



# POLARIS MATERIALS AGGREGATES



## Environmental Product Declaration

This document is a product-specific Type III Environmental Product Declaration (EPD) for three concrete aggregate products manufactured by Polaris Materials Corporation at the Orca Sand and Gravel Ltd. facility located in Port McNeill, BC, Canada.

## General information

### Environmental Product Declaration

This Environmental Product Declaration (EPD) reports the impacts for 1 US ton (dry weight) aggregates, for use in business-to-business (B2B) in accordance with ISO 14025, ISO 21930, and ASTM International's EPD program operator rules.

Product Name	Construction Aggregates
Manufacturer Name and Address	Polaris Materials Corporation Suite 2740, 1055 West Georgia Street, PO Box 11175 Vancouver, BC V6E 3R5 Canada
Program Operator	ASTM International <a href="http://www.astm.org/EPDs.htm">http://www.astm.org/EPDs.htm</a> 
General Program instructions and Version Number	ASTM Program Operator for Product Category Rules (PCRs) and Environmental Product Declarations (EPDs), General Program Instructions. Version 8.0, revised April 29, 2020.
Declaration Number	EPD 734
Reference PCR and Version Number	ISO 21930:2017 Sustainability in Building Construction – Environmental Declarations of Building Products serves as the core PCR. Product Category Rule for Environmental Product Declarations: Construction Aggregates – NSF/ASTM 1126-23 V2.0
EPD Type and Scope (facility/product/average)	Type III EPD Cradle-to-gate (modules A1 to A3) Facility specific
Defined functional or declared unit	1 US Ton of aggregate
Product's intended Application and Use	This EPD is intended for business-to-business (B-to-B) audiences.
Product RSL (Reference Service Life) *	Not Applicable (B modules not included in scope)
Markets of Applicability	United States and Canada
Date of Issue	August 01, 2024
Period of Validity	Five years – until July 31, 2029
Year of reported manufacturer primary data	January 1st, 2023, to December 31st, 2023
LCA Software and Version Number	Simapro 9.1
LCI Database and Version Number	USLCI, SmartData, Construction Aggregates – NSF/ASTM 1126-23 Annex A V2.0

LCIA Methodology and Version Number	TRACI 2.1 v1.04
Overall Data Quality Assessment Score	1.8
The sub-category PCR review was conducted by:	Industrial Ecology Consultants, Thomas P. Gloria, Ph.D t.gloria@industrial-ecology.com
This declaration was independently verified in accordance with ISO 14025: 2006. ISO 21930:2017 serves as the core PCR. Sub-category PCR: NSF/ASTM 1126: Construction Aggregates Product Category Rule	<input type="checkbox"/> Internal <input checked="" type="checkbox"/> External
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	Nawal Shoaib nawal@climateearth.com Climate Earth, Inc. 137 Park Place, Suite 204, Point Richmond, CA, 94801 (415) 391-2725 • <a href="http://www.climateearth.com">http://www.climateearth.com</a>
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas P. Gloria, PhD <a href="mailto:t.gloria@industrial-ecology.com">t.gloria@industrial-ecology.com</a> Industrial Ecology Consultants 35 Bracebridge Rd. Newton, MA 02459-1728 (617) 553-4929 <a href="http://www.industrial-ecology.com">http://www.industrial-ecology.com</a>
Explanatory material may be obtained from the following:	Ken Sears, FACI Manager, Southern California Sales & Technical Innovation 909-925-9624 searsk@vmcmail.com
*Only applicable where the LCA/EPD includes Module B.	



Products covered in this facility average EPD are detailed in Table 1. All products contain 100% construction aggregate.

**Table 1: Products manufactured at the Orca Quarry**

Product Name	Product Description	ASTM Standard	Images
<b>#57 Gravel</b>	A 1" aggregate which has 100% passing the 1 1/2" sieve and 95-100% passing the 1" sieve. Typically used as a concrete aggregate and may be used in other applications. Also known as ASTM C 33 #57 aggregate.	ASTM C33	
<b>#7 Gravel</b>	A 1/2" aggregate which has 100% passing the 3/4" sieve and 90-100% passing the 1/2" sieve. Typically used as a concrete aggregate and may be used in other applications. Also known as ASTM C 33 #7 aggregate.	ASTM C33	
<b>WCS</b>	A washed sand that has 100% passing the 3/8" sieve with 95-100% passing the #4 sieve. Used for ready mix applications and may be used in other applications. Conforms to ASTM C 33.	ASTM C33	

# LCA Study

## System boundary

This study captures the following mandatory cradle-to-gate (A1-A3) life cycle product stages (as illustrated in Figure 1):

- A1 - Extraction and processing of raw materials including fuels used in extraction and transport within the process;
- A2 – Specific transportation of raw materials from extraction site or source to manufacturing site (including any recovered materials from source to be recycled in the process) and including empty backhauls and transportation to interim distribution centers or terminals.
- A3 – Manufacturing of the product, including all energy and materials required and all emissions and wastes produced.

Product Stage			Construction Process Stage		Use Stage							End of Life Stage			
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
Raw material supply	Transport	Manufacturing	Transport	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

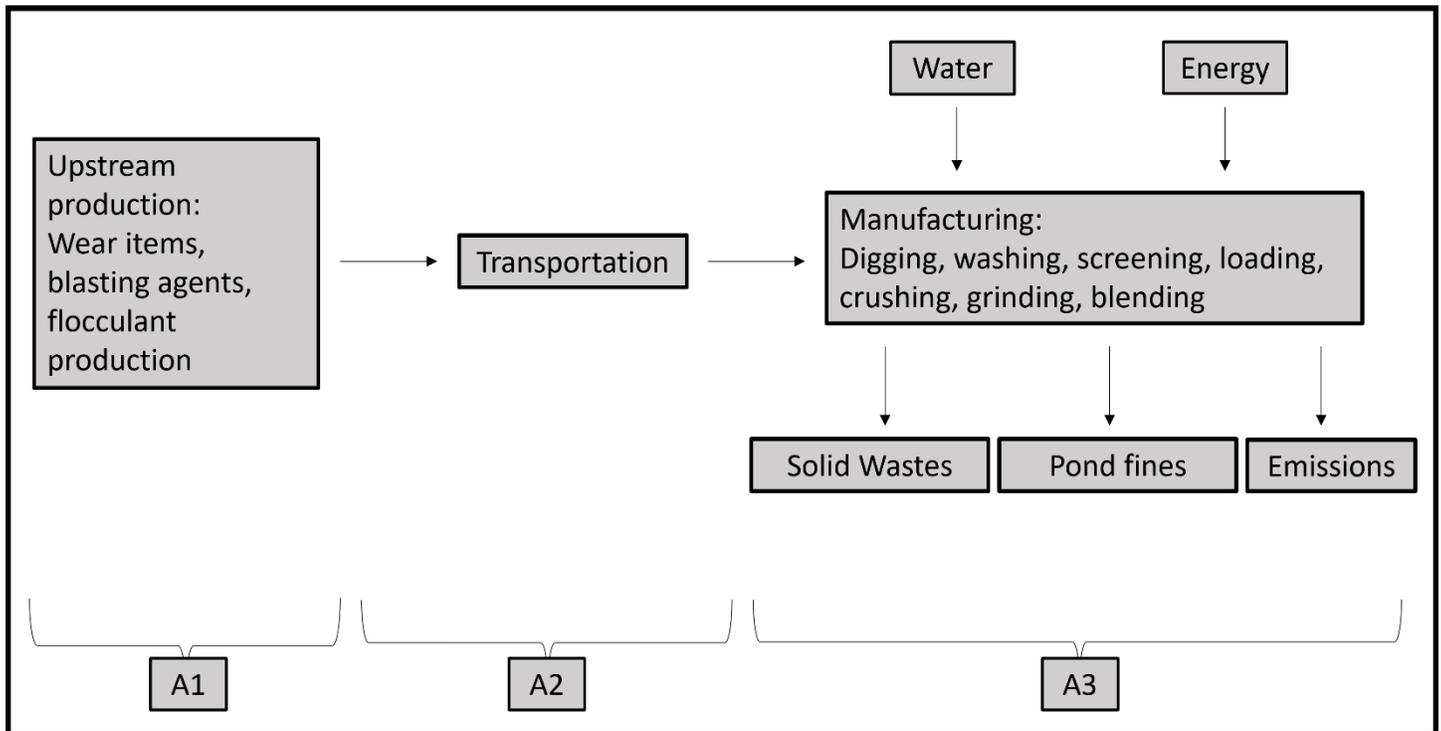
**Figure 1. Life-Cycle Stages and Modules (Note: MND = module not declared; x = module included)**

Except as noted above, all other life cycle stages as described in Figure 1 are excluded from the LCA study. The following processes are also excluded from the study:

1. Production, manufacture, and construction of manufacturing capital goods and infrastructure;
2. Production and manufacture of production equipment, delivery vehicles, and laboratory equipment;
3. Personnel-related activities (travel, furniture, office supplies);
4. Fuel used to transport personnel around the mine and sand & gravel facility.
5. Energy and water use related to company management and sales activities.

The main processes included in the system boundary are illustrated in Figure 2.

# System Boundary



**Figure 2. Main Processes Included in System Boundary**

Explanatory materials may be requested by contacting:

Ken Sears, FACI  
Manager, Southern California  
Sales & Technical Innovation  
909-925-9624  
searsk@vmcmail.com

## Secondary data sources

A list of each secondary with its LCI data sources is provided below.

Diesel: USLCI process (2020): “Diesel, combusted in industrial equipment - Northern America”

Electricity: EcoInvent 3.8 (2021): “Electricity, high voltage {CA-BC}| market for | Cut-off, U”

Electricity for Long Beach and Richmond Terminals: U.S. DOE NETL (2020)

Electricity for Hawaii Terminal: EPA (2022): Hawaii Interconnection

Flocculants: EcoInvent 3.8 (2021): “(Polyacrylamide {GLO}| market for | Cut-off, U”

Gasoline: USLCI process (2020): “Gasoline\_\_combusted\_in\_equipment\_\_RNA”

Lubricating oil: US-EI process (2021): “Lubricating oil, at plant/US”

Manganese: NSF PCR for Construction Aggregates (2022): “Manganese”

Propane: USLCI process (2020): “Operation of liquefied petroleum gas equipment; industry average; > 56 kW and < 560 kW”

Truck Transport: USLCI process (2020): “Transport, combination truck, long-haul, diesel powered/West”

Tires: US-EI process (2021): “Synthetic rubber, at plant/US- US-EI U”

Steel wear parts: US-EI process (2021): “Steel, low-alloyed, at plant/US- US-EI U” and “Steel, low-alloyed {RoW}| steel production, electric, low-alloyed | Cut-off, U”

Waste: EcoInvent 3.8 (2021): “Municipal solid waste {RoW}| treatment of, sanitary landfill | Cut-off, U”

## Data gaps, assumptions, and limitations

Electrical data collected for this plant included the entire plant. Some of the electricity reported may not be used directly in the production of the above mentioned products at Orca Quarry. Dry and Liquid flocculants are modelled as Polyacrylamide as proprietary information about the flocculants is unavailable.

Electrical, water, and diesel data for the terminals is allocated to all the products brought into the ports. Long Beach and Richmond use NETL data balancing authorities for the background data while Hawaii terminal uses EPA (EPA, 2022) Hawaii Interconnection resource mix.

## Environmental Impacts

Cradle to Gate (A1-A3) facility average impact results per 1 US ton (short ton, TN.SH) for construction aggregates produced at Orca Quarry (see Table 1) are outlined in Table 2.

**Table 2: Cradle-to-Gate Impact Results for Orca Quarry Covered in Study per 1 US ton**

Impact category	Unit	A1	A2	A3	A1 to A3
Global warming	kg CO2 eq	0.17	0.04	0.97	1.18
Ozone depletion	kg CFC-11 eq	2.01E-08	1.77E-12	2.30E-08	4.31E-08
Eutrophication	kg N eq	1.25E-03	2.94E-05	1.95E-03	3.23E-03
Acidification	kg SO2 eq	3.86E-03	4.91E-04	9.91E-03	1.43E-02
Smog	kg O3 eq	5.59E-03	0.01	0.33	3.46E-01
Abiotic depletion non-fossil mineral	kg Sb eq	1.55E-06	x	9.89E-09	1.56E-06
Abiotic depletion (fossil fuels)	MJ	2.58	0.60	12.7	15.89
Renewable primary energy resources as energy	MJ	0.09	x	7.08	7.17
Renewable primary resources as material	MJ	x	x	x	x
Non-renewable primary resources as energy	MJ	2.75	0.60	13.2	16.58
Non-renewable primary resources as material	MJ	x	x	x	x
Consumption of fresh water	m3	2.77E-03	x	0.12	0.13
Secondary materials	kg	x	x	x	x
Renewable secondary fuels	MJ	x	x	x	x
Non-renewable secondary fuels	MJ	x	x	x	x
Recovered energy	MJ	x	x	x	x
Hazardous waste disposed	kg	x	x	x	x
Non-hazardous waste disposed	kg	x	x	7.98E-03	7.98E-03
High-level radioactive waste	m3	8.99E-11	x	2.23E-10	3.12E-10
Intermediate and low-level radioactive waste	m3	6.36E-10	x	2.21E-09	2.84E-09
Components for reuse	kg	x	0	0	0
Materials for recycling	kg	x	x	0.02	0.02
Materials for energy recovery	kg	x	x	3.23E-03	3.23E-03
Recovered energy exported from product system	MJ	x	x	x	x
Calcination	kg CO2 eq	x	x	x	x
Biogenic CO2 emissions	kg CO2 eq	x	x	x	x

This EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers or programs, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the construction works level per ISO 21930:2017 guidelines. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis.

Cradle to Gate (A1-A3) facility average impact results per 1 metric tonne for construction aggregates produced at Orca Quarry (see Table 1) are outlined in Table 3

**Table 3: Cradle-to-Gate Impact Results for Orca Quarry Covered in Study per 1 metric tonne**

Impact category	Unit	A1	A2	A3	A1 to A3
Global warming	kg CO2 eq	0.18	0.05	1.07	1.30
Ozone depletion	kg CFC-11 eq	2.21E-08	1.95E-12	2.54E-08	4.75E-08
Eutrophication	kg N eq	1.38E-03	3.24E-05	2.15E-03	3.56E-03
Acidification	kg SO2 eq	4.25E-03	5.41E-04	1.09E-02	1.57E-02
Smog	kg O3 eq	6.16E-03	0.01	0.36	3.82E-01
Abiotic depletion non-fossil mineral	kg Sb eq	1.71E-06	x	1.09E-08	1.72E-06
Abiotic depletion (fossil fuels)	MJ	2.84	0.66	14.0	17.51
Renewable primary energy resources as energy	MJ	0.09	x	7.81	7.90
Renewable primary resources as material	MJ	x	x	x	0
Non-renewable primary resources as energy	MJ	3.04	0.66	14.6	18.28
Non-renewable primary resources as material	MJ	0	x	x	x
Consumption of fresh water	m3	3.05E-03	x	0.13	0.14
Secondary materials	kg	x	x	x	x
Renewable secondary fuels	MJ	x	x	x	x
Non-renewable secondary fuels	MJ	x	x	x	x
Recovered energy	MJ	x	x	x	x
Hazardous waste disposed	kg	x	x	x	x
Non-hazardous waste disposed	kg	x	x	8.80E-03	8.80E-03
High-level radioactive waste	m3	9.91E-11	x	2.45E-10	3.44E-10
Intermediate and low-level radioactive waste	m3	7.01E-10	x	2.43E-09	3.13E-09
Components for reuse	kg	x	x	x	x
Materials for recycling	kg	x	x	0.03	0.03
Materials for energy recovery	kg	x	x	3.56E-03	3.56E-03
Recovered energy exported from product system	MJ	x	x	x	x
Calcination	kg CO2 eq	x	x	x	x
Biogenic CO2 emissions	kg CO2 eq	x	x	x	x

This EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers or programs, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the construction works level per ISO 21930:2017 guidelines. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis.

Cradle to Gate (A1-A3) plus transportation to the mentioned terminals impact results per 1 US ton (TN.SH) are outlined in Table 4 below.

**Table 4: Cradle to Gate (A1-A3) plus transportation to the mentioned terminals impacts per 1 US ton (TN.SH)**

Impact category	Unit	Long Beach, LA	Richmond, CA	Barbers Point, Oahu, HI
Global warming	kg CO2 eq	10.28	8.21	22.75
Ozone depletion	kg CFC-11 eq	2.13E-06	1.64E-06	4.80E-06
Eutrophication	kg N eq	1.61E-02	1.26E-02	0.03
Acidification	kg SO2 eq	3.94E-01	3.08E-01	0.85
Smog	kg O3 eq	7.67E+00	5.99E+00	16.44
Abiotic depletion non-fossil mineral	kg Sb eq	7.85E-09	6.33E-09	1.67E-08
Abiotic depletion (fossil fuels)	MJ	133.17	103.03	295.4
Renewable primary energy resources as energy	MJ	0.13	0.10	1.19
Renewable primary resources as material	MJ	x	x	x
Non-renewable primary resources as energy	MJ	134.12	103.77	297.5
Non-renewable primary resources as material	MJ	x	x	x
Consumption of fresh water	m3	0.82	0.64	1.85
Secondary materials	kg	x	x	x
Renewable secondary fuels	MJ	x	x	x
Non-renewable secondary fuels	MJ	x	x	x
Recovered energy	MJ	x	x	x
Hazardous waste disposed	kg	x	x	x
Non-hazardous waste disposed	kg	x	x	x
High-level radioactive waste	m3	4.89E-10	3.82E-10	1.08E-09
Intermediate and low-level radioactive waste	m3	2.36E-09	1.84E-09	5.20E-09
Components for reuse	kg	x	x	x
Materials for recycling	kg	x	x	x
Materials for energy recovery	kg	x	x	x
Recovered energy exported from product system	MJ	x	x	x
Calcination	kg CO2 eq	x	x	x
Biogenic CO2 emissions	kg CO2 eq	x	x	x

This EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers or programs, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the construction works level per ISO 21930:2017 guidelines. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis.

Cradle to Gate (A1-A3) plus transportation to the mentioned terminals impact results per 1 metric tonne (tonne) are outlined in Table 4 below.

**Table 5: Cradle to Gate (A1-A3) plus transportation to the mentioned terminals impacts per 1 metric tonne (tonne)**

Impact category	Unit	Long Beach, LA	Richmond, CA	Barbers Point, Oahu, HI
trGlobal warming	kg CO2 eq	11.33	9.06	25.08
Ozone depletion	kg CFC-11 eq	2.35E-06	1.81E-06	5.29E-06
Eutrophication	kg N eq	0.02	1.39E-02	0.04
Acidification	kg SO2 eq	0.43	3.40E-01	0.94
Smog	kg O3 eq	8.45	6.60E+00	18.12
Abiotic depletion non-fossil mineral	kg Sb eq	8.65E-09	6.98E-09	1.84E-08
Abiotic depletion (fossil fuels)	MJ	146.8	113.58	325.6
Renewable primary energy resources as energy	MJ	0.15	0.12	1.32
Renewable primary resources as material	MJ	x	x	x
Non-renewable primary resources as energy	MJ	147.8	114.39	328.0
Non-renewable primary resources as material	MJ	x	x	x
Consumption of fresh water	m3	0.91	0.70	2.04
Secondary materials	kg	x	x	x
Renewable secondary fuels	MJ	x	x	x
Non-renewable secondary fuels	MJ	x	x	x
Recovered energy	MJ	x	x	x
Hazardous waste disposed	kg	x	x	x
Non-hazardous waste disposed	kg	x	x	x
High-level radioactive waste	m3	5.39E-10	4.21E-10	1.19E-09
Intermediate and low-level radioactive waste	m3	2.60E-09	2.03E-09	5.73E-09
Components for reuse	kg	x	x	x
Materials for recycling	kg	x	x	x
Materials for energy recovery	kg	x	x	x
Recovered energy exported from product system	MJ	x	x	x
Calcination	kg CO2 eq	x	x	x
Biogenic CO2 emissions	kg CO2 eq	x	x	x

This EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers or programs, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the construction works level per ISO 21930:2017 guidelines. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis.

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