AECOM

Lower Duwamish Waterway Upper Reach Remedial Action

Green Remediation Plan
Revision 6

October 27, 2024

Delivering a better world

Quality information

Prepared by	Checked by	Verified by	Approved by	Contractor Approval
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Revision History

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Abbreviations

BODR	Basis of Design Report
BMP	Best management practices
DCR	Daliy Construciotn Report
EPA	U.S. Environmental Protection Agency
GRP	Green Remediation Plan
LDW	Lower Duwamish Waterway
PPM	Pacific Pile & Marine
RAWP	Remedial Action Work Plan
RM	River Mile
ROD	Record of Decision
Site	Lower Duamish Waterway Superfund Site
SMA	Sediment Management Area
WCR	Weekly Construciton Report

1. Introduction

The Green Remediation Plan (GRP) for the Lower Duwamish Waterway (LDW) Upper Reach Superfund Site (Site) in King County, Washington describes the best management practices to be implemented during remedial construction activities to minimize environmental impacts namely reduction in air emissions; reduce use of water, materials and energy; and minimize waste generation; all intended for the protection of land and ecosystems.

1.1 Purpose

The purpose of this GRP is to outline procedures and practices to be implemented during Site activities to meet the requirements for green remediation practices. These requirements are consistent with EPA Region 10's Clean and Green Policy (EPA, 2009) and include the following:

- Use renewable energy and energy conservation and efficiency approaches, including Energy Star equipment.
- Diesel fuel will be ultra-low sulfur diesel fuel, following current requirements.
- Use cleaner fuels such as biodiesel, diesel emissions controls and retrofits, and emission reduction strategies.
- Minimize transportation of materials and use rail rather than truck transport to the extent practicable.
- Use water conservation and efficiency approaches including Water Sense products.
- Use reused or recycled materials within regulatory requirements.

The following Site documents were used to prepare this GRP:

- Final (100%) Remedial Design Basis of Design Report (BODR) for Lower Duwamish Waterway Upper Reach (Anchor QEA, 2024);
    - BODR Volume II, Part I, Appendix N Green Remediation Evaluation and Implementation Approach (Anchor QEA, 2024)
- Specification Section 01 33 00 (Submittals);
- Specification Section 01 35 44 (Green Remediation Requirements);
- Specification Section 01 41 00 (Environmental Regulatory Requirements); and
- Specification Section 35 20 2301 (Transloading, Upland Transportation, and Disposal).

Work for the Site will be performed in accordance with the plans and specifications or as directed by the Project Representative to execute this GRP.

1.2 Construction Activities

The general scope of work includes the following:

- Mobilization of construction equipment and materials;
- Site preparation activities, including construction and setup of the staging and stockpile area(s), temporary erosion and sediment controls, water collection and treatment management practices, utility disconnection, and clearing/grubbing;
- Dredging, excavation, potential contingency re-dredging, barge dewatering, in-water transportation, transloading, upland transportation, and disposal of dredge material, dredge debris, identified debris, and piling from the Sediment Management Areas (SMAs);
- Placement of clean imported materials in and around the SMAs;

- Removal of pilings, bulkhead strengthening and reinforcement, replacing of piling with steel pipe, and installation of outfall energy dissipation structures; and
- Site restoration, cleanup, and demobilization.

Table 5-1 of the RAWP provides a summary of the equipment to be used and the relevant construction activity and serves to identify within which individual Plan the equipment is described with supporting materials and certifications, and includes a cross-walk between multiple Plans where the specific equipment will be employed.

2. Air Pollution

This section discusses air pollution sources, methods to reduce/control emissions, and equipment usage assumptions during remedial activities. Additional details are included in the Air Pollution and Odors Control Plan (**RAWP Volume 3**).

2.1 Air Pollution Sources

Air pollution sources are principally the heavy equipment used to conduct the work of this contract. Air constituents evaluated in the design basis concluded that the vast majority of total direct emissions are due to sediment transload, upland transport and disposal, dredging and material placement. In the model evaluated for Appendix N of the BODR, baseline and local average market conditions showed that the equipment used to dredge and transport material to the transload facility (including a crane, hydraulic excavator, push boats, and work boats) accounted for the majority of the emissions (29-64%). Under the baseline condition, train transport accounts for the majority of total direct air emissions (26-33%), followed by truck usage (14-29%). Diesel fueled vehicles are the primary source of energy consumption for this project.

The work of the contract includes the construction activities listed in **Section 1.2**. The type of equipment that will be used to perform the construction activities includes:

- Hydraulic excavators for dredging and material placement;
- Tugboats, push boats and other work boats;
- Front-end loaders for managing material;
- Cranes for structural work;
- Street sweepers for dust control;
- On- and off-road trucks to transport material;
- Excavator for transloading material; and
- Train transport from the transload facility to the disposal location.

See **Section 2.3 f**or details on each type of equipment including quantities, make, model, plans for use at the Site, EPA tier requirements, and estimated usage. Additional details are provided in the Remedial Action Work Plan (RAWP, Table 5-1).

2.2 Air Pollution Controls

PPM will implement the controls and policies discussed below during remedial activities to reduce air emissions. Site operations, prevention, and mitigation measures for equipment used during each type of construction activity is described in the Air Pollution and Odor Control Plan.

- Follow operation and maintenance inspection schedules for equipment to maximize peak operating efficiency (e.g., schedule engine tune-ups according with manufacturer recommendations, check fuel tank for dirt/insects, keep tight connections and moving parts well-lubricated, periodically replace filters in air and fuel systems, use manufacturer’s recommended grade of motor oil).

- As noted in Appendix N to the BODR, vessel electrification was assessed during design. PPM supplied information for use in the study. It concluded that there are no substations along the LDW capable of delivering sufficient electrical power to conduct the dredging and transport operations consequently electrical power is limited for support facilities. An electric powered excavator will be used to offload the contaminated sediment barges at the transload facility (see **Section 3.1**). The excavator at the transload facility is the only use of electric construction equipment at the Site, see the Dredging and Excavaiton Plan for more details.

- Use cabin warming devices to avoid running the engine to keep operators warm during winter months.
- Use D particulate filters on all dredge excavators and other air pollution control measures, as described in the Air Pollution and Odor Control Plan (**RAWP Volume 3**).
- PPM will continue to look for areas to convert equipment to electric and/or hydrogen powered and will update this plan when changes are executed.
- Limit idling time to 5 minutes for on-road vehicles before equipment engines are shut off. This includes turning off all diesel engines on construction equipment when not in active use (excluding heavy marine construction equipment). Engines are permitted to idle after 5 minutes in cases where the following criteria apply:
    - Vehicles are stationary in traffic;
    - It is necessary to maintain safe operation of the equipment;
    - It is necessary to test, service, and repair the equipment; and
    - Engine operation is needed for intermittent activities.
- Adjusting daily routines:
    - Select High-Quality Equipment Lubricants: Biodegradable hydraulic fluid will be used in all dredging excavators.
    - Immediate Clean-Up of Spilled Fuels: Spilled fuels will be cleaned up immediately to reduce the release of volatile organic compounds (VOCs) into the atmosphere.
    - Proper Handling and Disposal of Absorbent Materials: All materials used to absorb fuel spills will be handled and stored in noncombustible containers according to site HASP and SPCC to prevent fire hazards.
    - Proper Disposal or Recycling of Waste Materials: Disposal or recycling of spent materials and liquid waste, including tires, transmission fluids, brake fluids, used oil and filters, wash-rack waste, coolant, and spent solvent will be done to reduce air pollutants and mitigate greenhouses gasses in new material creation.
    - Adjust Driving Techniques: Avoid rapid acceleration, braking, and excessive speeds to reduce fuel consumption and emissions. Remove unneeded items from vehicles to decrease weight and improve fuel efficiency.
- Manage fleet effectively (e.g., plan to minimize fuel consumption through efficient transportation routes, transfer only full loads, select fuel efficient vehicles, and facilitate low-carbon commuting and travel by workers including carpooling, electric or hybrid vehicles, or public transportation). Given PPM's local facility, over 30% of the staff live in City limits with the balance of staff in commuting distance to the office. All Site personnel will meet at the PPM yard and commute to the Site via work boat to eliminate excess vehicles and the need for parking at or near the work Site.
- Workers will be encouraged to carpool, use electric or hybrid vehicles, or utilize public transportation to commute to and from the PPM yard. PPM is undertaking installation of electric car chargers at their facility to enable staff to use electric vehicles for both personal use and allow the fleet expansion/conversion to electric vehicles. PPM offers financial incentives to staff for carpooling and/or use of public transportation as described in the Air Pollution Control Plan.

2.3 Summary of Equipment to be Used

This section describes the equipment to be used during construction and equipment tracking in accordance with Specification Section 01 35 44 (Green Remediation Requirements). **Table 2-1** provides a summary of the expected equipment type, number of each piece of equipment, associated engine Tier, and the estimated approximate usage as a percentage of the total operating hours of each equipment type operating at that engine Tier for each activity and each Construction Season. Construction Season 1 is October 1, 2024 through February 15, 2025, Construction Season 2 is October 1, 2025 through February 15, 2026, and Construction Season 3 is October 1, 2026, through February 15, 2027. Engine Tiers are defined by EPA's Tier system (EPA, 2022) as reported in the BODR (Anchor QEA, 2024):

- Pre-Tier Engines: All equipment manufactured prior to 1996; it is assumed that this equipment was produced without a requirement to meet specific air emission standards.
- Tier 1 Engines: Equipment manufactured between 1997 and 2005. Exact applicability date depends on horsepower.
- Tier 2 Engines: Equipment manufactured between 2001 and 2010. Exact applicability date depends on horsepower.
- Tier 3 Engines: Equipment manufactured between 2006 and 2011. Exact applicability date depends on horsepower.
- Tier 4 Engines: Equipment manufactured in 2008 and later. Exact applicability date depends on horsepower.

Equipment usage will be tracked on a daily basis and reported as described in **Section 8**. The total operating hours and engine tier will be recorded for each piece of equipment for each Site activity in accordance with the Air Pollution and Odors Control Plan (**RAWP Volume 3**).

PPM will track the following information for the equipment listed in **Table 2-1**:

- Construction equipment type (and number of equipment pieces) for each construction activity
- Distribution of construction equipment by engine Tier for each construction activity

Usage of these equipment types (i.e., percentage of total operating hours of equipment type operating at a certain engine Tier) The equipment on site (make/model), activities of use, engine Tier, and hours of use every day will be logged on the daily equipment checklist and submitted in the Daily Construction Report (DCR). The information from each DCR will then be summarized in each Weekly Construction Report (WCR). The WCRs will be used to generate activity specific total hours used for each piece of equipment each Construction Season. See the Construction Quality Control Plan for details on reports to be submitted each Construction Season. The estimated usage hours included in Table 2-1 are based on the draft project schedule which includes the following assumptions:

- PPM will work 5 days per week for 10 hours per day with the exception of SMA1, SMA9, and SMA11 which will require 6 days per week for 10 hours per day.
- During each season, 12 working days will not be available due to tribal fishing activities.
- No work will occur on the following federal holidays:
    - January 1st New Year's Day
    - Martin Luther King Day
    - Memorial Day
    - July 4th

- Labor Day
- Day before Thanksgiving
- Thanksgiving Day
- Day after Thanksgiving
- Christmas Eve
- Christmas Day
- New Year’s Eve

PPM will begin converting the PPM truck fleet to electric vehicles in January 2025 with an estimated full fleet conversion in December 2028. The Superintendent for the LDW will be one of the first to receive an electric truck estimated to arrive on June 2025. Other personnel at the site will use public transportation or personal vehicles to commute to and from the Site.

Table 2-1. Equipment Usage

Construction Equipment Type	Number of Equipment Pieces	Equipment Model and Engine Tier	Construction Activity/Activities	Minimum Required Engine Tier	Required Usage at Required Engine Tier	Season 1 Estimated Usage (hrs)	Season 2 Estimated Usage (hrs)	Season 3 Estimated Usage (hrs)	Total Usage (Hrs)
Hydraulic Excavators[1,3]	1	EX 1200-5- Tier 2	Dredging	Tier 2 Engine	100%	0	100	0	100
	1	EX 1200-6- Tier 2				541	441	541	1,523
	1	ZX 470- Tier 4				200	0	0	200
	1	EX 1200-5- Tier 2	Material Placement	Tier 2 Engine	100%	0	100	0	100
	1	EX 1200-6- Tier 2				541	541	541	1,623
	1	ZX 470- Tier 4				200	0	0	200
Long Reach Excavator[2,3]	1	TBD 50 ton +/- 70’ reach	SMA 5 Excavation	TBD	TBD	N/A	N/A	TBD	TBD
Excavator[2,3]	1	TBD 50 tons +/-	SMA 5	TBD	TBD	N/A	N/A	TBD	TBD
Excavator[2,3]	1	TBD 20 tons +/-	SMA 5	TBD	TBD	N/A	N/A	TBD	TBD
Crawler Crane	1	218 HSL- Tier 4	Bulkhead Wall	Tier 2 Engine	40%	83	0	0	83
PPM Yard Crane	1	Link-Belt 218HSL Tier, 4	Bulkhead Wall	Tier 2 Engine	40%	40	0	0	40
Electric Excavator	1	SENNBOGEN 875E	Offload Dredge Material at Transload (DRF)	N/A	N/A	N/A	N/A	N/A	N/A
Vibratory Hammer	1	Cat C9- Tier 3	Bulkhead Wall/Piling Install-Removal	N/A	N/A	164	0	0	164

Construction Equipment Type	Number of Equipment Pieces	Equipment Model and Engine Tier	Construction Activity/Activities	Minimum Required Engine Tier	Required Usage at Required Engine Tier	Season 1 Estimated Usage (hrs)	Season 2 Estimated Usage (hrs)	Season 3 Estimated Usage (hrs)	Total Usage (Hrs)
Vibratory Hammer	1	Pile Shear	Piling Install-Removal	N/A	N/A	N/A	N/A	N/A	N/A
	2	GM 12V-71, Tier 2	Transportation of Sediment and Clean Placement Materials	Pre-Tier Engine	100%	1,082	1,082	1,082	3,246
	3	Cummins QSK19, Tier 3	Transportation of Sediment and Clean Placement Materials	Pre-Tier Engine	100%	360	360	360	1,082
Tugboats[3], Push Boats, Work Boats	2	Cat C18, Tier 2	Transportation of Sediment and Clean Placement Materials	Pre-Tier Engine	100%	360	360	360	1,082
	1	Fog Dog Survey Boat Cummins B Series- Tier 2	Surveying	Pre-Tier Engine	100%	216	216	216	648
	2	Honda BF60- Tier 3	Sampling Activities and Inspections	Pre-Tier Engine	100%	216	216	216	648
Front-End Loaders[3]	2	John Deere 624-Tier 4	Miscellaneous Activities	Tier 2 Engine	100%	640	640	840	2,120
Powered Street Sweeper[2]	1	TBD	SMA 5	TBD	TBD	N/A	N/A	TBD	TBD

Construction Equipment Type	Number of Equipment Pieces	Equipment Model and Engine Tier	Construction Activity/Activities	Minimum Required Engine Tier	Required Usage at Required Engine Tier	Season 1 Estimated Usage (hrs)	Season 2 Estimated Usage (hrs)	Season 3 Estimated Usage (hrs)	Total Usage (Hrs)
Water Truck[2]	1	TBD	SMA 5	TBD	TBD	N/A	N/A	TBD	TBD
5 CY Bucket Weel Loader[2,3]	1	TBD	SMA 5	TBD	TBD	N/A	N/A	TBD	TBD
Trucks (On-road, Off-road)[2]	TBD	TBD	Upland Transportation of Clean Placement Material from CalPortland Seattle Aggregate Yard to SMA 5	Tier 4 Engine	100%	N/A	N/A	TBD	TBD
	TBD	TBD	Upland Transportation of Sediment from SMA 5 to DRF	Tier 4 Engine	100%	N/A	N/A	TBD	TBD
Train (Locomotive)[2,4]	TBD	TBD	Upland Transportation from the DRF	Tier 4 Engine	100%	TBD	TBD	TBD	TBD

Source: Specification Section 01 35 44 (Green Remediation Requirements), Table 01 35 44-1: Air Pollution Compliance Requirements

1. *Hydraulic Excavators will be used for both dredging and material placement activities. Decontamination procedures will be implemented as described in the Personnel and Equipment Decontamination Plan.*
2. *All equipment information labeled TBD will be provided to the Project Representative for review and acceptance in advance of the construction season of use. The planned equipment under construction equipment type will remain the selected equipment type.*
3. *Equipment will be equipped with diesel particulate filters.*
4. *100% of the long haul trains expected for use are Tier 4. The Duwamish Reload Facility trackmobile railcar mover is Tier 3, use of this equipment will be limited to one hour a day for gondola switches and does not have a significant contribution to emission hours for transportation.*

3. Transportation/Energy Consumption

As noted in Section 2, diesel fueled vehicles are the primary source of energy consumption for this project This section presents the actual facilities that will be used during project implementation which net reduced diesel consumption compared to design assumptions as well as additional methods that will be used to reduce energy demands. During implementation, records of vehicle and fuel use will be collected and the estimate from the design will be updated.

3.1 Waste Material

PPM has contracted with Waste Management's Duwamish Reload Facility (DRF) located at 8th Avenue in Seattle near RM 2.8 on the LDW to serve as its transload facility. Materials dredged, dredge debris, identified debris, and pilings removed from the project site will be transported to the facility by contaminated sediment barges (approximately 0.2 to 2.2 miles depending on SMA) and off-loaded by its electric powered excavator and tracked using barge displacement, with the exception of dredge material transported from SMA 5. Material from SMA 5 will be transported to the facility by truck directly to the DRF (approximately 2.5 miles). The use of the DRF greatly reduces fuel consumption on the overall project. From the DRF, material will be managed on site and transported via rail car gondolas to UP ARGO (approximately 4 miles) and then connected to the Seattle train bound for the Columbia Ridge Landfill in Arlington, OR (approximately 300 miles) where it will be offloaded and landfilled.

With the exception of the electric powered excavator, all handling is via diesel powered equipment, therefore, the controls outlined in **Section 2** for diesel fuel apply to these operations. These measures are restated in **Section 3.4**.

3.2 Clean Material

Clean material will be sourced from CalPortland Dupont and CalPortland Enumclaw. Material sourced from Enumclaw will be transported approximately 42 miles via truck and material sourced from Dupont will be direct loaded onto the clean import material barges and transported approximately 41 miles to the site. Material required for SMA5 (Aggregate Material Types 1, 1A, 4, and 5) will be transported to SMA5 from CalPortland Dupont (approximately 45 miles) and CalPortland Enumclaw via truck (approximately 40 miles). Specifics on material sources, transportation method, and distance from the site are provided in **Section 5**. All material transport is via diesel powered equipment, therefore, the controls outlined in **Section 2** for diesel fuel apply to these operations. These measures are restated in **Section 3.4**.

3.3 Barge Transportation

Tugboats will be operated by Boyer Towing to maneuver and transport the barges.

3.4 Transportation/Energy Conservation Best Management Practices

PPM will implement best management practices (BMPs) for energy conservation associated with its diesel fuel consumption. Energy use reduction BMPs include the following:

- Follow equipment vendor recommendations for routine maintenance, conduct periodic inspections, and quickly repair/upgrade industrial equipment when needed.
- PPM has policies and procedures in place to replace aging equipment with newer models meeting higher energy conservation standards. PPM will evaluate the equipment each year and determine if equipment will need to be replaced for the next construction season. At this time, no equipment is scheduled to be replaced.
- Operate vehicles avoiding rapid acceleration, braking, and excessive speeds, and removing unneeded items in a vehicle.
- Tracking energy consumption through tools such as plug-in meters and whole-system meter devices. Total fuel delivered to the site will be tracked daily.

- PPM will work with its energy providers to the Site to explore renewable energy options and adopt carbon-free/low carbon sources for its power needs.

4. Recycling, Reuse, and Waste Minimization

This section considers both water use and generation of wastes in the course of the project work. As described in the BODR, water use on this project is limited to two principal activities: dust control and decontamination activities. The design assumed water needs would be supplied by non-potable sources, namely collected rainwater, river water or other non-potable source. Regarding use of materials and waste generation, the design assumed that sediment and debris would be too impacted to be reused and placement of clean material would need to be produced from virgin materials and sourced from sand, gravel and quarry spalls.

This section presents the actual operations that will be employed during project implementation as well as additional methods that will be used to reduce waste and maximize reuse.

4.1 Water Supply and Usage

In water work is restricted to winter months limiting the need for dust control. Water will be stored in 500gallon water buffalos to be used for equipment decontamination consistent with typical dredging activities. Other site uses for water include the wheel wash and decontamination pad at SMA 5 and watering of plantings at SMA 5. If water supply plans change, associated plans will be revised prior work being conducted at SMA 5, which is expected to take place from December 2026 to March 2027. Water for personnel decontamination will be brought to the site from an outside source, work elements associated with performing SMA5 remain under development and will be submitted at a later date prior to construction. PPM will implement measures to conserve use by implementing the following:

- Minimize freshwater and potable water consumption by using low-flow fixtures in decontamination equipment and handwash stations.
- Implement closed-loop wash racks and wheel wash systems that recycle water for repeated use in decontamination.
- Use water sparingly for dust control, ensuring it is applied only when necessary and in amounts that prevent overwatering and runoff.
- Utilize high-pressure washers that require less water for decontaminating equipment and surfaces.

4.2 Reuse and Waste Minimization

PPM will implement measures to recycle, reuse, and minimize waste during remedial activities. Methods of recycling, reuse, and waste minimization include the following:

- Use local (within a minimal radius of the Project area) and recycled materials (materials with post- or pre-consumer materials) where opportunities are available that meet Site Specifications and with production and distribution centers near the Site to minimize fuel consumption associated with delivery. See **Section 5** for additional detail on material sources.
- Properly dispose of or recycle spent materials or liquid waste such as tires, transmission or brake fluids, used oil and filters, wash-rack waste, coolant, and spent solvent.
- Pilings will be segregated and recycled to the extent practicable in accordance with Section 01 35 44 (Green remediation Requirements), see Section 5.3.
- Use of Biodegradable Ingredients: PPM will prioritize the use of biodegradable ingredients for equipment lubricants wherever possible, such as the use of the Clarity Hydraulic Oil being utilized in the hydraulic systems of the equipment.
- Unused Materials: PPM will work with it’s suppliers to take back unused materials. If materials cannot be returned then PPM will utilize the materials on other projects or sell/give away the

material to other contractors or the general public. This approach will minimize waste and encourage the recycling and proper disposal of materials.

- Promoting Material Reuse and Recycling: PPM is using locally sourced backfill, sand, and armor materials on the project. PPM will also attempt to salvage and sort clean materials for recycling or reuse on other projects, ensuring that materials are recycled or reused to reducing the project's overall environmental footprint.

5. Material Use/Sources

This section discusses the sources for material needed to implement the remedial design. The largest use of material is clean backfill for placement over the dredged sediment profile. Based on restrictions emplaced on the design parameters for this material, use of a recycled source could not be identified. In the absence of locating a recycled source, the design suggests use of a local source to minimize energy and emissions generation associated with its supply.

Table 5-1 provides a summary of the material, supplier, and supplier location for all aggregates and steel needed to complete the work.

Table 5-1: Material Sources

Material	Supplier	Supplier Location	Transport Method	Transport Distance (Miles)
Aggregate Material Type 1	CalPortland	DuPont	Barge	41
Aggregate Material Type 1A	CalPortland	DuPont	Barge	41
Aggregate Material Type 2	CalPortland	DuPont	Barge	41
Aggregate Material Type 3	CalPortland	DuPont	Barge	41
Aggregate Material Type 4	CalPortland	Enumclaw	Truck	42
Aggregate Material Type 5	CalPortland	Enumclaw	Truck	42
Granular Activated Carbon	Xylem	Los Angeles	Truck	1,089
Steel Pipe Piling and Sheet Piling	JD Fields	Tacoma	Truck	29
Rebar	Addison Rebar	Tacoma	Truck	29

5.1 Aggregates

Aggregates for this project will be supplied by CalPortland. Angular aggregate will be sourced from the White River Aggregate Plant in Enumclaw, WA while sand will be sourced from the DuPont Pit located in DuPont, WA.

5.2 Granular Activated Carbon

Granular Activated Carbon (GAC) will be supplied by Xylem in Los Angeles, CA.

5.3 Steel Sheet Piling, Pipe Piling and Rebar

Steel sheet piling will be supplied by JD Fields and sourced from ArcelorMittal. ArcelorMittal incorporates both scrap as well as post-consumer steel in their manufactured sheets. The environmental product declaration for EcoSheetPile™ Plus from ArcelorMittal is included in **Attachment 1**. EcoSheetPile™ Plus is produced from 100% scrap input in an electric arc furnace route with 100% renewable electricity supply and is part of ArcelorMittal's XCarb® recycled and renewably produced initiative. ArcelorMittal's steels reduce the CO_2 impact through lightweighting, design optimization, and by reducing the thickness of protective coatings while maintaining corrosion resistance. Where possible, low-carbon emission construction materials will be used and associated environmental product declarations will be provided. Any piling cutoffs generated during the install will be reused by PPM on other projects if the length is

greater than 10’. Any lengths under 10’ will be recycled. Rebar will be supplied by Addison Rebar in Tacoma, WA.

6. Protection of Land and Ecosystems

Design consideration for protection of the land and ecosystems at the Site were addressed during the Record of Decision (ROD) and BODR processes, in which an evaluation of impacts to all habitat types, including ROD-defined “habitat areas” (EPA 2014), from implementation of remedial activities will be conducted to comply with the Clean Water Act Section 404 and Section 7 of the Endangered Species Act (ESA). The approach for the upper reach will seek to maintain or improve habitat to the extent practicable.

See the Environmental Mitigation Binder Appendix U of the RAWP for environmental preservation considerations to be implemented at the Site. The approved in-water construction season window was designed to minimize impacts on certain fish species including threatened or endangered species under the ESA. BMPs to be implemented during the in-water work activities for protection of the land and ecosystems can be found in the Water Quality Protection Plan (WQPP) (Appendix V of the RAWP) and the Spill Prevention, Control and Countermeasures Plan (Appendix Z of the RAWP). BMPs to be implemented during the upland work activities for protection of the land and ecosystems can be found in the Erosion and Sediment Control Plan (Appendix W of the RAWP), the Stormwater Pollution Prevention Plan (Appendix X of the RAWP), and the Spill Prevention, Control and Countermeasures Plan (Appendix Z of the RAWP).

7. Business Practices

Environmentally sustainable business practices will be used when possible. This includes the use of an electronic data management process for document submittals, requests for information, correspondence, schedules, and Drawings. King County has established a project SharePoint which will be used for electronic data management.

8. Reporting and Documentation

During the construction season, compliance with the air pollution requirements outlined in **Section 2** will be documented in Daily and Weekly Construction Reports prepared by the Construction Quality Control Officer. In addition, a monthly Air Pollution Compliance Summary Report will be provided to summarize the equipment type, associated engine Tier, and number of hours used for each construction activity of the project, additional details on the Air Pollution Compliance Summary Report are located in the Air Pollution and Odors Control Plan (**RAWP Volume 3**).

An Annual Construction Season Summary Report will be submitted after each construction season. This report will include a compilation of the monthly Air Pollution Compliance Summary Reports and will also include a summary of the staff transportation fleet mix used including the number of battery electric, plug-in hybrid, or hybrid vehicles used, and any additional relevant information regarding the vehicles.

9. References

Anchor QEA, 2024. Final (100%) Remedial Design Basis of Design Report for Lower Duwamish Waterway Upper Reach. Anchor QEA. January 2024.

EPA, 2009. Principles for Greener Cleanups. Prepared by Office of Land and Emergency Management. August 27, 2009. Available at: https://www.epa.gov/greenercleanups/epa-principles-greener-cleanups.

EPA, 2014. Record of Decision. Lower Duwamish Waterway Superfund Site. United States Environmental Protection Agency Region 10. November 2014.

EPA, 2022. Emission standards reference guide for on-road and nonroad vehicles and engines [online]. US Environmental Protection Agency. Updated August 5, 2022. Available from: https://www.epa.gov/emission-standards-reference-guide.

Attachment 1 Environmental Product Declaration

Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

EcoSheetPile™ Plus – Steel Sheet Piles

from

ArcelorMittal Europe – Long Products

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-11071
Publication date:	2023-11-10
Valid until:	2028-11-09

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.environdec.com

General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
E-mail:	info@environdec.com

Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): *PCR 2019:14 Construction products, version 1.3.1 Published on 2023.06.20. Based on CEN standard EN 15804. ISO standard ISO 21930 and CEN standard EN 15804 serves as the core PCR.*
PCR review was conducted by: The Technical Committee of the International EPD®System. See www.environdec.com/TCfor a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.
Life Cycle Assessment (LCA)
LCA accountability: *Leonardo Guimarães Ribeiro, ArcelorMittal Global R&D*
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third party verifier: *Matt Fishwick, Fishwick Environmental Ltd*      Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☒ Yes ☐ No [Procedure for follow-up the validity of the EPD is at minimum required once a year with the aim of confirming whether the information in the EPD remains valid or if the EPD needs to be updated during its validity period. The follow-up can be organized entirely by the EPD owner or together with the original verifier via an agreement between the two parties. In both approaches, the EPD owner is responsible for the procedure being carried out. If a change that requires an update is identified, the EPD shall be re-verified by a verifier]

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

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison.

For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: ArcelorMittal Europe – Long Products

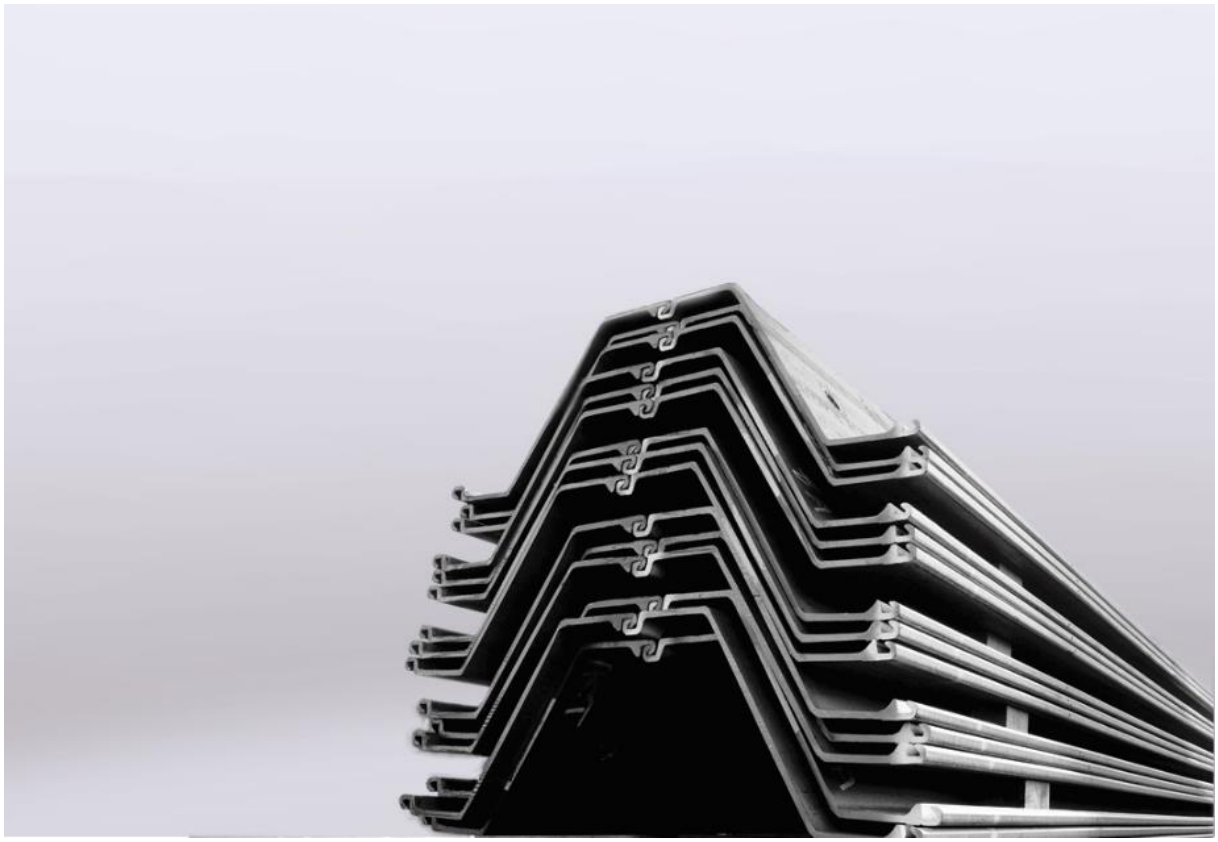
Contact: sheetpiling@arcelormittal.com, Tel.: +352 5313 3105

Description of the organisation:
ArcelorMittal Europe – Long Products operates 27 production sites in ten countries and is a leader in the manufacture of sections, sheet piles, rails, quality wire rod, rebars, and bars. ArcelorMittal is the world's largest supplier of cost-effective tailor-made steel foundation solutions, as well as the largest manufacturer of sustainable hot-rolled steel sheet piles. ArcelorMittal Sheet Piling is in charge of sales, marketing and promotion of hot rolled and cold formed steel sheet piles, HP bearing piles and steel tubes produced in its European mills, as well as accessories used for installation.

Our journey towards becoming carbon neutral by 2050 is well underway. In line with the Paris Climate Goals and the European Green Deal, ArcelorMittal has also committed to reduce CO_2 emissions in our European operations by 35% by 2030.

Product-related or management system-related certifications:
ArcelorMittal's sheet piling mills are covered by ISO 9001, ISO 14001, ISO 45001, ISO 50001, and *Responsible Steel*™

Name and location of production site(s): ArcelorMittal Belval & Differdange S.A. (AMBD), Luxembourg



AZ sheet piles produced at ArcelorMittal Belval & Differdange S.A.

Product information

Product name: EcoSheetPile™ Plus – Steel Sheet Piles

Product identification: EcoSheetPile™ Plus – Steel Sheet Piles included in this EPD are covered by one of the following names: EcoSheetPiles™ Plus or steel sheet piles.

Product description:
An EcoSheetPile™ Plus is a hot rolled steel sheet pile used in various construction and infrastructure applications. It is produced from 100 % scrap input in an electric arc furnace route with 100 % renewable electricity supply with Guarantee of Origins (GoO). EcoSheetPile™ Plus is part of ArcelorMittal's *XCarb® recycled and renewably produced* initiative. EcoSheetPile™ Plus can be produced in a wide range of shapes and dimensions, lengths, steel grades and specifications. The declaration covers the whole range of steel sheet piles produced in the Luxemburgish production site ArcelorMittal Belval & Differdange (AMBD), especially the mills of Belval and Differdange: Z-type, U-type, straight-web and H-type. EcoSheetPile™ Plus is a final product ready to be installed.

This EPD is valid for EcoSheetPile™ Plus of various grades and geometries as covered by following standards:

- European Standards: EN 10248-1, EN 10248-2;
- ASTM International: ASTM A6, ASTM A572, ASTM A690;
- Canadian Standard Association (CSA): G40.20/G.40/21 260W, 300W, 350W, 400W, 450W.

EcoSheetPile™ Plus can also be delivered according to following ArcelorMittal mill specification: steel grade AMLoCor.

Manufacturing process:
EcoSheetPile™ Plus is a hot-rolled steel sheet pile, manufactured on the site of ArcelorMittal Belval & Differdange (AMBD). The steel for the production of sheet piles at Belval and Differdange originates mainly from the EAF in Differdange and marginally from the EAF in Belval.

EcoSheetPile™ Plus applies to steel sheet piles made via the Electric Arc Furnace route using 100% scrap input and 100% renewable electricity. The electricity used in the steelmaking process is independently verified, with a 'Guarantee of Origin' given that it is from renewable sources. This is ensured by our purchasing of 'Renewable Energy Certificates' (RECs), a market-based offering that certifies the bearer owns a specific amount (in megawatt-hours) of electricity generated from a renewable energy source.
The production of EcoSheetPile™ Plus goes through following main technological steps:

- scrap melting in Electric Arc Furnace;
- steel refining in Ladle Furnace;
- continuous casting;
- hot rolling;
- cooling and finishing.

Applications:
EcoSheetPile™ Plus is a hot rolled steel sheet pile used to build quite impervious retaining walls and cut-off walls, in permanent or temporary applications in the construction and infrastructure field. The main goal is to retain soil and/or water. Typical applications are:

- ports and waterways: quay walls, jetties, breakwaters, riverbanks, embankments, flood protection walls, locks, temporary cofferdams.

- on land: retaining walls, underground car parks, basements, underpasses, bridge abutments, cut-off walls (polluted soils), pit excavations.

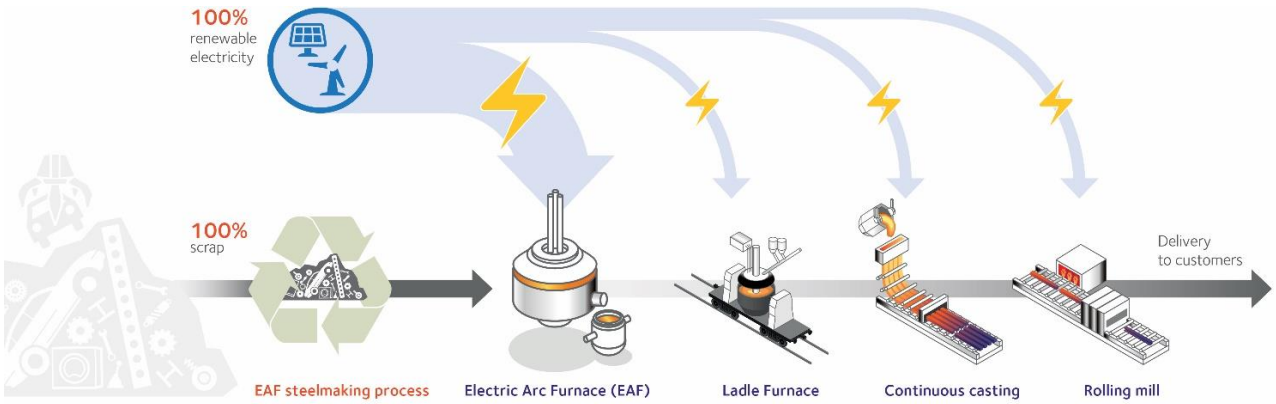
In case of mechanical destruction, no risks are expected to occur in terms of environment and human health. The product does not cause any adverse health effects or release of VOCs to indoor air.

For the use and application of the product the respective national provisions at the place of use apply, in Germany for example the building codes of the federal states and the corresponding national specifications.

At the end of life, they will be recovered and recycled in a new steel product.

UN CPC code: 412 Products of iron or steel

Geographical scope: Europe



Input of renewable energy in the production process of EcoSheetPile™ Plus

LCA information

Functional unit / declared unit: 1 metric tonne of EcoSheetPile™ Plus – Steel Sheet Piles

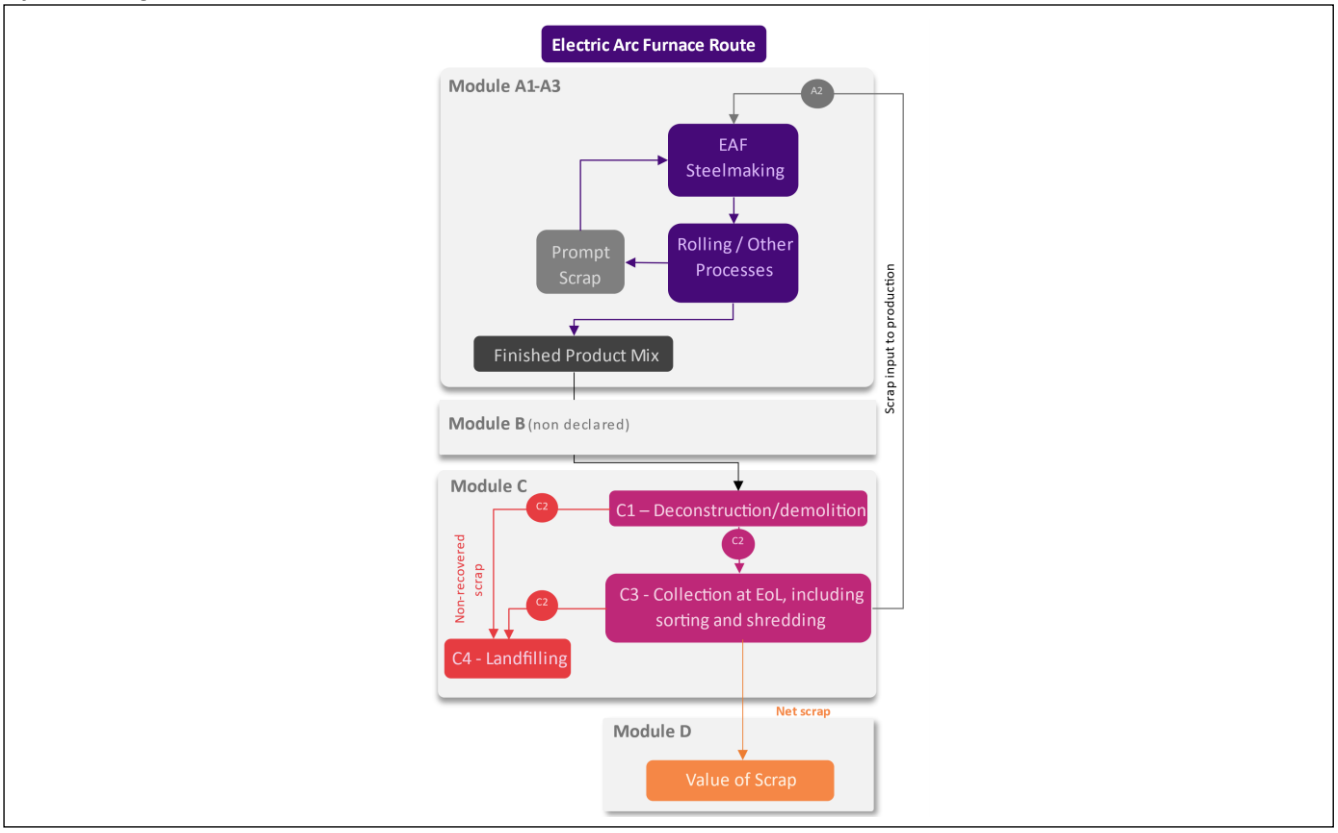
Reference service life: Not applicable

Time representativeness: The collection of the foreground data refers to the year 2021.

Database(s) and LCA software used:
The background data has been taken from the latest available Sphera Managed LCA Content 2023.2 and the LCA model was created using LCA Sphera for Experts software, version 10.7.1.28

Description of system boundaries:
The system boundaries are: Cradle to gate with options, modules C1–C4, and module D.

System diagram:



- *Module A1 to A3:*

The product stage includes provision of all materials, products and energy, as well as waste processing up to the end-of waste state or disposal of final residues during the product stage.

These modules consider the production of beam blanks in Belval and Differdange, the transport within the site as well as the manufacturing of sheet piles in Belval and Differdange. No emissions or waste from packaging is considered in modules A1-A3, as all raw materials, semi-products as well as the final products are transported bulk/loose.

For the modelling, the electricity supply was based on a renewable electricity grid mix (1kV-60kV) from the 2023.2 Managed LCA Content (Sphera) database. The emission factor for the GWP-GHG indicator is 17,8 g CO2eq./kWh.

- *Module C1 to C4:*

Within this EPD, the modules C1-C4 are included. These modules consider the dismantling of the considered product (C1), the transportation of the dismantled components to their End of Life (EoL) destination (C2), the waste processing for recovery or recycling (C3) as well as the disposal (C4), if given. At EoL, the steel material leaves the product system in C3 for recycling in Module D. The environmental impacts from grinding, sorting and transportation of steel scrap are not included.
The considered End-of-Life scenario for the steel material is 60 % recycling, 25 % reuse, and 15 % landfill.

Category	Subcategory	Unit	Quantity
Collection process	Collected separately	kg	1000
	Collected with mixed construction waste	kg	0
Recovery	Reuse	kg	250
	Recycling	kg	600
	Landfill	kg	150
	Incineration	kg	0
	Incineration with energy recovery	kg	0
	Energy conversion efficiency rate	kg	0
Disposal	Material for final disposal	kg	0
Transport	Deconstruction site to scrap processing plant	km	100
	Scrap processing plant to site for end of waste	km	200

- *Module D:*

Module D includes any declared benefits and loads from net flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state in the form of reuse, recovery and/or recycling potentials.

Metals are assumed to reach the end of waste status directly at the construction site. The treatment as well as net benefits and loads of reuse or recycling potentials (for the net scrap amount only) are grouped to module D.

Potential environmental benefits are given for the net steel scrap that is produced at the end of a final product's life. This net scrap is determined as follows:
Net scrap = Amount of steel recycled at end-of-life – Scrap input from previous product life cycles.

For the product under study, in case of 60 % recycling, 25 % reuse, and 15 % landfill:
In the production of EcoSheetPiles™ Plus, 1192 kg of external scrap material was utilized. Upon reaching the end of its life cycle, 600 kg of scrap is reclaimed for recycling, and an additional 250 kg is set aside for reuse. The decision to reuse helps prevent the need for manufacturing new steel, thereby saving 298 kg of scrap (calculated as 1192/1000*250). Consequently, the system demonstrates a net flow of -294 kg of scrap (calculated as 600 + 298 - 1192). This net value is reflected in module D and can be considered as either an environmental credit or burden, depending on the specific impact category.

This End-of-Life scenario represents an average use of the entire sheet pile production of ArcelorMittal. To describe more specific application purposes (e.g.: reuse in temporary applications), further End-of-Life scenarios are provided in the Annex B.

Cut-off criteria:
The environmental impact of the product studied has been assessed by considering all significant processes, materials, and emissions. Excluded flows are assumed to have a negligible impact, contributing less than 5% to the cumulative impact assessment categories. The production of capital equipment, facilities, and infrastructure required for manufacture has not been considered.

More information: https://sheetpiling.arcelormittal.com/

Data quality and sources:
Data quality is compliant with ISO 14025:2006. All primary data were collected for 2021. All background data come from the Sphera Managed LCA Content 2023.2 databases and are representative for the years 2018-2023.

Allocation:
Primary data are allocated using the partitioning approach developed by Worldsteel/EUROFER. The result for GWP-total and GWP-GHG indicators would increase by less than 2.6 % if no allocation was applied. Scrap inputs in module A1-A3, including pre-consumer scrap, are treated as 'burden free'. Scrap produced and used internally within the company but in a different product system has been considered without any value (economic allocation, with a value of zero). Externally sourced pre-consumer scrap was treated as post-consumer scrap meaning that the only burdens considered are a transport burden, taken into account in A2, and a burden on the end-of-life scenarios (waste processing, transport, and destination). For such scraps, economic allocation was deemed not feasible. For all background data used in the model, the standard allocation assumptions of the used datasets were maintained.

Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results)

	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	X	X	X	NR	NR	NR	NR	NR	NR	NR	NR	NR	X	X	X	X	X
Geography	EU	EU	EU	-	-	-	-	-	-	-	-	-	GLO	GLO	GLO	GLO	GLO
Specific data used	>95%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

NR- Not reported. MNR- Module not declared.

Content information

EcoSheetPile™ Plus – Steel Sheet Piles

Product content	**Weight, kg**	**Post-consumer material, weight**[1]	**Biogenic material, weight**
Steel	1000	66%	0% and 0 kg C / kg
Chemical composition			
Iron	> 971,8		
Carbon	< 2,00	-	-
Manganese	< 17,00	-	-
Silicon	< 5,50	-	-
Copper	< 5,50	-	-
Other	< 2,2	-	-

[1]According to ISO 14021:2016, the average recycled content, which includes pre- and post-consumer recycled scrap and additional sources of Fe (such as Ferro alloys), is approximately 98%.

The products do not contain any of the substances of very high concern (SVHC) regulated by the Regulation (EC) No 1907/2006 (REACH) or the Regulation (EC) No 1272/2008 of European parliament. Also, no packaging is considered in the scenario.

Results of the environmental performance indicators

The environmental performance of the functional unit of one metric tonne of EcoSheetPile™ Plus – Steel Sheet Piles are reported below using the parameters and units as specified in PCR 2019:14.

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

Mandatory impact category indicators according to EN 15804+A2:2019

Results per one metric tonne of EcoSheetPile™ Plus – Steel Sheet Piles							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	4,09E+02	4,30E+01	2,63E+01	1,34E+00	2,23E+00	4,08E+02
GWP-fossil	kg CO_2 eq.	4,09E+02	4,26E+01	2,61E+01	1,34E+00	2,22E+00	4,08E+02
GWP-biogenic	kg CO_2 eq.	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
GWP-luluc	kg CO_2 eq.	3,06E-01	3,73E-01	2,45E-01	1,04E-03	7,00E-03	-8,58E-03
ODP	kg CFC 11 eq.	2,35E-08	1,54E-11	3,45E-12	2,20E-11	5,73E-12	-6,57E-09
AP	mol H^+ eq.	1,30E+00	2,46E-01	1,92E-01	3,30E-03	1,60E-02	9,24E-01
EP-freshwater	kg P eq.	2,65E-04	1,50E-04	9,69E-05	4,80E-06	4,54E-06	5,26E-05
EP-marine	kg N eq.	3,40E-01	1,19E-01	9,51E-02	9,70E-04	4,13E-03	1,16E-01
EP-terrestrial	mol N eq.	3,68E+00	1,32E+00	1,05E+00	1,04E-02	4,54E-02	8,78E-01
POCP	kg NMVOC eq.	1,01E+00	2,31E-01	1,82E-01	2,63E-03	1,25E-02	5,62E-01
ADP-minerals&metals*	kg Sb eq.	2,02E-04	2,77E-06	1,76E-06	1,95E-07	1,04E-07	2,84E-03
ADP-fossil*	MJ	5,29E+03	5,81E+02	3,61E+02	2,71E+01	3,00E+01	3,76E+03
WDP*	m^3	1,01E+02	6,23E-01	3,20E-01	2,66E-01	2,47E-01	9,15E+00
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment. EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption						

** 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. We discourage the use of the results of modules A1-A3 without considering the results of module C.*

Resource use indicators according to EN 15804+A2:2019

Results per one metric tonne of EcoSheetPile™ Plus – Steel Sheet Piles							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	7,98E+03	4,68E+01	2,63E+01	1,51E+01	4,89E+00	-2,20E+03
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	7,98E+03	4,68E+01	2,63E+01	1,51E+01	4,89E+00	-2,20E+03
PENRE	MJ	5,29E+03	5,83E+02	3,62E+02	2,71E+01	3,00E+01	3,75E+03
PENRM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	5,29E+03	5,83E+02	3,62E+02	2,71E+01	3,00E+01	3,75E+03
SM	kg	1,19E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	2,68E+00	4,96E-02	2,88E-02	1,22E-02	7,58E-03	5,10E+01
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

Waste indicators according to EN 15804+A2:2019

Results per one metric tonne of EcoSheetPile™ Plus – Steel Sheet Piles							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	-1,60E-06	9,53E-10	1,12E-09	-1,96E-09	6,54E-10	3,84E-05
Non-hazardous waste disposed	kg	2,86E+01	9,69E-02	5,52E-02	1,87E-02	1,50E+02	-6,86E+01
Radioactive waste disposed	kg	1,00E-01	2,88E-03	6,78E-04	3,99E-03	3,42E-04	-2,56E-02

Output flow indicators according to EN 15804+A2:2019

Results per one metric tonne of EcoSheetPile™ Plus – Steel Sheet Piles							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	2,50E+02	0,00E+00	0,00E+00
Material for recycling	kg	0,00E+00	0,00E+00	0,00E+00	6,50E+02	0,00E+00	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, thermal	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Other environmental performance indicators according to EN 15804+A2:2019

Results per one metric tonne of EcoSheetPile™ Plus – Steel Sheet Piles							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG	kg CO_2 eq.	4,10E+02	4,27E+01	2,62E+01	1,36E+00	2,23E+00	4,08E+02
Biogenic carbon content in product	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Biogenic carbon content in packaging	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

References

- General Programme Instructions of the International EPD® System. Version 4.0.
- PCR 2019:14. Construction Products, Version 1.2.5
- Sustainability of construction works - Environmental product declarations - Methodology for selection and use of generic data; CEN/TR 15941:2010
- CPR: Regulation (EU) No 305/2011 of the European parliament and of the council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC.
- EN 15804: EN 15804:2012+A2:2019: Sustainability of construction works -Environmental Product Declarations - Core rules for the product category of construction products.
- EN ISO 14025: EN ISO 14025:2011-10 Environmental labels and declarations - Type III environmental declarations - Principles and procedures
- EN ISO 14040: EN ISO 14040:2009-11 Environmental management - Life cycle assessment - Principles and framework
- EN ISO 14044: EN ISO 14044:2006-10 Environmental management - Life cycle assessment - Require-ments and guidelines.
- LCA FE: LCA FE Software System and Database for Life Cycle Engineering, Sphera Solution GmbH, Leinfelden-Echterdingen, 2022 (https://www.gabi-software.com/support/gabi)
- EN 10248-1:2023, Hot-rolled sheet piles of non-alloy steels - Part 1: Technical delivery conditions. CEN, 2023.
- EN 10248-2:1995, Hot rolled sheet piling of non-alloy steels - Part 2: Tolerances on shape and dimensions. CEN, 1995.
- ASTM A572 / A572M-21e1:2021, Standard: Specification for High-Strength Low-Alloy Columbium- Vanadium Structural Steel, ASTM International, West Conshohocken, PA, 2021.
- ASTM A6 / A6M-22:2022, Standard: Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling, ASTM International, West Conshohocken, PA, 2022.
- A690M-13a:2018, Standard: Specification for High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments
- CSA G40.20:2013, General requirements for rolled or welded structural quality steel. Canadian Standard Association.
- CSA G40.21:2013, General requirements for structural quality steel. Canadian Standard Association.
- ISO 9001: 2015, Quality management systems — Requirements
- ISO 45001:2018, Occupational health and safety management systems — Requirements with guidance for use
- ISO 14001:2015, Environmental management systems — Requirements with guidance for use
- ISO 50001: 2018, Energy Management

Annex A

Impact category indicators according to EN 15804+A1

For additional information and transparency, this annex lists the impact category indicators according to the previous standards EN 15804+A1.

Results per one metric tonne of EcoSheetPile™ Plus – Steel Sheet Piles							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	4,07E+02	4,22E+01	2,59E+01	1,34E+00	2,13E+00	4,00E+02
Depletion potential of stratospheric ozone layer	kg CFC 11 eq.	2,77E-08	1,82E-11	4,06E-12	2,59E-11	6,74E-12	-7,74E-09
Acidification potential of land and water	kg SO2-Eq..	1,03E+00	1,68E-01	1,31E-01	2,57E-03	1,27E-02	8,10E-01
Eutrophication potential	kg(PO4)3--Eq	1,20E-01	4,20E-02	3,31E-02	4,06E-04	1,44E-03	3,82E-02
Formation potential of tropospheric ozone photochemical oxidants	kg ethene-Eq.	6,60E-02	-6,19E-02	-5,10E-02	2,30E-04	9,58E-04	2,26E-01
Abiotic depletion potential for non-fossil resources	kg Sb-Eq.	2,03E-04	2,77E-06	1,75E-06	2,22E-07	1,06E-07	2,84E-03
Abiotic depletion potential for fossil resources	MJ	4,97E+03	5,67E+02	3,55E+02	1,56E+01	2,88E+01	4,00E+03

Annex B

Additional End-of-Life scenarios according to EN 15804+A2:2019

For additional information and transparency, this annex lists End-of-Life scenarios that could be useful, to precisely describe a project situation.

B1. LCIA results (80% Reuse, 18% recycling, 2% landfill)

Reuse / Rental / Buy back scenario: This scenario describes a typical use of sheet piles in temporary applications: 5x use in total, adapting a conservative approach including some cut-offs after each use, and landfill.

Results per one metric tonne of EcoSheetPile™ Plus – Steel Sheet Piles							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	4,09E+02	4,30E+01	2,64E+01	1,35E+00	2,97E-01	-2,26E+02
GWP-fossil	kg CO_2 eq.	4,09E+02	4,26E+01	2,61E+01	1,34E+00	2,96E-01	-2,26E+02
GWP-biogenic	kg CO_2 eq.	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
GWP-luluc	kg CO_2 eq.	3,06E-01	3,73E-01	2,45E-01	1,04E-03	9,33E-04	-2,31E-01
ODP	kg CFC 11 eq.	2,35E-08	1,54E-11	3,45E-12	2,20E-11	7,64E-13	-1,90E-08
AP	mol H^+ eq.	1,30E+00	2,46E-01	1,92E-01	3,30E-03	2,13E-03	-7,92E-01
EP-freshwater	kg P eq.	2,65E-04	1,50E-04	9,69E-05	4,80E-06	6,05E-07	-1,89E-04
EP-marine	kg N eq.	3,40E-01	1,19E-01	9,51E-02	9,70E-04	5,51E-04	-2,32E-01
EP-terrestrial	mol N eq.	3,68E+00	1,32E+00	1,05E+00	1,04E-02	6,06E-03	-2,59E+00
POCP	Kg NMVOC	1,01E+00	2,31E-01	1,82E-01	2,63E-03	1,66E-03	-6,46E-01
ADP-minerals&metals*	kg Sb eq.	2,02E-04	2,77E-06	1,76E-06	1,95E-07	1,39E-08	4,13E-04
ADP-fossil*	MJ	5,29E+03	5,81E+02	3,61E+02	2,71E+01	4,00E+00	-3,22E+03
WDP*	m^3	1,01E+02	6,23E-01	3,20E-01	2,66E-01	3,30E-02	-7,41E+01
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment. EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption						

B2. LCIA results (100% recycling)

Recycling scenario: After the service life of a sheet pile, it is generally retrieved and recycled.

Results per one metric tonne of EcoSheetPile™ Plus – Steel Sheet Piles							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	4,09E+02	4,30E+01	2,64E+01	1,35E+00	0,00E+00	3,33E+02
GWP-fossil	kg CO_2 eq.	4,09E+02	4,26E+01	2,61E+01	1,34E+00	0,00E+00	3,33E+02
GWP-biogenic	kg CO_2 eq.	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
GWP-luluc	kg CO_2 eq.	3,06E-01	3,73E-01	2,45E-01	1,04E-03	0,00E+00	4,44E-02
ODP	kg CFC 11 eq.	2,35E-08	1,54E-11	3,45E-12	2,20E-11	0,00E+00	-4,48E-10
AP	mol H^+ eq.	1,30E+00	2,46E-01	1,92E-01	3,30E-03	0,00E+00	8,16E-01
EP-freshwater	kg P eq.	2,65E-04	1,50E-04	9,69E-05	4,80E-06	0,00E+00	7,77E-05
EP-marine	kg N eq.	3,40E-01	1,19E-01	9,51E-02	9,70E-04	0,00E+00	1,31E-01
EP-terrestrial	mol N eq.	3,68E+00	1,32E+00	1,05E+00	1,04E-02	0,00E+00	1,17E+00
POCP	Kg NMVOC	1,01E+00	2,31E-01	1,82E-01	2,63E-03	0,00E+00	5,32E-01
ADP-minerals&metals*	kg Sb eq.	2,02E-04	2,77E-06	1,76E-06	1,95E-07	0,00E+00	1,89E-03
ADP-fossil*	MJ	5,29E+03	5,81E+02	3,61E+02	2,71E+01	0,00E+00	3,31E+03
WDP*	m^3	1,01E+02	6,23E-01	3,20E-01	2,66E-01	0,00E+00	2,25E+01

Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment. EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption

Note: 1.192 kg scrap is used to manufacture 1.000 kg of EcoSheetPile™ Plus. After use 1.000 kg is recycled. Net amount of scrap in the system: -1.192 + 1.000 kg = -192 kg.

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