



# Vaagen Timbers

Mass Timber Industry



Environmental Impact  
Report

August 2022

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## Company Description

Vaagen Timbers is a company that, using its unique forest-harvesting practices, aims to produce more-sustainable engineered building products such as Cross-Laminated Timber (CLT) panels, Glu Laminated Timber (glulam), and glulam beams in its manufacturing facility in Washington. Vaagen Timber's goal is to reduce fire danger by targeting small lumber and to decarbonize the built environment.

Headquarters	Colville, WA
Founded	2017
Business model	LLC
Employees	65+
Product Certifications	10+ for various products
Website	<a href="https://vaagentimbers.com/">https://vaagentimbers.com/</a>
Strategic partners	IFG Asset Management, Wildwood Trading Group, Vaagen Brothers Lumber, FOUST Fab & Erectors, DCI Engineers

## Alignment with the United Nations' Sustainable Development Goals



Industry, Innovation, and Infrastructure



Responsible Consumption and Production



Climate Action

## Environmental Impact Score: 8.8/10



## Boundless Analysis

- ▶ This report compares floors produced by Vaagen Timbers using its Cross-Laminated Timber (CLT) panels against slab on metal deck floors, concrete floors, and wooden joist floors.
- ▶ The Environmental Impact Score is based on per-unit impact for key performance indicators, including Greenhouse Gas (GHG) Footprint, Fossil Energy Footprint, Water Footprint, Particulate Matter Emissions, Material Costs, and GHG Abatement Costs.
- ▶ Boundless scores Vaagen Timbers' CLT flooring systems a 8.8 on per-unit impact. The score rationale can be found in Appendix E.
- ▶ Vaagen Timbers' CLT flooring was able to realize a 77% reduction in GHG Footprint, 77% reduction in Fossil Energy Footprint, 90% reduction in Water Footprint, and 93% reduction in Particulate Matter Emissions compared with slab on metal deck flooring systems.
- ▶ Transportation accounts for a large portion of the emissions associated with concrete and slab on metal decks. Since the materials in these flooring systems are heavy compared with the two wood-based floorings, and wood is more likely to be sourced locally, the transportation GHG emissions will be reduced for Vaagen Timbers CLT floors and wooden joist floors.
- ▶ Between 2022 and 2030, Vaagen Timbers' CLT flooring would potentially save 547,000 tonnes of CO<sub>2</sub>e if it were to replace slab on metal decks.

## Management Team

- ▶ Russ Vaagen, CEO, founded Vaagen Timbers, LLC. in 2017. Russ was born and raised in Colville, WA and attended Washington State University where he earned degrees in Human Resources and Business Management. Following college, Russ worked for accounting firm BDO Seidman in Seattle, WA before returning to his family business, Vaagen Brothers Lumber where he served in purchasing, sales, and marketing roles over several years before assuming the role of Vice President in 2005, overseeing Corporate Operations. As VP of Operations, Russ was responsible for the company's sawmill operations and oversaw two additional sawmill acquisitions. Russ is the former Chairman of both the Timber Product Manufacturers Association and the Western Wood Products Association Export Committee, and currently serves on the board of Sustainable Northwest and the Northeast Washington Forest Coalition as past President.
- ▶ Spencer Bishop, vice president of Sales, joined Vaagen Timbers in 2021. He has experience in leading high-performance cross-functional R&D, Sales, Operations, Legal, IT, and Marketing teams. He previously served as a project manager and later as the manager for the Global Project Management team at Pyrotek, where he was responsible for 80 different locations. Spencer's team developed, launched, and scaled up technical solutions in both the automotive and aerospace industries. He has several years of business development and management experience.
- ▶ Mike Carter, director of Manufacturing Operations, joined Vaagen Timbers in 2022. Mike previously worked at the D&L Foundry as a sales manager and production manager. He has experience in operations management and as a credit manager at Wells Fargo.

## Technology

- ▶ Vaagen Timbers is a producer of sustainable CLT and glulam engineered building materials, which combined are also known as "mass timber." These products are known to be strong, durable, and fire-resistant and can therefore compete with more traditional building materials in complex building projects such as mid-rise commercial buildings, modular housing, and other types of housing construction.
- ▶ Vaagen Timbers aims to harvest its wood exclusively from small-log timber products. The company produces timber out of smaller lumber with the goal of promoting sustainable forest management. By targeting smaller forest growth and thinning overgrown forests, Vaagen is able to produce more sustainable forest products while reducing the risk of wildfires. Using sustainable wood-based building materials also aids in decarbonizing the built environment.
- ▶ Mass timber construction is relatively new in North America but has been a well-accepted building material and means of construction for over a decade in Europe.
- ▶ Vaagen Timbers produces CLT panels and glulam beams and panels from locally sourced wood in its Washington facility.

## Operations and Partnerships

- ▶ Vaagen Timbers' headquarters is located in Colville, WA.
- ▶ Vaagen Timbers works in conjunction with Vaagen Brothers Lumber to source local lumber for its lumber products.
- ▶ Vaagen Timbers has built feedstock partnerships with Wildwood Trading Group and Vaagen Brothers Lumber, and also has several strategic partners, including Western Forest Products, DCI Engineers,



FOUST Fab & Erectors, Anderson Construction, and SolTerra.

## Environmental Highlights

Summarized below are the most relevant impact categories and codes that refer to the United Nations' Sustainable Development Goals (SDGs). This section highlights the most important factors that explain how this technology impacts the environment and society.



### Greenhouse Gas Emissions

Production of CLT flooring using Vaagen Timbers' product results in lower GHG emissions from production, material sourcing, transportation, and floor design when compared with GHG emissions from concrete slab flooring, slab on metal deck flooring, and wooden joist flooring models. Vaagen Timbers' CLT flooring has a GHG Footprint of 35 kilograms of CO<sub>2</sub>e per meter squared of flooring. The analysis uses GWP 100 and assumes that the wood itself is carbon neutral, meaning it is assumed that all carbon removed from the atmosphere is eventually emitted to the atmosphere as CO<sub>2</sub>.

Relevant code: [SDG 13](#), Climate Action



### Industry, Innovation, and Infrastructure

Vaagen Timbers sources its products through sustainable forest management operations and harvesting small timber, allowing the larger trees to thrive while promoting the health of the forests. By sourcing wood locally and implementing sustainable forest management techniques, Vaagen Timbers aims to reduce both the impacts of forestry and the risk of spreading forest fires. Lowering the concentration of smaller trees in forests promotes forest health and decreases the spreadability of forest fires.

Relevant code: [SDG 9](#), Industry, Innovation, and Infrastructure



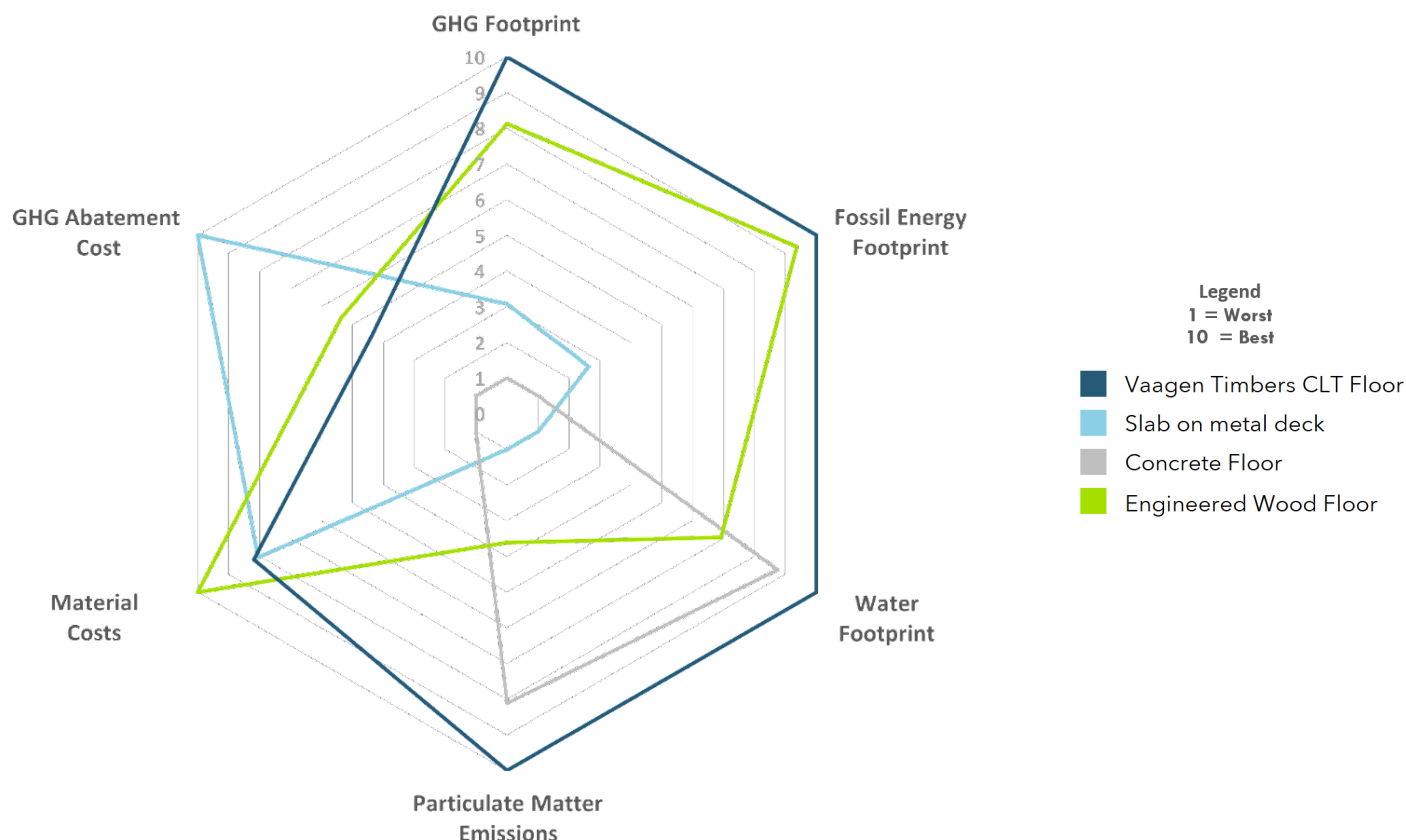
### Responsible Consumption and Production

Vaagen Timbers is able to use less fossil fuel to produce its flooring than its concrete and steel-based competitors. Because concrete and steel are so heavy in comparison, they require more fossil fuel to assemble and transport than their wood-based alternatives. By relying on locally sourced lumber, Vaagen is able to reduce GHG emissions from the production and transportation of cement and metal while supporting the responsible use of local products.

Relevant code: [SDG 12](#), Responsible Consumption and Production



## Benchmarking and Conclusions



Boundless compared three different flooring designs to Vaagen Timbers' CLT flooring to evaluate the relevant life cycle performance of each flooring type across several environmental key performance indicators (EKPIs). Boundless measured the GHG Footprint, Fossil Energy Footprint, Water Footprint, Particulate Matter Emissions Footprint, Material Costs, and GHG Abatement Cost of each floor design. All floor designs in this study have a minimum one-hour fire-resistance rating. Vaagen Timbers' CLT floor has the potential to significantly reduce GHG emissions, fossil energy consumption, water consumption, and particulate matter emissions compared with its main competition. However, due to the novelty of its product, its material costs are higher than those of competing floor designs in this study.

Vaagen Timbers' CLT flooring is able to have a lower GHG Footprint than concrete, slab on metal deck, and wooden joist flooring due to the materials used in each flooring design. Per-cubic-meter of raw materials, steel and concrete have higher GHG impacts than their wood alternatives. Vaagen's material sourcing and CLT production is lower than that of concrete and is, therefore, able to reduce the GHG emissions associated with the key component of the flooring structure. The high volumes of steel used in rebar and metal decking also cause a higher Water Footprint and particulate matter Emission Footprint compared with CLT panels.

Boundless estimated the GHG emissions savings if Vaagen Timbers' CLT flooring were to replace either concrete or slab on metal deck floorings in the northwestern United States, with production ramping up in stages over the period of 2022 through 2030, and a new facility opening up in 2025. Emissions of Vaagen Timbers' CLT flooring, slab on metal decks, and concrete flooring are calculated and compared on a per-square-meter-of-flooring basis. Between 2022 and 2030, Vaagen Timbers' CLT flooring would be able to potentially save 421,000 tonnes of CO<sub>2</sub>e if it were to replace slab on metal decks. These emissions savings would be equal to the carbon sequestered by up to 55,400 acres of U.S. forest per year over the same nine-year time period.

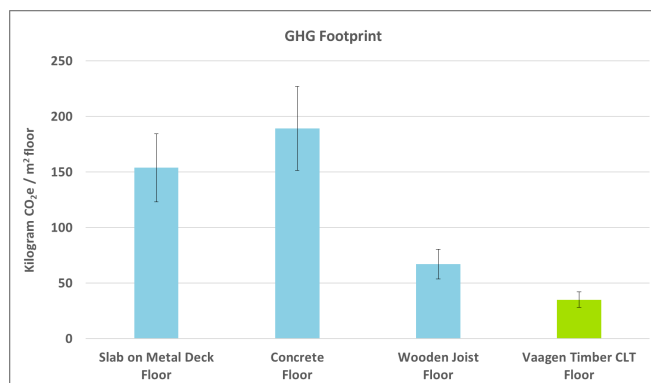
## Environmental Key Performance Indicators

Boundless evaluated the life cycle inputs and impacts per square meter of Vaagen's 5-Ply CLT floor, slab on metal deck floor, cement floor, and wooden joist floor. This section presents a description of each EKPI addressed and a review of Vaagen Timbers' CLT floor's environmental performance relative to its competitors. The impact metrics are reported graphically using bar charts to illustrate a baseline result value, along with sensitivity bars reflecting a range of possible result values around deployment scenarios and key variables.

### GHG Footprint

This metric represents the GHG emissions associated with the material sourcing, production, and transportation required to produce one square meter of flooring.

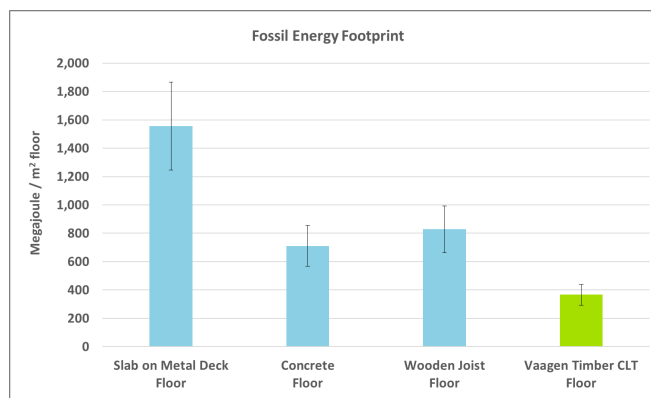
- ▶ Vaagen Timbers' 5-Ply CLT floor has a GHG Footprint of 35.1 kilograms of CO<sub>2</sub>e emissions per square meter of flooring, while 54% of Vaagen Timbers' 5-Ply CLT floor's GHG Footprint is a direct result of the CLT product, whereas the remaining 46% results from other floor layers such as gypcrete, fasteners, isolation mats, undercoat, and transportation steps throughout the supply chain.
- ▶ Vaagen is able to realize a 77%, 81%, and 48% reduction compared with slab on metal deck floors, concrete floors, and wooden joist floors, respectively.
- ▶ Transportation accounts for a large portion (up to 40%) of the GHG Footprint of the concrete floor structure due to its material origin and high density. Production of steel rebar (up to 42%) is responsible for a large portion of the GHG Footprint of slab on metal deck floors.



### Fossil Energy Footprint

This metric represents the fossil fuel energy inputs as a result of the mining and/or material collection processes, production, and transportation steps through the supply chain, reported in megajoules (MJ) of fossil energy per one square meter of flooring.

- ▶ Vaagen Timbers' CLT floor has a Fossil Energy Footprint of 367 MJ per square meter, which realizes a 77%, 81%, and 22% reduction from slab on metal deck, concrete, and wooden joist floorings, respectively.
- ▶ The large Fossil Energy Footprint of slab on metal flooring is attributed to steel production, whereas the large Fossil Energy Footprint of concrete flooring is a result of concrete production and transportation.
- ▶ Wooden joist floors have a similar Fossil Energy Footprint to Vaagen Timbers' 5-ply CLT flooring, with the wooden framing, insulation, and metal channels being the largest contributors.



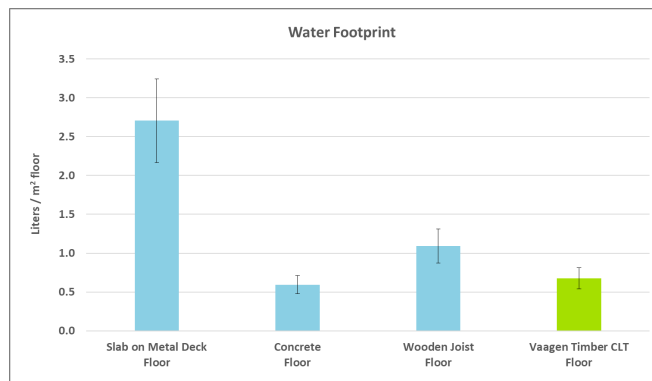
## EKPIs continued

Boundless evaluated the life cycle inputs and impacts per square meter of Vaagen's 5-Ply CLT floor, slab on metal deck floor, cement floor, and wooden joist floor. This section presents a description of each EKPI addressed and a review of Vaagen Timbers' CLT floor's environmental performance relative to its competitors. The impact metrics are reported graphically using bar charts to illustrate a baseline result value, along with sensitivity bars reflecting a range of possible result values around deployment scenarios and key variables.

### Water Footprint

This metric represents the water consumption from the material sourcing, production, and transportation of raw materials associated with one square meter of flooring and is measured in liters of water consumption per one square meter of flooring.

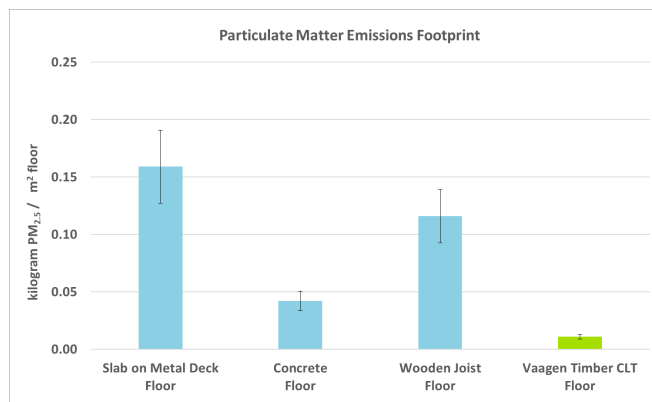
- ▶ The Water Footprint of Vaagen's CLT flooring is 0.3 liters per square meter of flooring. This Water Footprint metric includes the use of water withdrawn from groundwater or surface water (blue water) and pollution of water (grey water), but as it is most often done, excludes the use of rainwater (green water).
- ▶ Vaagen Timbers' CLT flooring has a Water Footprint 90% lower than that of slab on metal deck, 76% lower than that of wooden joist flooring, and 57% lower compared to concrete decks.
- ▶ Steel production is the main cause of the high Water Footprint associated with slab on metal flooring. Boundless assumed virgin steel in this assessment. The Water Footprints of these builds could be lower if recycled steel were used.



### Particulate Matter Emissions Footprint

This metric represents the release of small particulate air pollution equal to or less than 2.5 microns ( $PM_{2.5}$ ) in diameter associated with the production, material sourcing, and transportation of one square meter of flooring.

- ▶ Vaagen Timbers' 5-Ply CLT flooring has a Footprint of 0.011 kg  $PM_{2.5}$  per square meter of flooring, with the largest contributors being the production of 5-Ply CLT and gypcrete.
- ▶ Vaagen's flooring releases 93%, 74%, and 91% less  $PM_{2.5}$  emissions than slab on metal flooring, concrete flooring, and wooden joist flooring, whose biggest contributors are steel production, concrete production, and fiberglass insulation, respectively.



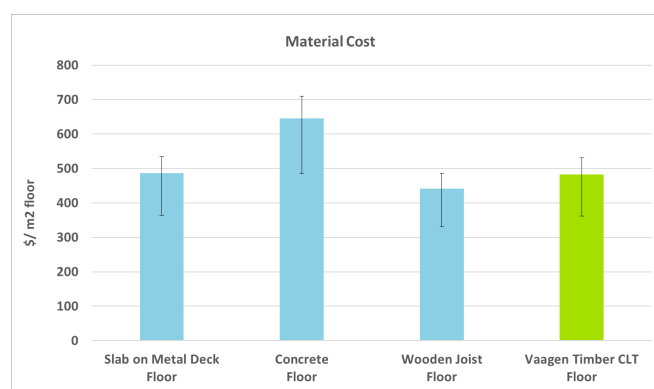
## EKPIs continued

Boundless evaluated the life cycle inputs and impacts per square meter of Vaagen's 5-Ply CLT floor, slab on metal deck floor, cement flooring, and wooden joist floor. This section presents a description of each EKPI addressed and a review of Vaagen Timbers' CLT floor's environmental performance relative to competitors. The impact metrics are reported graphically using bar charts to illustrate a baseline result value, along with sensitivity bars reflecting a range of possible result values around deployment scenarios and key variables.

### Material Costs

This metric represents the material production costs from a customer perspective, based on commodity prices, and excludes labor and transportation costs, as these can vary significantly depending on the season, location, and project size.

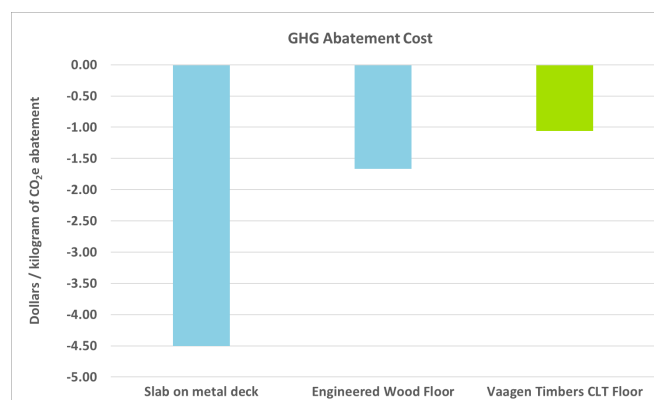
- ▶ Vaagen Timbers' 5-Ply CLT flooring material costs are estimated at \$483 per square meter of flooring, with 72% of these material costs coming from the CLT product directly.
- ▶ Material costs of competitor flooring models are based on quotes given by external local general contractors. Material costs could vary depending on project size, location, and market demand.



### GHG Abatement Costs

This metric represents the minimum costs of GHG emissions that would enable the subject technology to reach cost parity with the existing industry baseline technology and is presented in dollars per tonne of avoided GHG emissions. A negative value signifies that the technology is estimated to be cost competitive with the baseline technology even in the absence of costs for GHG emissions.

- ▶ The estimated GHG Abatement Costs of Vaagen Timbers' 5-Ply CLT floor are -\$1.06 per kg of CO<sub>2</sub>e abatement. Considering the material cost assumptions provided by Vaagen Timbers, it was estimated that its technology can reduce GHG emissions while also being cost competitive.





## GHG Emissions Projections

Long-term potential GHG emissions and savings were projected for three scenarios that each share the same annual production rates proportional to Vaagen Timbers' projected output in 2022 through 2030. One scenario incorporates Vaagen Timbers' projected annual production rates of CLT flooring systems, whereas the other two scenarios assume slab on metal decks or concrete flooring systems will satisfy the same annual production in the absence of Vaagen Timbers' CLT flooring systems. The projections cover the years 2022 through 2030. GHG Projection results are presented in metric tons of CO<sub>2</sub>e per year.

- ▶ Boundless estimated the GHG emissions savings if Vaagen Timbers' CLT floors were to replace either concrete floors or slab on metal decks in the northwestern United States, with production ramping up in stages over the period of 2022 through 2030, and a new facility opening up in 2025.
- ▶ Concrete Flooring Scenario presents the GHG emissions associated with concrete flooring systems that are comparable to Vaagen Timbers' CLT flooring systems in terms of structural load requirements, safety, and applications. Comparisons are on a per-square-meter basis.
- ▶ Slab on Metal Deck Scenario- presents the GHG emissions associated with slab on metal deck flooring systems that are comparable to Vaagen Timbers CLT flooring systems in terms of structural load requirements, safety, and applications. Comparisons are on a per-square-meter basis.

The projection analyses incorporated the following considerations:

- Vaagen Timbers' first plant will increase production from 2022 through 2024 and operate at full capacity (23,631 cubic meters of CLT) over subsequent years.
- Vaagen Timbers' second plant will start operations in 2024 and increase production through 2027, after which it will operate at full capacity (472,383 cubic meters of CLT) over subsequent years.
- Emissions of Vaagen Timbers' CLT floors, slab on metal decks, and concrete floors are calculated and compared on a per-square-meter-of-flooring basis.
- GHG emission factors are assumed to be 35.1 CO<sub>2</sub>e per m<sup>2</sup> of Vaagen Timbers' 5-Ply CLT flooring, 154 kg CO<sub>2</sub>e per m<sup>2</sup> of slab on metal deck flooring, and 189 kg CO<sub>2</sub>e per m<sup>2</sup> of concrete flooring, as discussed in the GHG Footprint section of this report.

GHG emission savings are calculated by subtracting the cumulative GHG emissions of the slab on metal deck or concrete floors produced in 2022 through 2030 by the cumulative emissions of Vaagen Timbers' 5-Ply CLT floors produced in the same time period. Boundless estimates that, over the period of 2022 through 2030, up to 421,000 and 547,000 tonnes of GHG emissions could be saved if the produced 5-Ply CLT floors from Vaagen Timbers directly replaced either slab on metal deck or concrete flooring systems.

