ENVIRONMENTAL PRODUCT DECLARATION

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AGGREGATES

Image © Tony Hewitt

In accordance with ISO 14025 and EN 15804:2012+A2:2019

EPD Registration no. S-P-05493 | Version 1.0
15 December 2022 | Valid to 15 December 2027
Geographical Scope: Western Australia

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.epd-australasia.com

BGC Quarries

AUSTRALASIA EPD ENVIRONMENTAL PRODUCT DECLARATION

ECO PLATFORM EPD VERIFIED

Aggregates for Commercial Construction:

Ready-Mix Footings and Floors, Precast and Hollowcore Panels, Retaining Walls, Landscaping.

Contents

BGC Quarries

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Building on 60 years of industry experience, BGC Quarries, a Western Australian owned company, is a major supplier of crushed aggregates to the civil engineering industry in the Perth metropolitan region.

These raw materials are essential inputs into a sustainable built environment with multiple applications including asphalt and roads; drainage and ballast; concrete panels, pavers, roof tiles and Ready-Mix; bricks and landscaping.

BGC Quarries has a commitment to our community and a passion for excellence in everything we do. We operate to the highest industry standards and maintain ISO 9001:2015 Quality Management, ISO 14001:2015 Environmental Management and ISO 45001:2018 Occupational Health and Safety Management Systems certifications. All of our products are tested to ensure we meet Australian Standards for the construction industry, so customers can be assured what we make will make the grade.

Aggregates

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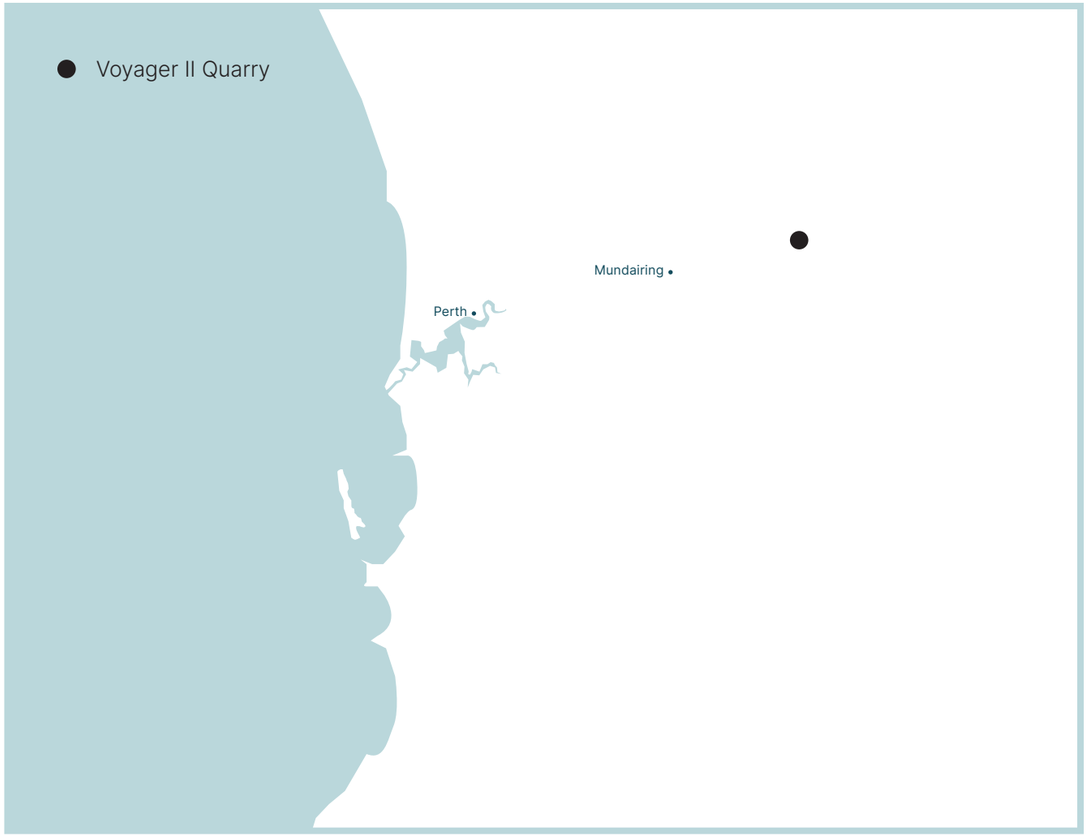
Our Location

BGC Quarries operates the Voyager II quarry located at The Lakes, 57 km east of Perth. Voyager II is a 90 million tonne resource and has been operating since 2010 with a remaining expected life of at least 40 years.

Figure 1: Location of the Voyager II quarry



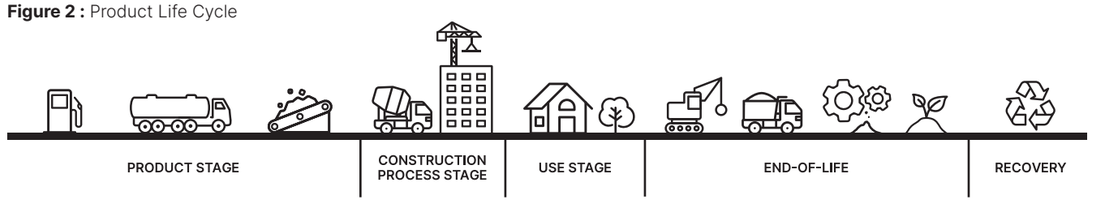
Product Life Cycle

Creating an EPD is an extensive process based on a set of Product Category Rules (PCR) and a Life Cycle Assessment (LCA). Environmental data, such as fuels and explosives (raw material) usage through to production of aggregates is evaluated, modelled, and then reported through an independently verified EPD.

This EPD is a “cradle-to-gate” declaration covering production of aggregates and their supply chain.

The construction process (modules A4-A5), use stages (B1-B7) and end-of-life modules (C1-C4 and D) have not been modelled as these are best modelled at the building or infrastructure project level given the vast and varied applications of aggregates. See S-P-05491 Ready-Mix Concrete and S-P-05492 Hollowcore Planks EPD’s for specific applications to C1-C4 & D.

Figure 2 : Product Life Cycle



Aggregates

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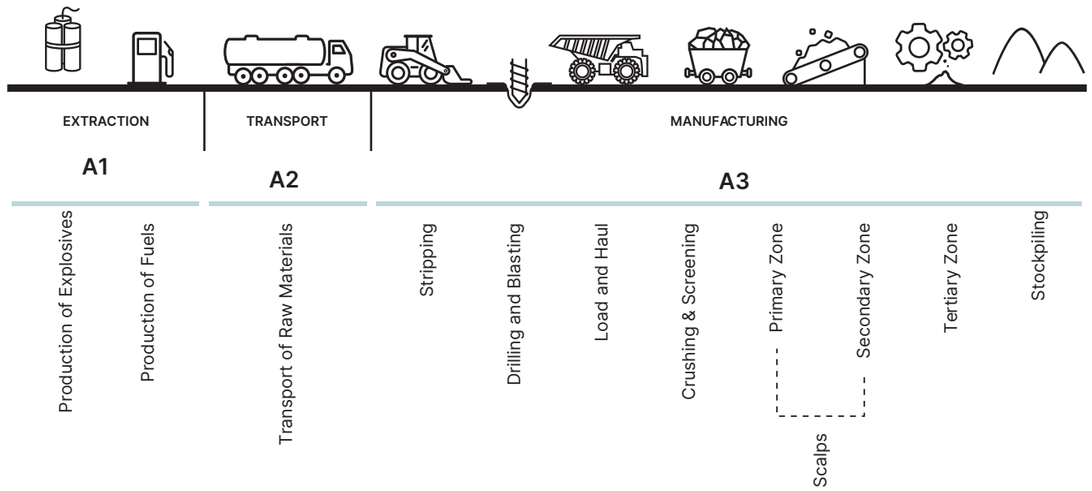
Aggregate Production

The quarry utilises a conventional three-phase process. This comprises of drilling and blasting, load and haul and then crushing and screening. After the rock has been blasted, it is loaded into dump trucks, which dump the fractured rock into the primary crusher.

A series of crushers and screens are then used to produce crushed rock aggregate of varying dimensions. The aggregate is then stockpiled and loaded onto road trucks using front-end loaders for transport to market. This EPD is a specific EPD for aggregates produced at a single quarry.

Figure 3 : Product Production Process



Product Application

Aggregates
Single sized aggregates between 5mm to 20mm, which can be washed or coated and blended as a series of single sized aggregates. Typically used for asphalt, roads, pavement sealing and concrete applications.

Crushed Rock Base Material
Cost effective base course alternative compliant with MRWA Specification 501 and also used by Local Government Authorities, Land Developers and under hard stands.

Road Base – Base Course
Graded coarse and fine aggregates typically used as base for roads and hard stands.

Quarry Sand
Fine (< 5mm) granite used in certain concrete blends, at horse arenas, under paving and as a fill material.

Spalls
Larger sized specialty rock of consistent size between 250mm to 600mm typically used for stabilisation applications.

Ballast
Larger sized specialty rock of consistent size between 20mm to 60mm used as drainage ballast.

Content Declaration -

Table 1: Product composition, per declared unit

Product Components	Mass, kg	Post-cosumer material, mass - %	Renewable material, mass - %
Granite Rock	1,000	0%	0%
Total	1,000	0%	0%

Aggregates do not contain any biogenic carbon.

The products included in this EPD do not contain any substances of very high concern as defined by European REACH regulation in concentrations >0.1% (m/m).

Industry Classification

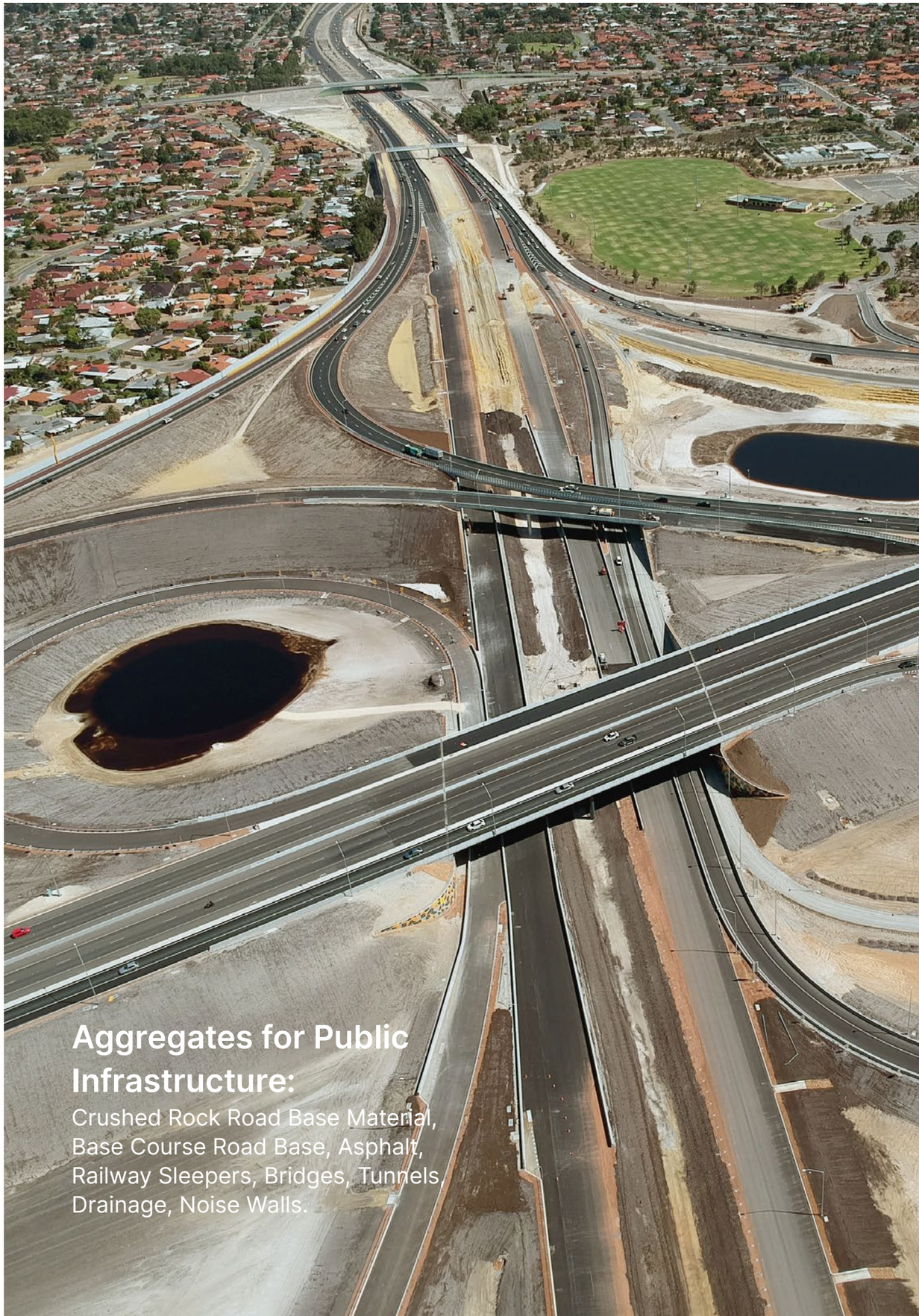
The UN CPC and ANZSIC Codes applicable to granite products are listed below.

UN CPC 15130 - Granite, sandstone and other monumental or building stone
ANZSIC 09190 – Granite quarrying

Declared Unit

1 tonne of aggregates (in bulk), as ordered by our clients.

The information contained in this EPD applies to bulk products (i.e. no packaging is used).



Technical Information

Technical Compliance

BGC Quarries does not simply supply aggregates. It provides innovative solutions based on local knowledge and experience. Our team consists of highly committed customer and quality focused members with over 80 years combined experience in all aspects of the construction industry.

BGC Quarries maintains an ISO 9001:2015 certified Quality System to ensure we meet Australian Standards for the construction industry. All of our products are tested at our onsite NATA accredited laboratory 20393 before they are released for sale. We maintain ISO 14001:2015 and work under rigorous environmental management plans approved by the Minister for the Environment which are publicly available via our website.

As climate change has motivated BGC Quarries and its customers to work towards a carbon neutral future, the publication of technical information via this EPD is an important step in this process. We support science-based research that will enable a lower environmental footprint and bring us closer to our goal of carbon neutral aggregates.

Our products achieve technical compliance with:

- AS 2758 Aggregates and rock for engineering purposes
- Main Roads Western Australia Specification 501.09 Crushed Rock Subbase
- Main Roads Western Australia Specification 501.07 Crushed Rock Basecourse
- Main Roads Western Australia Publication 6706-02-133 Water to be used in Pavement Construction

In addition, BGC's Hazelmere material recovery facility can supply virgin material alternatives which contribute to a circular economy for multiple cycles of use and re-use.

System Boundary

This EPD covers the cradle-to-gate life cycle stages (modules A1-A3). Downstream stages have not been included in this EPD as there are many applications for our quarry products. Please refer to BGC's Ready-Mix Concrete EPD for the specific application to downstream stages of aggregate in concrete (modules A1-A3, C1-C4 and D) and BGC's Hollowcore Planks EPD for the specific application to downstream stages of aggregate in precast hollowcore planks (A1-A3, C1-C4 and D). The modules declared, geographical scope, share of specific data (in GWP-GHG indicator) and data variation are shown in Table 2.

Table 2: Scope of EPD

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	✓	✓	✓	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geography	AU	AU	AU	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Specific data used	>90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-

✓: Module is declared
ND: Module is not declared

Product Stage

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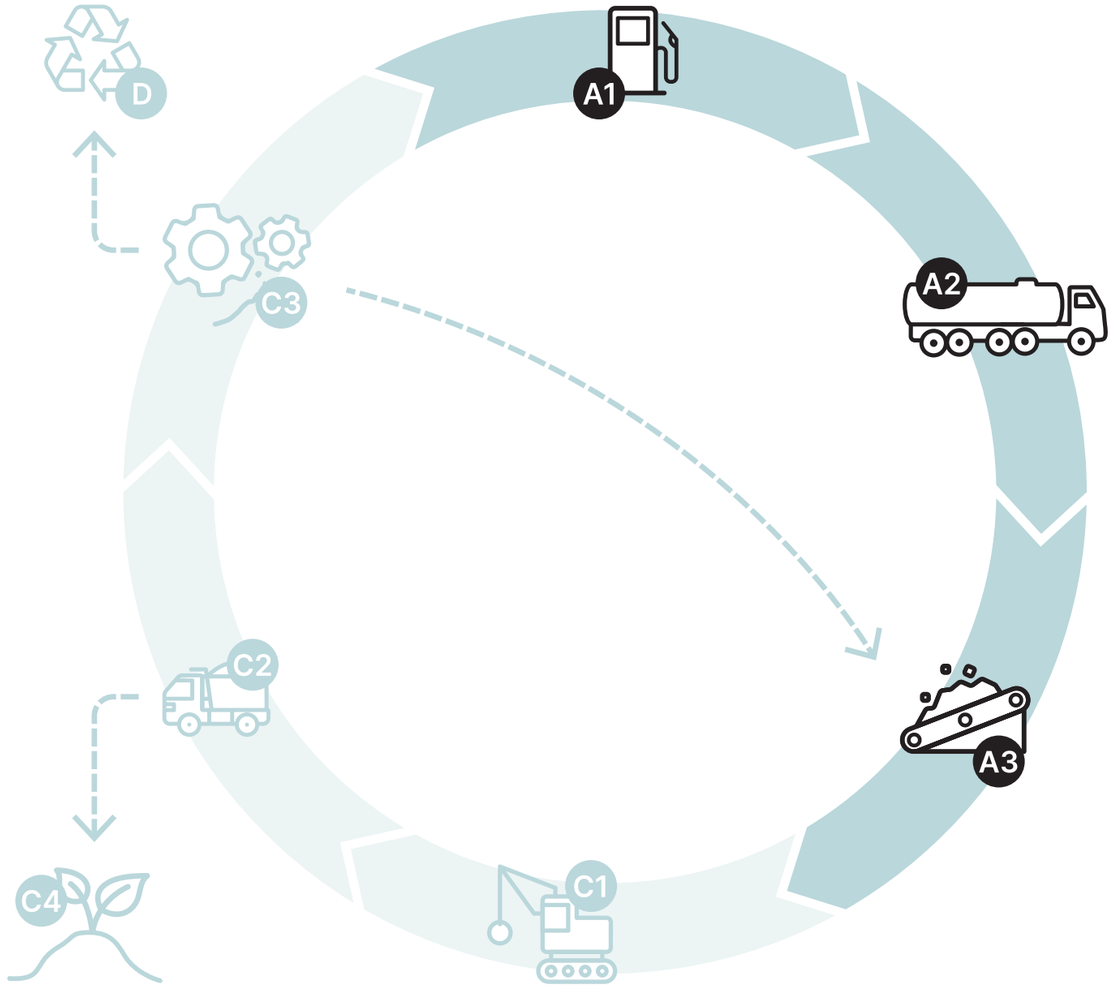
Figure 4: Product Stage and End-of-Life



A4-A5 and B1-B7 are excluded from the EPD and therefore not shown in this figure.
C1-C4 and D are excluded from this EPD as there are many applications of aggregates.

Product Stage (A1-A3)

Investigates the environmental impacts related to the manufacturing of aggregates before they leave the quarry.

A1 Raw Material Supply
Extraction and production of raw materials to produce fuels and explosives.

A2 Transportation
Transport of raw materials to the Voyager II quarry.

A3 Manufacturing
Manufacturing of aggregates begins with stripping, then drilling and blasting, load and haul, crushing and screening, and stockpiling.

End-of-Life (C1-C4 & D)

Investigates the environmental impacts related to the aggregates after they have reached the end of their useful life. While not part of the scope of this EPD, the circularity of aggregates is important. Refer to BGC's Ready-Mix Concrete EPD (S-P-05491) and Hollowcore Planks EPD (S-P-05492) for specific applications to C1-C4 and D.

C1 Demolition
Demolition of product containing aggregates.

C2 Transport
Transport of demolished product for processing or to landfill.

C3 Waste Processing
Processing of product containing aggregates.

C4 Disposal
Landfill of product containing aggregates.

D Resource Recovery Stage
Reuse, recovery, and recycling potential of the product after its end-of-life.

Life Cycle Assessment (LCA) Methodology

Background Data

BGC has collected and supplied the primary data for the aggregates LCA based on the FY21 reporting period (1 July 2020 – 30 June 2021). Background data (e.g. for explosives, energy and transport processes) have predominantly been sourced from AusLCI and the AusLCI shadow database (v1.36) (AusLCI 2021). Background data used are either less than 10 years old or have been reviewed within this period.

Methodological choices have been applied in line with EN 15804; deviations have been recorded.

Allocation

The key process that requires allocation is the shared production of aggregates:

- Aggregates are produced through crushing of rock, which is graded in different sizes. The energy required for the crushing and screening does not differentiate between products. Therefore, impacts are allocated to products (e.g. crushed rock, manufactured sand) based on the mass of product. In effect, all aggregates have the same environmental profile.

Cut-off Criteria

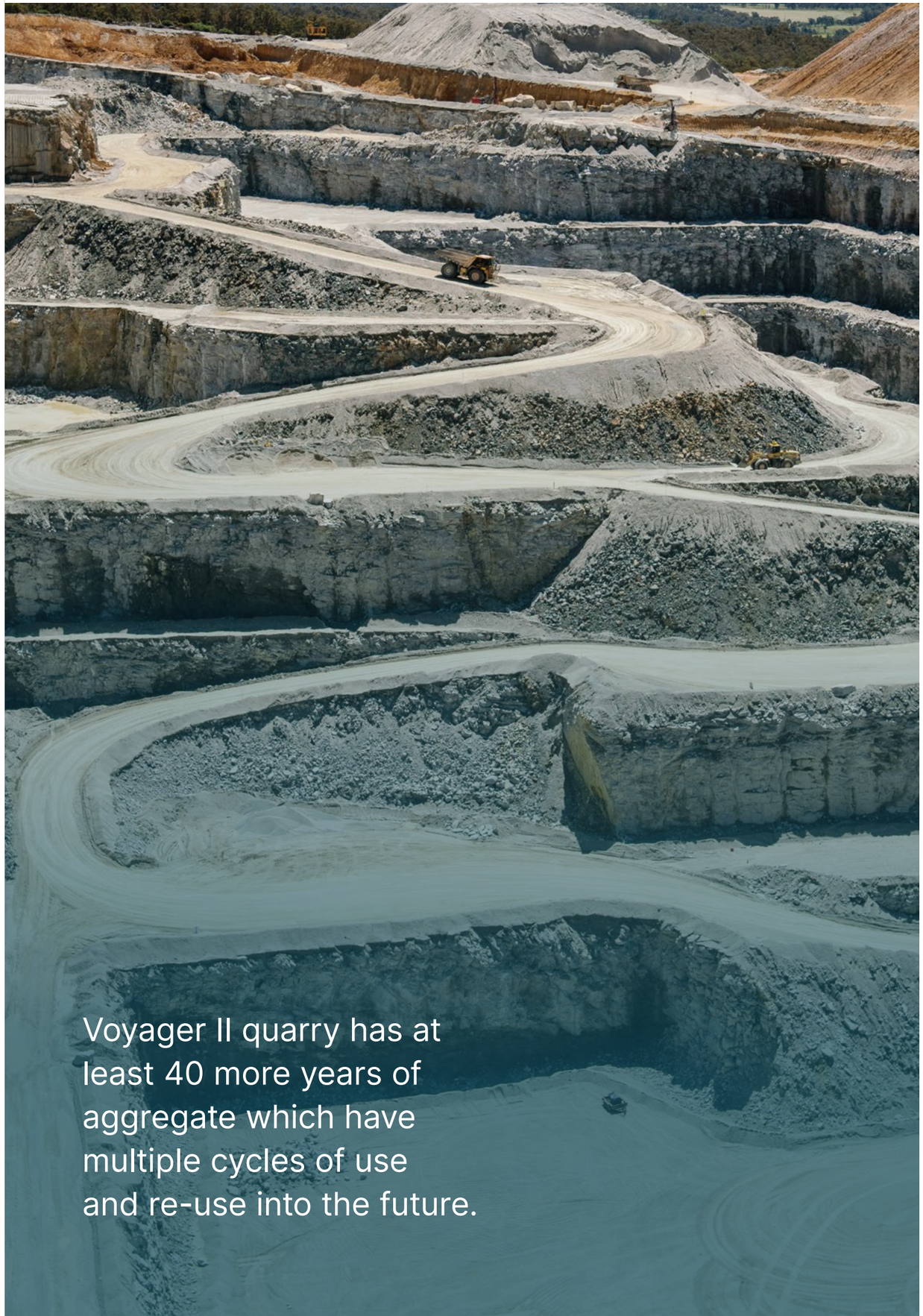
We have conducted a rigorous and robust LCA. The cut-off criteria applied are not more than 1% of non-renewable primary energy usage and not more than 1% of the total mass input of a process, while considering environmental impacts of small flows. We do however believe that detail counts, and we are counting it.

- The thermal expansion of diesel can be up to 2% in open, hot environments. Our electronic fuel management system has reconciled fuel use to within 0.45% of that invoiced by our fuel supplier.
- Although explosives make up less than 1% of material flows, they contribute 12% to the greenhouse gas emissions of our aggregates and have therefore been included.
- Greases, lubricants and welding gases used for maintenance of equipment have been included. The impact on the footprint of the aggregate products is 0.14% of our scope 1 greenhouse gas emissions footprint.
- The contribution of capital goods (production equipment and infrastructure) and personnel is excluded, as these processes are non-attributable and they contribute less than 10% to GWP-GHG.

Key Assumptions

The key choices and assumptions in the LCA are:

- Product allocation: All products coming out of the quarry are assigned the same impact on a per tonne basis. This is considered to be the most practical allocation approach.



Environmental Impact Indicators

An introduction to each environmental impact indicator is provided below, along with the best known cause and effect.

Global Warming Potential (GWP)
Is due to the heat absorbed by greenhouse gases, causing the rise of the global temperature.

Photochemical Smog (POCP)
Is due to a mixture of pollutants which includes volatile organic compounds, particulates, nitrogen oxides and ozone. It's harmful to human health (causing lung irritation problems, coughing and wheezing) and the environment (damage to plants and crops).

Acidification Potential (AP)
Is due to emissions of acids, causing the degradation of materials such as metals, limestone and concrete, and damage to trees and life in lakes and rivers.

Abiotic Resource Depletion (ADP)
Is due to extraction and consumption of non-renewable resources such as oil, coal and metals, causing a decrease in future availability of functions supplied by these resources.

Eutrophication Potential (EP)
Is due to emissions of nutrients, causing blooms of algae. The degradation of dead algae consumes oxygen leading to the loss of plants and animals.

Ozone Depletion Potential (ODP)
Is due to emissions which destroy the ozone layer causing higher levels of UV light to reach earth which damages DNA in humans, animals and plants.

Water Deprivation Potential (WDP)
Is due to water availability versus demand. The less water remaining per area, the more likely another user will be deprived.

Life Cycle Assessment (LCA) Results

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Environmental Profiles for Aggregates

The background LCA serves as the foundation for this EPD. A LCA analyses the environmental processes in the value chain of a product. It provides a comprehensive evaluation of all upstream (and sometimes downstream) material and energy inputs and outputs. The results are provided for a range of environmental impact categories, in line with EN 15804:2012+A2:2019.

Table 3: Potential environmental impacts – mandatory indicators according to EN 15804:2012+A2:2019

Indicator	Abbreviation	Units	Total A1-A3
Global Warming Potential - total	GWP-total	kg CO_2-eq.	4.96
Global Warming Potential - fossil fuels	GWP-fossil	kg CO_2-eq.	4.95
Global Warming Potential - biogenic	GWP-biogenic	kg CO_2-eq.	1.22E-02
Global Warming Potential - land use and land use change	GWP-luluc	kg CO_2-eq.	1.67E-04
Depletion Potential of the Stratospheric Ozone Layer	ODP	kg CFC-11-eq.	5.24E-07
Acidification potential	AP	mol H^+-eq.	4.42E-02
Eutrophication potential - freshwater	EP-freshwater	kg P-eq.	8.09E-06
Eutrophication potential - marine	EP-marine	kg N-eq.	1.65E-02
Eutrophication potential - terrestrial	EP-terrestrial	mol N-eq.	1.86E-01
Formation potential of tropospheric ozone	POCP	kg NMVOC-eq.	4.91E-02
Abiotic depletion potential for non-fossil resources*	ADP-minerals & metals	kg Sb-eq.	7.95E-08
Abiotic depletion potential for fossil resources	ADP-fossil	MJ	56.1
Water (user) deprivation potential	WDP	m^3world-eq.deprived	4.95

*Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

Table 4: Potential environmental impacts – additional indicators according to EN 15804:2012+A2:2019

Indicator	Abbreviation	Units	Total A1-A3
Particulate Matter emissions	PM	Disease incidence	1.02E-06
Ionising Radiation - human health **	IRP	kBq U-235-eq.	2.15E-03
Eco-toxicity - freshwater*	ETP-fw	CTUe	17.1
Human toxicity potential - cancer effects*	HTP-c	CTUh	3.23E-10
Human toxicity potential - non-cancer effects*	HTP-nc	CTUh	2.46E-08
Land use related impacts / soil quality*	SQP	dimensionless	118

* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.
** Disclaimer: This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Table 5: Carbon footprint in line with Australian climate change reporting frameworks

Indicator	Abbreviation	Units	Total A1-A3
Global Warming Potential - Greenhouse Gas emissions	GWP-GHG	kg CO_2-eq.	4.89

The GWP-GHG indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product as defined by IPCC AR5 (IPCC 2013). This indicator is determined using IPCC AR5 Global Warming Potentials (GWP) with a 100-year time horizon.

Table 6: Use of Resources

Indicator	Abbreviation	Units	Total A1-A3
Use of renewable primary energy excluding renewable primary energy	PERE	MJ	1.35E+00
Use of renewable primary energy resources used as raw materials	PERM	MJ	0.00E+00
Total use of renewable primary energy resources	PERT	MJ	1.35E+00
Use of non-renewable primary energy excluding non-renewable primary	PENRE	MJ	6.91E+01
Use of non-renewable primary energy resources used as raw materials	PENRM	MJ	0.00E+00
Total use of non-renewable primary energy resources	PENRT	MJ	6.91E+01
Use of secondary material	SM	kg	0.00E+00
Use of renewable secondary fuels	RSF	MJ	0.00E+00
Use of non-renewable secondary fuels	NRSF	MJ	0.00E+00
Net use of fresh water	FW	m^3	2.08E-01

Table 7: Waste Production

Indicator	Abbreviation	Units	Total A1-A3
Hazardous waste disposed	HWD	kg	0.00E+00
Non-hazardous waste disposed	NHWD	kg	3.37E-03
Radioactive waste disposed	RWD	kg	0.00E+00

Table 8: Output Flows

Indicator	Abbreviation	Units	Total A1-A3
Components for re-use	CRU	kg	0.00E+00
Materials for recycling	MFR	kg	1.18E-02
Materials for energy recovery	MER	kg	0.00E+00
Exported energy - electrical and thermal	EE	MJ	0.00E+00

Table 9: Potential environmental impacts – mandatory indicators according to EN 15804:2012+A1:2013

Indicator	Abbreviation	Units	Total A1-A3
Global warming potential	GWP	kg CO_2-eq.	4.91
Ozone depletion potential	ODP	kg CFC-11-eq.	4.14E-07
Acidification potential	AP	kg SO_2-eq.	2.76E-02
Eutrophication potential	EP	kg PO_4^{3-}-eq.	6.08E-03
Photochemical ozone creation potential	POCP	kg C_2H_4-eq.	3.02E-03
Abiotic depletion potential for non-fossil resources	ADPE	kg Sb-eq.	7.97E-08
Abiotic depletion potential for fossil resources	ADPF	MJ	65.8

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 as they enable transparency and comparability between EPDs. This EPD provides environmental indicators for aggregates produced by BGC Quarries at its Voyager II quarry in Perth, Western Australia. This EPD is a “cradle-to-gate” declaration covering production of aggregates and their supply chain.

This EPD is verified to be compliant with EN 15804+A2. 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 standards or PCRs may not be comparable.

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

Declaration Owner	BGC Quarries	BGC Quarries	Address: 1881 Great Southern Hwy, The Lakes, WA 6556 Web: www.bgc.com.au/bgc-quarries Phone: 08 9572 6088 Email: quarrywb@bgc.com.au
EPD Program Operator	AUSTRALASIA EPD ENVIRONMENTAL PRODUCT DECLARATION	EPD Australasia Limited	Address: 315a Hardy St, Nelson 7010, New Zealand Web: www.epd-australasia.com Phone: 02 8005 8206 Email: info@epd-australasia.com
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CEN standard EN 15804:2012+A2:2019 served as the core PCR	
PCR:	PCR 2019:14 Construction Products, Version 1.11, 2021-02-05 (valid until 2024-12-20)
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Claudia A. Peña Contact via info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	◯ EPD process certification (Internal) ⊘ EPD verification (External)
Procedure for follow-up of data during EPD validity involves third-party verifier:	◯ Yes ⊘ No

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Contact Information

Contact your BGC Quarries Representative today for more information

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