste avoidance, reuse and recycling;
- Waste storage and segregation methods;
- Waste treatment and disposal techniques; and
- Destination of waste materials.

Regular waste audits will facilitate continual improvement of waste management practices implemented on the Island, which will contribute to improved environmental outcomes.

5.4.2 Records

General Wastes

The Resort Operator shall maintain records of all outgoing wastes, including at least the following details:

- Waste type;
- Volume / weight;
- Date of removal;
- Name and registration number of waste transporter; and
- Destination of waste (eg. landfill, recycler etc).

Trackable Wastes

Records of all "trackable wastes" as specified in schedule 1 of the EPR (Waste Management) that are generated during operation of the resort will be recorded and maintained in accordance with the requirements of the EPR (Waste Management).

During the operational phase, the resort operator will be the 'generator' for reporting purposes.

5.4.3 Incidents and Complaints

All environmental incidents, including complaints relating to waste management which have the potential to cause environmental harm must be reported to DERM in accordance with section 320 of the *Environmental Protection Act 1994*. Details of all complaints or environmental incidents relating to waste management shall be recorded in an appropriate environmental incident / complaint register.

All complaints or environmental incidents shall be investigated and corrective actions implemented to prevent recurrence. Corrective measures may include provision of additional waste containers or an increase in the frequency of waste collection. If a spillage or dispersal of waste causes contamination on the Island, the area affected by the spillage shall be immediately remediated and contamination reported to the relevant authorities.



5.5 TRAINING AND AWARENESS

All staff, including contractors and sub-contractors, working on the Island, shall be provided with training in waste management issues as part of their site induction. Training shall address the following:

- Relevant policies and legal requirements;
- Potential impacts of waste spillage and dispersal, particularly in relation to the environmental values of the area;
- Procedures for storage and handling of waste materials, including correct separation and appropriate disposal of waste materials;
- Procedures for responding to a complaint or incident involving waste; and
- Roles and responsibilities of all parties.

In addition, the Resort Operator shall provide adequate information to staff and visitors on the opportunities and procedures for waste minimisation and recycling on the Island. This includes information relating to the correct use of recycling bins to ensure staff and visitors understand what materials can be deposited in each bin, and encouraging staff and visitors not to use plastic bags. The Resort Operator shall implement regular waste education and clean-up initiatives such as Clean-up Australia Day campaigns on the Island.



6. POTENTIAL IMPACTS AND MITIGATION MEASURES

6.1 OVERVIEW

A risk assessment of potential impacts associated with waste management practices during construction and operation of the GKI Resort Revitalisation Plan has been undertaken and is described in the following section, along with proposed mitigation measures to address each identified risk. A standard risk assessment matrix as presented in **Table 4** has been used for the purpose of assessing waste management risks associated with the GKI Resort Revitalisation Plan.

	Consequences					
Probability	Insignificant	Minor	Moderate	Major	Catastrophic	
Rare	Low	Low	Low	Low	Medium	
Unlikely	Low	Low	Medium	Medium	Medium	
Moderate	Low	Medium	Medium	High	High	
Likely	Low	Medium	High	High	Extreme	
Almost Certain	Medium	Medium	High	Extreme	Extreme	

Table 4: Risk Assessment Matrix

Great Keppel Island is located within the Great Barrier Reef World Heritage Area and Marine Park, and Rodds Bay Dugong Protection Area. The Island supports a range of native flora and fauna, while surrounding coral reefs are rich in marine life. Construction and operation of the resort has the potential to generate a range of wastes that could potentially impact on the environmental values of GKI and surrounding marine environments, if not managed appropriately. Potential impacts range from pollution of waterways and harm to marine animals, to impacts on existing residents and visitors through litter and odour nuisance.

The following risk assessment has been based on the waste storage, handling, transport and disposal methods outlined for each waste in sections 4 and 5.

A summary of potential impacts and proposed mitigation measures associated with waste management as part of the GKI Resort Revitalisation Plan is provided in **Table 5** below.



Potential Impact	Risk Level	Risk Level	Mitigation Measures
	(Unmitigated)	(Mitigated)	
Contributing to increased pressure on the capacity of Council's landfill facilities.	Med	Low	Limit waste generation by resort activities by considering waste in terms of the waste management hierarchy framework contained in <i>Environmental Protection</i> <i>(Waste Management) Policy 2000.</i>
			Implement a range of activities to maximise reuse and recycling of waste streams generated by the resort, including composting and processing of food waste, green waste and biosolids on the Island to produce soil conditioners, to reduce volume of waste disposed to landfill.
			Segregate recyclable from non-recyclable waste on the Island and transfer separately to Council's facilities.
			Prior to being transported to the mainland for disposal at Council's facilities, general waste shall be compacted on the Island.
			Records shall be kept of waste quantities removed from the Island to assist in identifying further opportunities to reduce, reuse and recycle.
Contamination of soils, surface or groundwater as a result of waste- related incidents during storage and handling on the Island, including spills or loss of containment.	High	Low	Regular training shall be provided to staff to ensure they are aware of the environmental risks and costs associated with inappropriate waste management, and understand the opportunities to reduce waste generation through their specific tasks.
			All potentially hazardous wastes (eg. waste oils, batteries, fuels and chemical wastes etc) shall be stored in separate containers located within a bunded and roofed hardstand area in accordance with AS1940:2004.
			A spill response procedure shall be established and implemented, and appropriate clean up equipment / materials shall be provided where any waste storage activities are undertaken to prevent the

Table 5: Summary of Potential Waste Impacts and Proposed Mitigation Measures



Potential Impact	Risk Level	Risk Level	Mitigation Measures
	(Unmitigated)	(Mitigated)	
			contamination of stormwater.
			areas used for the storage and / handling of wastes or other hazardous materials shall be pumped out and disposed of at an appropriately licensed facility.
			Regular inspections shall be undertaken for stormwater drainage systems in areas used for the storage or handling of wastes and other hazardous materials to ensure all drains are free of litter and operating at optimum efficiency.
			All bulk waste storage areas shall be located at least 50m from any watercourse or drainage line.
			All stockpiles shall be provided with appropriate erosion and sediment control and located at least 50m from any watercourse or drainage line.
Contamination of soils, surface or groundwater as a result of waste- related incidents during transportation of waste from the Island, including spills.	High	Low	Transportation of wastes from the Island to mainland recycling and disposal facilities shall only be undertaken by contractors licensed under the <i>Environmental</i> <i>Protection Act 1994</i> .
			All waste transported on and off the Island shall be covered or otherwise secured to prevent litter dispersal.
			Transportation of wastes during periods of high winds or swells shall be avoided as far as practicable.
Plastic bags and other plastic wastes causing mortality to native wildlife.	High	Low	Operational guidelines shall be developed for retail and commercial business associated with the resort to minimise or avoid the use of plastic bags. This may include requiring businesses to provide alternatives to plastic bags, encouraging the collection of donations from sale of plastic bags to customers to contribute to the Biodiversity Fund. Regular staff and visitor awareness
			programs shall be conducted to provide



Potential Impact	Risk Level	Risk Level	Mitigation Measures
	(Unmitigated)	(Mitigated)	
			education on the impacts of plastic bags
			and other wastes on native wildlife.
Littering contributing to impacts on	Med	Low	Daily inspections of all waste storage areas
visual amenity.			shall be undertaken by the Resort Operator
			including:
			 Monitor bin capacity to determine if additional waste collection services are required and provide additional bins where necessary to prevent overflowing;
			 General walkover of resort areas to identify evidence of litter and poor house-keeping practices and request clean-up activities if litter is observed.
			Bulk items that cannot fit within waste collection containers shall be stored within the facilities maintenance compound and removed as soon as possible.
			Waste collection containers shall be collected regularly to prevent overflowing.
			Waste collection containers provided for the storage of paper and plastics shall be covered to prevent wind-blown litter.
			All waste transported on and off the Island shall be covered or otherwise secured to prevent litter dispersal.
Cross contamination of wastes,	Med	Low	Colour-coded and/or labelled bins will be
making wastes unsuitable for reuse and/or recycling, thus increasing the quantity of waste			the segregation of wastes and maximise waste recovery and recycling.
being disposed of to landfill.			Regular awareness programs shall be
			provided to visitors to educate them on correct recycling procedures and the impacts of inappropriate waste management on the environment, including impacts on potition flore and fauna of the
			Great Barrier Reef.
Odour, dust and noise generation	High	Low	Cover all waste receptacles and storage
i tom waste narioling and storage.			bins for organic and 1000 wastes.



Potential Impact	Risk Level (Unmitigated)	Risk Level (Mitigated)	Mitigation Measures
			Ensure no bulk storage of food or other putrescible wastes within 50 metres of existing residential or tourist areas.
			Ensure no biosolids storage within 200 metres of existing residential or tourist areas and ensure biosolids are appropriately stabilised to reduce pathogens and odour potential prior to reuse in landscaping.
			Providing regular mechanical aeration and screening of feedstock, and / or use of composting systems incorporating odour containment / aeration systems, to ensure composting activities are managed to prevent odour generation.
			Avoid mulching and chipping of green wastes during windy conditions or in close proximity to residential or tourist areas that may be impacted by dust and other particulates.
Propagation of pests, vermin and disease vectors.	High	Low	Waste receptacles and storage bins for organic and food wastes will be covered.
			No pooling or ponding will be allowed to occur around storage areas.
			Waste storage areas shall be regularly inspected and where necessary, pest control shall be undertaken to control or prevent pest outbreaks.
			All staff, including contractors, working on the Island shall be provided with training in waste management procedures and good house-keeping practices as part of their site induction.



7. CONCLUSION

A range of wastes will be generated during the demolition, construction and operational phases of the GKI Resort Revitalisation Plan. Key components of the waste stream generated during operation of the resort will comprise paper, food waste and packaging (plastics, glass, cans all recyclable) consistent with domestic and commercial waste sources. During demolition and construction, concrete, bricks and pavers, and timber are expected to comprise the dominant sources of waste.

This report outlines a strategy for managing wastes generated during the demolition, construction and operational phases of the proposed GKI Resort Revitalisation Plan in accordance with the principles of the waste management hierarchy specified in the *Environmental Protection (Waste Management) Policy 2000.* This strategy focuses on avoiding waste generation during construction and operation wherever possible, through implementation of procurement policies, planning and scheduling, training and awareness, and specific work practices. Given the high costs associated with transporting and disposing of Island-generated waste on the mainland, reducing the total volume of waste generated by the GKI Resort Revitalisation Plan, and in particular the volume of waste requiring disposal, is an economic imperative for this Project while also achieving a range of environmental and social benefits.

A range of wastes will also be reused on the Island, including but not limited to, salvaging of demolition and construction wastes, and composting of food and other organic wastes, including biosolids for reuse as soil conditioner on the Island during operation. Waste collection and storage practices will also be implemented to enable effective and efficient collection of recyclables, which will be transported to recycling facilities on the mainland. Wastewater will be treated to a standard that will enable use of recycled water for irrigation of the golf course, landscaped areas and potentially for toilet flushing. These procedures will reduce the volume of waste requiring disposal during operation of the resort to approximately 8-25% of total waste generated.

During operation of the resort, a waste transfer station will be established within the facilities maintenance compound on the Island. Wheelie bins will be collected from around the Island by the resort operator using a utility / tractor trailer before being emptied into bulk bins within the compound. It is anticipated this will occur at least weekly during normal operation, increasing to twice weekly or more during peak periods. Separate wheelie bins and bulk bins will be provided for collection of general waste and recyclable materials. A small stationary compactor, bin press or similar will be installed to reduce the volume of waste requiring transfer to the mainland to reduce transport frequency and cost, and reduce pressure on the capacity of Council's landfill facilities. Composting facilities will also be provided within the facilities maintenance compound for processing of food waste and other organics, including biosolids into soil conditioner.

The waste transfer station and associated areas for storage and handling of bulk waste materials, are to be located with appropriate setbacks to environmentally sensitive areas, existing residential properties and tourist accommodation. Appropriate containment and drainage systems are to be installed for waste storage and handling areas to prevent the release of contaminants to receiving environments.

A commercial waste contractor holding the appropriate licence under the *Environmental Protection Act 1994* will be engaged to collect bulk bins containing general waste and recyclable wastes from the Island, and to transport these materials to appropriately licensed disposal and recycling facilities on the



mainland. It is anticipated that the majority of general and recyclable waste removed from the Island will be transported to Rockhampton Regional Council's Yeppoon Waste Management Facility, which provides facilities for recycling a range of materials as well as landfill for disposal. Waste collection vehicles will travel to and from the Island via the regular barge service at least weekly or more frequently as required during peak periods.

During construction of the resort, bulk bins for storage of segregated wastes and recyclables will be provided within the construction compound. These bins will be emptied as required (approximately weekly) by arranging for collection by an appropriately licensed commercial waste contractor. Waste collection vehicles will travel to and from the Island on the barge services, with trips scheduled in conjunction with the delivery of materials to minimise barge movements.

A range of environmental controls and mitigation measures have been recommended to minimise potential risks to the environment associated with waste management practises for the GKI Resort Revitalisation Plan. These measures include regular monitoring and inspections, tracking of wastes, and regular audits of waste streams to identify opportunities for increased reuse and recycling, and improved waste management practices. Engineering and procedural controls, such as construction of bunded containment areas, covering bins and stockpiles likely to generate odour or litter, aeration of composting materials, etc have also been recommended to minimise the potential environmental impacts of waste management.

A number of environmentally relevant activities as defined in schedule 1 of the *Environmental Protection Regulation 2008* have been identified as potentially being associated with the proposed waste management strategy, including ERA 63 – Sewerage treatment, ERA 53 – Composting and soil conditioner manufacturing and possibly ERA 62 – Waste transfer station operation and ERA 33 – Crushing, milling grinding or screening. Approvals will be required under the *Environmental Protection Act 1994* to operate these ERAs on the Island.

Although this waste management strategy deals specifically with wastes generated by GKI resort activities proposed under the GKI Resort Revitalisation Plan, an opportunity may exist for existing residential and commercial properties on the Island to utilise the waste collection and storage facilities established as part of the GKI Resort Revitalisation Plan subject to further negotiation and agreement between the relevant parties.

A consolidated approach to waste management on GKI will provide a range of benefits including:

- Reducing costs to Rockhampton Regional Council due to the inefficiency of providing current waste management services to the Island;
- Increasing opportunities for implementation of reuse and recycling initiatives, which are currently not available to Island residents; and
- Improving facilities for storage and handling of wastes on the Island to reduce potential environmental impacts and public health risks, including:
 - Safer transfer of waste onto vessels for transport to mainland by construction of the new marina;
 - Providing greater separation of waste material being transferred to the mainland from other passengers travelling to and from the Island; and
 - Upgrade of existing collection and storage facilities on the Island to improve containment of potential contaminants.



For these reasons, it is considered that the GKI Resort Revitalisation Plan provides an opportunity to improve current waste management practices on the Island for the benefit of the environment, as well as Island residents and visitors.



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APPENDIX A

GKI Resort Revitalisation Plan







APPENDIX B

Summary of Waste Related ERAs



Summary of Waste-related Environmentally Relevant Activities and Relevance to the GKI Resort Revitalisation Plan

ERA Definition ¹	Belevance to Project
	Helevance to Project
 33 Crushing, milling, grinding or screening (1) Crushing, milling, grinding or screening (the <i>relevant activity</i>) consists of crushing, grinding, milling or screening more than 5,000t of material in a year. (2) The activity includes crushing waste, other than putrescible waste, to extract resources for reuse or recycling. (3) The relevant activity does not include – (a) crushing, grinding, milling or screening agricultural products for the purpose of a farming operation; or (b) an activity to which section 16, 55 or 61 would apply, if the activity were carried out within a stated threshold under that section. (4) There is no aggregate environmental score for the relevant activity. 52 Battery recycling (1) Battery recycling consists of operating a facility for receiving, and recycling or reprocessing, any type of battery. (2) There is no aggregate environmental score for battery recycling. 	Crushing of concrete and other materials from demolition of the existing resort for reuse in construction works on the Island, will conform to the definition of ERA 33 where the quantity of material crushed exceeds 5,000t per year. No battery recycling activities will be undertaken on the Island by GKI Resort. Batteries will be collected at the GKI Resort waste collection facilities, prior to being transported to
	mainland recycling
53 Composting and soil conditioner manufacturing	Tacilities.
 (1) Composting and soil conditioner manufacturing (1) Composting and soil conditioner manufacturing (the <i>relevant activity</i>) consists of manufacturing, from organic material or organic waste, 200t or more of compost or soil conditioners in a year. (2) The relevant activity does not include— (a) manufacturing mushroom growing substrate; or (b) composting material from agriculture or livestock production on the site where it is produced. (3) The aggregate environmental score for the relevant activity is 18. (4) In this section— organic waste— (a) includes the following— (i) a substance used for manufacturing fertiliser for agricultural, horticultural or garden use; (ii) animal manure; (iii) biosolids; (iv) cardboard and paper waste; (v) fish processing waste; (v) food and food processing waste; (vi) plant material; (vii) plant material; (viii) poultry processing waste; or (i) contaminated from an abattoir; but (b) does not include— (i) contaminated soil; or (ii) organic chemicals, other than a substance mentioned in paragraph (a)(i); or <i>Examples of organic chemicals for subparagraph (iii)</i>— chlorinated hydrocarbons, lubricating 	conditioning activities conforming to the definition of ERA 53 may be undertaken on the Island by GKI Resort, including composting of food and other organic waste, and treatment of biosolids from the sewerage treatment plant for use as soil conditioners on the golf course and landscaped areas.
 55 Regulated waste recycling or reprocessing (1) Regulated waste recycling or reprocessing (the <i>relevant activity</i>) consists of operating a facility for receiving, and recycling or reprocessing, regulated waste to produce saleable products. (2) The relevant activity does not include— (a) carrying out an activity to which section 25, 34 or 53 would apply if the activity were carried out within a stated threshold under any of those sections; or <i>Editor's note</i>—section 25 (Meat processing) or 34 (Mushroom growing substrate manufacture) (b) carrying out an activity to which section 52 applies; or 	No regulated waste recycling or reprocessing activities will be undertaken on the Island by GKI Resort. Some regulated wastes generated by Island residents as well as regulated wastes generated by the resort



ERA Definition ¹	Relevance to Project
 (c) recycling or reprocessing tyres. (3) In the following table, the aggregate environmental score for the relevant activity is the score stated opposite the threshold within which the relevant activity is carried out. 1 carrying out the relevant activity if— (a) the regulated waste is in a solid form or an aqueous solution or suspension; and (b) no more than 10t of regulated waste is stored or processed at the facility in a day; and (c) all liquid or solid waste generated from the activity is released to a local government's sewerage infrastructure or a facility mentioned in section 56, 58, 60 or 61 2 otherwise carrying out the relevant activity. 	itself, may be received at the GKI Resort waste collection facilities on the Island. These wastes will be stored for transport to mainland disposal or recycling facilities.
 56 Regulated waste storage Regulated waste storage (the <i>relevant activity</i>) consists of operating a facility for receiving and storing regulated waste for more than 24 hours. The relevant activity does not include— (a) storing less than 5t, or fewer than 500 equivalent passenger units, of tyres or parts of tyres; or (b) storing regulated waste in transit; or (c) storing at a facility, for no more than 28 days, any of the following, awaiting removal from the facility for recycling, reprocessing, treatment or disposal— (i) fewer than 500 batteries; (ii) pharmaceuticals; (iii) body parts; (iv) clinical waste consisting only of sharps in sharps containers that comply with AS 4031 or AS/NZ 4261; (v) less than 5000L of waste oil; or (d) storing at a facility, for no more than 90 days, chemically treated power poles awaiting removal from the facility for recycling, reprocessing, treatment or disposal; or (e) carrying out an activity to which section 20, 25, 27, 53, 59, 60, 61 or 62 would apply if the activity were carried out within a stated threshold under the section; or <i>Editor's note—</i> (3) In the following table, the aggregate environmental score for the relevant activity is the score stated opposite the threshold within which the relevant activity is carried out. 1 receiving and storing regulated waste other than Tyres (4) In this section— AS 4031 means 'AS 4031:1992—Non-reusable containers for the collection of sharp medical items used in health care areas'. <i>AS/NZ</i> 4261 means 'AS/NZ 4261:1994—Reusable containers for the collection of sharp medical items used in health care areas'.	Some regulated wastes may be received at the GKI Resort waste collection facilities on the Island from residents as well as regulated wastes generated by the resort. This activity may conform to the definition of ERA 56 depending on the type and quantity of materials temporarily stored at the facility.
 57 Regulated waste transport (1) Regulated waste transport (the <i>relevant activity</i>) consists of— (a) transporting on a non-commercial basis 250kg or more of regulated waste in a vehicle; or (b) transporting on a commercial basis any quantity of regulated waste in a vehicle. (2) The relevant activity does not include transporting chemically treated power poles in a vehicle. (3) In the following table, the aggregate environmental score, if any, for the relevant activity is the score stated opposite the threshold within which the relevant activity is carried out. 1 transporting regulated waste, other than tyres, in— (a) 1 to 5 vehicles (b) 6 to 35 vehicles (c) 36 or more vehicles (4) In this section— vehicle vehicle includes the part of an aircraft, boat, rolling stock, semi-trailer, tanker, trailer or truck, used to transport the regulated waste. 	A commercial contractor holding a current development approval and registration certificate for this ERA will be engaged by GKI Resort to transport regulated waste to the mainland for disposal or recycling.



ERA Definition ¹	Relevance to Project
58 Regulated waste treatment	No regulated waste
(1) Regulated waste treatment (the <i>relevant activity</i>) consists of operating a facility for	treatment as defined by
receiving and treating regulated waste or contaminated soil to render the waste or soil non-	this ERA will be
hazardous or less hazardous.	undertaken on the Island
(2) The relevant activity does not include—	by the GKI Resort.
(a) carrying out an activity to which section 25, 27, 53, 59 or 61 would apply if the activity	
were carried out within a stated threshold under any of those sections; or	
Editor's note—	
section 25 (Meat processing) or 27 (Seafood processing)	
(b) carrying out an activity to which section 52, 54 or 55 applies; or	
(c) remediation of contaminated soil at the site of the contamination.	
(3) The aggregate environmental score for the relevant activity is 90.	
(4) III IIIIs section— regulated waste does not include reconditioned drums or containers that are clean and do	
not contain residues	
60 Waste disposal	No waste disposal as
(1) Waste disposal (the <i>relevant activity</i>) consists of only 1 of the following—	defined by this FBA will
(a) operating a facility for disposing of—	be undertaken on the
(i) only regulated waste: or	Island by the GKI
(ii) regulated waste and any, or any combination, of the following—	Resort.
(A) general waste:	
(B) limited regulated waste;	
(C) if the facility is in a scheduled area—no more than 5t of untreated clinical waste in a year:	
(b) operating a facility for disposing of, in a year, 50t or more of waste consisting of-	
(i) only general waste; or	
(ii) general waste and either, or a combination, of the following-	
(A) a quantity of limited regulated waste that is no more than 10% of the total amount of	
waste received at the facility in a year;	
(B) if the facility is in a scheduled area—no more than 5t of untreated clinical waste.	
(2) The relevant activity does not include using clean earthen material as fill.	
(3) In the following table, the aggregate environmental score for the relevant activity is the	
score stated opposite the threshold within which the relevant activity is carried out.	
(4) In this section—	
crean earth means earth that has trace elements and contaminant levels within the interim	
B(1)—Guidelines on the Investigation of Soil and Groundwater' forming part of the National	
Environment Protection (Assessment of Site Contamination) Measure 1999	
Editor's note-	
The National Environment Protection (Assessment of Site Contamination) Measure 1999	
made under the National Environment Protection Council Act 1994 (Cwlth), section 14(1), is	
available at government bookshops. On the day this regulation was notified in the gazette the	
document was also available on the Environment Protection and Heritage Council's website	
at <www.ephc.gov.au>.</www.ephc.gov.au>	
<i>clean earthen materials</i> means—	
(a) bricks, pavers, ceramics or concrete that does not contain embedded steel reinforcing	
rods, pulverised to size of no more than 100mm; or	
(b) clean earth.	
<i>Tacility</i> includes a naturally occurring or constructed hollow or pit, including, for example, a	
guily, mining shaft or quarry, but does not include a hollow or pit on a farm used for receiving	
61 Wests insincration and thermal treatment	No wasto incincration or
(1) Waste incineration and thermal treatment (the relevant activity) consists of operating a	thermal treatment as
facility for incinerating or thermally treating waste	defined by this FBA will
(2) The relevant activity does not include—	be undertaken on the
(a) incinerating human or animal remains unless the remains are clinical waste or quarantine	Island by GKI Resort.
waste; or	,
(b) thermal treatment of waste carried out as part of another activity mentioned in this	
schedule.	
Example—	
thermally treating waste to generate electricity under section 14 (Electricity generation)	



ERA Definition ¹	Relevance to Project
(3) In the following table, the aggregate environmental score, if any, for the relevant activity is	
the score stated opposite the threshold within which the relevant activity is carried out.	
(4) In this section—	
facility, for incinerating vegetation, includes a fixed or mobile apparatus for blowing air into a	
hole in the ground to facilitate the incineration of the vegetation.	
thermally treating, in relation to waste, means applying heat to the waste to render the	
waste less hazardous for disposal.	
62 Waste transfer station operation	Operation of the GKI
(1) Waste transfer station operation (the relevant activity) consists of operating, of a	facilities may conform to
commercial basis of in the course of carrying on a commercial enterprise, a waste transfer	the definition of EBA 62
$(2) \Delta$ waste transfer station is taken to have received a quantity of at least $30m^3$ of waste if	depending on the actual
the station receives containers or vehicles that have a combined total canacity of at least	quantities of waste
30m ³ .	generated by the resort
(3) The relevant activity does not include operating a waste transfer station on a site if an	and Island residents (if
activity to which section 60 applies is carried out on the site.	using the facility). At this
(4) The aggregate environmental score for the relevant activity is 31.	stage, it is anticipated
(5) In this section—	that approximately 5 to 6
waste transfer station means a facility used for—	tonnes of waste may be
(a) sorting or consolidating waste; and	generated by the resort
(b) temporarily storing the waste before moving it from the site where the relevant activity is	each day.
Carried out.	
a facility managed commercially that receives and corts waste, conde the recyclable waste to	
a recycling facility and the non-recyclable waste to a landfill on another site	
63 Sewage treatment	A sewage treatment
(1) Sewage treatment (the <i>relevant activity</i>) consists of—	plant having a peak
(a) operating 1 or more sewage treatment works at a site that have a total daily peak design	design capacity greater
capacity of at least 21EP; or	than 21 EP will be
(b) operating a sewage pumping station with a total design capacity of more than 40KL in an	established on the Island
hour, if the operation of the pumping station is not an essential part of the operation of	to treat sewage
sewage treatment works to which paragraph (a) applies.	generated by the resort.
(2) The relevant activity does not include—	Accordingly,
(a) carrying out works, other than operating a sewage pumping station mentioned in subsection (1)(b) involving only infrastructure for the collection of sewage including for	and a registration
example, pipes: or (b) carrying out works involving either of the following—	certificate will be
(i) operating or maintaining composting toilets:	required by the GKI
(ii) treating or recycling greywater.	Resort to operate ERA
(3) In the following table, the aggregate environmental score for the relevant activity is the	63.
score stated opposite the threshold within which the relevant activity is carried out.	
(4) In this section—	
daily peak design capacity, for sewage treatment works, means the higher EP for the	
works calculated using each of the following formulae— (a) EP = $V/200$	
(a) LF = V/200	
V is the volume, in litres, of the average dry weather flow of sewage that can be treated at the	
works in a day;	
(b) $EP = M/2.5$	
where	
<i>M</i> is the mass, in grams, of phosphorus in the influent that the works are designed to treat as	
the inlet load in a day.	
no-release works means sewage treatment works from which neither solid nor liquid	
onerating sewage treatment works includes.	
(a) collecting gas from the treatment works: and	
(b) operating a pump station or other works associated with the treatment works.	



APPENDIX C

Summary Literature Review for Estimation of Operational Waste Generation



Table C1 presents a summary of waste generated in Queensland in 2007-08 as derived from the Queensland

 Waste and Recycling Report Card 2007/08 (DERM, 2008).

Waste Source	Volume of Waste (thousands of tonnes)			
	Landfill	Recovery	Indefinite Storage	Total
Domestic	1,342	316		1,658
Green	41	455		496
Commercial and Industrial	1,361	1,682		3,043
Construction and Demolition	2,346	1,665		4,011
Heavy Industry	3,725		16,055	19,780
Other	1,743	1,565		3,308
TOTAL	10,558	5,683	16,055	32,296

Excluding heavy industrial wastes and 'other' waste sources (ie. contaminated and acid sulfate soils), this equates to approximately 2.4 tonnes per person per annum or approximately 6.66kg/person/day of which approximately 55% is disposed to landfill (refer to **Figure C1**).



Figure C1: Total Municipal Waste Generated in Queensland 2007-08 per person.

According to the *Queensland Waste and Recycling Report Card 2007/08* (DERM, 2008), approximately 466kg/person/year of domestic waste is collected by kerbside collection or delivered direct to landfill (bulk items), which equates to approximately 1.3 kg/person/day (refer to **Figure C2**). This excludes green waste and includes about 64kg/person/year of recyclable paper and packaging.





Figure C2: Volume of Domestic Waste Generated Per Person in Queensland 2007-08 (Source: DERM, 2008)

Of the recyclable paper and packaging collected from domestic sources via kerbside collection, the percentages of various recyclable materials were as shown in **Figure C3**.



Figure C3: Proportion of Recyclable Materials Recovered from Kerbside Collection in Queensland 2007-08

(Source: DERM, 2008)

These results are comparable with the proportions of recyclable materials identified by Rockhampton Regional Council in a recent audit of kerbside recycling bins within the region as part of Council's latest Waste Audit (refer to **Figure C4**).




Figure C4: Proportion of Recyclable Materials Recovered from Kerbside Collection in Rockhampton 2010

(Source: Rockhampton Regional Council, 2011)

The following table presents data relating to the typical composition of commercial and residential waste in Brisbane, excluding green waste (refer to **Table C2**).

Type of Waste	Percentage by Weight (%)			
	Commercial	Domestic		
Newspaper	4.5	5.2		
Other Paper	29.3	13.5		
Plastic	6.4	7.7		
Rubber	2.1	1		
Glass	6.3	10.5		
Steel	5.4	5.1		
Other Metal	0.5	1		
Food Waste	11.6	28		
Other Organic (eg. cardboard)	12.9	22		
Other	21	6		

Table C2: Typical Composition of Commercial and Domestic Waste in Brisbane

(Source: Solid Waste, a Policy Paper for SEQ2001 Project, July 1993 in Green and Organic Waste Processing and Marketing in Queensland, EPA, 2002)

Removing food waste from the data in **Table C2**, the percentages for remaining waste components are comparable to data derived from recyclable domestic waste generated in Queensland and kerbside recycling collection by Rockhampton Regional Council (refer to **Table C3**).



Type of Waste	Percentage by Weight (%)		
	Commercial	Domestic	
Newspaper	5.1	7.2	
Other Paper	33.1	18.8	
Plastic	7.2	10.7	
Rubber	2.4	1.4	
Glass	7.1	14.6	
Steel	6.1	7.1	
Other Metal	0.6	1.4	
Other Organic (eg. cardboard)	14.6	30.6	
Other	23.8	8.3	

Table C3: Typical Composition of Commercial and Domestic Waste (excluding food waste) in Brisbane

The proportional composition of waste as described above is generally consistent between data available for Queensland, Brisbane and Rockhampton. As such, compositional data for Brisbane has been applied to waste generation data for GKI as this provides the most comprehensive range of waste types and provides data for both commercial and domestic waste streams, which is considered to reflect the dominant uses on GKI.

A waste generation rate of 2.2kg/person/day has been adopted from data for the former resort, which excluded green waste. This rate is considered to be conservative and the actual waste generation rate is likely to be somewhat less given that the above estimates are based on waste generation rates for the previous GKI resort, which was implementing minimal waste reduction initiatives.

Furthermore, reference to data from other Australian hotels indicates waste generation rates much less than the quantities estimated for the previous GKI resort. For example, a study of fifteen (15) hotels in Melbourne estimated that in 2005, an average or 0.52 tonnes of waste was disposed of to landfill per hotel room each year (Great Forest Australia, 2005). A summary of the results of the study by Great Forest Australia in 2005 is provided in **Table C4**. The composition of wastes generated by these hotels as identified through the Great Forest Australia (2005) survey is presented in **Figure C5**.

Table C4: Waste Characterisation Study of 15 Melbourne Hotels

Hotel	Rooms	Star Rating	Waste to Landfill Annual Reduction	
Grand Hyatt	548	5	140 tonnes	23.3%
Hilton on the Park	403	5	148 tonnes	20.0%
Holiday Inn Melbourne	385	4.5	178 tonnes	32.6%
Travelodge Southbank	275	3.5	85 tonnes	44.4%
Hotel Ibis Melbourne	250	3.5	75 tonnes	35.5%
Holiday Inn on Flinders	204	4.5	104 tonnes	44.5%
Hotel Enterprize	190	3.5	57 tonnes	31.9%
Radisson on Flagstaff	184	4.5	100 tonnes	38.1%
Hotel Grand Chancellor	160	4	108 tonnes	38.2%



Hotel	Rooms	Star Rating	Waste to Landfill Annual Reduction	
Medina Grand Hotel	154	4.5	73 tonnes	34.5%
Sofitel Grand Hotel	118	5	47 tonnes	22.0%
Quay West Hotel	115	5	91 tonnes	31.0%
The Sebel Melbourne	107	5	37 tonnes	29.0%
Hotel Miami	69	3.5	23 tonnes	44.7%
Quest on Bourke	63	4.5	25 tonnes	35.8%
Totals	3225		1290 tonnes	30.6%

Source: Sustainability Victoria: 2006



Figure C5: Waste Characterisation Study of 15 Melbourne Hotels

Source: Sustainability Victoria: 2006

Given that the Melbourne hotels contained in this study were metropolitan hotels rather than Island resorts such as the proposed GKI resort, there are a number of factors that could contribute to the seemingly much lower rates of waste generation, including:

- Not all metropolitan hotels contain a restaurant whereas Island resorts such as that on GKI provide a range of dining options. As such, less food and associated packaging waste would be expected in a hotel not containing a restaurant;
- The availability of dining options external to the hotel are much greater in relation to a metropolitan hotel compared to an Island resort. That is, a person staying at the GKI resort is generally limited to dining at restaurants and cafes etc operated by the resort whereas a person staying in a Melbourne hotel can choose to dine anywhere in the city rather than only at the restaurant contained in the hotel. As such, food and associated wastes generated per person at an Island resort, could be expected to be somewhat higher than at a metropolitan hotel; and
- The type of dining options provided at a metropolitan hotel may also differ to an Island resort, which could influence the amount of waste generated. For example, it may be that restaurants contained within metropolitan hotels offer more a-la-carte style meals compared to an Island resort where buffet style meals may be more common. In order to satisfy the expectations of guests, buffets typically provide an extensive range of food options and are regularly topped up to always appears full, which is likely to generate more waste than an a-la-carte serving method. As such, the volume of food and



associated packaging waste generated by a resort or hotel serving buffet style meals would be higher than a hotel serving a-la-carte meals.

This reasoning is supported by the low proportion of compostable or food waste identified in the waste stream by the survey of Melbourne hotels, which recorded only 11% compostable waste (refer to **Figure C5**) relative to an average 25-50% compostable food and other organic wastes indicated by studies of other domestic and commercial waste streams.

Based on an average daily population of staff and visitors on the Island of 2,356 persons, and an average waste generation rate of 2.2kg/person/day (excluding green waste) and applying the proportional composition rates in **Table C2** above, estimated quantities of various types of waste have been prepared for operation of the Great Keppel Island Revitalisation Plan (refer to **Table C5**). It is anticipated that actual waste quantities generated on GKI will fall within the range between commercial and domestic waste generation rates in **Table C5**.

	Com	Commercial		Domestic	
Type of Waste	Percentage by Weight	Volume of Weight (kg/day)	Percentage by Weight	Volume of Weight (kg/day)	
Newspaper	4.5%	233	5.2%	270	
Other Paper	29.3%	1519	13.5%	700	
Plastic	6.4%	332	7.7%	399	
Rubber	2.1%	109	1.0%	52	
Glass	6.3%	327	10.5%	544	
Steel	5.4%	280	5.1%	264	
Other Metal	0.5%	26	1.0%	52	
Food Waste	11.6%	601	28.0%	1451	
Other Organic	12.9%	669	22.0%	1140	
Other	21.0%	1088	6.0%	311	
Total	100%	5183	100%	5183	

Table C5: Estimated Waste Generation Rates for Operation of GKI Resort Revitalisation Plan

In addition to waste volumes presented in **Table C5**, an estimated quantity of green waste for the GKI Resort Revitalisation Plan has been prepared based on a waste generation rate of approximately 130kg/per/year (from DERM, 2008) and an average of 2,356 persons per day on the Island, which equates to approximately 840kg/day of green waste being generated by the resort.

It is estimated that of the total waste generated on site, approximately 0.2% (BIEC, 1997) or about 10kg/day of hazardous waste materials such as waste oil, pharmaceuticals, cleaning chemicals, batteries etc may be generated on GKI.

Of the above wastes, it is estimated that only about 0.4 to 1.2 tonnes per day or roughly 8-25% will comprise materials not able to be reused or recycled.



APPENDIX D

Location of Existing & Former Waste Facilities on GKI





