FT. CHIPEWYAN

RED GRANITE MINING IMPACT ASSESSMENT

ELEMENT UNITED | HTTPS://ELEMENTUNITED.COM

SUMMARY

Element's report* provides

Open quarry Mining Environmental Impact Assessment for Chipewyan Quarry at Ft. Chipewyan, Alberta, CA

Element's leadership

Scott Lomu • President

Over 25 years in the precious elements industry.
A passionate voice for responsible, humane mining.
Leading the digital gold rush to provide access for all.

David Kasteler • COO

FINSERV entrepreneur who has built multiple high-value organizations.
Consulted for or represented over $750M in mining assets.

Element's purpose

Element is bringing the blockchain + metaverse revolution to gold and precious elements. We digitize precious elements by building digital economies on top of mines.

Why is it important to slow mining?

- End Hoarding
- Reduce CO_2 Emissions
- End Exploitation
- Corruption
- Free Access for All

*Document information provided by a 3rd party. Data not verified by Element United.

EXECUTIVE SUMMARY

This report was produced independently and resulted from Element United's ambition to mine differently, support future generations by protecting the planet, and reclaim land once destroyed by harmful practices, ultimately giving power back to the people most hurt by industrial mining.

Research is intended to give the reader of this report an overview of red granite and its impact on the sustainability framework surrounding open quarry mining. People, planet, and prosperity underline this report's themes, starting with the introduction of granite at the Bay of Fundy Granite company in 1872.

Next, we discuss granite as part of the materials economy, from extraction to processing, which supports Scopes 1 and 2 emissions, but without prevailing data, leaves out the emissions produced by Scope 3 – the consumer. Though the number is unidentifiable, heavy stone use in the consumer sector is expected to be significant compared to other mining sectors.

In brief, this report introduces the Athabasca Chipewyan First Nation, their five groups, territory, culture, language, and one way they continue to achieve resource management on their own. References and keywords are indicated in **bold** for the reader of this report to continue independent research on the rich history of the Athabasca Chipewyan people.

Closing this report, we offer carbon reduction data and analysis related to Scopes 1 and 2 emissions. Scope 3 emissions are still largely unknown. Our team conducted no on-site testing. Instead, we used prevailing and relevant data, professional SME sources to include the airline industry, product retailers, and academics, as well as EPA calculators, and reliable, annotated, public, educational, and generally accepted resources to form estimations or conclusions.

Research notes and resources are provided at the end of this document.

INTRODUCTION

Granite has long been the "carver's" canvas, discovered in pyramids throughout Egypt, temples in India, and Imperial Roman architecture. Today, we have found many uses for this versatile stone, from sculptures and memorials to buildings, engineering, paving, tombstones, and even the sport of curling.

Much of Canada's granite industry can be traced back to The Bay of Fundy Red Granite Company, founded in 1872, in New Brunswick, by Scottish miners. Hand methods were used in boring holes and blasting, but Horse derricks were used to pull the granite from the earth (pole, pulley, and rope)[1].

The U.S. [Granite] Market is Estimated at 4.9 Trillion Metric Tons, While China is Forecast to Grow at 6.4% CAGR.
—Research and Markets

For many reasons, mines like the Fundy Red Granite Company open and close, change hands or withdraw from operation. The Ft. Chipewyan red granite mine had a somewhat similar history.

THE CHIPEWYAN QUARRY

The Chipewyan quarry is located 20 kilometers north of Ft. Chipewyan, on the shoreline of Lake Athabasca, with riverfront access to its south, where access to the Precambrian Shield shows an abundance of red granite for ornamental building stone. Geologic assessment mapped in sufficient detail of the Chipewyan quarry indicates a total of 680 acres with an additional 8448 hectares, or 20,875 acres, leased by its parent agency. Both mineral lease claims are included in Canada's mineral projects disclosure; a National Instrument (NI) 43-101 Technical Report and Geological survey, indicating a potential land reclamation, which permits use and analysis in this summary report[2].

Proven mineral reserves have already been excavated at a depth of 20 meters over a portion of this mineral lease. A 50% Recovery Factor (RF) analysis from drill core exploration demonstrates an additional 180 meters of excavation, totaling a usable 7,848,897,900 cubic meters of reserves over 21555 acres. At 50% reclamation, 7,848,897,900 cubic meters of the earth are estimated for ore tailings and waste. Continued area mining would require additional overburden removal to expose

[1] O'Halloran, M. E. (n.d.). *The Grant Industry of St. George and Recollections of its People*. History of the granite industry in St. George, NB. https://sites.rootsweb.com/~nbpstgeo/stge5a35a.htm#no.1
[2] Hamilton, W., & Langenburg, C. W. (2020, December 1). *NI 43-101 Alberta Red Granite*. Alberta Research Council.

layers of the Precambrian Shield and granite reserves, contributing to biomass disturbances and carbon released into the atmosphere[3].

STONE MINING MARKET

Like gold, an exceptional amount of energy is consumed upstream during extraction and mineral processing, but the consumer phase (Scope 3 emissions) remains largely undocumented.

A quick glimpse into that market shows segmentation by product (slabs and tiles), application (kitchen, flooring, stair, and monuments; bridges and buildings), geography, and critical mining and manufacturing companies. So far, studies for decorative or ornamental applications are too extensive and lack funding for full Scope 3 emissions analyses.

As with other industries, the global COVID-19 pandemic greatly impacted the granite market, with many mines suspending, if not shuttering, operations altogether. Still, market analysts expect global granite trends to rise by at least 4.1% *compound annual growth rate* (CAGR) through 2028[4].

QUARRY MINING

THE QUARRYING PROCESS[5]

[3] Hamilton, W. (2020, December 1). *NI 43-101 Alberta Red Granite*. Alberta Research Council.

[4] Research and Markets. (2021, April 23). *Global granite, marble and Stone Market Report 2021: Growing prominence of green granite, marble and stone benefit market expansion.* GlobeNewswire News Room. https://www.globenewswire.com/en/news-release/2021/04/23/2215789/28124/en/Global-Granite-Marble-and-Stone-Market-Report-2021-Growing-Prominence-of-Green-Granite-Marble-and-Stone-Benefit-Market-Expansion.html

[5] Kittipongvises, Suthirat & Chavalparit, Orathai & Sutthirat, Chakkaphan. (2016). Greenhouse Gases and Energy Intensity of Granite Rock Mining Operations in Thailand: A Case of Industrial Rock-Construction. Environmental and Climate Technologies. 18. 10.1515/rtuect-2016-0014.

Ft. Chipewyan quarry offers the potential for 365 days of mining processes but may have interruptions in the summer months, delaying the mine for a day or two.

Site preparation: Before construction begins on a new mine site, prepping the prospective property includes readying the property for excavation and building an infrastructure (such as roads) that supports the operation.

Drilling and blasting: Granites are primarily extracted from their natural location by drilling. Horizontal boring machines drill holes up to 12 meters deep. Blast holes are created by detonating explosives inside them. Ammonium nitrate fuel oils (ANFO) are today's most common blasting agent. They consist of ammonium nitrate combined with diesel fuel (about 5 to 6 percent by weight).

Digging up and transport: After breaking the rock outcrop at the quarry, broken blocks are transported from the mining site to the processing plant by heavy-duty diesel trucks.

Comminution: Comminution (crushing and grinding) breaks down the granite blocks into smaller pieces until they reach the desired size. The crushed rock is then transported to the stockpile by heavy-duty trucks and delivered to the primary crushing machines (i.e., jaw crushers), where they are crushed further. The crushed stone is then fed into impact or conical crushers for further processing. After the crushing process, the crushed rocks are sieved into different sizes by vibratory screens or sent back to the crusher for further processing.

INDICATIONS OF POLLUTION

Granite mining, like that of jade, gold, and other precious elements, primarily functions as a utilitarian aesthetic if nothing else, weighing so egregiously on the Sustainability Nexus (water-energy-food-ecosystem) any potential site remediation after mine closure is negated.

The distribution of GHGs emissions by scope clearly shows that CO2 dominated Scope 1 direct emission (68 %). Those emissions came principally from diesel engine combustion during the mining operations.
—Kittipongvises, et al.

PC: AECOM

KNOWN POLLUTIVE IMPACTS PEOPLE, PLANET, CARBON

People

- √ Linked to serious illnesses and even fatal respiratory diseases, cancers, chronic obstructive pulmonary disease, and kidney disease due to Free silica particles released during mining and manufacturing[6]
- √ Granite can promote initial in-home VOCs if installed poorly
- √ It is pollutive, increasing airborne particulates due to "excavations, drilling, and blasting operations, transportation of materials, haul roads, exhaust emissions from mobile sources[7]."

Planet

- √ Requires high volumes of water for extraction
- √ Ore, tailings, and rock waste damage surface waters and drainage ways and contaminate topsoil used in food production, and ecosystem development, arresting plant growth – contributing to food insecurity
- √ Soil pH values increase, resulting in acidic soils; heavy metals concentrate – contributing to food insecurity

[6] *United States Department of Labor*. US Department of Labor takes action to reduce miners' exposure to silica dust as work continues on an improved health standard | Mine Safety and Health Administration (MSHA). (n.d.). Retrieved October 26, 2022, from https://www.msha.gov/news-media/press-releases/2022/06/08/us-department-labor-takes-action-reduce-miners%E2%80%99-exposure-silica

[7] Oniyide G.O., Idowu K. A. and Anikoh G. A. "Investigations of the Environment Effects of Granite Rock Quarry (A Case Study Of Ebenezer Quarry, Akure, Nigeria)." IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), vol. 16, no. 3, 2019, pp. 41-49.

The average per ton emissions produced by granite mining is 2.92kgCO_2e.
—Kittipongvises, et al.

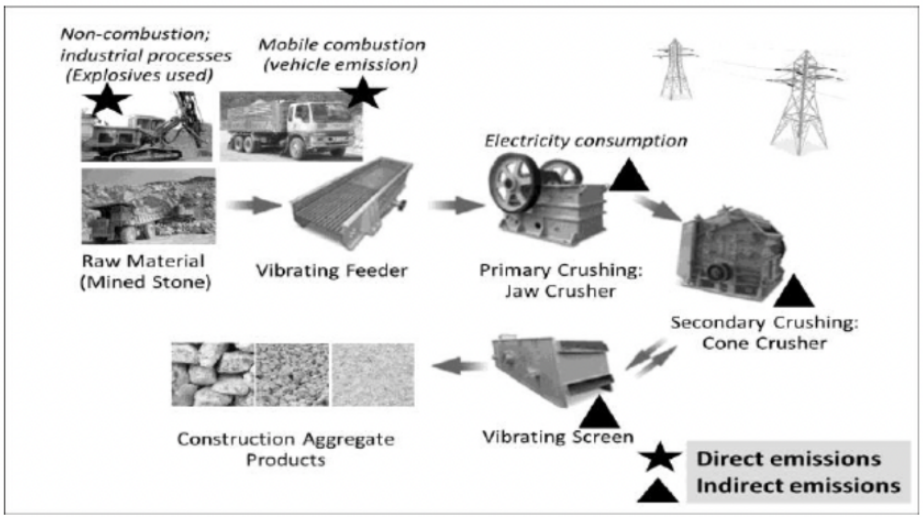
- √ Contributes to erosion, loss of biodiversity, and soil contamination, rendering land useless[8].
- √ Anthropogenic noise vibration exceeds permissible levels leading to nearby structural collapse and environmental degradation[9]
- √ Granite is neither renewable nor recycled
- √ Is pollutive, increasing airborne particulates "as a result of excavations, drilling, and blasting operations, transportation of materials, haul roads, exhaust emissions from mobile sources[10]" (repeated from "people" because it impacts both)

Carbon

- √ Requires high energy for extraction
- √ Carbon pollutive, requiring lengthy transportation from site to manufacturing facility, warehouse, and consumer homes for installation

SCOPE 1 AND 2 EMISSIONS

Heavy mining industries like granite require intense, destructive, polluting processes from quarry to consumer use.



PC: KITTIPONGVISES et al.

We discovered just one study in Thailand that provided carbon pollution data and ways to reduce electricity generation and

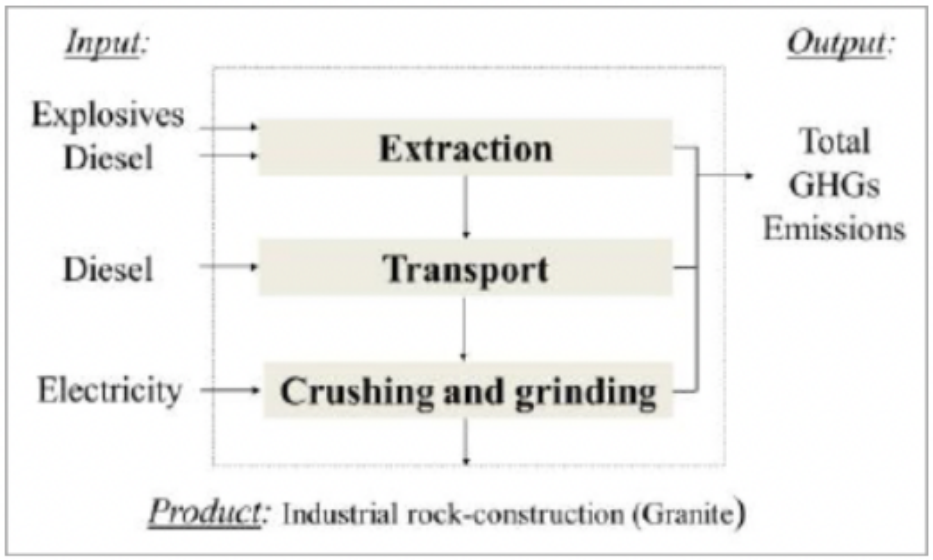
[8] Oniyide G.O., Idowu K. A. and Anikoh G. A. "Investigations of the Environment Effects of Granite Rock Quarry (A Case Study Of Ebenezer Quarry, Akure, Nigeria)." IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), vol. 16, no. 3, 2019, pp. 41-49.
[9] Oniyide G.O., Idowu K. A. and Anikoh G. A. "Investigations of the Environment Effects of Granite Rock Quarry (A Case Study Of Ebenezer Quarry, Akure, Nigeria)." IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), vol. 16, no. 3, 2019, pp. 41-49.
[10] Oniyide G.O., Idowu K. A. and Anikoh G. A. "Investigations of the Environment Effects of Granite Rock Quarry (A Case Study Of Ebenezer Quarry, Akure, Nigeria)." IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), vol. 16, no. 3, 2019, pp. 41-49.

transportation emissions for both Scope 1 and Scope 2. Scopes 1 and 2[11].

Measurement parameters include direct and indirect emissions of Greenhouse Gases (GHGs)[12] at the quarry and in manufacturing:

Researchers found the average GHGs emissions were 3.387,718 kg CO2e per year and 2.92 kg CO_2e per ton of granite. "Of this, the carbon intensity of grid-electricity consumption for the crushed rock production was 1.84 kgCO2/kWh. Diesel fuel combustion for transport activities in the mining factories was the most significant contributor to GHGs emissions (68%) compared to the purchased electricity and explosion process, with 31 % and 1 %, respectively.[13]"

At the quarry[14]:



PC: KITTIPONGVISES et al.

- Emissions associated with site preparation
- Emissions associated with mining and milling operations (i.e., electricity and fuel utilization, transportation of materials to the facility, embodied energy, etc.)

[11] Kittipongvises, Suthirat & Chavalparit, Orathai & Sutthirat, Chakkaphan. (2016). Greenhouse Gases and Energy Intensity of Granite Rock Mining Operations in Thailand: A Case of Industrial Rock-Construction. Environmental and Climate Technologies. 18. 10.1515/rtuect-2016-0014.

[12] Kittipongvises, Suthirat & Chavalparit, Orathai & Sutthirat, Chakkaphan. (2016). Greenhouse Gases and Energy Intensity of Granite Rock Mining Operations in Thailand: A Case of Industrial Rock-Construction. Environmental and Climate Technologies. 18. 10.1515/rtuect-2016-0014.

[13] Kittipongvises, Suthirat & Chavalparit, Orathai & Sutthirat, Chakkaphan. (2016). Greenhouse Gases and Energy Intensity of Granite Rock Mining Operations in Thailand: A Case of Industrial Rock-Construction. Environmental and Climate Technologies. 18. 10.1515/rtuect-2016-0014.

[14] Kittipongvises, Suthirat & Chavalparit, Orathai & Sutthirat, Chakkaphan. (2016). Greenhouse Gases and Energy Intensity of Granite Rock Mining Operations in Thailand: A Case of Industrial Rock-Construction. Environmental and Climate Technologies. 18. 10.1515/rtuect-2016-0014.

- Emissions from fuel use in facility-owned equipment and vehicles
- Emissions related to net electricity imports to the facility
- Emissions from the consumption of explosives (composition: ammonium nitrate fuel oil, diesel combustion)
- Emissions from chemicals processed during mining
- Emissions embodied in reagents
- Emissions from solid and liquid wastes
- Carbon uptake from land-use change

In manufacturing[15]:

- Emissions associated with transport trucks, heavy-duty diesel trucks
- Emissions as a result of comminution (crushing and grinding)

The Kittipongvises et al. (2016) study found, "In terms of productivity, the average value of granite rock production of all case factories ranked approximately 816201 to 2000000 MtC/year[16]," or as much as 5479 MtC/day.

[15] Kittipongvises, Suthirat & Chavalparit, Orathai & Sutthirat, Chakkaphan. (2016). Greenhouse Gases and Energy Intensity of Granite Rock Mining Operations in Thailand: A Case of Industrial Rock-Construction. Environmental and Climate Technologies. 18. 10.1515/rtuect-2016-0014.

[16] Kittipongvises, Suthirat & Chavalparit, Orathai & Sutthirat, Chakkaphan. (2016). Greenhouse Gases and Energy Intensity of Granite Rock Mining Operations in Thailand: A Case of Industrial Rock-Construction. Environmental and Climate Technologies. 18. 10.1515/rtuect-2016-0014.

PC: ATHABASCA CHIPEWYAN FIRST NATION

ATHABASCA CHIPEWYAN FIRST NATION (ACFN[17])

MIXED INDUSTRIAL USE HEAVY POLLUTION

Assessment of the Ft. Chipewyan granite quarry mining impact would require environmental impact studies that the government of Alberta, Canada, has so far refused to conduct. When coupled with the nearby oil sands activities, defining a "beginning" or an "end" to the scourge of threats weighing on the health and well-being of Athabascan First Nation people becomes next to impossible.

Like First Nation people next door in the Northwest Territories, Athabasca Nations have depended on the boreal forests for their food and water security, cultural identity, and livelihoods. Boreal forests are where grizzly bears, wolves, lynx, nesting migrating birds, thousands of plant species, and abundant waterways provide millions of people with jobs,

[17] Athabasca Chipewyan First Nation. (n.d.). https://www.acfn.com

income, and cultural wealth[1819]. But the oil sands moved onto the Athabascan land-just next door to the Ft. Chipewyan quarry. Alberta's tar and oil sands are consistently one of Canada's most significant environmental disasters and the worst example of Canadian government regulation.

PC NARWHAL

Thirty years on, with money from big oil, pipelines, and poor, if not absent, environmental mitigation, the oil sands made certain that the land is irrevocably altered. Canada now produces one million barrels of black bitumen each day, a highly toxic synthetic oil that comes at a cost to the environment and the people. Given the immutable and daily ecocide, continued production makes it impossible for First Nation people to live or prosper on these lands.

Layered effects behind polluted land in Alberta and at Fort Chipewyan are now too complex and intertwined with other pollutive agencies within the same geographical confines to indicate just one root cause. Yet what is known is that the multiple impacts of light-to-heavy industrial activities haven't just forced the evacuation of Athabascan First Nation peoples from their sacred land. Instead, an entire culture faces inevitable devastation after three decades of imposed trauma and incurable cancers[20]. Alberta's government has yet to provide any scientific,

[18] Denchak, Melissa. (2015) *The dirty fight over Canadian tar sands oil.* Natural Resources Defense Council. https://www.nrdc.org/stories/dirty-fight-over-canadian-tar-sands-oil
[19] Willms, I. (2022). *A life - and death - in Fort Chipewyan, downstream from the Oilsands*. The Narwhal. https://thenarwhal.ca/alberta-oilsands-cancer-fort-chipewyan/
[20] Willms, I. (2022). *A life - and death - in Fort Chipewyan, downstream from the Oilsands*. The Narwhal. https://thenarwhal.ca/alberta-oilsands-cancer-fort-chipewyan/

comprehensive, or unbiased study and health impact assessment[21] that could prevent or possibly end the trauma.

PC THE GUARDIAN, Illegal granite mine

GRANITE MINING IMPACTS ELSEWHERE[22]

Scientists from the Centre of Earth Science Studies in Thiruvananthapuram have noted severe environmental impacts of unregulated granite mining, including significant swaths of coastline and the removal of entire mountains and ecosystems while producing ground tremors[23]. The people in these granite zones are experiencing air pollutants and emission particulates from factories and plants, water pollutants in freshwater surface and groundwater sources, and noise pollution impacting their quality of life. With an increase in contaminants, locals are experiencing respiratory, eye, and skin diseases, including Chronic asthma, Bronchitis, and Tuberculosis[24].

[21] Denchak, Melissa. (2015) *The dirty fight over Canadian tar sands oil.* Natural Resources Defense Council. https://www.nrdc.org/stories/dirty-fight-over-canadian-tar-sands-oil

[22] Chandran, Sarath & Sasikala. (2015). Impact Of Granite Quarry on Human Life and Environment A Case Study of Vellarada Panchayat of Thiruvanantahpuram District, Kerala. Proceedings of International Conference on Climate Change & the Developing World. pp. 342-350

[23] Krishnan, H. (2012, October 2). *Kerala: Caught between quarries and sea erosion*. The Guardian. Retrieved November 7, 2022, from https://www.theguardian.com/environment/2012/oct/02/kerala-quarrying-sea-erosion

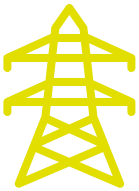
[24] Chandran, Sarath & Sasikala. (2015). Impact Of Granite Quarry on Human Life and Environment A Case Study of Vellarada Panchayat of Thiruvanantahpuram District, Kerala. Proceedings of International Conference on Climate Change & the Developing World. pp. 342-350

CARBON VALUE LIFETIME*

MEASURE: LIFETIME

SCOPE 1

- 84,193,458 LIFETIME MtC



SCOPE 2

- 38,382,312 LIFETIME MtC

SCOPE 3

- UNKNOWN CALCULATIONS

SCOPE 1

CAT 330B
KOMATSU D65-E
REFUELING TRUCK
ADDITIONAL MINING EQUIPMENT, I.E., GENERATOR
HAULING TRUCK 154-TON LOAD-CARRYING CAPACITY
PRIMARY CRUSHERS, CUTTING, AND PROCESSING
ENTITY-OWNED VEHICLES
BIOMASS DISTURBANCES

SCOPE 2

INDIRECT ELECTRICITY CONSUMED

SCOPE 3

UPSTREAM
SUPPLIERS
GOODS
SERVICES
(INCL. BUSINESS TRAVEL & EMPLOYEE COMMUTING)

(DOWNSTREAM - CONSUMPTION)
ORNAMENTAL APPLICATIONS
COMMERCIAL APPLICATIONS

FT. CHIPEWYAN TOTAL CARBON PRODUCTION OVER A LIFETIME:

123,813,911 MtC

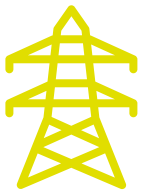
* See legal notes, pg. 18

CARBON VALUE MINE HALTED*

MEASURE: HALTED AFTER PROVEN SEASONS

SCOPE 1

- 79,983,785 MtC AS A SHUTTERED MINE



SCOPE 2

- 36,463,196 MtC AS A SHUTTERED MINE

SCOPE 3

- UNKNOWN CALCULATIONS

SCOPE 1

CAT 330B
CAT 966F
REFUELING TRUCK
ADDITIONAL EQUIPMENT, I.E., DRILLING, EXPLOSIVES
HAULING TRUCK 154-TON LOAD-CARRYING CAPACITY
PRIMARY CRUSHERS, CUTTING, AND PROCESSING
ENTITY-OWNED VEHICLES
BIOMASS DISTURBANCES

SCOPE 2

INDIRECT ELECTRICITY

SCOPE 3

UPSTREAM
SUPPLIERS
GOODS
SERVICES
(INCL. BUSINESS TRAVEL & EMPLOYEE COMMUTING)

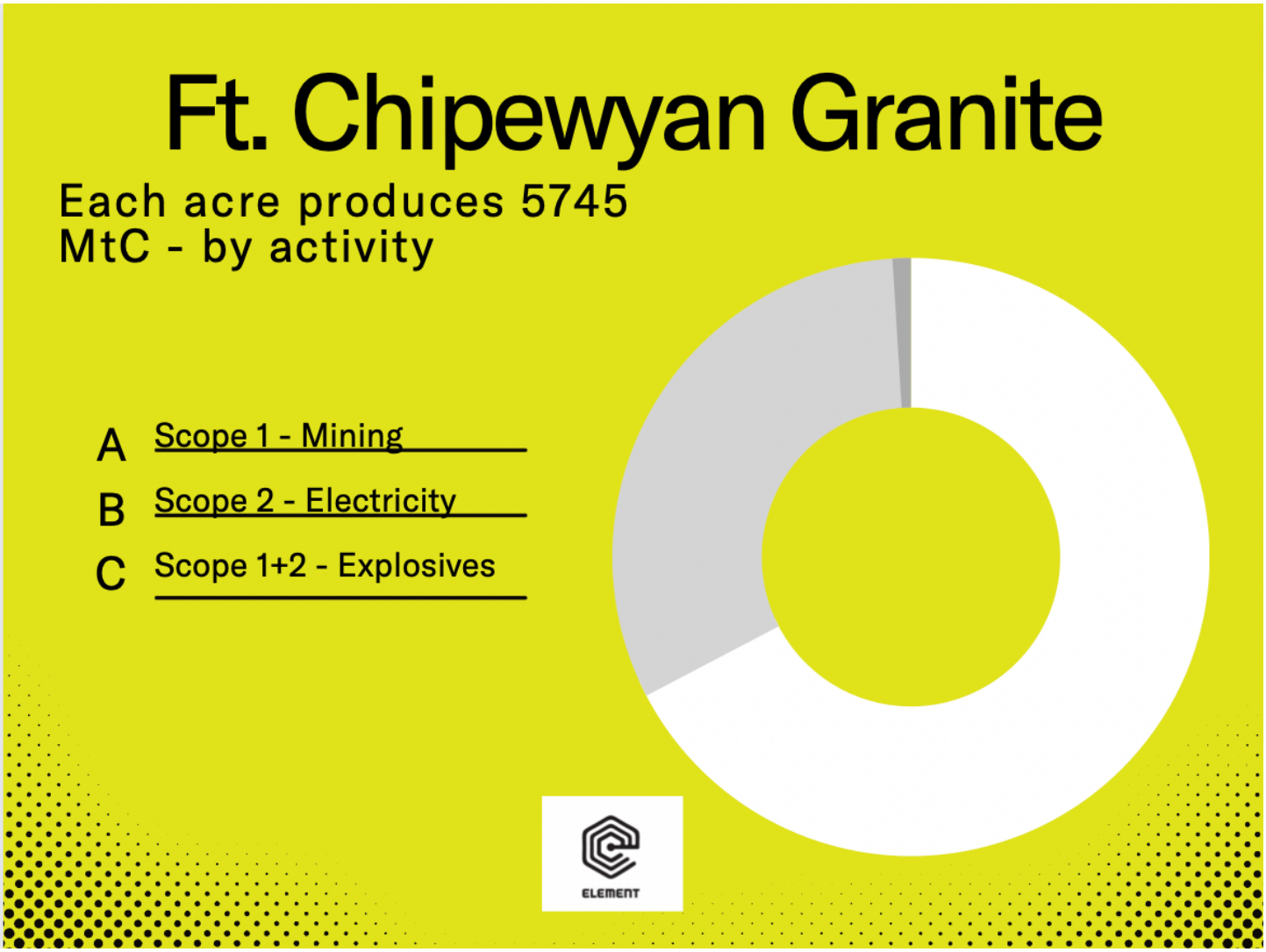
(DOWNSTREAM - CONSUMPTION)
ORNAMENTAL APPLICATIONS
COMMERCIAL APPLICATIONS

FT CHIPEWYAN FULL CARBON SAVINGS AFTER SHUTTERING MINE

117,623,215 MtC

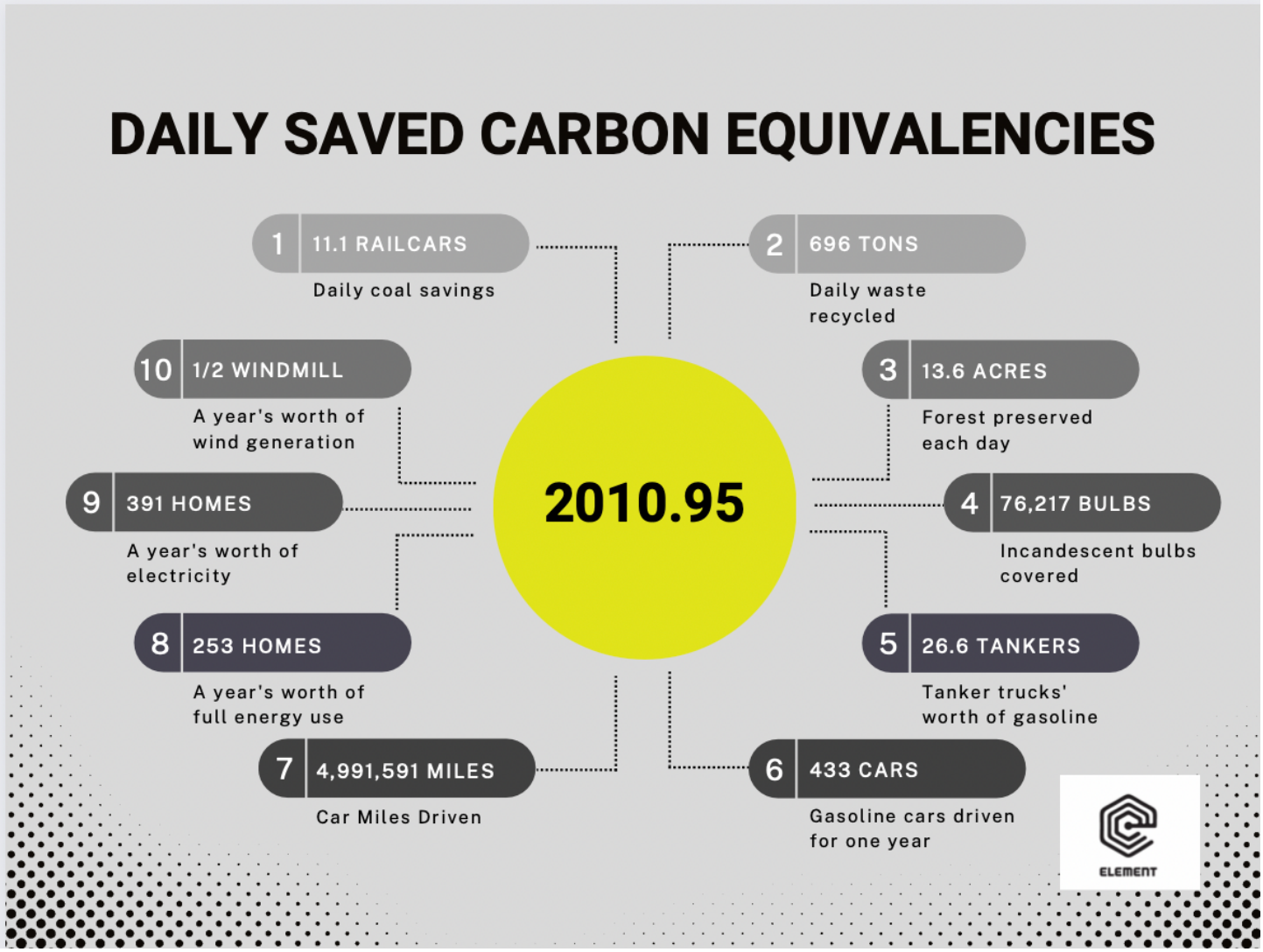
* See legal notes, pg. 18

EST. 5745 METRIC TONS OF CARBON PRODUCED PER ACRE[25]



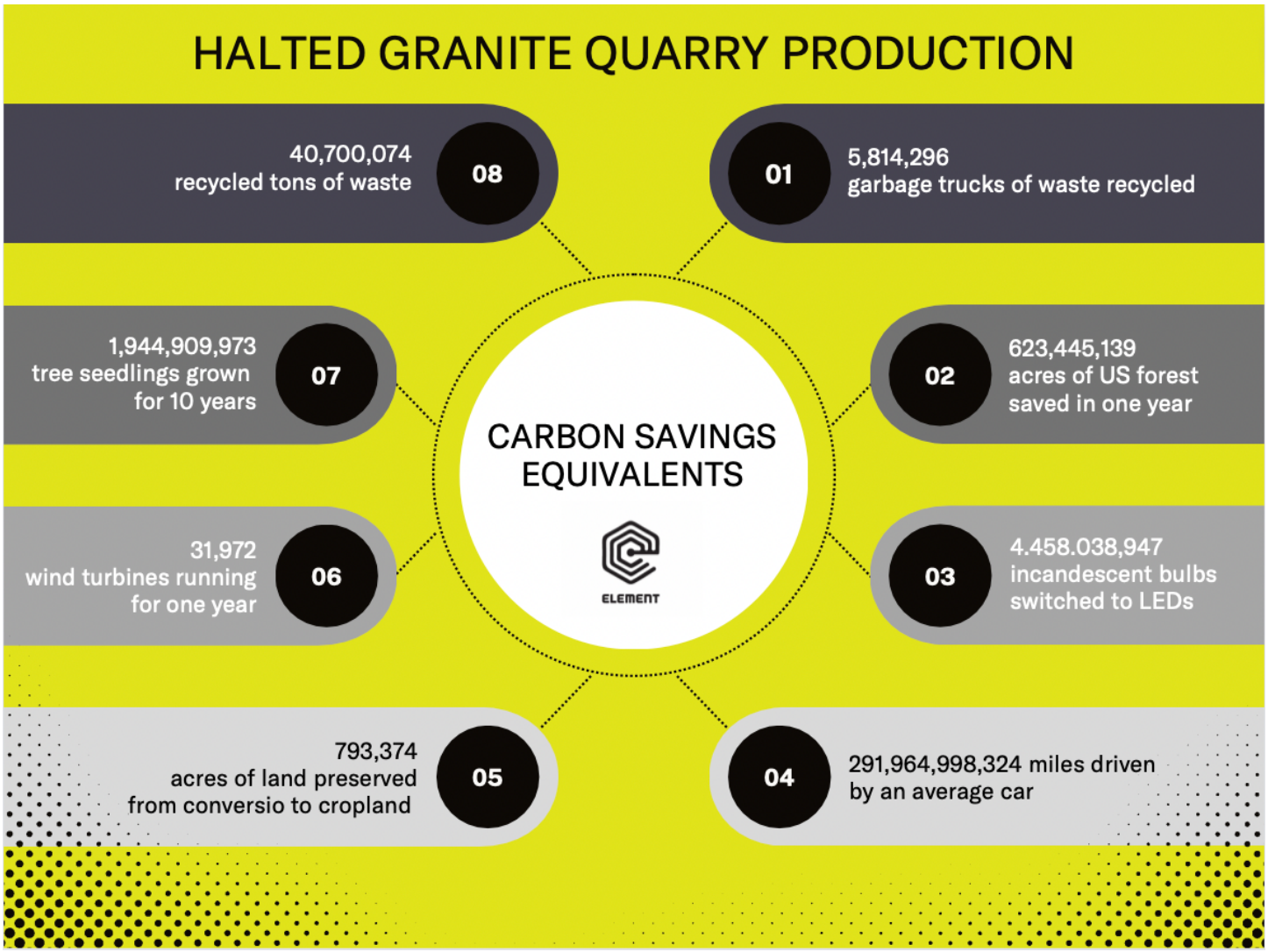
[25] See legal notes, pg. 18

EST. 2011 METRIC TONS CARBON SAVED DAILY[26]



[26] See legal notes, pg. 18

SHUTTERED QUARRY SAVES EST. 117,623,215 METRIC TONS CARBON[27]



[27] See legal notes, pg. 18

LEGAL NOTES

FORWARD-LOOKING STATEMENT

This presentation may contain forward-looking statements that involve substantial risks and uncertainties. Forward-looking statements discuss plans, strategies, prospects, and expectations concerning the business, operations, markets, risks, and other similar matters. There may be events in the future that we cannot accurately predict or control. Any forward-looking statement in this presentation speaks only as of the date on which it is made. Factors or events that could cause our results to differ may emerge from time to time, and it is impossible for us to predict all of them. We do not plan to update or revise publicly any forward-looking statements except as required by law.

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RESEARCH NOTES

SITE DETERMINATION

Data was collected from the executive summary to make site determinations

LAND SIZE AND MINING OPERATION

Calculations based on 21555 potential acres of land

Significant annual potential for mining 365 days +/- summer rain

Maximum 10 tons carrying weight per load via trucking @ rate of 6.5 mpg fuel burn.

PREVAILING DATA

Mining, extraction, refining, prime retrieval rate, and all other environmental estimations used prevailing data and gathered evidence from the U.S., Canadian, and other global agencies offering similar or general findings. University studies included.

SME FINDINGS

SMEs were contacted for earth mover equipment fuel capacity verification - Local Caterpillar Dealership

Diesel carbon burn was calculated at 22.38 lbs. carbon/gal. Aviation SME contacted (Pilot – Captain David Parlotz)

OWNER'S MANUALS

Where such data as a fuel burn on Caterpillars and Komatsu earth moving machinery was unavailable, a general estimation of 7.5 diesel gallons per hour was used given retrievable owner's manuals.

CALCULATIONS

Maximum machine/vehicle daily run times measured @ 12 hours.
Diesel carbon burn was calculated at 22.38 lbs. carbon/gal.
Online conversion calculators use for kWh to CO_2, Btu to kWh, Lbs. to MtC
E.P.A. calculators were employed for compiling all other CO_2 scopes.
Airplane CO_2 data was retrieved directly from booking agencies.

RESOURCES

Athabasca Chipewyan First Nation. (n.d.). https://www.acfn.com

Chandran, Sarath & Sasikala. (2015). Impact Of Granite Quarry on Human Life and Environment A Case Study of Vellarada Panchayat of Thiruvananthapuram District, Kerala. Proceedings of International Conference on Climate Change & the Developing World. pp. 342-350

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