Environmental Product Declaration Type III ITB No. 144/2021

Issuance date: 05.01.2021
Validation: 07.10.2024
Validity date: 05.01.2026

Green roof systems

Nature Impact Standard 60/25

Owner of the EPD

Nature Impact A/S
Address: Sdr Hojrupvejen 130
5750 Ringe, Denmark
Website: www.natureimpact.com
tel.: +45 65 98 22 23

EPD Program Operator

Instytut Techniki Budowlanej (ITB)
Address: Filtrowa 1,
00-611 Warsaw, Poland
Website: www.itb.pl
Contact: Michał Piasecki
energia@itb.pl

ITB is the verified member of The European Platform for EPD program operators and LCA practitioner www.eco-platform.org

Basic information

This declaration is the Type III Environmental Product Declaration (EPD) based on EN 15804+A2 and verified according to ISO 14025 by an external auditor. It contains the information on the impacts of the declared construction materials on the environment and their aspects verified by the independent party according to ISO 14025. Basically, comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804+A2. The intended use of an EPD is to communicate scientifically based information for product, for the purpose of assessing the environmental performance of buildings.

Life cycle analysis (LCA): A1-A5, C1-C4 and D modules in accordance with EN 15804+A2
(Cradle-to-Grave with module D)
The year of preparing the EPD: 2020
The year of EPD validation: 2024
Service Life: 50 years
Product standard: FLL
PCR: ITB-PCR A (PCR v 1.6 based on PN-EN 15804+A2)
Declared unit: 1 m^2 of Nature Impact Green Roof Standard 60/25
Reasons for performing LCA: B2B
Representativeness: Europe

MANUFACTURER

Fig 1. A view of Kompozycje Ozdobne the nursery for Nature Impact - Karwice Sp z o.o. in Karwice (Poland).

Nature Impact A/S is a Danish company that produces and delivers concept-based systems solution within green roofs and plant walls. Nature Impact was founded by the Larsen family in 2013. The family has been in the gardening and horticulture industry for 5 generations. Nature Impact A/S's nursery, Kompozycje Ozdobne - Karwice Sp z o.o., is located in northern Poland.

PRODUCT DESCRIPTION AND APPLICATION

Fig 2. A view of Standard 60/25 module

Nature Impact Green Roof Standard 60/25 consists of recycled plastic trays, substrate and plants – at least 12-15 species of sedum, approx.. 4 of them are naturally occurring species in Danish vegetation. Coverage minimum 90%. Can be applied to roofs with a slope of 0 to 25 degrees (above 14 degrees support profiles should be installed).
The specification of the Green Roof Standard 60/25 is presented in Table 1.

Nature Roof is seen as a varying surface, in which colours and seasons interact. The plants are harvested at the nursery from mother plants. After the harvest, 15 different types of sedum are carefully mixed. This mix of plants makes up the Nature Roof.

Table 1. The specification of the Green Roof Standard 60/25 is presented in Table 1.

Physical properties of the substrare	Value	Reference value fll
weight when fully saturated with water	1020 kg/m^3	–
weight when dry	554 kg/m^3	–
maximum water capacity	53%	≥35 ≤65
water permeability	12.1 mm./min.	0.6 – 70
total pore volume	75.5%	–
air volume at saturation with water	22%	≥10
organic matter content	61 g/L	≤65
PH (CaCl2)	6.9	6.0 – 8.5
EC	513 um/cm	–
salt content	2.04 g/L	≤3.5
Plactic trays RPET	0.94 kg/m^2	
Substrate	28.6 kg/m^2	
Sedum cuttings	0.51 kg/m^2	

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Declared unit

Declared unit is 1 m^2 of green roof systems (average mass with packing 18.9 kg/m^2).

Allocation

The allocation rules used for this EPD are based on economic basis in accordance with ITB PCR A. Production of green roofs is a line process in nursery of Nature Impact A/S - Kompozycje Ozdobne - Karwice Sp. z o.o. in Karwice (Poland). All impacts from raw materials extraction and electricity production are allocated in module A1 of the LCA. Impacts from the global production of Kompozycje Ozdobne - Karwice Sp. z o.o. were inventoried and 52% was allocated to the production of the green roofs. The packaging materials were included in the system boundaries. Module A2 includes transportation of raw materials from their suppliers to Kompozycje Ozdobne - Karwice Sp. z o.o. in Karwice (Poland). Energy consumption, emissions and municipal wastes were allocated to module A3.

System limits

The life cycle analysis of the declared products covers “Product Stage”, A1-A5, C1-C4 and D modules (Cradle to Gate with options) in accordance with PN-EN 15804+A2 and ITB PCR A (2023). The product stage A1-A3 comprises the acquisition of all raw materials, products and energy, transport to the production site, packaging and waste processing up to the ”end-of-waste” state or final disposal. The details of systems limits are provided in the product technical report. All materials and energy consumption inventoried in factory were included in the calculations. In the assessment, all significant parameters from gathered production data are considered, i.e. all material used per formulation, utilized thermal energy, internal fuel and electric power consumption, direct production waste, and all available emission measurements. It can be assumed that the total sum of omitted processes does not exceed 5% of all impact categories. In accordance with PN-EN 15804+A2 -04, machines and facilities (capital goods) required for and during production are excluded, as is transportation of employees.

A1 and A2 Modules: Raw materials supply and transport

Substrate, recycled plastic trays, fertilizer, pallets and foil stretch come from both Polish and foreign suppliers. Means of transport include trucks with load: <10t, 10–16t and >16. For calculation purposes European fuel averages were applied. The soil substrate mix consist of a compost mix delivered by truck by a dedicated company.

A3: Production

The production process of the green roofs by the Nature Impact nursery: Kompozycje Ozdobne - Karwice Sp. z o.o. is presented in Fig. 3. The LCA results are declared in aggregated form for the product stage, which means, that the sub-modules A1, A2 and A3 are declared as one module A1-A3. The soil substrate mix is mixed at the production site. The trays are made of secondary PET granulate and delivered by truck. At the production site water is used. The production site gets the water from own source, so only the electricity used to pump the water is included as well as the impacts associated with the water depletion potential. Fertilizer production and nutrient supply during the production phase (A3) is included. Diesel used for machinery at the production site is included. If there is waste from the bulk material like compost mix, it is recycled at the production site. The final products are delivered on pallets and wrapped in PE film/net. Inputs for the packaging materials are included in A3.

When the trays are delivered, they have a finished sedum plant cover, which means that the sedum seeds/cuts used have grown, which is included in the input under the input plant/water to account for the weight during transport. The biogenic carbon uptake during the growth and subsequent re-emission into the atmosphere is included based on the biogenic C content in substrate and Sedum. Approximately 21% of the energy used for production comes from the company's own energy production resources using photovoltaic panels.

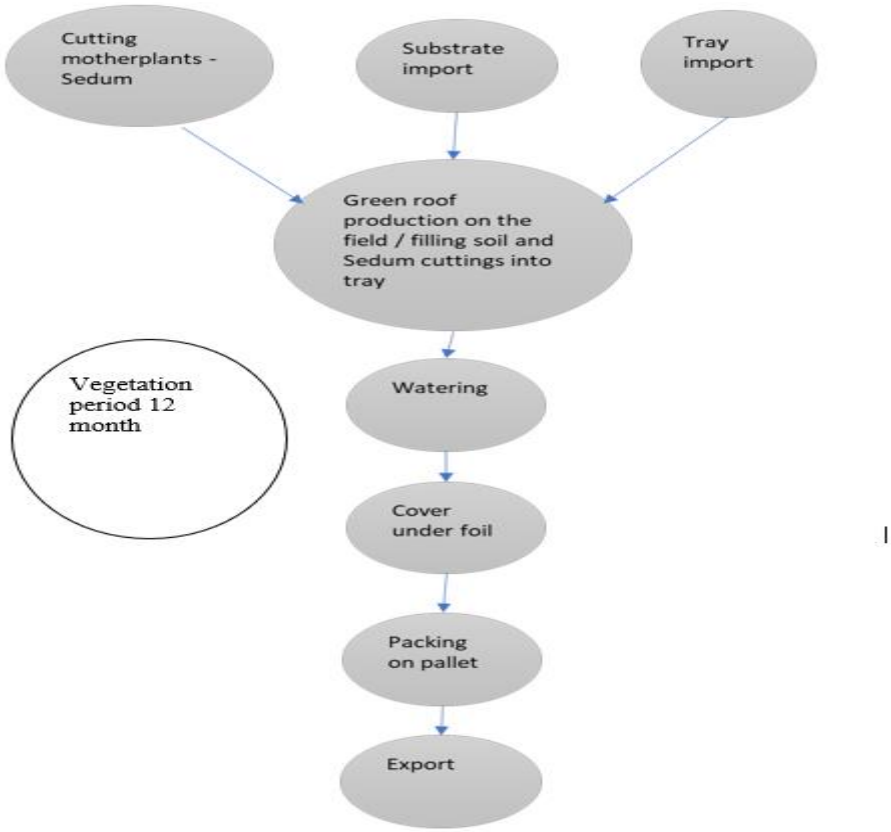

Fig. 3. A scheme of the production process of the green roofs by Kompozycje Ozdobne - Karwice Sp z o.o.

A4-A5 Construction process stage

For the A4 transport, a transport distance of 435 km with truck is used. The Trays are manually placed on the roof, so no installation energy is included in this study. Packaging material is sent for either incineration or recycling according to EUROSTAT data for packaging waste. The credit related to energy recovery from incineration or material credit for recycling are included in module D. Trays are manually placed on the roof, so minor installation energy is included. The packaging waste are sent for recycling/incineration.

C1-C4 and D Modules: End-of-life scenarios

The ending scenario after this lifetime is that to collect green roof system from the roof, clean the soil for the future reuse and send plastic trays for recycling and energy recovery. In the adapted end-of-life scenario, the de-constructed products are transported to recycling plant on the distance 100 km with > 10t lorry, EURO 5. The recycling potential of materials is presented in Table 1. It is assumed that at the end-of-life 100% of the green roof is recovered are deconstructed manually with minor electrical tool used. 100% of the plants undergo composting and further can be re-used for fertilization purposes. 90% of the substrate can be re-used, e.g. for road foundation or ballast instead

of primary sand or gravel while the plastic trays undergo recycling, energy recovery and landfilling according to the Polish treatment practice of industrial waste what is presented in Table 2.

Table 2. End-of-life scenario for Nature Impact Green Roof Standard 60/25.

Component	Material recovery	Re-use	Recycling	Energy recovery	Landfilling / Composting
Plants	100%	0%	0%	0%	100%
Substrate	90%	100%	0%	0%	0%
Plastic trays	90%	0%	45%	45%	10%

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2023– 31.12.2023 (1 year). The life cycle assessments were prepared for Portugal as reference area.

Data quality

The values determined to calculate the LCA originate from verified Kompozycje Ozdobne - Karwice Sp. z o.o.inventory data. No specific data collected is older than five years and no generic datasets used are older than ten years. The representativeness, completeness, reliability, and consistency are judged as good. The database, Ecoinvent 3.10 is utilized for the background system. As a result, both upstream- and downstream activities are based on average supply mixes for the specific country or region depending on the given dataset and KOBIZE data is used (Polish electricity mix and combustion factors for fuels). Specific (LCI) data quality analysis was a part of the input data verification.

Assumptions and estimates

Impacts of the representatives of the green roofs were aggregated using weighted average.

Calculation rules

LCA was performed using ITB-LCA tool developed in accordance with EN 15804+A2. Emission of greenhouse gases was calculated using the IPCC 2013 GWP method with a 100-year horizon.

Additional information

Polish electricity emission factor is 0.685 kg CO_2/kWh (KOBiZE 2021). European electricity mix used is 0.430kg CO_2/kWh (Ecoinvent v3.9.1, RER). The EPD does not give information on release of dangerous substances to indoor air and release of dangerous substances to soil and water because the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised test methods according to the provisions of the respective technical committees for European product standards are not available.

Biogenic carbon and CO2 sequestration

The data on the content of biogenic carbon in the compost at Substrate shows that there is 0.7 kg of biogenic C, which translates (*44/12) into sequestration of -2.7 kg of CO_2. CO_2 sequestration from Sedum plants is calculated as -0.85 kg CO_2 sequestered. The calculated biogenic carbon content C in a wooden pallet per m^2 is 0.5 kg. Since these values must be balanced to zero in the life cycle, these values have been virtually balanced in module C3 and C4. Regarding GWP, the compost mix has the biggest influence, regarding uptake of biogenic carbon due to the input of biowaste.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to declared unit (DU) – 1 m^2 of the Nature Impact Green Roof Standard 60/25

Table 3. System boundaries for the environmental characteristic of the Green Roof Standard 60/25

Environmental assessment information (MNA – Module not assessed, MD – Module Declared, INA – Indicator Not Assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction-installation process	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
MD	MD	MD	MD	MD	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MD	MD	MD	MD	MD

Table 3. Life cycle assessment (LCA) results of the Green roof systems – environmental impacts (DU: 1 m^2)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Global Warming Potential	eq. kg CO_2	-2.35E+00	1.22E+00	3.89E-01	-7.38E-01	2.23E+00	2.23E+00	6.85E-02	3.15E-01	5.42E+00	2.10E-01	-3.57E+00
Greenhouse potential - fossil	eq. kg CO_2	4.83E+00	1.21E+00	4.05E-02	6.08E+00	2.22E+00	2.48E-02	6.85E-02	3.14E-01	4.00E+00	2.79E-01	-3.56E+00
Greenhouse potential - biogenic	eq. kg CO_2	-7.18E+00	4.15E-03	2.40E-03	-7.17E+00	7.58E-03	2.21E+00	1.85E-04	1.07E-03	1.57E-03	2.54E-05	-8.84E-03
Global warming potential - land use and land use change	eq. kg CO_2	6.41E-03	4.76E-04	9.34E-05	6.98E-03	8.70E-04	7.49E-05	1.07E-05	1.23E-04	4.65E-05	9.40E-06	-1.38E-03
Stratospheric ozone depletion potential	eq. kg CFC 11	3.13E-07	2.81E-07	2.12E-08	6.15E-07	5.13E-07	1.25E-14	3.77E-10	7.27E-08	7.80E-01	4.03E-09	-1.97E-07
Soil and water acidification potential	eq. mol H+	3.24E-02	4.92E-03	4.10E-03	4.14E-02	9.00E-03	2.85E-05	7.25E-04	1.28E-03	3.04E-02	9.36E-05	-1.30E-02
Eutrophication potential - freshwater	eq. kg P	1.49E-03	8.16E-05	6.20E-04	2.19E-03	1.49E-04	3.26E-08	1.18E-04	2.11E-05	7.77E-06	9.27E-07	-5.26E-04
Eutrophication potential - seawater	eq. kg N	5.81E-03	1.49E-03	7.04E-04	8.00E-03	2.72E-03	9.20E-06	1.03E-04	3.85E-04	1.75E-02	3.26E-05	-2.39E-03
Eutrophication potential - terrestrial	eq. mol N	8.36E-02	1.62E-02	5.49E-03	1.05E-01	2.96E-02	1.22E-04	8.95E-04	4.20E-03	1.75E-01	3.56E-04	-2.60E-02
Potential for photochemical ozone synthesis	eq. kg NMVOC	1.94E-02	4.97E-03	1.60E-03	2.59E-02	9.07E-03	2.36E-05	2.57E-04	1.29E-03	4.31E-02	1.04E-04	-1.00E-02
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	1.75E-04	4.30E-06	1.08E-06	1.80E-04	7.86E-06	6.35E-10	2.58E-08	1.11E-06	5.44E-07	2.28E-08	-8.17E-05
Abiotic depletion potential - fossil fuels	MJ	6.85E+01	1.80E+01	6.85E+00	9.34E+01	3.29E+01	1.38E-01	1.08E+00	4.66E+00	3.09E-01	2.73E-01	-6.15E+01
Water deprivation potential	eq. m^3	1.15E+00	8.33E-02	1.47E-01	1.38E+00	1.52E-01	1.10E-02	2.07E-02	2.16E-02	3.99E-02	8.66E-04	-4.97E-01

Table 4. Life cycle assessment (LCA) results of the Green roof systems – additional impacts indicators (DU: 1 m^2)

Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Particulate matter	disease incidence	INA	INA	INA	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTUe	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTUh	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTUh	INA	INA	INA	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA	INA	INA	INA

Table 5. Life cycle assessment (LCA) results of the Green roof systems - the resource use (DU: 1 m²)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Consumption of renewable primary energy - excluding renewable energy sources used as raw materials	MJ	1.51E+01	3.22E-01	1.02E+00	1.64E+01	4.72E-01	1.50E-02	8.90E-02	6.69E-02	9.12E-02	2.37E-03	-1.64E+00
Consumption of renewable primary energy resources used as raw materials	MJ	4.82E-01	0.00E+00	0.00E+00	4.82E-01	0.00E+00	-2.39E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total consumption of renewable primary energy resources	MJ	1.55E+01	3.22E-01	1.03E+00	1.69E+01	4.72E-01	-2.39E+01	8.90E-02	6.69E-02	9.12E-02	2.37E-03	-1.64E+00
Consumption of non-renewable primary energy - excluding renewable primary energy used as raw materials	MJ	3.41E+01	2.25E+01	5.78E+00	6.23E+01	3.29E+01	1.38E-01	1.08E+00	4.66E+00	-4.19E+01	2.73E-01	-1.82E+01
Consumption of non-renewable primary energy resources used as raw materials	MJ	2.88E+01	0.00E+00	0.00E+00	2.88E+01	0.00E+00	-3.42E-01	0.00E+00	0.00E+00	4.22E+01	0.00E+00	0.00E+00
Total consumption of non-renewable primary energy resources	MJ	6.29E+01	2.25E+01	6.93E+00	9.22E+01	3.29E+01	-2.04E-01	1.08E+00	4.66E+00	3.09E-01	2.73E-01	-6.55E+01
Consumption of secondary materials	kg	1.53E+00	7.53E-03	9.85E-04	1.54E+00	1.10E-02	0.00E+00	9.40E-05	1.56E-03	1.36E-03	5.73E-05	-9.20E-03
Consumption of renew. secondary fuels	MJ	1.06E-02	8.29E-05	1.21E-05	1.06E-02	1.22E-04	0.00E+00	4.75E-07	1.72E-05	1.77E-05	1.50E-06	-9.95E-05
Consumption of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net consumption of freshwater	m³	5.58E-02	2.82E-03	3.12E-02	8.98E-02	4.14E-03	2.66E-04	3.11E-03	5.87E-04	5.12E-04	2.99E-04	-1.71E-02

Table 6. Life cycle assessment (LCA) results of the Green roof systems – waste categories (DU: 1 m²)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	kg	2.37E-01	2.52E-02	5.03E-02	3.13E-01	3.69E-02	8.82E-13	8.38E-03	5.23E-03	5.10E-03	2.90E-04	-8.20E-02
Non-hazardous waste	kg	6.79E+00	4.47E-01	3.13E+00	1.04E+01	6.56E-01	3.09E-03	5.65E-01	9.29E-02	8.71E-02	4.09E-03	-1.51E+00
Radioactive waste	kg	7.43E-05	1.68E-06	9.12E-06	8.51E-05	2.46E-06	1.67E-06	1.62E-07	3.48E-07	2.00E-06	1.81E-06	-2.93E-05
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	3.20E-03	6.95E-05	3.30E-01	3.33E-01	1.02E-04	1.28E+00	7.26E-06	1.44E-05	4.85E-01	5.46E-07	-2.37E-04
Materials for energy recovery	kg	3.84E-06	5.62E-07	3.79E-01	3.79E-01	8.24E-07	0.00E+00	1.17E-08	1.17E-07	1.40E-07	6.47E-09	-1.39E-06
Exported Energy	MJ	2.57E+00	0.00E+00	1.94E-02	2.59E+00	0.00E+00	1.47E-01	3.46E-03	0.00E+00	6.52E-01	0.00E+00	-3.74E-02

Verification

The process of verification of this EPD is in accordance with ISO 14025 and ISO 21930. After verification. this EPD is valid for a 5-year-period. EPD does not have to be recalculated after 5 years. if the underlying data have not changed significantly.

The basis for LCA analysis was EN 15804 and ITB PCR A
Independent verification corresponding to ISO 14025 (sub clause 8.1.3.) [x] external [ ] internal
External verification of EPD: Halina Prejzner. PhD. Eng. LCA. LCI audit and input data verification: Michał Piasecki. PhD.. D.Sc.. Eng. EPD verification: Halina Prejzner. PhD. Eng.

Note 1: The declaration owner has the sole ownership. liability. and responsibility for the information provided and contained in EPD. Declarations of construction products may not be comparable if they do not comply with EN 15804+A2. For further information about comparability. see EN 15804+A2 and ISO 14025.

Note 2: ITB is a public Research Organization and Notified Body (EC Reg. no 1488) to the European Commission and to other Member States of the European Union designated for the tasks concerning the assessment of building products' performance. ITB acts as the independent. third-party verification organization (ISO 17025/17065/17029). ITB-EPD program is recognized and registered member of The European Platform - Association of EPD program operators and ITB-EPD declarations are registered and stored in the international ECO-PORTAL.

Normative references

- ITB PCR A General Product Category Rules for Construction Products
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- PN-EN 15804+A1:2014-04 - Zrównoważoność obiektów budowlanych -- Deklaracje środowiskowe wyrobu -- Podstawowe zasady kategoryzacji wyrobów budowlanych
- PN-EN 15804+A2:2020-03 Zrównoważenie robót budowlanych – Deklaracje środowiskowe wyrobu – Podstawowe zasady kategoryzacji wyrobów budowlanych
- PN-EN 15942:2012 Sustainability of construction works – Environmental product declarations – Communication format business-to-business
- PN-EN 1090-1+A1:2012 Wykonanie konstrukcji stalowych i aluminiowych -- Część 1: Zasady oceny zgodności elementów konstrukcyjnych
- KOBiZE Wskaźniki emisyjności CO_2. SO_2. NO_x. CO i pyłu całkowitego dla energii elektrycznej. grudzień 2019
- FLL – Green Roof Guidelines – Guidelines for the planning. construction and maintenance of green roofs. 2018

LCA,LCI, input data verification
Michał Piasecki, PhD. D.Sc.

Qualified electronic signature

Head of Thermal Physic, Acoustic and Environment Department
Agnieszka Winkler-Skalna, PhD.

Qualified electronic signature

Instytut Techniki Budowlanej

Instytut Techniki Budowlanej

00-611 Warsaw, Filtrowa 1

Thermal Physics, Acoustics and Environment Department

02-656 Warsaw, Ksawerów 21

CERTIFICATE № 144/2021
of TYPE III ENVIRONMENTAL DECLARATION

Product:

Green roof systems

Manufacturer:

Nature Impact A/S

Sdr Hojrupvejen 130, 5750 Ringe, Denmark

confirms the correctness of the data included in the development of
Type III Environmental Declaration and accordance with the requirements of the standard

PN-EN 15804

Sustainability of construction works.
Environmental product declarations.
Core rules for the product category of construction products.

This certificate, issued for the first time on 5th January 2021 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Acting Head of the Thermal Physic, Acoustics and Environment Department
Agnieszka Winkler-Skalna, PhD

INSTYTUT TECHNIKI BUDOWLANEJ

Deputy Director
for Research and Innovation
Krzysztof Kuczyński, PhD

Warsaw, January 2021