



**Review of the Environmental Impact Assessment (EIA)  
For proposed mining operations in the  
Special Mining Lease 173 area  
Parishes of St Ann and Trelawny**

**EIA done by:**

**Conrad Douglas & Associates (CDA)**

**Review prepared by:**

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**With technical assistance from  
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*This document contains the professional opinion of the Jamaica Environment Trust (JET). In arriving at our opinion, we made every reasonable attempt to ensure that our resource persons are informed and reliable and experts in the area in which their comment and analysis is sought. JET encourages readers to apply their own critical analysis to the information provided in this document and by others, particularly where JET's opinion differs from those others.*

## Summary Statement

The Jamaica Environment Trust (JET) calls upon the National Environment and Planning Agency (NEPA) to **reject the Environmental Impact Assessment (EIA)** submitted by consultants Conrad Douglas and Associates (CDA) with regard to the application for an Environmental Permit to carry out mining activities in the area delineated by Special Mining Lease 173 by Noranda Jamaica Bauxite Partners II, as it does not adhere to the Terms of Reference (TOR) and has many failings of bias, rigour, citation and accuracy.

JET participated in the virtual public consultation held on 8 December 2020 and found those proceedings also tainted by the obvious bias of the EIA consultant. **JET calls on NEPA to reject the public consultation as well.**

We regard the pending decision to mine for bauxite in an area of Cockpit Country for a period of between 25 and 30 years as critical to Jamaica’s ability to weather the climate emergency, to enhance the country’s food security, to support rural lives and livelihoods and to protect ecosystem functions, biological diversity and historical heritage. As we have recently collaborated with eight experts to produce a multidisciplinary study on the bauxite industry in Jamaica, entitled RED DIRT and to be released in January 2021, we are keenly aware of how little effort has been made to collect important data and assess the full costs of bauxite mining and processing in Jamaica over the almost 70-year life of the industry. We urge NEPA not to accept the substandard work presented by this EIA.

### **SECTION A: FAILURE TO CONFORM TO THE TOR FOR THE EIA/INADEQUACY OF THE TOR THEMSELVES**

#### **1. The EIA lacks maps of all elements of the project**

Section 5 of the TOR for the EIA for the project requires the following (in summary):

- A description of all major elements of the project (construction, operation, recommissioning and rehabilitation)
- The provision of essential site maps, illustrating estimated reserves and extent of target area to be mined, used for ore transport, storage and/or stockpiling of material.

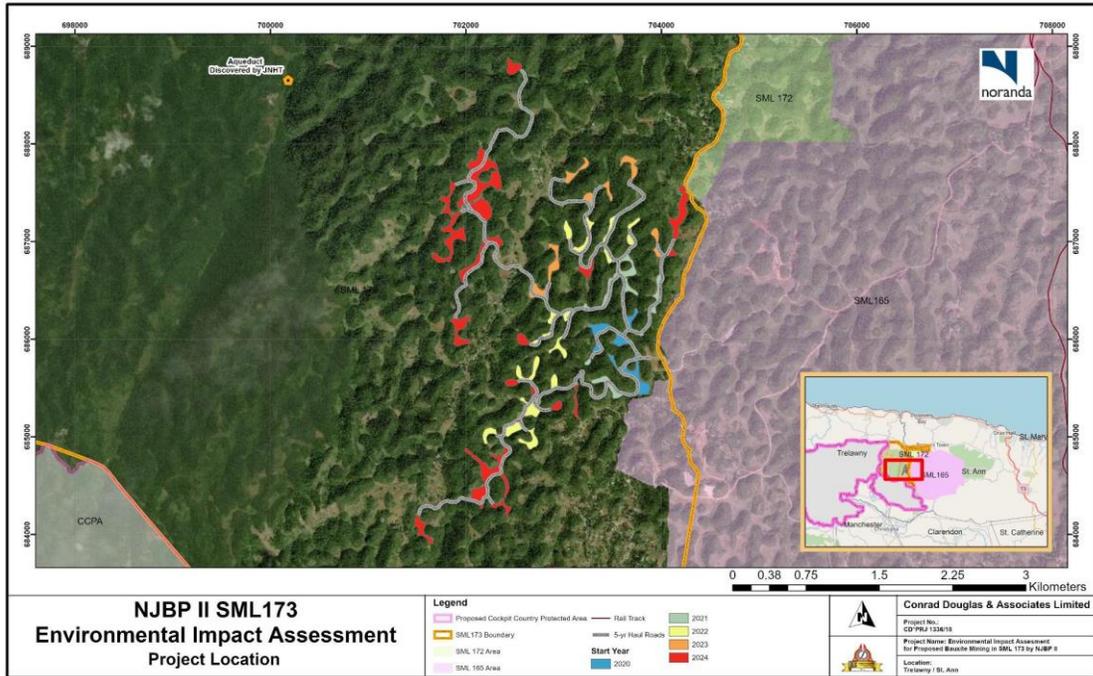
In Table 4-1 on page 4-8 of the EIA, we learn that 1000 hectares of land would be ‘disturbed’ by the project, with more than 90% of the disturbance occurring in final 19 years of the project (from 2025 to 2044). See below.

**Table 4-1: Size of areas to be disturbed over the next five years and five year increments thereafter**

Year	2020	2021	2022	2023	2024	TOTAL (2020 – 2024)	2025- 2029	2030- 2034	2035- 2039	2040- 2044	Total
Disturbed Area (ha)	10.2	9.94	18.89	10.75	47.47	97.24	175	257	274	197	1,000

Figure 4-2 on page 4-3 of the EIA (“Proposed project location showing Ore Bodies for SML 173 Five Year Plan”) shows information on the areas that would be used for mining.

The EIA is not clear on stockpiling, however, as it states on Pages 2-7 and 2-8 that the existing loading areas of Tobolski and Water Valley will be used, on Page 4-8 Water Valley is not mentioned, and on Page 4-9 there is mention of a satellite location, which is not identified.



No maps were included for the mining sequence and haul road networks after 2024 or the timing and patterning of reclamation and rehabilitation for the first five years or thereafter.

**2. The EIA lacks baseline data about the ecological services and the biological environment of the project area**

Section 6 of the TOR for the EIA requires the following (in summary):

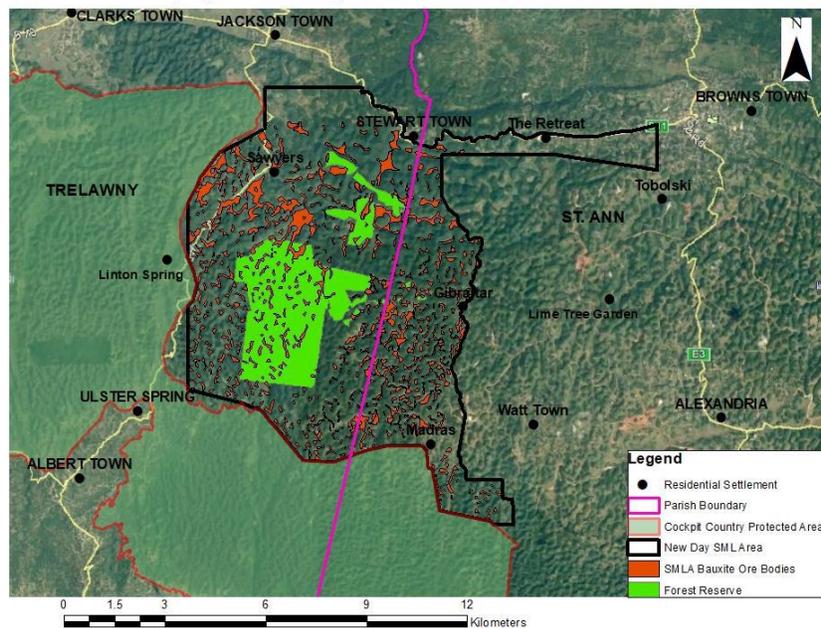
- Baseline data for terrestrial flora and fauna, including a ranking of flora/fauna regarding their ecological importance with special emphasis on rare, endangered, threatened, endemic, protected and economically important species, as well as migratory and nocturnal species
- Identification/description of different ecosystem types, structure and functions, including species dominance, dependence and diversity, biological loss and/or habitat fragmentation

However, the areas surveyed to collect information for the EIA about ecological services and the biological environment were **extraordinarily limited**. Vast areas – a substantial majority of the project area – were never surveyed, as discussed in more detail below.

First, **forest reserves within the project area were never surveyed**. Page 5-70 of the EIA states:

“In order to analyze the ecology of SML 173, excluding the forest reserves, the 8,335 hectares area was divided into nine (9) random blocks (See Figure 5-44). The exclusion of the forest reserves ensured that the requirements of the ToRs were met.”

The exclusion of surveys of forest reserves within the project area means that the ecological and biological baseline of a **large extent of the project area was never characterized**, as shown by Figure 5-223 (“Special Mining Lease 173 Area and Conservation Areas”) on page 5-305.



The TOR for the EIA suggests the exclusion of forest reserves from the characterization of the ecological services and biological environment. This excludes the most sensitive and vulnerable areas that could be affected by forest fragmentation, noise, dust and vibration associated with the project, even if not directly mined. **This is a major failing of the TOR.**

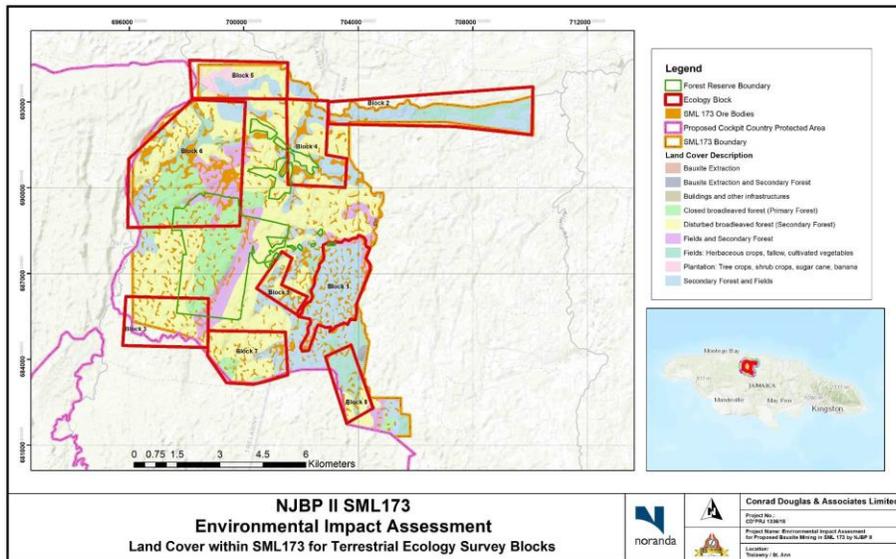
Second, the ecological and biological baseline of **only certain blocks were characterized**, including blocks that are not planned to be mined. See material below from Pages 5-70-

“In order to analyze the ecology of SML 173, excluding the forest reserves, the 8,335 hectares area was divided into nine (9) random blocks (See Figure 5-44). The exclusion of the forest reserves ensured that the requirements of the TORs were met. Only remote sensing was done in the areas overlapping with the Forest Reserves. The nine blocks

covered more than 50% of the 8,335 hectares SML 173 area, or 2.5 times of what best practice requires. It included all land uses within the area.

“Nine study blocks were identified of which seven (7) blocks were assessed in detail.”

As seen in Figure 5-44 “Terrestrial Ecology Study Area Blocks within SML 173 (numbered 1-9)” on page 5-72 of the EIA, the seven blocks that were surveyed (1, 3, 4, 6, 7, 8 and 9) **comprise a minority of the project area.**



**Third, biological resources located in hillocks were generally excluded from surveys.**

Page 5-87 of the EIA states:

“A 30m long transect line was deployed in the transition zone between lowland and hillock up the slope of the hillocks. In a number of cases the transect was limited to the contact with a significant geological feature on the hillock. This feature was a vertical cliff face of a height exceeding 3m in some cases (see Figure 5-58 below). This structure prevented further incursion up the hillock slope.”

Page 5-150 of the EIA states:

“A defining characteristic amongst most of the study regions was a 5m cliff wall at approximately 30m upwards the slope. This cliff face effectively prevented further ascents on most of the hillocks surveyed.”

The exclusion of surveys on hillocks generally means that areas containing the greatest extent of biodiversity were excluded from being characterized, as admitted on page 5-83 of the EIA:

“In using this method, the objective was to obtain information in a timely manner on the ecology of the general area of SML 173 in order to develop a detailed study protocol for Phase 2 of the assessment process. This initial analysis was based on the premise that most of the biodiversity exists within the hillocks and these would not be impacted significantly by the bauxite mining within the lowland areas between hillocks.”

The assumption that biodiversity within the hillocks would not be impacted significantly by bauxite mining within the lowland areas is incorrect as biodiversity within the hillocks can easily be affected by forest fragmentation, noise, dust and vibration associated with the project.

Also, the actual extent of the surveys within the seven blocks, was a single transect line of 30 metres, for a total of just over 200 metres of actual field work. Given the known diversity of flora and fauna in Cockpit Country, this is entirely insufficient. **It is completely misleading to portray the biological surveys as having covered 50% of the area.**

### **3. The EIA lacks information about the impact of the proposed project on biological resources**

Section 8.3 of the TOR for the EIA requires the following (in summary):

- Description of direct and indirect impacts and associated risks on terrestrial habitats, with emphasis on rare, endemic, protected or endangered species, loss of biodiversity, loss of ecosystem functions, habitat loss and fragmentation, loss of niches and natural features due to construction and operation.
- Exploration of the impact of noise, dust and vibration on flora and fauna.

Given that no information is provided in the EIA regarding mining activities disturbing more than 900 hectares of land and given that baseline information about existing ecological services and biological resources is based on extraordinarily limited surveys, **the EIA cannot and has not adequately assessed direct and indirect impacts on the ecology of terrestrial habitats.**

Where provided, the EIA gives cursory, uninformative and sometimes downright inaccurate information about the direct and indirect impacts on the ecology of terrestrial habitats. In its discussion of impacts to Terrestrial Wildlife Resources, page 7-11 of the EIA states only:

“Item WR1 – There exists a potential migration of wildlife resources within the immediate area.

“This migration is temporary. Any resident wildlife will temporarily migrate to nearby surrounding areas that are not affected. If identified during removal and relocation of vegetation, fauna will be carefully managed and returned to the wild or temporarily maintained in their habitats. The footprints of the operations will be strictly maintained to that which is unavoidable.”

This conclusion lacks any adequate foundation. **There is nothing in the EIA to substantiate a conclusion that resident wildlife that would temporarily migrate to nearby surrounding**

**areas would return.** Considering the interconnections of species within habitats, which wildlife would migrate and which wildlife would return depends on such factors as the nature of the species impacted and the causes of the impact (e.g. forest fragmentation, noise, dust and vibration associated with the project). Since these factors are not identified in the EIA, then a conclusion that wildlife would return to disturb areas is nothing more than hopeful speculation.

## **SECTION B: LACK OF INDEPENDENCE, EVIDENT PRO BAUXITE STANCE IN THE EIA**

The title page of the TOR for this EIA appears to have been issued by the proponent, Noranda Jamaica Bauxite Partners II (NJBPII), and the EIA Consultants, Conrad Douglas & Associates (CDA). NEPA's logo does not appear anywhere. We assume that NEPA did, in fact, have some input into the TOR and approve its final version, but presentation of the TOR supports the impression that it is the EIA consultant and the proponent who are in control of the EIA process.

The TOR does not contain a general description of the process of conducting an EIA, which could be described as follows:

*An environmental impact assessment is the process of predicting, identifying, evaluating and mitigating the biological, social and other relevant effects of developmental proposals prior to major decision being taken and commitment made. It is an important procedure for ensuring that the likely effects of new developmental activities on the environment are fully understood and taken into account before the development is allowed to go ahead.*

Nor does the TOR contain any guidance as to the overall objectives of an EIA, which could include:

- *To ensure that environmental considerations are addressed properly and incorporated into decision making process.*
- *To avoid, minimize or balance the adverse significant bio-physical, social and other relevant effects of developmental projects.*
- *To protect the productivity and capacity of natural system and ecological processes with maintain their function.*
- *To promote development that is sustainable and optimize resources use and management opportunities.<sup>1</sup>*

An EIA is a tool to guide a decision-maker. It should not present an argument for a development to proceed, nor is it a formal cost benefit analysis. While it may include an evaluation of economic benefits, if it does, it should also evaluate economic costs. An EIA should explore alternative course of action and cumulative impacts, not just for the life of the project, but into the future. Given the climate crisis, an EIA has a particular responsibility to consider any project in the context of the threats presented and the mitigation measures demanded by the global climate emergency. **This EIA fails on all counts.**

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<sup>1</sup> <https://www.aboutcivil.org/environmental-impact-assessment>

JET suggests that general guidelines for the conduct and purpose of any EIA should be included in all TOR.

### **B.1. Evidence of bias**

The EIA contains many examples of the pro bauxite stance of the Consultant. Non exhaustive examples are below:

#### **Executive Summary**

Page 1-2: “There are important bauxite deposits in the SML 173 area which are required for providing bauxite feedstock for NJBP II’s mining, railroading, drying, storage and shipping operations from Port Rhodes in Discovery Bay St Ann, to export markets overseas. NJBP II’s export earnings from bauxite are variable. However, based on the volume of bauxite, it can be as high as, or in excess of US\$150,000,000 per annum. This is a major contribution to maintaining NJBP II’s operations and a critically important contribution to Jamaica’s economy overall, and more specifically foreign exchange earnings, GDP growth and employment.”

Page 1-3: “Maintaining the mining sector, in general and bauxite mining in particular, is more important ever before for sustaining macro-economic performance and stability, and to continue the support and micro-economic development at the community level. There is no other sector of the Jamaican economy which can in the immediate and short term, provide the necessary level of export income to support the economy.”

Page 1-9: “The communities receptive to the proposed project anticipated employment opportunities and by extension an improvement in their quality of life. This is consistent with the mining of bauxite in Jamaica which has resulted in improvements in economic performance nationally and the provisions of social amenities at the community level.”

Page 1-10: “There will be at least a temporary reversible loss of habitat associated with the construction of these haul roads, as well as, changes in the landscape aesthetics.”

Page 1-13: “There are no other feasible immediate or short-term economic alternatives that have been identified that can be considered as a substitute to bring equal or greater macro or micro-economic benefits to Jamaica, at this time.”

Page 4-21: “Noranda Jamaica Bauxite Partners II’s’ (NJBP II) return to full production was like a shot in the arm for the local and national economy. Commerce, trade, service and manufacturing activities were bolstered by the effects of NJBP II local purchases and employment.”

Page 4-27: “The local economy will benefit from the mining operation within SML 173 and its environs. Jobs will be created and local goods and services will be required by NJBP II and its employees. Living standards of local communities (and Jamaica, in general) will improve through increased employment and earnings.” This is followed by a list of corporate social initiatives, which are unquantified.

Most of these statements are not referenced or supported by data. There is no economist listed in the EIA project team in Appendix II, so it is not clear what expertise has been brought to bear on these judgements and conclusions. There is no attempt to discuss or quantify the costs of bauxite mining to local communities in poor air quality, noise, loss of agricultural productivity, displacement and other quality of life issues. **This EIA fails any reasonable test of independence or objectivity.**

## **SECTION C: LACK OF RIGOUR**

### **C.1. Limited Biological Surveys**

The unacceptably limited biological surveys are discussed in Section A, but below are some questions relating to examples of incorrect, faulty or inadequately referenced statements in the EIA:

- What studies were used to guide the statement that bauxite mining and all its attendant activities, such as haul roads, constitute a “temporary” land use change? Does NEPA know of a single example of a haul road being restored to forest cover in Jamaica?
- There are several uses of the word “temporary” to describe impacts. For instance, on Page 5-29, it is acknowledged that water may collect in mined out pits and drain via sinkholes into the aquifer, causing “temporary” turbidity. What time period is considered “temporary”?
- On page 5-82, the EIA states that faunal assessments were undertaken during Phase 2 of the field surveys, during four days in August 2019, two days in September 2019, and an unstated period in December 2019. There is no indication of what factors guided the faunal surveys, so apparently the consultants did not consider breeding seasons, rainy/dry seasons, migration, insect emergence or other conditions which influence the presence or detectability of species.
- On page 5-195, the EIA refers to the food plant of the Giant Swallowtail Butterfly, the Water Mahoe (*Hernandia catalpifolia*), and on page 5-196, the EIA reports that “No Water Mahoe was observed.” This is unsurprising, given the Water Mahoe is restricted to Portland and St Thomas.
- The EIA detected 46 bird species. Checklists from eBird ([www.ebird.org](http://www.ebird.org)) for this same area report 86 species. Given the inadequate sampling periods and timing, the EIA was only able to record about half the bird species known to occur in the area, including near-threatened and vulnerable species.
- The EIA claimed that no species lists were found for Jamaican gastropods (snails and slugs) but scientific names and range maps are publicly available at iDigBio <<https://www.idigbio.org/>>. Potentially, up to 70 species of land snails could occur in SML 173 but the field surveys detected only two species of live snail, one type of empty shell, and one species of slug. These results are of even less value because the EIA mis-

identified one of the live snail species, failed to provide adequate supporting documentation to convince an independent reviewer that they correctly identified the second live snail species, and mis-identified the empty shell.

- For bat surveys, the consultants failed to demonstrate a minimum requisite knowledge for using ultrasonic detectors and analytic software, demonstrated that their species identification efforts are not reliable, and failed to conduct terrestrial surveys to identify flight travel-corridors and feeding areas. Their understanding of how the physical structure of the environment (how cluttered with vegetation or open is the horizontal and vertical flight species) influences flight accessibility by bats is too simplistic. The EIA's conclusion that 11-meter (35-foot) wide forest gaps, which will be created by haul roads, won't impact forest-dependent bats is not supported by the peer-reviewed literature, most notably for the one species of bat that can be reliably identified, *Pteronotus parnellii*.
- The EIA failed to include the risk of creating access to formerly inaccessible areas via haul roads, thus facilitating poaching and illegal harvesting long after mining has ceased.

## **SECTION D. ASESMENT OF POTENTIAL IMPACTS TO UNDERGROUND WATER RESOURCES**

### **D.1. Risk to Underground Water**

Pages 5-27 to 5-28 of the EIA characterizes the risk of the project to groundwater resources as follows (in summary):

“In an island state as Jamaica with a high reliance on groundwater stored in karstic and highly permeable limestone aquifers very susceptible to contamination, the risk to water resources will be always be present. The issue is how great is the risk and how is the risk ameliorated or managed to minimize impacts.

“Several potential risks to water resources associated with bauxite mining in the Rio Bueno Catchment Area/Cockpit Country have been set out by various stakeholders. These are:

- Turbidity from erosion of cleared and excavated land and the use of unsealed roads and tracks
- Hydrocarbon contamination through fuel spills from vehicles and machinery
- Pathogen contamination due to increased human activity in the area
- Pollution of the aquifer
- Blockage of conduits
- Erosion of the limestone leading to collapse of the limestone blocking caves and conduits and affecting flows.

The EIA mostly dismisses these risks, conceding that there may be increased surface runoff “but volumes will be small and can easily be absorbed by the highly permeable limestone”, failing to

discuss the role of vegetation in ensuring heavy rain percolates through soil and limestone to the aquifer, or the collection of rainfall in ore pits, which then connect to the aquifer.

The EIA goes on to state: “There is no doubt that sinkholes in the limestone facilitate rapid drainage to the underground and may transport fine grained particulate material in suspension to the water table discoloring water and increasing turbidity. This has been noted in the spring that supplies Usain’s Bolt community of Sherwood Content in Trelawny and the Lluidas Vale NWC’s well in St Catherine. However, it is very easy to identify sinkholes prior to mining and ensure buffer zones are created to prevent any infiltration of material.”

JET has a photograph of a haul road within a few feet of a sinkhole near Gibraltar, so we are not convinced of “how easy” this actually is in practice.

The EIA concludes: “The reasons not to mine bauxite in the Rio Bueno Catchment/sub-basin is neither based on scientific information nor on the experience of bauxite mining in Jamaica and indicates a clear misunderstanding of bauxite-limestone relationship and limestone geology and processes.”

It seems, however, that it is the EIA consultant that is without a clear understanding of limestone geology. JET is aware of the review of the physical components of the EIA done by Professor Simon Mitchell, Professor of Sedimentary Geology at the University of the West Indies, Mona campus, which points to many errors of fact or misleading statements regarding the geology of the area and supports Professor Mitchell’s critique.

## **D.2. Other comments on potential impacts to water resources:**

- Figure 5-18 in the EIA shows that only a single weather station was deployed inside the boundary of SML 173. This is entirely insufficient to detect changes in localized rainfall patterns.
- Page 2-3 of the EIA reports that the moisture content of bauxite *in situ* ranges from about 20% to 25% but no assessment was presented on how water in bauxitic soils affects terrestrial plants - including root crops, fruit trees and forests during periods of drought. In fact, the EIA pays scant attention to the functional role of bauxite soils and omits any description of how the removal of these soils with their large water storage capacity might affect the Rio Bueno Sub Basin.
- On Page 5-28, the EIA describes the flow of the Rio Bueno as follows:

“The trend line indicates a slight increase in flow despite the diversion of the Cave River and the mining of bauxite within the Rio Bueno Sub Basin by Kaiser Bauxite, and successive companies over the past 50 years.”

This is a superficial interpretation of the data and is not statistically significant. To get conclusions on the impact of bauxite mining on ground water (both flow and quality) would require years of data and careful analysis.

There is also a statement in the EIA that the mining to be carried out upgradient of the Dornoch Bluehole (source of the Rio Bueno) “may” present a risk to the water resources of the Rio Bueno sub-basin and river. During December 8 public meeting, however, EIA consultant, Dr Conrad Douglas, stated that there is “**no** risk to the flow rates and water quality” of the Rio Bueno if mining were to occur under SML 173. Why did the EIA consultant contradict the information contained in his own EIA?

Questions about water quality require years of data in order for conclusions to be drawn. To identify mining as a possible influence on water quality and quantity would require multivariate analysis techniques applied to large data bases covering a large number of parameters (including rainfall patterns, water flow, water chemistry, geological formations, and so on). We don't have such data sets and the 12 months or so of an EIA could not generate them. Why after 70 years of bauxite mining in Jamaica have these data not been generated or required by the regulatory bodies (Mines and Geology Division, Jamaica Bauxite Institute, NEPA) or by the University of the West Indies? We seem to prefer to proceed in ignorance.

JET concludes there **is** a risk to the Rio-Bueno sub basin and river presented by bauxite mining, but there is simply not enough data to assess its magnitude or likelihood. In the face of scientific uncertainty, the precautionary principle states that such projects should not go ahead – that we display “caution in advance”.

### **D.3. The EIA fails to assess known risks to groundwater resources of cadmium and arsenic contamination associated with bauxite mining**

The EIA adopts a cavalier attitude towards known risks of bauxite mining to groundwater resources as a result of contamination by toxic metals. A February 2001 report by the U.S. Army Corps of Engineers entitled “Water Resources Assessment of Jamaica” it is noted several times that:

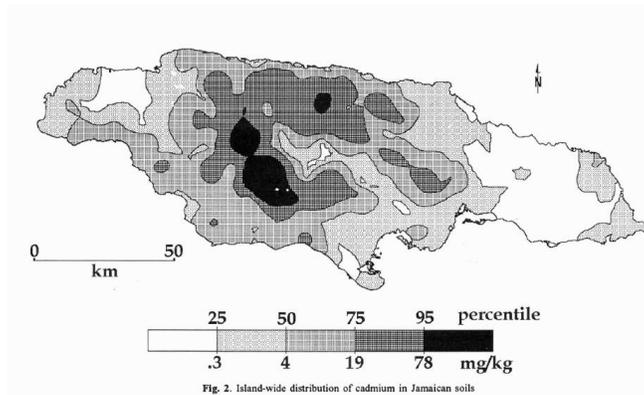
“Jamaica soils are enriched in heavy metals compared with the world average. Higher levels of As, Cd, Hg, and Pb may be found near bauxite deposits and could contaminate water.”<sup>2</sup>

In fact, areas where Jamaica soils contain especially high levels of cadmium and arsenic include areas where companies are seeking to mine bauxite in or adjacent to Cockpit Country.<sup>3</sup>

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<sup>2</sup> Miller, N., Waite, L., & Harlan, A. (2001). Water resources assessment of Jamaica. Mobile District & Topographic Engineering Center: US Army Corps of Engineers.  
<http://www.sam.usace.army.mil/Portals/46/docs/military/engineering/docs/WRA/Jamaica/Jamaica%20WRA%20-%20English.pdf>

<sup>3</sup> Lalor, G. C., Rattray, R., Simpson, P., & Vutchkov, M. (1998). Heavy metals in Jamaica. Part 3: The distribution of cadmium in Jamaican soils. *Rev Int Contam Ambient*, 14(1), 7-12.  
[https://www.researchgate.net/profile/Gerald\\_Lalor/publication/26474535\\_Heavy\\_metals\\_in\\_Jamaica\\_Part\\_3\\_The\\_distribution\\_of\\_cadmium\\_in\\_Jamaican\\_soils/links/00463519cd6a0624aa000000/Heavy-metals-in-Jamaica-Part-3-The-distribution-of-cadmium-in-Jamaican-soils.pdf](https://www.researchgate.net/profile/Gerald_Lalor/publication/26474535_Heavy_metals_in_Jamaica_Part_3_The_distribution_of_cadmium_in_Jamaican_soils/links/00463519cd6a0624aa000000/Heavy-metals-in-Jamaica-Part-3-The-distribution-of-cadmium-in-Jamaican-soils.pdf)



According to published data:

“The levels of cadmium in some Jamaican soils have been found by ICENS (International Centre for Environmental & Nuclear Studies, UWI, Jamaica) to be extremely high compared to other countries (Jamaican mean 20 mg/kg vs. world mean of 0.5 mg/kg). The soils with the highest levels (max about 900 mg/kg) are located in central Jamaica. The White Limestone group underlies soils with high Cd, As, etc. About 40% of Cd is bioavailable and could enter the food cycle. White Limestone is very transmissive, in places karstic, and allows for rapid circulation of infiltrated rainwater. What if the rainwater percolating through bauxitic soils picks up some heavy metals, dissolves them and carries down to aquifer?”<sup>4</sup>

Arsenic levels in soils with bauxite deposits in Jamaica are also unusually high (see below).<sup>5</sup>

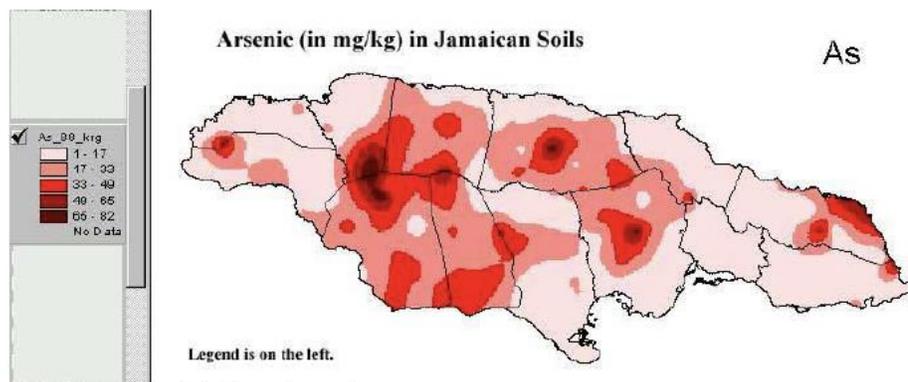


Figure 10. Arsenic in Jamaican soils.

The contamination of water resources by arsenic and cadmium nearby bauxite stockpiles is a documented impact of bauxite mining. A study examining water quality impacts of bauxite mining in Malaysia states the following:

<sup>4</sup> Karanjac, J. (2005, September). Vulnerability of ground water in the karst of Jamaica. In *Water Resources and Environmental Problems in Karst. Proceedings of the International Conference KARST* (pp. 27-36).

<sup>5</sup> *Ibid*, at Figure 10.

“The importance of ecological impact assessment due to bauxite mining activities might be of interest to the local communities and relevant authorities partly because the impacted water bodies could be the source for raw water supply (Kusin et al. 2016a). Given the extent of recent environmental degradation due to such mining activities, it is important that the occurrence of the pollution be investigated. Therefore, this study was undertaken to evaluate the overall ecological impacts due to bauxite mining activities in the vicinity of Kuantan, Pahang, on water ecosystems and within the mine water environments.

“The water sampled at S6 was from the stockpile area of bauxite mine storage, which is in the vicinity of Kuantan Port and is near to other industrial areas. S7 [Pengerak River] was also found polluted as a result of direct discharge from the stockpile area into the river. Based on current water quality status, the water from these locations can only be used as a source of raw water supply after extensive treatment and the water is only suitable for tolerant fish or aquatic species (DOE 2008).

“The high value of As at S6 was potentially associated with the leaching of the composition of stockpiles of bauxite that directly enters the river. Consequently, this has also resulted in high As concentration as the water flows to S7. ....

“It was found that the concentrations of Al, Fe, Mn, As, and Pb in the mine-impacted water were slightly higher than the recommended guidelines values, while the concentrations of Pb, Cu, Zn, and As in sediments were high at some sampling locations. The analysis of water samples showed that the bauxite stockpile areas and nearby streams are the most affected sites with low water quality index and have several metal contents, which were above the recommended values.”<sup>6</sup>

Essentially, much more data from Jamaica is needed before a conclusion can be drawn that there is no risk of heavy metal contamination as a result of bauxite mining.

***Prepared by: Jamaica Environment Trust  
28 December 2020***

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<sup>6</sup> Kusin, Faradiella Mohd, Muhammad Syazwan Abd Rahman, Zafira Madzin, Shamshuddin Jusop, Ferdaus Mohamat-Yusuff, and Mariani Ariffin. "The occurrence and potential ecological risk assessment of bauxite mine-impacted water and sediments in Kuantan, Pahang, Malaysia." *Environmental Science and Pollution Research* 24, no. 2 (2017): 1306-1321.

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