REPURPOSE IT®

Repurpose It - Recovered Mineral Aggregates

Environmental Product Declaration

In accordance with ISO 14025 and EN 15804
EPD Registration no. S-P-01546 | Version 1.0
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Geographical scope: Australia

AUSTRALASIA EPD
ENVIRONMENTAL PRODUCT DECLARATION

Contents

Program information and verification

An Environmental Product Declaration (EPD) is a standardised way of quantifying the potential environmental impacts of a product or system. EPDs are produced according to a consistent set of rules – Product Category Rules (PCR) – that define the requirements within a given product category. These rules are a key part of ISO 14025 (ISO 2006) as they enable transparency and comparability between EPDs. This EPD provides environmental indicators for Repurpose It's recovered mineral aggregates manufactured at the company's washing plant in Epping (VIC) in Australia. This EPD is a "cradle-to-gate" declaration covering production of recovered mineral aggregates and their supply chain.

This EPD is verified to be compliant with EN 15804. EPDs of construction products may not be comparable if they do not comply with EN15804. EPDs within the same product category but from different programs or utilising different PCRs may not be comparable.

Repurpose It, as the EPD owner, has the sole ownership, liability and responsibility for the EPD.

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PCR:	PCR 2012:01 Construction Products and Construction Services, Version 2.3, 2018-11-15
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact via info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ EPD process certification (Internal) ☒ EPD verification (External)

The product category classification is UN CPC 89420. The ANZSIC Business industry code is 29220 (Recycling of other non-metal waste and scrap).

Introduction

Repurpose It is a waste-to-resource business that holds the fundamental belief that all waste can be converted to valuable resources.

Repurpose It has a vision that in the very near future we will be 100% zero to landfill across our waste portfolio.

We operate from our company owned site at 460 Cooper St in Epping, Victoria and we are continually investing in the world's most advanced waste processing technologies in order to achieve our goal.

Our clients range from some of Australia's largest local government authorities and private waste operators to our local community members seeking the opportunity to be part of the Repurpose It journey towards a zero-landfill community.

We operate across a variety of waste streams, including:

- Green & Organic Waste
- Commercial & Industrial Waste
- Construction & Demolition Waste
- Solid Inert Waste
- Drilling & Drainage Waste

Product description

Repurpose It operates some of the world's most innovative waste to resource technologies, including washing, separating and sorting plants to create high value resource from waste. Current products, obtained from processing through our washing plant, are listed in Table 1. The product category corresponds to UN CPC 89420 (*Non-metal waste and scrap recovery (recycling) services, on a fee or contract basis*). The ANZSIC Business industry code is 29220 (*Recycling of other non-metal waste and scrap*).

Table 1: Typical products recovered after washing

 55 mm recycled ballast	Recycled railway ballast produced by Repurpose It's high-technology process, which fully complies with physical and durability requirements described in the Metro Trains Melbourne (MTM) Technical Specification for Ballast Supply and AS 1258.7 to provide a uniform support layer under railway tracks.
 20/14 mm recycled aggregate	High-quality washed single-size aggregate used for concrete production or drainage and filter applications.
 10/7 mm recycled aggregate 7/4 mm recycled aggregate	High-quality washed single-size aggregate used for concrete production or drainage and filter applications.
 Coarse sand	High-quality washed sand with particle sizes ranging from 4 mm and minimal fine content.
 Medium sand	High-quality washed sand used for concrete and asphalt production, pipe embedment and filter sand with particle sizes ranging from fines to 4 mm.
 Fine sand	High-quality washed sand with high fines content, which makes it suitable as bedding and packing sand.

The above are typical products. Actual fractions may vary with market demand.

The washing plant products are being currently tested for accreditation for the following product requirements and relevant standards:

- Capping Material Type A and B (VicRoads Section 204 – Earthworks)
- Asphalt Sand (VicRoads Section 407 - Hot Mix Asphalt)
- Bedding Sand (VicRoads Section 701 - Underground Stormwater Drains)
- A2 Granular Filter Material - (VicRoads Section 702 - Subsurface Drainage)
- AS 2758.1 – Concrete Aggregates (SA 2014)
- WSA PS 361- Embedment / 5mm Minus Fine Crushed Rock
- WSA PS 368 - Recycled Glass Sand for Pipe Embedment
- WSAA PS 351 - Processed Aggregates for Pipe Embedment (7, 10 and 20mm)
- Railway Ballast (AS 2758.7 Aggregates and rock for engineering purposes (SA 2015) and MTM Doc No. L1-CHE-SPE-064 - Technical Specification for Ballast Supply)

The washing plant products can also be tailored to customers' needs when required.

The products from the washing plant are classed as (100%) aggregates containing crystalline silica (quartz). They do not contain any substances that are listed in the "Candidate List of Substances of Very High Concern (SVHC) for authorisation" and that exceed 0.1 % of the weight of the product.

Scope of this EPD

This EPD covers the cradle-to-gate life cycle stages of recovered mineral aggregates (modules A1-A3). Downstream stages have not been included as per the following diagram and Figure 1:

Product Stage			Construction Stage		Use Stage							End-of-life Stage				Benefits beyond system boundary
Raw Materials	**Transport**	**Production**	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/Demolition	Transport	Waste Processing	Disposal	Reuse, recovery, recycling potential
A1	**A2**	**A3**	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
			Scenario		Scenario							Scenario				
✔	✔	✔	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

✔ = module is included in this study
MND = module not declared

Life cycle stages

Raw Materials - Module A1

The waste is sourced from a variety of projects in the greater Melbourne area. Materials are considered to have reached the end-of-waste state at the point of drop-off at Repurpose It's washing plant. Processes that are part of the waste processing in the previous product system are excluded, in line with the polluter pays principle (PPP).

The production of ancillary materials (tap water, flocculants, coagulants and anti-foaming agents), as well as the generation of fuels and electricity from primary energy resources have been included in module A1.

Transport of raw materials to manufacturing plant - Module A2

Module A2 includes the transport of waste materials directly to the washing plant. The waste is sourced mainly from local construction and demolition projects, predominantly located to the northern and western parts of Melbourne and surroundings. The average transport distance is estimated at 15 km (one-way). However, since the party disposing of the waste pays for transport, the transport leg is excluded from the LCA, in line with the polluter pays principle.

Waste washing plant operation - Module A3

The operation of the waste washing plant, including any movement of materials on-site, is the core process included in this LCA.

The wet processing system was specifically designed to process contaminated soil and waste materials whilst optimising material recovery. The plant is fed by a primary screening unit, which scalps off the oversized (>100mm) material. The remaining material enters the modular washing plant, which scrubs, screens, washes and stockpiles the recovered aggregates and sands.

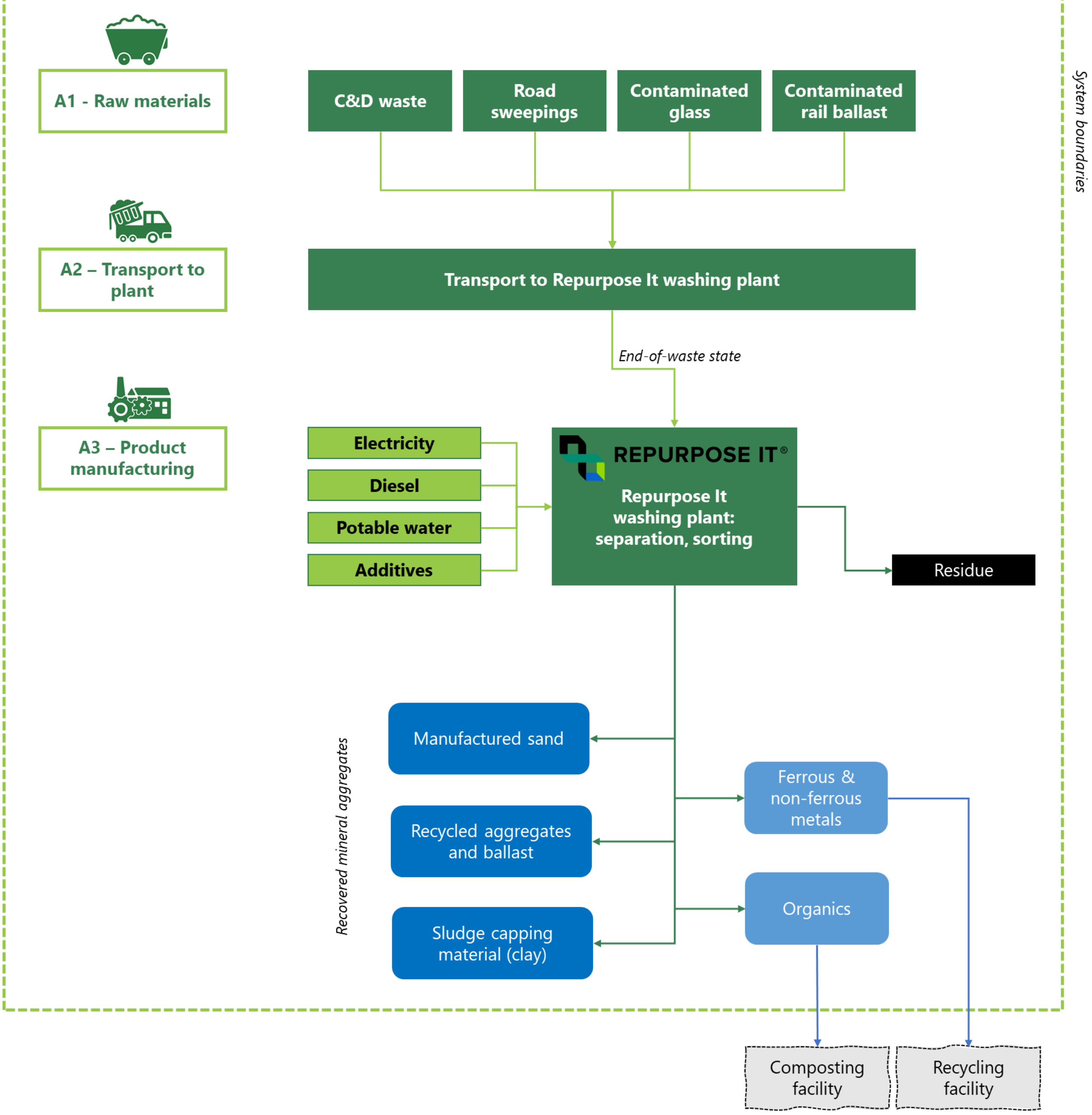
During the data collection period, the washing plant produced three washed aggregates (4-10 mm, 10-20 mm, 20-50 mm) and two washed sands (0-4mm and 0-2mm). The number of products (classifications) is increasing as more diverse input materials are accepted.

The sand is removed in the pre-screen and is pumped directly to the dual sand Evowash plant, and the 4-100 mm material passes into a Rotomax logwasher that combines scrubbing, sizing and litter removal, to ensure maximum product yield from clay-bound materials that are free from organics and low-density contaminants such as plastic.

The Evowash plant also includes dual sand conveyors which will give Repurpose It the flexibility to blend both sands to meet specific grading requirements.

To increase efficiency, the plant incorporates a full water treatment and sludge management system including an Aquacycle clarifier which, in combination with a centrifuge, ensures 90% of water can be recirculated for immediate reuse in the plant. This significantly reduces the amount of potable top up water required.

Figure 1: Product lifecycle of mineral aggregate products



Life Cycle Assessment (LCA) Methodology

Declared unit

The declared unit of the products covered by this EPD is:

1 tonne of final aggregate products from C&D waste washing processes.

The declared unit covers the whole range of secondary aggregate products that are produced at the plant.

Background data

Primary data have been collected during March-July 2019 from Repurpose It's washing plant. Background data are predominantly sourced from AusLCI plus the AusLCI shadow database (AusLCI 2019) and ecoinvent v3. Data for additives have been developed as proxies, based on available Material Safety Data Sheet (MSDS) composition data. The life cycle data used for the washing plant processes are less than five years old. Background data used are less than ten years old.

Methodological choices have been applied in line with EN 15804:2012+A1:2013 (CEN 2013); deviations have been recorded.

Average product and allocation

Repurpose It produces a number of mineral aggregate products (sand and aggregates in different size classifications). Since all of these products undergo the same washing plant process, it was decided that they should be allocated based on mass (causal relationship) and thus the products receive the same environmental impacts per tonne of product. (If economic allocation had been used, the aggregates would receive a higher portion of the impacts and the sands would receive a smaller portion. This result reflects the difference in respective values, which varies by +/- 10% from the median value.)

A small amount of ferro metal scrap can be present in the materials that enter our site (approximately 0.2%). Metals are separated before the C&D waste materials enter the washing plant and the scrap is sold-off to metal recyclers. Economic allocation was applied in the LCA to attribute the plant's environmental impacts to scrap and recovered aggregate co-products. If the amount of ferrous scrap in the received materials changes from 0.2%, the results of the LCA would be impacted.

Cut-off Criteria

The contribution of capital goods (production equipment and infrastructure) and personnel is outside the scope of the LCA, in line with the PCR (Environdec 2018).

Packaging is not relevant for the additives used or the products from the washing plant.

Key Assumptions

The washing plant commenced operations in 2019. The primary data are based on three months of operation, which is a deviation from the requirement for using twelve months of data. The three-month period was selected as the plant is new and twelve months of data were not yet available. We do not expect any material seasonal influences on the plant's energy consumption. There could be a seasonal impact on water use, but we expect this to be minor. Furthermore, we expect that the data collected during those three months are more conservative than when the plant is fine-tuned and fully operational. This EPD will be updated later in 2020, when 12 months of data are available.

The additives are modelled using (conservative) proxy data. Since the only consumed inputs into the process are energy, water and additives, the additives have a substantial impact on the results for a number of key indicators (ozone layer depletion, acidification, eutrophication, photochemical oxidation and abiotic depletion (elements)). This is a potential limitation for the LCA results.

Electricity

Electricity used by the washing plant has been modelled on the Victorian state electricity grid. The current AusLCI process contains the 2017 grid mix and defines it as 83% brown coal, 6.5% hydropower, 6.5% wind, 2.6% photovoltaic, 0.6% natural gas and 0.8% other. The greenhouse gas intensity of electricity – after taking into account losses in distribution – is 0.319 kg CO_2e/MJ (= 1.15 kg CO_2e/kWh).

Life Cycle Assessment (LCA) Results

The results of the LCA (see Table 2 and Table 3) are presented as the aggregated value for modules A1-A3, based on the declared unit of *1 tonne of final products from waste washing processes (recovered mineral aggregates)*.

Table 2: Results: Environmental indicators

Environmental Indicator	Unit	Results (A1-A3)
Global Warming Potential (GWP)	kg CO_2 eq	16
Ozone Depletion Potential (ODP)	kg CFC-11 eq	4.3E-07
Acidification Potential (AP)	kg SO_2 eq	0.032
Eutrophication Potential (EP)	kg PO_4^{3-} eq	0.023
Photochemical Ozone Creation Potential (POCP)	kg C_2H_4 eq	0.0012
Abiotic Depletion Potential - Elements (ADPE)	kg Sb eq	2.1E-06
Abiotic Depletion Potential - Fossil Fuels (ADPF)	MJ	170

Table 3: Parameters describing resource use, waste and output flows

Parameter	Unit	Results (A1-A3)
Parameters describing resource use		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ_{NCV}	6.7
Use of renewable primary energy resources used as raw materials (PERM)	MJ_{NCV}	0
Total use of renewable primary energy resources (PERT)	MJ_{NCV}	6.7
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (PENRE)	MJ_{NCV}	170
Use of non-renewable primary energy resources used as raw materials (PENRM)	MJ_{NCV}	0
Total use of non-renewable primary energy resources (PENRT)	MJ_{NCV}	170
Use of secondary material (SM)*	kg	1,400*
Use of renewable secondary fuels (RSF)	MJ_{NCV}	0
Use of non-renewable secondary fuels (NRSF)	MJ_{NCV}	0
Use of net fresh water (FW)	m^3	0.23
Waste categories		
Hazardous waste disposed (HWD)	kg	0
Non-hazardous waste disposed (NHWD)*	kg	5.2*
Radioactive waste disposed (RWD)	kg	0
Output flows**		
Components for re-use (CRU)	kg	0
Materials for recycling (MFR)	kg	0
Materials for energy recovery (MER)	kg	0
Exported energy (EE)	MJ	0

** The input to the washing plant is currently around 1.4 tonnes of secondary material per tonne of saleable product. The centrifuge cake is the main flow that is currently not sold. As it is used on-site, it has not been counted under "non-hazardous waste disposed". Repurpose It expects to find a saleable application for this material in the near future (which would bring this value closer to 1 tonne of secondary input per tonne of saleable product). This value will be reviewed with the first update of the EPD.*

*** The output flow parameters are calculated on the gross amounts leaving the system boundary when they have reached the end-of-waste state. This is not relevant for the materials leaving the A1-A3 stage at Repurpose It.*

Additional environmental information

The materials that are treated on our site, have mostly been traditionally excavated or collected with the objective of disposal, therefore ending up their life cycle with the associated loss of potential resources. The main values of Repurpose It's processing are the diversion of materials from landfill - so they can be reused/recycled - and the removal of contaminants in soils. Therefore, associated benefits are:

- Extend the lifespan of the materials: This contributes to saving resources such as sands and aggregates, which are limited in terms of availability worldwide. Extraction of these materials has also associated potential environmental and social impacts (deforestation, emissions and loss of biodiversity, transport, etc.).
- Diversion from landfill: Capacity of landfills is limited and requires land occupation plus health, safety and environmental management. Landfill can also have social impacts in the neighbouring areas as well. The "2019 CSIRO Victorian Attitudes to Waste Management survey" shows residents held concerns about living near waste hubs. The least desirable aspect of waste hubs were landfills, and the highest concerns were about odour, illegal roadside dumping, dust, health impacts, and environmental impacts on air, soil and water.[1] In addition, there is a current crisis in terms of landfill disposal, with one of the major recycling agents being temporarily shut down by the Environment Protection Authority in Victoria. This has led to a significant increase in recyclable waste sent to landfill and not being recycled. This has put more pressure on the current landfills' limited capacity to accept waste in the state of Victoria.
- Potential reduction of transport: Repurpose It accepts local materials that are typically used on local construction projects. This means that there is no need to transport waste material to landfill and there is no need to cart in virgin materials from quarries (that are increasingly located further away from the Melbourne market.) These benefits are variable - project by project - and therefore not included in the values shown in this EPD.

Around 0.5% of our input material is litter (plastics and organics) that currently has to be disposed of in landfill. The LCA accounting rules stipulate that the emissions from landfill are part of the recovered aggregates' life cycle, which increases the carbon footprint of our product by around 4 kg CO_2e per tonne. However, if the C&D waste had gone to landfill, the emissions would have occurred regardless.

Our Partners

In recognition of our innovative approach and willingness to invest in industry-leading technology, Sustainability Victoria has issued us a grant of $500,000 for our project "Washing Plant" 460 Cooper Street.

[1] Source: 2019 CSIRO Victorian Attitudes to Waste Management survey. Accessed 18 February 2020: https://www.sustainability.vic.gov.au/-/media/SV/Publications/About-us/Research/Engaging-communities-on-waste/Changes-in-Victorian-attitudes-and-perceptions.pdf

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CEN 2013	EN 15804:2012+A1:2013, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products, European Committee for Standardization (CEN), Brussels, November 2013
Environdec 2018	PCR2012:01 (version 2.3), Product category rules according to ISO 14025 and EN 15804, Combined PCR and PCR Basic Module for Construction products and Construction services, registration number 2012:01, published on 15 November 2018
ISO 2006	ISO14025:2006, Environmental labels and declarations - Type III environmental declarations - Principles and procedures. International Organization for Standardization, Geneva, Switzerland, 2006
SA 2014	AS 2758.1:2014 Aggregates and rock for engineering purposes Part 1: Concrete aggregates, published in 2014 by Standards Australia, Sydney
SA 2015	AS 2758.7:2015 Aggregates and rock for engineering purposes Part 7: Railway ballast, published in 2015 by Standards Australia, Sydney

Explanation of the environmental indicators

Table 4: Explanation of the environmental indicators

Environmental Indicator	Description
Global Warming Potential	Global warming impact of greenhouse gases such as carbon dioxide (CO_2), measured in kg carbon dioxide (CO_2) equivalents using a global warming potential over a 100-year time horizon.
Ozone Depletion Potential	Relative impact that the product can cause to the stratospheric ozone layer, measured in kg trichlorofluoromethane (CFC-11) equivalents
Acidification Potential	Increase of soil and water acidity that the product can cause, measured in kg sulphur dioxide (SO_2) equivalents.
Eutrophication Potential	Potential impact of nutrification by nitrogen and phosphorus to aquatic and terrestrial ecosystems, for example through algal blooms, measured in kg phosphate (PO_4^{3-}) equivalents.
Photochemical Ozone Creation Potential	Also known as summer smog, the potential impact from oxidising of volatile compounds in the presence of nitrogen oxides (NO_x) which frees ozone in the low atmosphere, measured in kg ethene (C_2H_4) equivalents.
Abiotic Depletion Potential (Elements)	Depletion of scarce non-renewable resources such as metals, measured in kg antimony equivalents.
Abiotic Depletion Potential (Fossil Fuels)	Depletion of fossil fuel resources such as oil or natural gas, expressed using their net calorific value.

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