iPLEX Pipelines

EPD - PE PIPES

Environmental Product Declaration
Polyethylene PE 100 & PE 100 Mobile Extrusion

ECO PLATFORM EPD EN 15804 VERIFIED

AUSTRALASIA EPD®

Environmental Product Declaration
Produced under the Australasian EPD Programme in Accordance with ISO 14025 and EN15804:2012+A1:2013.

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The Iplex® vision is to be the leading manufacturer and supplier of plastic building materials in New Zealand.

GENERAL COMPANY INFORMATION

Iplex Pipelines NZ is one of New Zealand's leading manufacturers of plastic pipeline systems. Iplex NZ is a wholly owned subsidiary of Fletcher Building Ltd with manufacturing facilities in Palmerston North, Christchurch and Ashburton

Iplex NZ manufactures plastic pipeline systems for a range of industry sectors including civil, rural, plumbing rainwater, and energy & communications.

In addition to StandardsMark™ third party product certification to Australasian Standard AS/NZS 4130, (Licence SMKP 20400), all Iplex NZ operations are conducted under a quality management system, accredited by SAI Global to ISO 9001, Licence QEC 4169.

Iplex NZ also participates in the Toitū Enviromark programme which requires a robust environmental management system at the manufacturing facilities.

EPDs within the same product category from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804. The EPD owner has the sole ownership, liability, and responsibility for the EPD.

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PRODUCT DESCRIPTION

Iplex PE100 (Poliplex®) and Iplex PE100 Mobile Extrusion

Iplex PE100 Poliplex® (here after known as Iplex PE100), and Iplex PE100 Poliplex® - Mobile Extrusion (hereafter known as Iplex Mobile Extrusion), are manufactured from fully pre compounded PE100 resins, complying to AS/NZS 4131, and listed on PIPA POP004.

Iplex PE100 pipe applications include bulk water transmission, distribution and reticulation, pressure sewers, mining and slurry lines, and trenchless installations for pipeline renewal, replacement or renovation. For buried applications, Iplex PE100 pipe is supplied with colour identification jackets or stripes to indicate the fluid or service type being conveyed. Iplex PE100 pipe sizes range from DN20 to DN710.

TECHNICAL INFORMATION

TABLE 1 - PRODUCT CHARACTERISTICS OF PE PRESSURE PIPES	
PRODUCT NAMES	Iplex Poliplex®
POLYETHYLENE MATERIAL TYPE	PE100
UN CPC CODE	3632
MINIMUM REQUIRED STRENGTH (50 YEAR @20°C)	10 MPa
FLEXURAL YIELD STRENGTH	32 MPa
CIRCUMFERENTIAL FLEXURAL MODULUS (3 MINUTE)	950 MPa
CIRCUMFERENTIAL FLEXURAL CREEP MODULUS (50 YEAR)	260 MPa
DENSITY	955 kg/m³
TENSILE YIELD STRESS (50MM/MIN)	25 MPa
TENSILE YIELD STRAIN (50MM/MIN)	10%
TENSILE MODULUS	900 MPa
POISSON'S RATIO	0.4
THERMAL EXPANSION COEFFICIENT	0.18 mm/m K
THERMAL CONDUCTIVITY	0.38 W/m K

INDUSTRY CLASSIFICATION

TABLE 2 - Product	Classification	Code	Category
Iplex PE100 pipe	UN CPC Ver.2	36230	Tubes, pipes and hoses, and fittings therefore, of plastics
	ANZSIC 2006	19120	Rigid and Semi-Rigid Polymer Product Manufacturing
Iplex Mobile Extrusion	UN CPC Ver.2	369	Other plastics products
	ANZSIC 2006	19120	Rigid and Semi-Rigid Polymer Product Manufacturing

From storage silos, the PE100 resin granulate is pneumatically transferred to the extruders where a portion of selected internally sourced PE100 pipe rework material is fed back into the feed mix to be utilised in production. Through a combination of friction and heat, the resin is brought up to the ideal temperature for extrusion, at which point it is forced through an annular die to form a pipe. The newly formed pipe is then cooled by refrigerated water while passing though a vacuum sizing sleeve. Pipe wall thickness is continuously monitored, and controlled with the computerised haul-off speed which also controls the saw which cuts the pipe at predetermined lengths.

Finally, the lengths of pipe are either packed in crates, coiled, or stored as loose lengths. The softwood timber used in crates is a NZ grown exotic species, and not a NZ native, it contains no treatment or preservative chemicals and is biodegradable..

This production phase is captured in A3. Machine consumables, water use, and disposal of waste and wastewater is taken into account.

PRODUCT COMPOSITION

The pipes investigated are manufactured from fully pre-compounded PE100 resin granulate, containing additives to introduce desirable properties such as stability, durability and colouration. A content declaration is indicated in Table 3 as per EN15804 requirements.

None of the products in this EPD contain hazardous materials identified in the European Chemicals Agency's Candidate List of Substances of Very High Concern (ECHA, 2020) at a concentration of greater than 0.1% of the mass.

TABLE 3 - CONTENT DECLARATION			
Material	**PE100**	**PE100 (mobile)**	**CAS number**
PE100 polyethylene granulate	✓	✓	9002-88-4
Pigment	✓	✓	Various (non-hazardous)

DESCRIPTION OF MANUFACTURING PROCESS

Iplex PE100 pipes are made from fully precompounded PE100 resin sourced from offshore production facilities and delivered via container ship to New Zealand. The PE100 resin is then delivered to the Iplex manufacturing sites by road transport and transferred into storage silos.

From the silos, the PE100 resin granulate is pneumatically transferred to the extruders where a portion of selected internally sourced PE100 pipe rework material is fed back into the feed mix to be utilised in production. Through a combination of friction and heat, the resin is brought up to the ideal temperature for extrusion, at which point it is forced through an annular die to form a pipe. The newly formed pipe is then cooled by refrigerated water while passing though a vacuum sizing sleeve. Pipe wall thickness is continuously monitored, and controlled with the computerised haul off speed, that also controls the saw which cuts the pipe at predetermined lengths.

Finally, the lengths of pipe are either packed in crates, coiled, or stored as loose lengths. The softwood timber used in crates is a NZ grown exotic species, and not a NZ native, it contains no treatment or preservative chemicals and is biodegradable.The Iplex PE100 pipe is manufactured in Palmerston North, Christchurch and Ashburton.

DISTRIBUTION

Iplex PE100 pipes are transported via road directly to the construction site or to reselling merchants. Finished products are typically distributed from the production facility closest to the customers' site (subject to availability and production runs).

IPLEX MOBILE EXTRUSION

Iplex Mobile Extrusion is a modular container based production facility that can be mobilised & relocated directly onto larger infrastructure projects. The mobile extrusion plant contains a single extrusion line manufacturing a wide range of PE100 plain, striped & jacketed options. Iplex Mobile Extrusion also operates as a fixed plant at its Ashburton base when not required off site.

SYSTEM BOUNDARIES

The life cycle of a building product is divided into three process modules according to the General Program Instructions (GPI) of the Australasian EPD Programme (AEPDP, 2015) and four information modules according to ISO 21930 and EN 15804 and supplemented by an optional information module on potential loads and benefits beyond the building life cycle. As shown in the table below, this EPD is of the 'cradle-to-gate' with options. The options include end-of-life processing (Modules C3-C4) and recycling potential (Module D). Use phase modules were deemed to be irrelevant for this study as Iplex's PE100 pipes rarely require any maintenance during the service life.

TABLE 4 - SYSTEM BOUNDARIES

Product Stage			Construction Process Stage		Use Stage							End-of-Life-Stage				Recovery Stage
Raw material supply	Transport	Manufacturing	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport	Waste processing	Disposal	Future reuse, recycling or energy recovery potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

(X = declared module; MND = module not declared)

ASSUMPTIONS

Key modelling assumptions used to formulate this EPD are described in the following sections. Note that not all assumptions used in this LCA study are included in this EPD document.

Product stage

Iplex PE100 pipes are manufactured from precompounded PE100 resin and pigments using a commercial extruder. Manufacturing can be performed at one of Iplex's 3 New Zealand sites in Palmerston North, Ashburton, or Christchurch. Alternatively, the Iplex Mobile Extrusion plant can be utilised which allows pipes to be manufactured on site for large infrastructure projects. PE100 pipe produced at fixed sites and at mobile sites are considered separately because the differences in construction transport (A4) was expected to have a notable influence on impact results. Electricity is sourced from the grid at fixed plants, whereas for mobile plants, diesel generators are used.

The PE100 granulate comes from Thailand. PE100 production and sourcing from India was used as a geographical proxy for Thailand due to an absence of background data. The background dataset 'IN: Polyethylene high density granulate (HDPE/PE-HD)' from Sphera was used to model the PE100 resin.

The electricity used in the manufacturing of Iplex PE100 pipe comes from the New Zealand national grid. The Sphera owned dataset 'NZ: Electricity grid mix' was used.

ASSUMPTIONS

Installation

Iplex PE100 pipes are usually installed below ground. The pipe is available in a variety of lengths typically from 12 m straight lengths to coils that are hundreds of metres long (size limitations apply). Iplex PE100 pipe systems utilise welded joints and as such results in long continuous lengths of pipeline that can take advantage of trenchless installation techniques (e.g. pipe cracking, slip lining and directional drilling). Iplex PE100 pipes are also installed using typical open trench options and is mostly used for pressure applications or non-pressure applications where installation to grade is not required (for example in communications applications).

In this EPD a deliberately conservative approach to installation has been adopted where the installation conditions will reflect the open trench technique. An excavated open-cut trench is prepared by a 15-kW diesel excavator. The trench width and depth vary between pipe size and type. Diesel consumption from excavators governs most of the environmental burden for the installation phase and is strongly correlated to the required size of the trench. For this EPD, a 110mm diameter Iplex PE100 pipe with a pressure rating (PN) of 12.5 was used. LCA results for the installation phase are only valid for an Iplex PE100 pipe matching these dimensions but can be used as a conservative estimate for larger pipes.

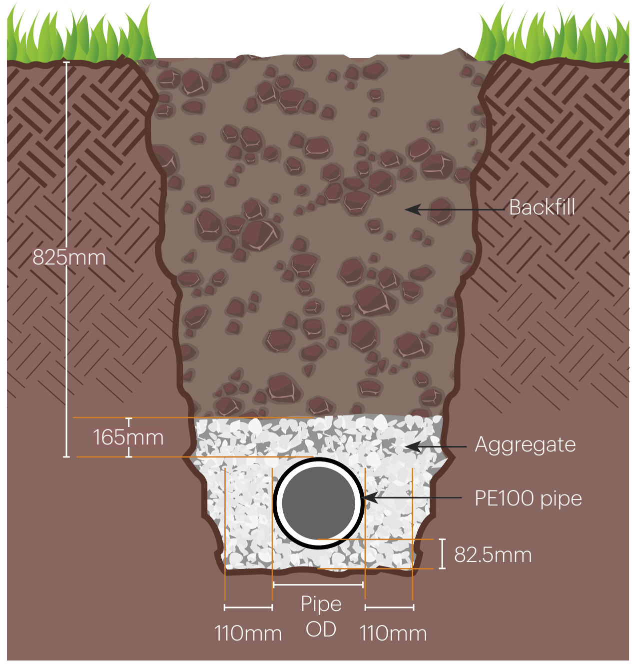

Fig. 1 Typical Open Cut Trench Application
(this more conservative method has been used for modelling in this EPD)

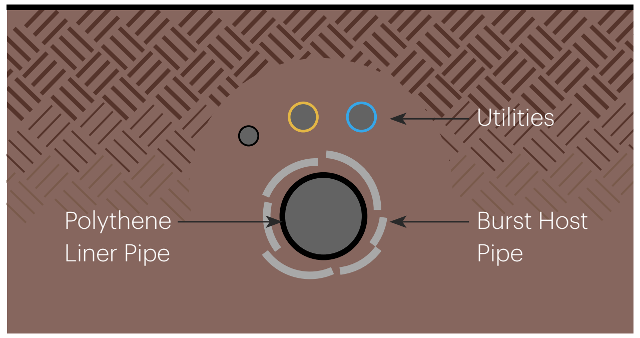

Fig. 2 Typical Trenchless Application
(this method provides additional efficiencies; however it has not been used in the modelling of this EPD)

Trench dimensions follow minimum requirements plus 10 percent of the Australasian-based standard AS/NZS 2033: Installation of PE pipe systems (Standards New Zealand, 2016). Dimensions are presented in Figure 1. The length of the trench per kilogram of pipe is 376mm, corresponding to a mass per linear meter of 2.66 kg/m (for a DN110 pipe). The impacts of open-cut installations have been modelled based on the consumption of diesel by a 15kW excavator used to excavate the trench. Aggregate was used to partially refill the trench and provide side support to the pipe in compliance with AS/NZS 2033. Upstream impacts of aggregate production were modelled using the dataset 'BR: Crushed rock 16-32 mm' from Sphera. The remainder of the trench was backfilled with the previously excavated soil.

The joints for Iplex PE100 pipes are almost always welded - butt fusion being the most used technique. Specified welding parameters are nominated in a PIPA document POP003 Butt Fusion Jointing of PE Pipes and Fittings (PIPA, 2011). Wastage of pipe is minimal and is estimated that unusable offcuts account for less than 1%. Electrofusion joints may also be used to fix Iplex PE100 pipe ends together, however, this was not included in the results as it is used far less often in industry.

ASSUMPTIONS

Transport

Distribution transport was calculated using a weighted average of product deliveries to regions around New Zealand. The average distance for delivery of Iplex PE100 pipe from Palmerston North or Christchurch sites was 346 km. As pipe is produced onsite for Iplex Mobile Extrusion, the distribution distance for Iplex Mobile Extrusion pipe is 0 km.

Transport distances of aggregate used for mobile set up and backfilling will also vary depending on installation location, so a distance from quarry to site of 50km was assumed.

End of Life and Recovery and Recycling Potential

Iplex PE100 pipes are generally installed underground and tend to remain there at the end-of-life. The pipes are inert and there is no incentive to dig them up to send for recycling. Therefore, extraction, transport, and end-of-life treatment (C1-4) was assumed to be negligible. PE100 pipes are not economically viable for reuse or recycling, so the same assumption applies for recovery and recycling potential (Module D).

Image 1. Truck transporting Iplex PE 100 straight lengths

LIFE CYCLE INVENTORY

The life cycle inventory (LCI) is a step in the life cycle assessment methodology that draws together all relevant inputs and output flows for a product system. The inventory is built to simulate the process of producing Iplex PE100 pipes by accounting for operations that fall under the modules specified within the system boundaries according to EN15804. A system diagram for the LCI used in this study is shown in Figure 3.

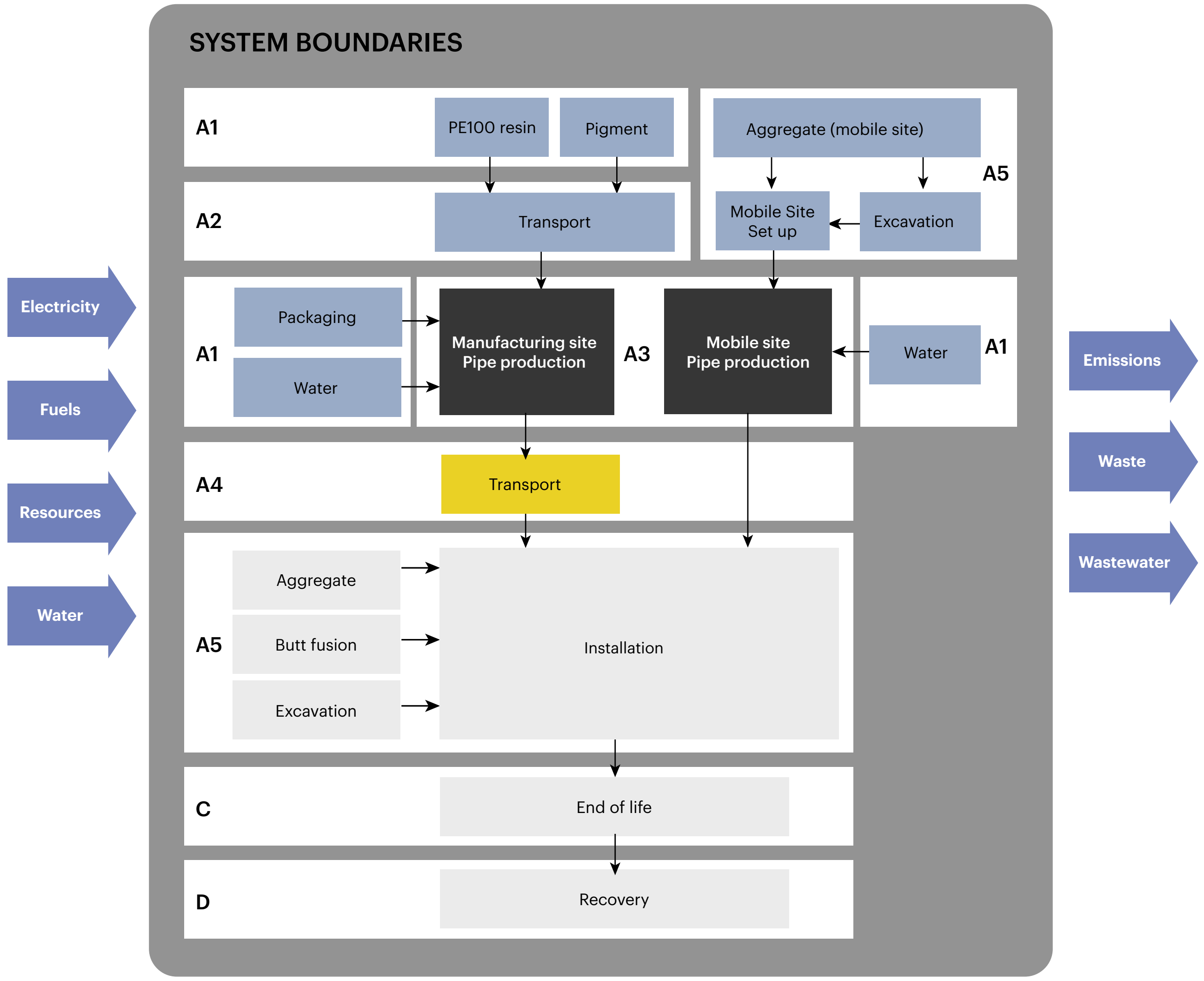

Fig. 3 System boundaries diagram

LIFE CYCLE ASSESSMENT METHODOLOGY

Declared unit

The product covered in this study is Iplex's PE100 pipe, used for a variety of functions within the construction sector such as for civil, rural, plumbing, energy & communications.

The declared unit is for 1kg of pipe and its packaging installed and then decommissioned. Impacts due to maintenance, repair and operation are excluded due to their negligible contribution to the overall impacts. Table 5 provides further details on product characteristics.

This EPD and the underlying LCA comply with the following standards:

- PCR 2012:01 Construction Products and Construction Services, Version 2.3 (EPD International, 2020)
- Instructions of the Australasian EPD Programme v3.0 (EPD Australasia, 2018)
- The International EPD System General Programme Instructions (GPI) v3.01 (EPD International, 2019)
- ISO standards on Life Cycle Assessment (ISO 14040, 2006) (ISO 14044, 2006)

TABLE 5 - DETAILS OF LCA

Product Characteristics	
Declared unit	1 kg of installed pipeline
Geographical coverage	New Zealand
LCA scope	Cradle to gate with options
Reference service life	100 years

Product categories

Two sets of results are presented in this document, corresponding to the two product categories referenced in the industry classification section. Product categories are required by EN 15804 to have results differing by no more than 10% to be amalgamated into a single set of results. Product category details are included in Table 6.

TABLE 6 - PRODUCT CATEGORY DETAILS

Product Category Name	Category details
Iplex PE100	Wide range of infrastructure applications. This product category is exclusively for pipes produced at Iplex's fixed manufacturing sites.
Iplex Mobile Extrusion	PE100 pipe manufactured at the installation site via the Iplex Mobile Extrusion plant.

LIFE CYCLE ASSESSMENT METHODOLOGY

Data for core processes

Primary life cycle information has been sourced from material quantity data and production process data from Iplex's reporting systems and staff. Primary data for Iplex's operations was sourced for a 12-month period from 1 July 2019 to 30 June 2020.

All data in the background system was from the GaBi Life Cycle Inventory Database 2020 (Sphera, 2020). Most datasets have a reference year between 2016 and 2019 and all fall within the 10 year limit allowable for generic data under EN 15804.

The PE100 resin comes from Thailand. Iplex's PE supplier exclusively uses ethylene derived from naphtha. As no data is available for PE granulate production in Thailand, the background dataset 'IN:Polyethylene high density granulate (HDPE/PE-HD)' from Sphera is used. India is an appropriate geographical proxy for Thai polyethylene production because the dataset uses naphtha-derived ethylene, and India is close to Thailand geographically.

Sphera's dataset 'BR: Crushed rock 16-32mm' is used as a proxy for production of aggregate that is used in installation (Module A5). The inclusion of this dataset provides explains why 'Renewable primary energy as energy carrier' (and subsequently 'Total use of renewable primary energy resources') and 'Use of net fresh water' are higher than would otherwise be expected from open trench pipeline installation.

Cut off criteria

Environmental impacts related to personnel, such as employee commuting, and infrastructure that is not directly consumed in the product's life cycle are excluded from the system. Data was modelled using the best available life cycle inventory data.

Allocation

Mass allocation is applied for manufacturing and installation life cycle stages. Allocation of background data (energy and materials) is specified in the GaBi documentation library (Sphera, 2021).

Explanation of average products and variation

For Iplex PE100 pipes, this EPD represents an average of Iplex's sites in Christchurch and in Palmerston North. Flow quantities are weighted by the annual product output from each site. The Iplex Mobile Extrusion is based on the sole mobile site operating in New Zealand during the data collection period, in Ashburton.

Image 2. Iplex Mobile Extrusion Plant

ENVIRONMENTAL IMPACT CATEGORY

The potential environmental impact categories, and references for the source of their characterisation factors, included in this EPD are described in the table below. See the References section for full details on characterisation methods. Life cycle inventory indicator results are also included in the EPD, but do not require characterisation factors for calculation.

TABLE 7 ENVIRONMENTAL IMPACT CATEGORY DESCRIPTIONS

Environmental Impact	Description	Unit	Reference
Global Warming Potential (GWP100)	A measure of greenhouse gas emissions, such as CO2 and methane. These emissions are causing an increase in the absorption of radiation emitted by the earth, increasing the natural greenhouse effect. This may in turn have adverse impacts on ecosystem health, human health and material welfare.	kg CO2 equivalent	(IPCC, 2013)
Abiotic Resource Depletion (ADP elements, ADP fossil)	The consumption of non-renewable resources leads to a decrease in the future availability of the functions supplied by these resources. Depletion of mineral resources and non-renewable energy resources are reported separately. Depletion of mineral resources is assessed based on ultimate reserves.	kg Sb equivalent, MJ (net calorific value)	(van Oers, de Koning, Guinée, & Huppes, 2002)
Eutrophication Potential	Eutrophication covers all potential impacts of excessively high levels of macronutrients, the most important of which nitrogen (N) and phosphorus (P). Nutrient enrichment may cause an undesirable shift in species composition and elevated biomass production in both aquatic and terrestrial ecosystems. In aquatic ecosystems increased biomass production may lead to depressed oxygen levels, because of the additional consumption of oxygen in biomass decomposition.	kg PO43- equivalent	(Guinée, et al., 2002)
Acidification Potential	A measure of emissions that cause acidifying effects to the environment. The acidification potential is a measure of a molecule's capacity to increase the hydrogen ion (H+) concentration in the presence of water, thus decreasing the pH value. Potential effects include fish mortality, forest decline and the deterioration of building materials.	kg SO2 equivalent	(Guinée, et al., 2002)
Photochemical Ozone Creation Potential (POCP)	A measure of emissions of precursors that contribute to ground level smog formation (mainly ozone O3), produced by the reaction of VOC and carbon monoxide in the presence of nitrogen oxides under the influence of UV light. Ground level ozone may be injurious to human health and ecosystems and may also damage crops.	kg C2H4 equivalent	(Guinée, et al., 2002)
Ozone Depletion Potential (ODP)	A measure of air emissions that contribute to the depletion of the stratospheric ozone layer. Depletion of the ozone leads to higher levels of UVB ultraviolet rays reaching the earth's surface with detrimental effects on humans and plants.	kg CFC-11 equivalent	(Guinée, et al., 2002)

EPD RESULTS - IPLEX PE100 PIPE

TABLE 8 - EPD RESULTS FOR 1KG OF PE100 PIPE

		Production	Distribution	Installation	Deconstruction	Waste Transport	Processing	Disposal	Recovery
Environmental Impact	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential (total)	kg CO_2-eq.	1.98	0.0405	1.41	0	0	0	0	0
Depletion potential of the stratospheric ozone layer	kg CFC11-eq.	2.06E-15	7.27E-18	1.06E-15	0	0	0	0	0
Acidification potential of land and water	kg SO_2-eq.	0.0120	8.64E-05	0.00637	0	0	0	0	0
Eutrophication potential	kg PO_4^{3-}-eq.	0.00104	1.84E-05	0.00114	0	0	0	0	0
Photochemical ozone creation potential	kg C_2H_4-eq.	0.00103	-2.44E-05	2.31E-04	0	0	0	0	0
Abiotic depletion potential – elements	kg Sb-eq.	1.37E-07	5.04E-10	1.00E-07	0	0	0	0	0
Abiotic depletion potential – fossil fuels	MJ	71.8	0.544	15.5	0	0	0	0	0
Resource use	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Renewable primary energy as energy carrier	MJ	5.74	0.00356	7.60	0	0	0	0	0
Renewable primary energy resources as material utilization	MJ	0	0	0	0	0	0	0	0
Total use of renewable primary energy resources	MJ	5.74	0.00356	7.60	0	0	0	0	0
Non-renewable primary energy as energy carrier	MJ	44.6	0.545	16.0	0	0	0	0	0
Non-renewable primary energy as material utilization	MJ	27.4	0	0	0	0	0	0	0
Total use of non-renewable primary energy resources	MJ	72.0	0.545	16.0	0	0	0	0	0
Use of secondary material	kg	0	0	0	0	0	0	0	0
Use of renewable secondary fuels	MJ	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels	MJ	0	0	0	0	0	0	0	0
Use of net fresh water	m^3	0.0183	5.09E-06	0.0378	0	0	0	0	0
Waste categories and output flows	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	1.40E-08	3.31E-11	6.26E-09	0	0	0	0	0
Non-hazardous waste disposed	kg	0.0111	1.27E-05	0.0354	0	0	0	1.00	0
Radioactive waste disposed	kg	6.13E-05	5.77E-08	1.89E-04	0	0	0	0	0
Components for re-use	kg	0	0	0	0	0	0	0	0
Materials for recycling	kg	0	0	0	0	0	0	0	0
Materials for energy recovery	kg	0	0	0	0	0	0	0	0
Exported electrical energy	MJ	0	0	0	0	0	0	0	0
Exported thermal energy	MJ	0	0	0	0	0	0	0	0

EPD RESULTS - IPLEX MOBILE EXTRUSION

TABLE 9 - EPD RESULTS FOR 1KG OF PE100 - IPLEX MOBILE EXTRUSION

		Production	Distribution	Installation	Decon strution	Waste Transport	Processing	Disposal	Recovery
Environmental Impact	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential (total)	kg CO_2-eq.	1.95	0	1.53	0	0	0	0	0
Depletion potential of the stratospheric ozone layer	kg CFC11-eq.	1.43E-15	0	1.20E-15	0	0	0	0	0
Acidification potential of land and water	kg SO_2-eq.	0.0118	0	0.00699	0	0	0	0	0
Eutrophication potential	kg PO_4^{3-}-eq.	0.00100	0	0.00124	0	0	0	0	0
Photochemical ozone creation potential	kg C_2H_4-eq.	0.00102	0	1.77E-04	0	0	0	0	0
Abiotic depletion potential – elements	kg Sb-eq.	1.11E-07	0	1.15E-07	0	0	0	0	0
Abiotic depletion potential – fossil fuels	MJ	70.7	0	17.7	0	0	0	0	0
Resource use	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Renewable primary energy as energy carrier	MJ	0.779	0	8.73	0	0	0	0	0
Renewable primary energy resources as material utilization	MJ	0	0	0	0	0	0	0	0
Total use of renewable primary energy resources	MJ	0.779	0	8.73	0	0	0	0	0
Non-renewable primary energy as energy carrier	MJ	43.4	0	18.2	0	0	0	0	0
Non-renewable primary energy as material utilization	MJ	27.4	0	0	0	0	0	0	0
Total use of non-renewable primary energy resources	MJ	70.9	0	18.2	0	0	0	0	0
Use of secondary material	kg	0	0	0	0	0	0	0	0
Use of renewable secondary fuels	MJ	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels	MJ	0	0	0	0	0	0	0	0
Use of net fresh water	m^3	0.00730	0	0.0433	0	0	0	0	0
Waste categories and output flows	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	1.14E-08	0	7.12E-09	0	0	0	0	0
Non-hazardous waste disposed	kg	0.0102	0	0.00419	0	0	0	1.00	0
Radioactive waste disposed	kg	5.69E-05	0	2.17E-04	0	0	0	0	0
Components for re-use	kg	0	0	0	0	0	0	0	0
Materials for recycling	kg	0	0	0	0	0	0	0	0
Materials for energy recovery	kg	0	0	0	0	0	0	0	0
Exported electrical energy	MJ	0	0	0	0	0	0	0	0
Exported thermal energy	MJ	0	0	0	0	0	0	0	0

PIPE CONVERSION TABLES

The table below is a comparison of mean OD dimensions and minimum weights per metre of pipe. They allow the designer to perform calculations for pipe diameters other than the baseline size of DN110.

TABLE 10 - PE100 WEIGHT PER LINEAL METRE - PIPE DIMENSIONS TO AS/NZS 4130 SERIES 1

SDR	41	26	21	17	13.6	11	9	7.4
PN	4	6.3	8	10	12.5	16	20	25
PE100	Weight kg/m	Weight kg/m	Weight kg/m	Weight kg/m	Weight kg/m	Weight kg/m	Weight kg/m	Weight kg/m
20	-	-	-	-	0.10	0.11	0.13	0.16
25	-	-	-	0.12	0.14	0.17	0.20	0.24
32	-	-	0.16	0.19	0.23	0.27	0.33	0.39
40	-	-	0.24	0.30	0.36	0.43	0.52	0.61
50	-	-	0.38	0.46	0.55	0.67	0.80	0.95
63	-	0.48	0.58	0.73	0.88	1.07	1.25	1.50
75	-	0.68	0.83	1.03	1.23	1.49	1.79	2.13
90	-	0.99	1.20	1.48	1.77	2.16	2.59	3.05
110	0.95	1.48	1.80	2.20	2.66	3.20	3.84	4.57
125	1.24	1.86	2.30	2.80	3.42	4.15	4.96	5.88
140	1.56	2.35	2.87	3.52	4.29	5.17	6.23	7.39
160	2.02	3.08	3.77	4.59	5.60	6.78	8.11	9.62
180	2.51	3.84	4.74	5.81	7.10	8.58	10.26	12.16
200	3.08	4.76	5.87	7.16	8.71	10.57	12.68	15.00
225	3.90	5.98	7.42	9.09	11.06	13.39	16.00	19.02
250	4.89	7.41	9.08	11.14	13.63	16.46	19.73	23.48
280	6.06	9.25	11.46	13.99	17.08	20.64	24.80	29.44
315	7.62	11.78	14.40	17.72	21.64	26.13	31.38	37.16
355	9.69	14.89	18.28	22.55	27.43	27.16	39.76	47.24
400	12.28	18.88	23.31	28.50	34.79	42.10	50.55	59.92
450	15.49	23.87	29.48	36.11	44.07	53.31	63.90	75.92
500	19.28	29.45	36.37	44.48	54.38	65.78	89.86	POA
560	24.00	36.91	45.52	55.89	68.22	82.40	98.93	POA
630	30.37	46.77	57.50	70.62	86.23	104.42	125.20	-
710	38.65	59.45	73.22	89.82	109.55	132.64	159.13	-

REFERENCES

ECHA (2020). Candidate List of Substances of Very High Concern for Authorisation. Helsinki: European Chemicals Agency.

EN 15804:2012+A1:2013. Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products. Brussels: European Committee for Standardization.

EPD Australasia. (2018). Instructions of the Australasian EPD Programme v3.01. www.epd-australasia.com.

EPD Australasia. (2019) General Programme Instructions for the International EPD System. Version 3.01. Retrieved from International EPD System.

EPD International. (2020). PCR 2012:01 Construction products and construction services, version 2.33. EPD International.

Guinée, J. B., Gorrée, M., Heijungs, R., Huppes, G., Kleijn, R., de Koning, A., . . . Huijbregts, M. (2002). *Handbook on life cycle assessment. Operational guide to the ISO standards*. Dordrecht: Kluwer.

IPCC. (2013). *Climate Change 2013: The Physical Science Basis*. Geneva, Switzerland: IPCC.

ISO 14040:2006. Environmental management – Life cycle assessment – Principles and framework. Geneva: International Organization for Standardization.

ISO 14044:2006. Environmental management – Life cycle assessment – Requirements and guidelines. Geneva: International Organization for Standardization

Sphera. (2021). GaBi LCI Data Documentation library. Retrieved from gabi-software.com.

Sphera. (2020). GaBi Life Cycle Inventory Database.

PIPA (Plastics Industry Pipe Association of Australia Ltd) issues the publication titled - Industry Guidelines POP004 Polyethylene Pipe & Fittings Compounds – Issue 26/ September 2021.

van Oers, L., de Koning, A., Guinée, J. B., & Huppes, G. (2002). *Abiotic resource depletion in LCA*. The Hague: Ministry of Transport, Public Works and Water Management.

ADDITIONAL INFORMATION

Toitū Environmark Gold - Iplex was awarded gold certification on 15 April 2021

GOLD DEFINITION: Toitū environmark gold certified organisations have developed a comprehensive plan to help them achieve their goals outlined in their formal environmental policy. They are measuring their impacts so that they can manage them. The organsation has the basis of a robust environmental management system in place.

Sustainable Business Network Awards - 2019

Iplex Pipelines NZ was a finalist in the 2019 NZI Sustainable Business Network Awards - Efficiency Champion category. The Iplex entry took out a distinguished runner up award for the use of post consumer PE recyclate into the Iplex Nova and Iplex Nexus range of land drainage products.

IPLEX EPD - PE
ADDITIONAL INFORMATION

Pipelines