# Glass Reprocessing Infrastructure Upgrade Project Report

Version: 2.0 Date: 09/01/2014

# Document Control

| Version | Prepared By | Date of issue | Authorised by | Signature & Date |
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| **Title** | **Materials Recovery Facility – Glass Reprocessing Infrastructure Upgrade Project Report** |
| **Author/s** | **Manager, Waste And Environment** |
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***Acknowledgements***

The contribution of the following individuals in preparing this document is gratefully acknowledged:

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*Nigel Crumpton, Waste Strategy & Business Coordinator, Cairns Regional Council*

*Dan Dixon, Waste Operations Coordinator, Cairns Regional Council*

*Rob Jones, Senior Management Accountant, Cairns Regional Council*

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# 1 Executive Summary

In 2009 the National Packaging Covenant Industry Association (NPCIA) in partnership with the Queensland Department of Environment and Resource Management (DERM) supported Cairns Regional Council (CRC) in the procurement and installation of a glass crushing plant.

At the time, market research identified four potential uses for the Recovered Crushed Glass (RCG):

- Blast medium for abrasive blasting;
- Filtering compound to be used instead of sand in sand filters;
- Substitute for sand for pipe embedment; and
- Aggregate for the construction of concrete and cement blocks.

The results from market surveys across these industries determined two key factors for take up of RCG in external markets:

- Consistent supply of required quantities of RCG: Deemed critical once the organisation had created dependency by incorporating the product into manufacturing processes
- Consistently clean RCG free of contaminants: Deemed critical due to the need to maintain a standard quality of manufactured product and ensure safety during manufacture and market supply

At the time, limited specifications to support the use of RCG in the above applications and limited reassurance in WH&S standards for the processing and handling of RCG were available. The glass was therefore used as an aggregate in landfill capping and remediation and stockpiled to avoid disposal costs.

A re-evaluation of the glass crushing plant in late 2011 determined the need to upgrade the plant to ensure the RCG would meet specifications and market requirements, which formed the basis for this project.

In 2012/13 the AFGC Packaging Stewardship Forum (PSF) provided funding and project support for CRC to upgrade the existing glass reprocessing infrastructure and incorporate equipment to clean the product and meet ARRB/PSF specifications.

The project outcomes contribute to the CRC recycling and sustainability targets as the product now meets ARRB Group/PSF specifications for use in civil construction applications. Production of the RCG avoids disposal to landfill and the significant transportation costs incurred in accessing traditional recycling markets located in South East Queensland. The majority of the product is currently supplied to CRC Water Operations for use as a pipe embedment material.

# 2 Overview

## 2.1 Vision

The production of quality RCG to meet ARRB/PSF specifications for supply to locally based secondary markets.

## 2.2 Project Objectives

Objective 1 To provide a local solution for the 4,200 tonnes of glass collected annually via kerbside recycling services from the CRC local government area;

Objective 2 To purchase and install suitable upgrade equipment to the existing glass reprocessing infrastructure at the CRC Material Recovery Facility plant that will process recovered glass to current ARRB/PSF specifications;

Objective 3 To establish local markets for the use of RCG in civil construction applications;

Objective 4 To produce a project report within two months following completion of this project that presents information on tonnages of glass reprocessed, tonnages of RCG sold into alternate markets and include a business case incorporating a cost benefit analysis

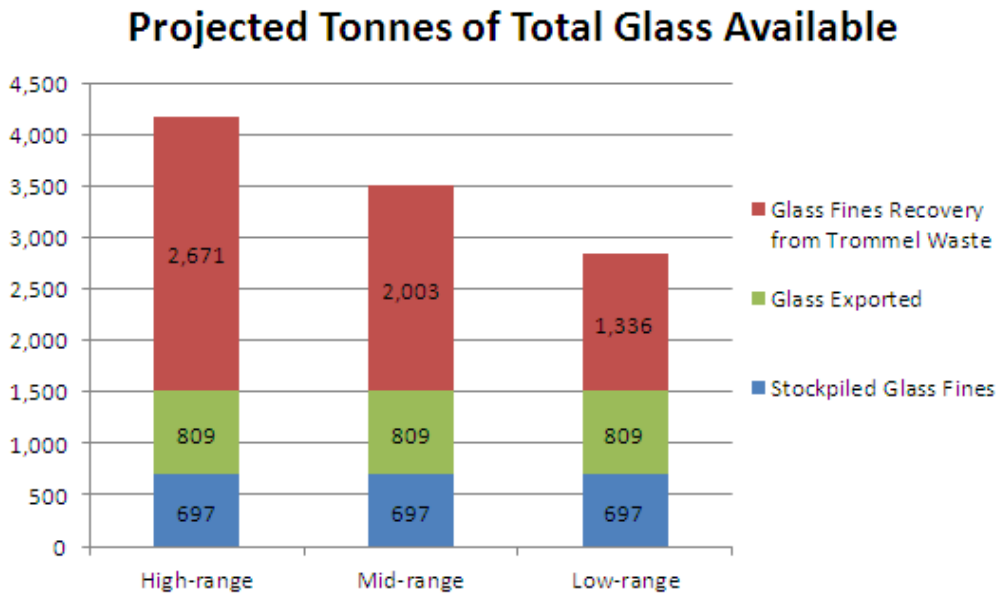
# 3 Business Case

The Glass Reprocessing Infrastructure Upgrade project aimed to enable the plant to process quality recycled crushed glass (RCG) to meet ARRB/PSF National Specifications.

## 3.1 Situational Assessment

CRC kerbside and transfer station recycling services yield approximately 12,500tpa of dry recyclable materials annually. In order to estimate the potential impact of increased recovery of glass a number of scenarios have been developed based on the estimated glass fines recovery from the trommel residual waste. Based on low-range projections it is estimated at least 2,800 tonnes of glass would be available for reprocessing per year. Under the high-range projections up to 4,200 tonnes of glass could be available for reprocessing.

The graph below shows the results of the low, mid and high-range projection modelling for the projected total tonnes of glass available per year.




From the high-range projection, glass represents approximately 33% or 4,200tpa. Currently only 800 tonnes of glass product is exported to reprocessing markets. The remaining 3,400 tonnes of glass are glass fines retrieved through the trommel screening process, which has typically been disposed of to landfill in the past. In recent years some glass fines have been separated and stockpiled onsite in anticipation of plant upgrades, which in the absence of any glass reprocessing would ultimately be disposed to landfill. It is estimated that approximately 6,000 tonnes of glass fines are currently stockpiled and available for reprocessing in addition to the projected yearly tonnages.

The table below demonstrated the glass management prior to the commissioning of the glass crusher.

| Tonnage (approx.) | Management |
|---|---|
| 800 tpa | Whole bottles transported to South East Queensland markets for recycling where the market price is net transport costs |
| 3400 tpa | Forms approximately 80% of the trommel residual waste from the processing system sent to landfill incurring transport and disposal costs |
| 6000 (stockpiled) | Glass fines that have previously been disposed to landfill but in the last 18 months have been stockpiled on site |

## 3.2 Projected Savings

**Operating Income & Costs**

Since the current MRF opened in 2005, the sale price for glass has stayed static at $92 per tonne gross or $30 per tonne net of transport. Total glass revenue over recent years has levelled at approximately $80,000 per annum.

Based on the high-range projection, it is estimated in 2012/13 that glass product exported to reprocessing markets will only represent 23% (800 tonnes) of the total glass received at the MRF. The remaining 77% (3,400 tonnes) of glass received at the MRF is contained within the trommel screen residual waste, and without any glass reprocessing infrastructure the greater portion of glass would ultimately be disposed to landfill.

The gross cost per tonne to process recyclable materials is approx. $207 per tonne (*Hyder Consulting, MRF Options Analysis Report, January 2012*). This indicates the operating position for processing 4,200 tonnes of glass (fines & product) is in the region of an $800,000 loss annually. The sorting and exporting of glass product to reprocessing markets has been a loss making venture in each and every year since the MRF opened.

For every tonne of glass fines not recovered a $38 per tonne landfill disposal charge is incurred. In 2012/13, the annual disposal cost for disposing of 3,400 tonnes of glass fines would be in the order of $130,000 or 15% of the total expenses associated with sorting the glass component.

A large window of opportunity exists to reduce glass fines disposal costs and increase the profitability of glass sorting at the MRF. This can be directly influenced by increasing the volume of glass fines recovered for reprocessing thus avoiding landfill disposal costs and reducing the cost per tonne to process.

**Opportunities for Improvement**

The introduction of new glass reprocessing infrastructure will not only reduce landfill disposal costs but will also enable the processing of quality RCG as an income stream.

It is estimated that by selling 4,200 tonnes of RCG at approximately $23 per tonne, potential revenue of approximately $100,000 can be achieved and a reduction in waste disposal costs stemming from diversion of glass fines from landfill in the order of $130,000.

Taking into account an extra FTE to operate the glass crusher the potential net saving by introducing glass reprocessing infrastructure to Council is in the region of a $160,000 operational saving per annum.

This established the benefit to the organisation for proceeding with the project and the need to reduce the organisation's reliance on vulnerable glass market prices, intrastate transport and the requirement to pay the disposal costs on the lesser grade glass fines.

A full cost benefit analysis will be undertaken at the close of the 13/14 financial year based on two quarterly production data reports.

# 4 Project Risk Management

Table 2 Identified project risks

| Risk Area | Level | Risk Plan | Management Outcome |
|---|---|---|---|
| Shipping/delivery issues that could delay delivery of infrastructure from overseas | Med | Delay in end date of project to be negotiated. Amended milestone table to be signed off by both parties | Project delays were incurred as a result of limited suppliers for the required equipment. Resulting in a negotiated project extension of six months |
| Construction issues related to proposed site for infrastructure equipment | Low | Cairns Regional Council to identify suitable site prior to delivery of equipment. | Project delays were incurred as a result of the changed location of glass crushing plant and additional civil works required. Extension of project as above. |
| Slow take up of alternate markets for RCG in the local regions | Low | Provision of information in the form of reports and existing case studies to be provided to Cairns Regional Council by PSF. CRC to identify suitable markets at the commencement of project. | PSF supplied case studies and specifications which were shared with potential internal council markets. A workshop on the use of RCG in civil construction projects was hosted by CRC and LAWMAC and coordinated by PSF held in Cairns in August 2013. |
| Ability to process glass to ARRB specifications | Low | Quality control prior to equipment purchase that specifies product outcome to be to specifications. Specification tot be provided to CRC by PSF prior to project commencement | Sample testing of RCG has confirmed it meets ARRB specifications. Testing will continue on a quarterly basis for quality assurance purposes |

## 4.1 Key Deliverables

Table 3 Project Deliverables and Performance Indicators

| Tangible Deliverables | Performance Indicator | Due Date | Responsible |
|---|---|---|---|
| Upgrade of glass reprocessing infrastructure at the MRF | Installation and operation of glass reprocessing plant at MRF | 15 August 2013 | CRC |
| Processing of >4,200tpa of RCG for use in civil construction markets | Production of >4,200tpa of RCG to meet ARRB/PSF specifications | Beginning 15 August 2013 | CRC |
| Diversion of 4,200 tpa glass from landfill | Diversion of 4,200 tpa glass from landfill | Beginning 15 August 2013 | CRC |
| Established local markets for use of RCG in civil construction applications | Supply of >4,200tpa of RCG to market | 26 August 2013 | CRC |

| | | | |
|---|---|---|---|
| Production of project report within two months of completion of the project | Submission of project report | 15 November 2013 | CRC |
| Provision of data on tonnages recycled into alternative markets in two (2) monthly intervals over a period of twelve (12) months post completion of project | Schedule of two monthly project data reports to PSF | December 2013 | CRC |
| Intangible Deliverables | Performance Indicator | Action Date | Responsible |
| Establishment of project alliance between CRC and PSF | Broader acceptance by community and industry of the benefits of RCG products | ABC radio interview & Mayoral media release on world environment day 2012 focused on recycling and RCG.<br><br>12/13 & 13/14 Continuing MRF site visits for schools, community, government, industry and professional groups | CRC |
| Increased awareness and take up in QLD of the alternate use and development of RCG markets by other regional councils | Demonstrated use of the benefits of inclusion of RCG in civil construction applications | LAWMAC workshop, 29/08/2013 and IPWEA conference 09/10/2013, in Cairns | CRC & PSF |
| Potential interest from other regional and groups of QLD councils in implementing a similar initiative to address similar issues related to glass recycling | Increased awareness by local government of the benefit s of inclusion of crushed glass sand in road pavement | LAWMAC workshop, 29/08/2013 and IPWEA conference 09/10/2013, in Cairns | CRC |

## 4.2 Project Milestones

Table 4 Project Milestones and Accomplishment

| | Milestone | Timeframe | PSF $+GST | CRC $+GST | Total Budget $+GST | Date Accomplished |
|---|---|---|---|---|---|---|
| 1 | Project MOU signed by all parties | September 2012 | | | | 17/09/2012 |
| 2 | Deposit paid on upgraded equipment | October 2012 | $20,000 | $32,000 | $52,000 | 06/11/2012 |
| 3 | Procurement and installation of upgraded equipment | November 2012 | $16,000 | $43,000 | $59,000 | 19/02/2013 |
| 4 | Commissioning of equipment upgrade to existing glass crushing plant including barrel dryer and trammel, conveyor and housing | February 2013 | $10,000 | $21,050 | $31,050 | 15/08/2013 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | container and electrical installation | | | | | |
| 5 | Commence establishment of local RCG markets by CRC | April 2013 | | | | 26/08/2013 |
| 6 | Demonstrated use of RCG in local civil construction | May 2013 | | | | 29/08/2013 |
| 7 | Project report | June 2013 | $ 4,000 | Staff time | $ 4,000 | 10/01/14 |
| | **TOTAL** | | **$50,000** | **$96,050** | **$146,050** | |

## 4.3 Market Development

CRC has undertaken background surveys and research for the establishment of alternate local markets for RCG and are committed to using the product in their own civil construction activities with the balance (where available) being marketed to businesses within the local region.

Forming part of the market development program, a workshop on the use of RCG in civil applications, was held for the regional group of North Queensland Councils forming the Local Authority Waste Management Advisory Committee (LAWMAC). The workshop, held in Cairns on the 29 August 2013 attracted over forty participants including industry representatives and included speakers from PSF, Great Lakes Council (NSW) and the Institute of Public Works Engineers Australia (IPWEA) NSW. The workshop increased awareness of the potential applications for RCG in local government and provided detailed information in regard to product specifications and workplace health and safety.

As CRC is a significant user of sand and aggregates in various civil applications, market research has focused on developing internal markets for the RCG materials.

Resulting from the plant upgrades achieved through this project, an RCG primary market has been established for use as:

Pipe embedment material within CRC Water and Wastewater pipe laying and replacement activities. The application of the material has been based on a 50/50 mix with raw materials, with an intention to increase this ratio over time;

A secondary external market is currently being trialled for use as:

Aggregate materials for concrete pavers. Trials began late 2013, however significant feedstock is required. Further investigations are underway to determine the capacity for CRC to meet this demand on an ongoing basis.

### 4.3.1 Product Specifications

The RCG produced since equipment upgrades have been achieved under this project meet the ARRB/PSF specifications as below.

Table 5 Pipe embedment material at <3mm

| Particle Size Distribution | Percent finer |
|---|---|
| 9.5mm | 100 |
| 4.75mm | |
| 2.36mm | 25-100 |
| 0.425mm | 0-60 |
| 0.075mm | 0-10 |

Source: *Specifications for Recycled Crushed Glass as an Engineering Material,* (ARRB,Date)

Table 6 Concrete block paving at <5mm

| Particle Size Distribution | Percent finer |
|---|---|
| 4.75mm | 95-100 |
| 2.36mm | 80-100 |
| 1.18mm | 50-95 |
| 0.600mm | 25-60 |
| 0.300mm | 10-30 |
| 0.150mm | 5-15 |
| 0.075mm | 0-10 |

Source: *Specifications for Recycled Crushed Glass as an Engineering Material,* (ARRB,Date)

Laboratory testing of the sample RCG on the 23 August 2013 showed no evidence of asbestos present in the materials. Laboratory testing of RCG samples taken at quarterly intervals will continue for quality assurance and safety purposes.

## 4.4 Glass Reprocessing

**Predicted annually processed amounts**

13/14 10,200 tonnes (including 6,000 tonnes of stockpiled material)

14/15 between 3,400 and 4,200 tonnes

## 4.5 Quality Management

Laboratory testing of RCG samples taken at quarterly intervals will continue on an ongoing basis for quality assurance and safety purposes. Samples of RCG will be taken from stockpile's that hold post manufactured product and testing will be undertake prior to distribution. Sampling and testing will be undertaken in accordance with AS1141 "Methods for sampling and testing aggregates'. Testing will be conducted by an external laboratory service.

Samples will be tested in accordance with RCG Specification 2: for use as fine aggregate in asphalt and concrete (*ARRB, Date*).

Certified RCG product is stored in bins on a clean, well-drained, and covered and contaminant free base at the MRF. The storage area is included in the asset management schedule.

CRC are in the process of developing a Material Safety Data Sheet for the RCG product.

## 4.6 Attachments

1. Memorandum of Understanding, CRC and PSF, September 2012
2. Photos

Attachment 1. Memorandum of Understanding, CRC and PSF, September 2012

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# Glass Reprocessing Infrastructure Upgrade Project - Cairns, Queensland
## Memorandum of Understanding

**DATED** **September 2012**

**BETWEEN**

**Cairns Regional Council**
**PO Box 359, 119-145**
**Spence St, Cairns QLD 4870**
**ABN: 24 310 025 910**

**AND**

**AUSTRALIAN FOOD AND GROCERY COUNCIL (ABN 23068732885)**
**2-4 Brisbane Avenue, Kingston**
**Australian Capital Territory 2600**
**(AFGC)**

*This Understanding is voluntary and is not intended to and does not create any contractual rights or obligations with respect to the signatories. Rather it is a declaration of understanding between two parties to join in a collaborative effort to improve recycling/resource recovery/build a culture of environmental stewardship.*

## Glass Reprocessing Infrastructure Upgrade Project - Cairns, Queensland
## Memorandum of Understanding

### *3. Mission*

To demonstrate a visible commitment to sustainable resource recovery by the AFGC Packaging Stewardship Forum, its members, Cairns Regional Council and their stakeholders through the production of quality RCG that meets ARRB/PSF National Specifications.

### *4. Objectives*

Objective 1 To provide a local solution for the 4,200 tonnes of glass collected annually through kerbside recycling services from the Cairns Regional Council local government area.

Objective 2 To purchase and install suitable upgrade equipment to the existing glass reprocessing infrastructure at the CRC Material Recycling Facility (MRF) plant that will process recovered glass to current ARRB/PSF Specifications.

Objective 3 To establish local markets for the use of RCG in civil construction applications.

Objective 4 To produce a project report within two months following completion of this project that presents information on tonnages of glass reprocessed, tonnages of RCG sold into alternate markets and include a business case incorporating a cost benefit analysis.

A key objective of the AFGC's Packaging Stewardship Forum is to demonstrate that voluntary approaches can and do work when all parties recognise their roles and responsibilities and collaborate. Programs focus on litter prevention and increasing recycling as well as supporting members' Australian Packaging Covenant commitments. www.afgc.org.au/psf.

# Glass Reprocessing Infrastructure Upgrade Project - Cairns, Queensland
## Memorandum of Understanding

### 5. *Key Contacts and Roles*

| Organisation | Key contacts | How Are They Affected, or How Are They Participating? |
|---|---|---|
| Cairns Regional Council | Debra Mackeen<br>Manager Waste and Water<br>Cairns Regional Council<br>Ph: (07) 4044 8265<br>E: D.Mackeen@Cairns.qld.gov.au | • Contribution of **$105,000** towards infrastructure purchase and installation<br>• Project Management<br>• Establishment of local markets<br>• Preparation of project report |
| AFGC Packaging Stewardship Forum | Chris Jeffreys<br>National Program Manager PSF<br>Ph: 0403 486 454<br>E: chris.jeffreys@afgc.org.au | • Contribution of **$50,000** towards project infrastructure<br>• General project oversight |
| Glass Machinery Manufacturing P/L | Jim McLeod<br>PO BOX 6758<br>Gold Coast Mail Centre QLD 9726 | • Supply and commissioning of glass reprocessing equipment upgrade |

### 6. *Key Deliverables*

**Tangible Deliverables:**

- Upgrade of glass reprocessing infrastructure at Cairns Regional Council MRF.
- Processing of >4,200 tonnes of glass per annum for use in local civil construction markets.
- Diversion of 4,200 tonnes of glass from landfill.
- Established local markets for use of RCG in a range of civil construction applications locally.
- Production of project report within two months of completion of the project that includes business case, cost benefit analysis, local markets developed and tonnages of glass reprocessed per annum.
- Provision of data on tonnages recycled into alternative markets to continue at 2 monthly intervals for a period of 12 months post completion of project.

**Intangible Deliverables (indicative only):**

- Establishment of project alliance between Cairns Regional Council and PSF.
- Increased awareness and take up in QLD of the alternate use and development of RCG markets by other regional councils.
- Potential interest from regional groups and other Queensland councils in implementing a similar initiative to address similar issues related to glass recycling.

## 7. *Project Plan/Milestones*

| | Milestone | Timeframe | PSF ($)+GST | CRC $ +GST | Total Project Budget ($) +GST |
|---|---|---|---|---|---|
| 1. | Project MOU signed by all parties | September 2012 | 0 | 0 | 0 |
| 2. | Deposit paid on upgraded equipment | October 2012 | $20,000 | $32,000 | $52,000 |
| 3. | Procurement and installation of upgraded equipment | November 2012 | $16,000 | $43,000 | $59,000 |
| 4. | Commissioning of equipment upgrade to existing glass crushing plant including barrel dryer and trommel, conveyor and housing container including electrical installation | February 2013 | $10,000 | $21,050 | $31,050 |
| 5. | Commence establishment of local RCG markets by CRC | April 2013 | 0 | 0 | 0 |
| 6. | Demonstrated use of RCG in local civil construction | May 2013 | 0 | 0 | 0 |
| 6. | Project report | June 2013 | 4,000 | Staff time | 4,000 |
| | **TOTAL:** | | **$50,000** | **$96,050** | **$146,050** |

## 8. *Project Measures (indicative):*

***Quantitative*:**

1. Installation and operation of glass reprocessing plant upgrade at Cairns Regional Council MRF.
2. Reprocessing of >4,200 tonnes of glass per annum.
3. Diversion of 4,200 tonnes of glass from landfill per annum.
4. Establishment of local markets for the use of RCG into civil construction.
5. Project Report that incorporates business case and cost benefit analysis.

6. Data on tonnages recycled into alternative markets at 2 monthly intervals for a period of 12 months post completion of project.

***Qualitative*:**

1. Broader acceptance by community and industry of the benefits of RCG products.
2. Demonstrated use of the benefits of inclusion of RCG in civil construction applications such as; pipe bedding, road pavement, pathways, curbing and guttering.
3. Increased awareness by local government of the benefits of inclusion of crushed glass sand in road pavement.

## *10. Project Risks:*

| Risk Area | Level | Risk Plan |
|---|---|---|
| Shipping/delivery issues that could delay delivery of infrastructure from overseas | Med | Delay in end date of project to be negotiated. Amended milestone table to be signed off by both parties |
| Construction issues related to proposed site for infrastructure equipment | Low | Cairns Regional Council to identify suitable site prior to delivery of equipment. |
| Slow take up of alternate markets for RCG markets in the local regions | Low | Provision of information in the form of reports and existing case studies to be provided to Cairns Regional Council by PSF<br><br>CRC to identify suitable markets at commencement of project |
| Ability to process glass to ARRB specifications. | Low | Quality Control prior to equipment purchase that specifies product outcome be to specifications Specification to be provided to CRC by PSF prior to project commencement |

## *11. Reporting & Communication*

1. Progress reporting in line with milestone table.
2. Launch of project – in line with communication plan attached.

## Glass Reprocessing Infrastructure Upgrade Project - Cairns, Queensland
### Memorandum of Understanding

**SIGNING PAGE**

**Cairns Regional Council**
Manager Waste & Environment
Debra Mackeen

11/10/12
Date

**Australian Food and Grocery Council**
PSF General Manager
Jenny Pickles

17/9/12
Date

*This Understanding is voluntary and is not intended to and does not create any contractual rights or obligations with respect to the signatories. Rather it is a declaration of understanding between two parties to join in a collaborative effort to improve recycling/resource recovery/build a culture of environmental stewardship.*

# Glass Reprocessing Infrastructure Upgrade Project - Cairns, Queensland
## Memorandum of Understanding

**Attachment 1**

**COMMUNCATIONS PLAN**

| Activity | Timing | Target Audience | Communication Channel |
|---|---|---|---|
| 1. Project Launch in line with commencement of project once infrastructure is installed | February 2013 | All media including industry publications<br><br>Local Mayor/ councillors/staff and other regional councils | PSF Public Affairs Officer in consultation with communications person from Cairns Regional Council . |
| 2. Media Release upon Project Completion and acceptance of project report | June 2013 | All media including industry publications | PSF Public Affairs Officer in consultation with communications person from Cairns Regional Council. |
| 3. Presentation of paper to technical forums or conferences | Post June 2013 | Industry sector and local government | • Presentations offered by staff from Cairns Regional Council or by PSF at WMAA or other (eg LAWMAC) technical forums.<br>• Potential also for presentation at industry conference on project achievements and outcomes for alternate markets |

# Attachment 2. Photos


-3mm RCG


Left bin -3mm Right bin -3 to -5mm


Mixing -3mm 50-50 with sand


Pipe embedment

Pipe embedment 50-50 blend

Pipe laying

RCG