anne bindoff CONSULTANCY

Reg no: 2014/011805/07

MOTIVATION IN SUPPORT OF THE APPLICATION TO EXCLUDE FILTER CAKE WASTE FROM THE DEFINITION OF WASTE

for

GLEDHOW SUGAR COMPANY (PTY) LTD

by

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June 2023

Revision 3.

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DETAILS OF THE SPECIALIST

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Qualifications: MSc (Eng – Enviro) UKZN, BSc (Chem and App Chem) UKZN, HED UNISA. RMPASA and Plant Science Consultants Association (PSCA) attendance for GHS training
Professional Affiliations: RPMASA, IWMSA, PSCA
Professional Registration: SACNASP: application pending
Company Specialities: Environmental Management, specialising in Waste Management, Hazardous Waste, Legal aspects, GHS: UN Standards Safety Data Sheet Compilations for Hazardous chemicals, Agri-Remedies (New standards) and fertilizers (New standards)

Experience:

- **Regulatory DAEA/EDTEA:** Pollution and Waste Management: Acting Assistant Manager ILembe DM 2006 - 2009.
- **Corporate: SAPPI Mandeni:** 2009 – 2013: Environmental Specialist: SHEQ systems, landfill site management, waste management, legal compliance for permits licences, waste classifications, water permits, waste permits, etc.
- **Own Business: Anne Bindoff Consultancy: As above**
  Clients:
  - **Sappi Mandeni:** Hazardous waste removal.
  - **INDIFLORA: Brookdale Assessment Centre** - Rehabilitation: Waste removal for legal compliance.
  - **Aquasol:** SDS and labels, HCA and DALRD new requirements.
  - **NCP Chlorchem**: Waste assessment.
  - **Intellichem:** Tremcards supply.
  - **IFF:** Tremcards supply.
  - **SAPREF:** Tremcards supply.
  - **Bowisolve:** Legal requirements for road transportation of waste/Hazardous waste.
  - **Andermatt Madumbi:** Agri-remedies SDS assessments and advisory.
  - **RPMASA:** GHS training for Safety Data Sheets.
  - **IWMSA:** Hazardous waste management training.
  - **ECOGUARD:** Agri-remedies SDS compilations – new requirements and advisory.
  - **Aquasolve:** Supply of Safety Data Sheets: Fertilizers, new agricultural standards as per Dept of Labour HCA requirements.
  - **Dow/Corteva:** SDS advisory and tremcards supply.
  - **BPL**: Tremcards Supply.
  - **WALLACE AND GREEN ENVIRONMENTAL SPECIALISTS**: Waste Specialist
    - Motivation in support of the removal of Sumitomo Mill waste ash and rubber compound from definition of waste.
    - Motivation in support of the removal of various waste streams from Illovo mills: Eston, Noodsberg, Gledhow mills.
    - Motivation in support of the removal of various waste streams from Umfolozi Sugar Mill.

1. INTRODUCTION

The Gledhow Sugar Company (GSC) first commenced operation at the current site in 1912. The original owners of the mill were CG Smith, F Reynolds, W Pearce and the Crookes brothers. Later, Illovo Sugar Limited took ownership, and between 2004 and 2009 Ushukela Milling. The Gledhow Sugar Company (Pty) Ltd was founded on the 10th September 2009 on the acquisition of the Gledhow Sugar Mill at Stanger, KwaZulu Natal, by a consortium of four shareholders:

- Ushukela Milling (Pty) Ltd (34.9%)
- Illovo Sugar Limited (30%)
- The Gledhow Growers' Share Trust (25.1%)
- Sappi (10%)

Gledhow Sugar Company (henceforth referred to as "GSC") has the philosophy of empowering the local community and expanding the company to reach new heights. (ref: https://www.gledhowsugar.com/about). This is in line too with Illovo Sugar (South Africa) (Pty) Ltd, as an invested, long-term contributor to South Africa's economy, committed to partnering for the continuing transformation of its agricultural and sugar production sectors. The mill is located in the small village of Gledhow near the small town of Stanger within the Kwadukuza local municipality, Ilembe District municipality, within KwaZulu-Natal province.

Figure 1a: Google Earth photo of the Gledhow Sugar Company in Kwadukuza: KZN;
shows the mill to be surrounded by:

- small residential dwellings, mixed socio-economic dwellings housing,
- the SAPPI Fine Paper Mill,
- sugar cane,
- closely located to the town of Stanger with an approximate town population of approximately 59,900 people. (ref: https://south-africa.places-in-the-world.com/1001814-place-gledhow.html.)
- The 2011 census gives the unemployment rate to be 30,6%, with the youth unemployment of 37,2%.

Figure 1b**:** Google Earth photo of the Gledhow Sugar Company showing the location of the filter cake storage. (Screen shot from GOOGLE EARTH). Shows the location clearly of the filter cake storage within the mill site.

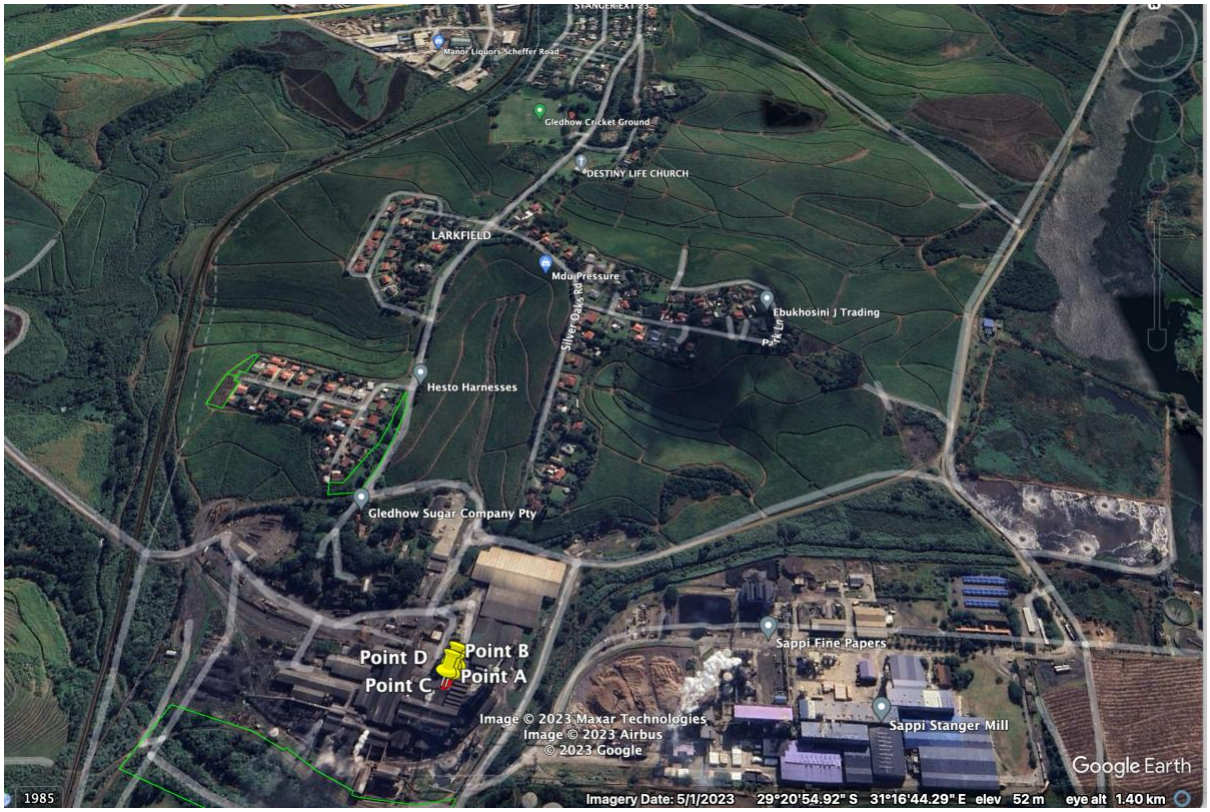

Figure 1a: Google Earth photo of the Gledhow Sugar Company in Kwadukuza: KZN (Source: Google Earth023)

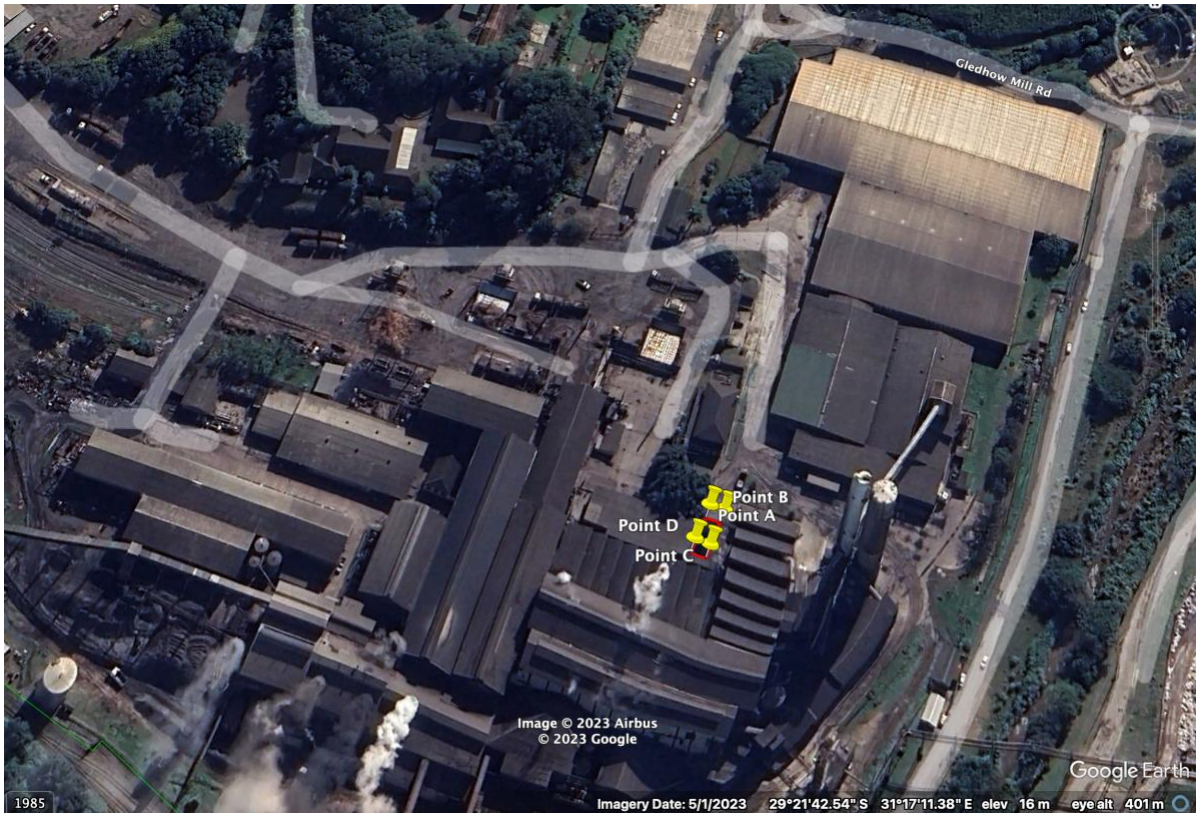

Figure 1b: Google Earth photo showing the location of the filter cake storage (Source: Google Earth, 2023)

The GPS co-ordinates of the filter cake location are given in Table 1: GPS coordinates of the filter cake storage location in the GSC site.

Table 1: GPS coordinates of the filter cake storage location in the GSC site.

GPS CO-ORDINATES AT CORNERS OF WASTE GENERATING FACILITY OR FACILITIES	**Pin locations**	**LATITUDE**			**LONGITUDE**		
	A	29	21	49.94	31	17	22.51
	B	29	21	49.99	31	17	22.71
	C	29	21	50.46	31	17	22.47
	D	29	21	50.39	31	17	22.27

"The Gledhow mill in KwaDukuza crushes sugar for more than 245 growers who produce more than 1.1-million tonnes of sugar cane a year. SA Canegrowers, an industry organisation, says this amounts to 6% of the industry's total output. These growers employ more than 3,400 workers from surrounding communities." (ref: https://www.businesslive.co.za/bd/national/2023-03-22-kzn-sugarcane-farmers-worry-as-another-mill-enters-business-rescue/#:~:text=The%20Gledhow%20mill%20in%20KwaDukuza,of%20the%20industry%27s%20total%20output.)

There are two particularly important factors that have also been considered in drafting this report while considering the issues:

- Currently the mill is undergoing a business rescue process which the Board of Directors of Gledhow Sugar Company Proprietary Limited announced to voluntarily commence business rescue proceedings on 10th March 2023. The company has been facing significant challenges in recent years, including the forced closure of its factory due to social unrest in KwaZulu-Natal in July 2021 and catastrophic flood damage to its machinery and infrastructure in April 2022 amongst other challenges being faced. This report considers these circumstances with the motivation to encourage beneficiation of the waste streams to enhance the performance of the mill for waste streams to be managed to maximize the benefit to the mill by reducing costs, increasing efficiencies and compliance to the environmental laws of the land.
- A site inspection was conducted by the Environmental Management Inspectors (EMI) on the 26th October 2022. There were findings from the inspection where the mill was found to have "failed to adhere to the provisions of the environmental law in respect of the activities taking place on site." (refer to Attachment 6: S31L NEMA PCN Gledhow Sugar.). A compliance notice has been issued to the mill with requirements to comply to.

This report serves as a basis for the application to remove filter cake wate from the definition of waste as per the NEM:WA legal requirement and is compiled as the basis for the risk assessment and the risk management plan. This is done to manage the filter cake waste stream as a beneficiated product for supply to the farmers for soil fertilizer.

This report fulfils the requirements as set out in the legislative framework given in Section 2 below.

2. LEGISLATIVE FRAMEWORK

2.1. Acts:

- The Constitution of the Republic of South Africa, Act 108 of 1996
- National Environmental Management Act (NEMA): Act No 107, 1998. 27 November 1998. (NEMA)
- National Environmental Management: Waste Act. (NEM:WA) No. 59 of 2008
- The National Environmental Management: Waste Amendment Act (NEM:WAA), 2014 (Act No 26 of 2014)
- National Environmental Management: Waste Act (59/2008): National Waste Management Strategy, 2020 (NWMS)
- National Road Traffic Act (RTA), No. 93 of 1996
- Occupational Health and Safety Act (**OHSA)** no: 85 of 1993

2.2. National Norms and Standards. Listed Activities and other relevant documents

- NEM:WA Regulation 331 National Norms and Standards for the Remediation of Contaminated Land and Soil Quality. 2013
- The Framework for the Management of Contaminated Land, Department of Environmental Affairs (DEA), May 2010
- National Norms and Standards for the Storage of Waste. 2013
- NEM:WA (Act 59 of 2008) Government Notices (23 August 2013):
  - R.634 Waste classification and Management Regulations
  - R.635 National norms and standards for the assessment of waste for landfill disposal
  - R.636 National norms and standards for disposal of waste to landfill.
- National Environmental Management: Waste Act (59/2008): Regulations regarding the exclusion of a waste stream or a portion of a waste stream from the definition of waste (18 July 2018)
- **SANS 10234 (2019)(2nd ed):** Globally Harmonized System (GHS) of Classification and Labelling of Chemicals
- **GHS:** UN Standards Purple Book 9th ed

3. GLEDHOW SUGAR COMPANY CONTACT DETAILS

Name: Gledhow Sugar Company (Pty) Ltd
Physical address:1 Gledhow Mill Road, KwaDukuza, 4450
Postal Address: PO Box 55, KwaDukuza, 4450, South Africa

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Portfolio: SHERQ Manager
General Mill Contact no: +27 32 437 4400
Tel: +27 32 437 4502 | **Mobile:** +27 82 904 1645
Email: CSithole@Gledhow.co.za

4. ILLOVO INTEGRATED MANAGEMENT SYSTEM

As part of the mill operations, the Illovo Integrated Management System which includes the SHERQ Management Systems has been adopted for best practice in the industry and is adhered to by all its sugar mills. In relation to environmental responsibility, the following is an extract from Illovo's Code of Conduct and Business Ethics (see Attachment 1a: Illovo Group Code of Conduct and Business Ethics).

4.1. Environmental management

Excerpts from the Illovo Group Environmental Management document are given as follows:

- Illovo supports and encourages operating, manufacturing, farming and agricultural practices and production systems that are sustainable.
- As an environmentally sensitive business, Illovo supports a precautionary approach to environmental challenges and is committed to promoting environmental responsibility and encouraging the development and diffusion of environmentally friendly technologies in our operations.
- Suppliers should adopt a precautionary approach to environmental challenges and continually strive towards improving the efficiency and sustainability of their operations, including water conservation programmes, initiatives to promote greater environmental responsibility and encourage the development and diffusion of environmentally friendly technologies.
- The following aspects of environmental management will be included in the assessments of Suppliers:-
    - they should be aware of, and be able to demonstrate compliance with all current environmental legislation that may affect their activities;
    - they should conduct an environmental review of all aspects of their products and services.
- Any enforcement, improvement or prohibition notices served on a Supplier within the last three years by any competent authority must be disclosed and will be reviewed.

Illovo has developed its own Integrated Risk Management System (IIRMS) to ensure that the standards to which the business conforms are unified under a single platform, guiding and measuring compliance.

IIRMS guidelines have been developed from best practices in the Illovo Group, and from best practice in their industry where necessary. IIRMS assists in the management of environmental risks at Illovo and ensures that these standards are implemented by the whole group.

Many of the Illovo Group sugar factories already operate to high environmental standards through a circular economy model where outputs such as molasses, vinasse, condensed molasses solids (CMS), bagasse, bagash/boiler ash, and filter cake are turned into co-products; such as energy feedstock, fertiliser, soil conditioning nematodes and bioethanol.

This is aligned to the circular economy, meaning that, as much as possible, we eliminate waste, and re-use resources, putting them back into the process.

Gledhow Sugar Company (GSC) has its own inhouse specific management system protocols: refer to Attachment 1b: Waste management plan.

5. FACILITY WASTE GENERATING PROCESS

Refer to Attachment 2: Schematic - Sugar Production Process flow chart showing filter cake generation. This illustrates the overall process flow diagram of the mill to produce sugar and the accompanying waste streams: filter cake, bagasse and ash. It must be noted that for the purpose of this report and application for waste exclusion, a brief overview of the main processes that generate the waste streams have been discussed below.

5.1. Brief overview

The purpose of this section is to satisfy the legal requirement for the description of the components that make up the filter cake waste stream.

5.2. Process description to produce sugar and the filter cake waste stream

The following section describes the sugar milling processes briefly to produce raw sugar. This gives the overall view for the various waste stream generated. The filter cake components sources are described in the following sections.

Figure 2: Process description to make sugar: Gledhow Sugar Company is the process description obtained from the Gledhow Sugar Company website on the link: https://www.gledhowsugar.com/process.

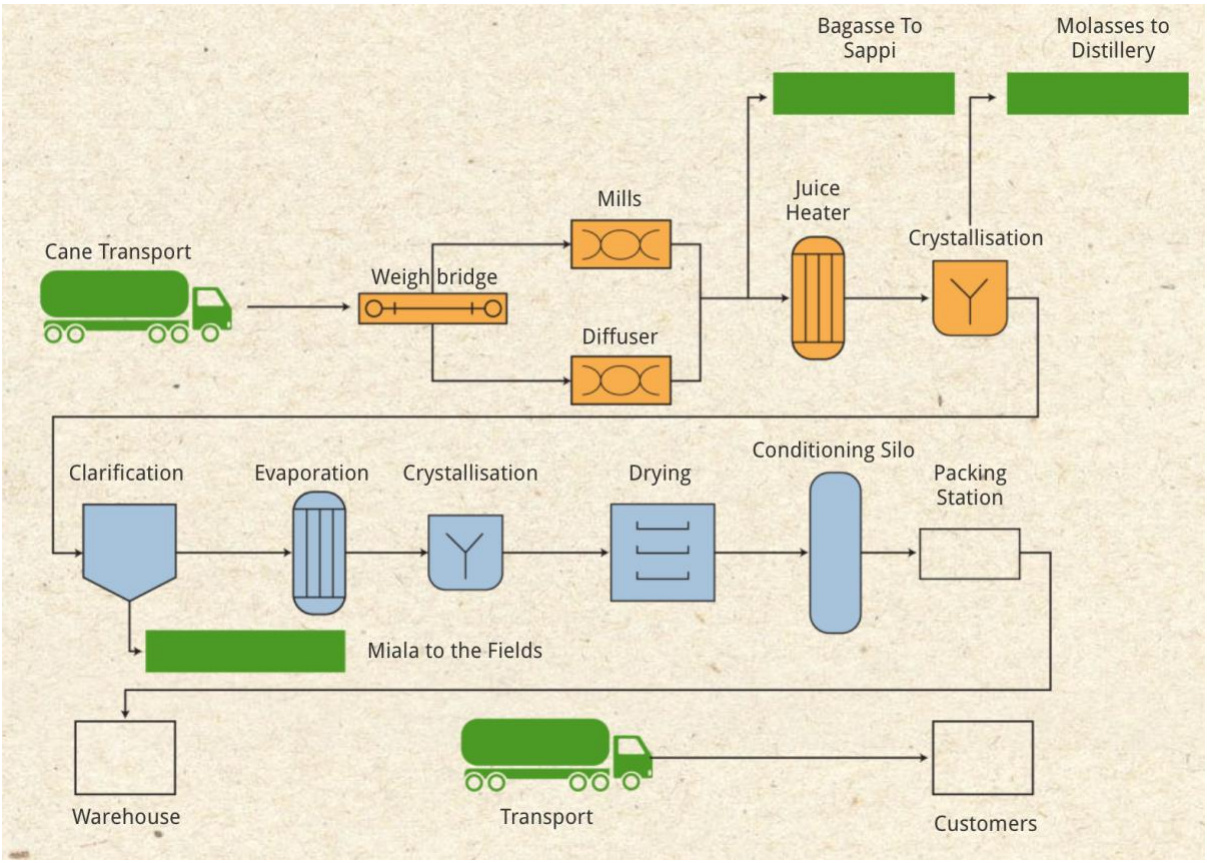

Figure 2: Process description to make sugar: Gledhow Sugar Company

5.2.1. Delivery

Cane is delivered to the mill in articulated vehicles, called Hilos, to where it is spilled onto the feed table for direct processing. The factory processes approximately 300 tons of cane per hour.

5.2.2. Juice Extraction

Cane entering the factory is first prepared by chopping with 3 sets of Cane Knives, and a Shredder which reduces it to a fine consistency. It then passes into either the Mill or Diffuser where approximately 98% of the sucrose is extracted and sent for processing.

The spent cane, called Bagasse, is then sent to the Depithing Plant for processing prior to being sent to the SAPPI mill to be made into paper products. No bagasse is burnt in the boilers yet. A cogeneration project is being proposed, where a potential fuel may be bagasse.

5.2.3. Raw Sugar Process

The juice leaving the Extraction Process contains various impurities, including soil, and has to be clarified prior to processing. Clarification is done by heating the juice, adding:

- Milk-of-lime,
- Flocculant,
- Allowing the resulting mud (miala) to settle out in large decanting vessels called clarifiers.

The juice, now free of mud is returned to the process. The thin, clear juice is then concentrated into a heavy syrup in Evaporators.

Sugar is made in Vacuum Pans by growing small grains of sugar to a required size by introducing syrup into the pan in controlled temperature conditions. When the boiling cycle is complete, the resultant product, Massecuite (sugar crystals suspended in molasses), is struck into the Crystallizers where the crystal continues to grow.

The Sugar Crystals are separated from the Molasses by spinning the Massecuite in a perforated spinning basket (Centrifugals) which retains the crystal but allows the Molasses to drain off.

The Molasses is processed further to recover sugar and the final exhausted molasses (Final Molasses) is stored in bulk tanks, prior to sale for the manufacture of ethanol. The Raw Sugar is melted and sent on for further processing in the refinery to remove the colour components in the sugar.

The refined sugar process will not be described here as it is not relevant for the purposes of this report.

5.3. Waste and Effluent stream filter cake.

Solid waste from the cane juice clarifier is sent to the Oliver mud filters. The waste generated after the Oliver filters is called filter cake.

All the effluent liquid and boiler liquid waste is pumped to the ash dam, the sedimentation of this is the sludge.

5.3.1. Waste streams generated - a schematic.

Figure 3: Schematic - Sugar Production Process Flow Chart Showing Filter cake Waste Generation below shows the schematic process to produce the filter cake waste stream. This schematic diagram together with the main process diagram given above: Figure 2: Process description to make sugar: Gledhow Sugar Company describes the waste streams generation in the mill.

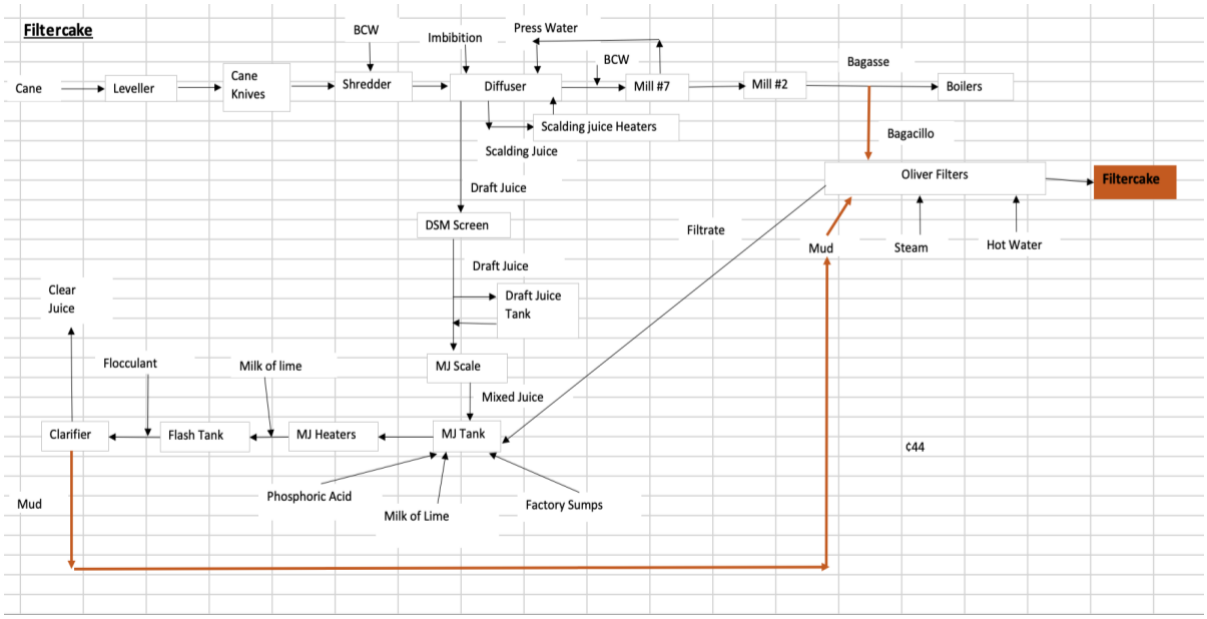

Figure 3: Schematic - Sugar production process flow chart showing filter cake waste generation

5.4. Filter cake waste recipient

The filter cake is stored in a bin and is loaded directly into trucks and is delivered to sugar cane farmers that apply it onto their sugar cane fields as fertilizer and soil enhancer.

5.5. Waste generated

For 2021/2022, the waste generated was as follows:

Ash: 120 tpd av.

Filter cake: 190 tpd av.

Sludge: Last year Gledhow Sugar Company (GSC) removed about 8000 tons after 10 + years. (A statistical estimate of 800 tons of sludge generated per annum).

5.6. Waste Removed

Ash: Clients take all ash off site to make concrete blocks. However, ash would become available for construction as well.

Filter Cake: The growers take all filter cake to their fields as a soil enhancer / fertilizer.

Sludge: This sludge is only removed by dredging after a few years and all the dry sludge is taken by growers to their fields as a soil enhancer/fertilizer.

6. CONSEQUENCES OF NOT RECYCLING OR REUSING THE FILTER CAKE PRODUCED

The only recourse for the filter cake if it is not reused or recycled is to dispose to landfill. Landfilling is the option chosen by many to dispose of waste as the most convenient option. Unfortunately landfilling as a waste management practice contributes to high airspace use on the landfill site. This leads to very costly sourcing and development requirement for additional landfill space. So, in line with the NEM:WA: National Waste Management Strategy (NWMS - 2020); the focus is on amongst others to divert waste from landfilling and to implement the circular economy principles to beneficiate the waste as a resource in a safe and responsible manner.

Should the filter cake not be permitted to be used as a fertilizer on the sugar cane fields:

- The requirement of Gledhow Sugar Company would be to dispose of the filter cake to a permitted and properly managed landfill site. The costs to the company in terms of:
  - Cost of:
    - Pre-treatment to enable the disposal of this waste stream to landfill,
    - Laboratory for assessment and classification once treated.
  - Landfilling fees;
  - Fuel which is changing and generally increasing monthly in 2023,
  - Driver salaries,
  - Truck fees and maintenance.

- The filling up of landfill space much quicker with ttreated filter cake.

- Opportunities to earn an income for those with no or low income:
  - youth,
  - women and
  - entrepreneurs in general

- The potential users of this waste stream have opportunities that may be lost due to the cost of buying the extra fertilizers to make up for the lost rich macro and micro nutrient value of the filter cake. This would lead to other effects such as the inability for the farmer to employ the local community to work the land to maximise the sugar cane output for the farmers. The sugar industry together with the unemployment rate are not in a healthy state currently, in South Africa.

- The cost to GSC to treat the waste stream to bring it into compliance:

  - adjust the pH > 6,
  - reduce the moisture content < 71%, while balancing the levels of heavy metals. This would require diluting the filter cake with a dry material, thereby adding to the bulk and hence the cost to landfilling.

6.1. Benefits of reuse and recycling

6.1.1. Intended use of filter cake

The filter cake will be used as a soil enhancer / fertilizer for sugar cane farmers.

6.1.2. Benefits of Reuse and recycling

The benefits of reusing and recycling the filter cake aligns with the objectives of the South African National Waste Management Strategy (NWMS) - 2020 and are also aligned with the Sustainable Development Goals (SDG) 2030. Examples of the relevant SDG's:

- **SDG 3**: To avoid/minimize waste related environmental factors that prevent ill-health and disease.

- **SDG 8**: Promoting the waste management sector as a key contributor to overall economic growth and development.
- **SDG 9**: Use of natural resources to improve people's standard of living without damaging the environment.
- **SDG 12**: Through: ensuring production patterns, implementing initiative that reduce waste, promote re-cycling, re-use.

The NWMS 2020 strategy is directing South Africa to a future with zero waste in landfills. This will be achieved through eight strategic goals, two of which are relevant for this report namely:

- **Goal 1:** Promote waste minimisation, re-use, recycling and recovery of waste. Focuses on implementing the waste management hierarchy, and with the ultimate aim of diverting waste from landfill.
- **Goal 8:** Establish effective compliance with and enforcement of the Waste Act. Ensures that everyone adheres to the regulatory requirements for waste management, and builds a culture of compliance.

The re-use of the filter cake benefits:

- The cost savings of diverting these waste streams from landfilling.
- Not having to treat the filter cake, but to maximise the benefit of the filter cake by
    - possibly ash or lime addition to the soils to adjust the pH to a suitable pH value for purpose of use as a fertilizer for sugar cane farmers. These are to be done under the management of a suitably qualified and experienced agronomist.
- The moisture of the filter cake, although high, which means transporting water, this benefits the soils with the moisture retention properties of the filter cake.
- The filter cake has benefits to the soil which research work has shown to enhance the soil properties.
- the community; through employment of people within the community due to cost savings through not having to buy commercial fertilizer.
- Potential to supply small community farmers to assist them with their soil management for growing their own food.
- Business creation and thus job creation. in this endeavour.
- A practical use of the filter cake would be in the mixing of the filter cake with ash to:
    - reduce the moisture of the filter cake to reduce the volume of water in the transportation of the potential soil fertilizer,
    - to enhance the use of the ash in the mix to the microfauna and micro flora of the soils, to enhance uptake of the nutrients,
    - to dilute the heavy metal content of the ash in the mix, subject to the management of the agronomist.
    - to enhance the removal of the ash from disposal off from landfill.

By correct management of the waste, the potentially hazardous components will be managed to minimize any hazards presented.

To be able to benefit from this opportunity, the filter cake will need to be characterised to understand the chemical and physical nature of the waste stream. It is then assessed for landfilling using the standard criteria and classified by Globally Harmonised Standards (GHS) aligned to the United Nations standard for health and environmental risk. Understanding these characteristics of the filter cake will help to minimise the risk for use for the purpose of soil fertilizer. The following section describes this process and the results describe the nature of the waste.

7. METHODOLOGY USED TO ASSESS THE CHEMICAL/HAZARDOUS NATURE OF THE WASTE TO BE EXCLUDED.

7.1. Rationale

Research work has been done for the use of filter cakes on agricultural crops.. There are promising results that this may be successful with proper understanding of the chemical makeup of the filter cake. To understand the potential implications on the environment and to human health, this section focuses on the chemical makeup of the filter cake and the potential hazards and risks these pose in its proposed application. A risk assessment and a risk management plan will be formulated to minimise any harm to people and the environment.

7.2. Characterisation of the waste filter cake

The waste sample taken at the GSC was received at Talbot and Talbot accredited laboratories on 17th September 2021, and testing commenced on the same day. It was tested using the **NEM:WA Norms and standards Regulations** for assessment and classification of waste. See:

- Attachment 3a: Certificate of Analysis,
- Attachment 3b: Waste Assessment and Classification, and
- Attachment 3c: Safety Data Sheet - SDS.

This gives:

- the chemical composition from a prescribed list,
- the assessment of the waste for
  - waste type
  - the landfill class
- the GHS classification for any hazards from
  - the physical nature of the waste with any risks associated with it,
  - any risk to health, and
  - any risk to the environment.

The second approach is to determine the hazard thresholds of the chemicals in soils and hence the effect on the environment and the health of the community. The following was used:

- **The Framework for Contaminated Land Rehabilitation (DEA- May 2010) guideline** was used, and compared with the Total Concentration values (TC)

obtained as well as the Leachable Concentration (LC) results from the laboratory analyses obtained.

The filter cake is then managed appropriately using the mitigation/management provided from the identified risks.

7.3. Results

Note: refer to:

- Attachment 3a: Certificate of Analysis,
- Attachment 3b: Waste Assessment and Classification and
- Attachment 3c: Safety Data Sheet - SDS.

for the full details of the analyses and assessments.

7.3.1. Waste assessment to landfill

- GN 636 S5: Current Prohibition/Restriction from Disposal:
  - **(1)(b)** - Waste with a pH value of <6 or >12. Analytical value of: pH 4.6
  - **(1)(q)(ii):** Waste with a moisture content >40% or that liberates moisture under pressure in landfill conditions, and which has not been stabilised by treatment. Analytical value of: 71 %.
- GN R636 S5: Future Prohibition/Restriction from Disposal:
  - **(1)(r)(iv):** >6% Total Organic Carbon (TOC). Hazardous waste with analytical value of: 69 %. (Prohibited from: Aug 2028)
- GN R634: **Overall Waste Disposal to Landfill: Type 0 Waste - very high risk.** Prohibited as per GN 636 S5 given above for current restrictions.
  - Subject to waste treatment and re-assessment per GN R634, the prohibition or restriction may be excluded.
- GN R635 S7, the waste is chemically assessed as a Type 3 waste, which is low risk.
- Class C Landfill (GLB^{+}).

NOTE: pH was measured at 4.6,
Moisture content at 71% and
TOC at 69%.
Wet dark brown sludge cake.
Odour: Sweet, sugary odour.

7.3.2. GHS Classification and Hazard Management

IMPORTANT NOTE: refer to the attachment 3c, Safety Data Sheet (SDS) for full details referred to in this report.

Table 2: Summary of filter cake GHS hazard classification.

Classification in accordance with SANS 10234:2019:	
Physical	Not classified
Health: H315: Cat 2: Skin irritation.	Causes skin irritation
H319: Cat 2A: Serious eye irritation.	Causes serious eye irritation
Environment	Not classified
Overall classification:	**HAZARDOUS - HEALTH**

7.4. Hazards not otherwise classified:

In the current form (wet filter cake), the waste is not expected to carry any significant inhalation hazards.
[Inhalation of dust containing respirable crystalline silica is associated with silicosis, lung cancer and autoimmune disorders. Long term exposure to Aluminium oxide dust can lead to lung damage, while long term exposure to Iron Oxide dust can lead to pneumoconiosis (siderosis)

7.5. Composition or information on ingredients in filter cake.

Table 3: Inorganic composition or information of ingredients in filter cake.

Ingredient(s) - Metal oxides	**[C/I/SA] %**	**GHS Classification (Regulation)**
Mixture	-	H315 H318
Silicon dioxide (SiO_2). -	14,27%[NS]	-
Aluminium oxide (Al_2O_3). -	3,22%[NS]	-
Calcium carbonate ($CaCO_3$). -	~6,82%[NS]	-
Iron oxide (Fe_2O_3). -	2,33%[NS]	-
Titanium dioxide (TiO_2). -	0,18%[NS]	-
Manganese oxide (MnO). -	0.16%[NS]	-

Notes to above table: [C] Constituent component; [I] Impurity; [SA] Stabilising Additive; [NS] Not Specified; [O]

Other possible ingredients.
Potassium salts, Phosphorous (phosphates) and Sulphur (sulphates/ sulphites) containing compounds, Calcium oxide/hydroxide, Residual sugars

Additional Notes:
Elemental oxides were used to represent chemical composition.

7.6. Hazards identification

Health hazards:
identified uses:
WASTE - intended for transport by road or rail, and disposal.

Uses advised against:
WASTE: if a commercial product residue, not intended for original use. KEEP AWAY FROM clothing. DO NOT eat, drink or smoke when using this product. AVOID release to the environment. Collect spillage.

7.6.1. Precautionary measures

Prevention:

- KEEP AWAY FROM clothing.

- AVOID breathing dust, fume, gas, mist, vapours, spray.
- DO NOT get in eyes, on skin, or on clothing.
- Wash skin thoroughly after handling.
- DO NOT eat, drink or smoke when using this product.
- AVOID release to the environment.
- Wear protective gloves, protective clothing, eye protection, face protection.

Responses:

- Get medical advice / attention if you feel unwell.
- Fight fire with normal precautions from a reasonable distance.
- Collect spillage.
- IF SWALLOWED: Call a POISON CENTRE or doctor/physician if you feel unwell.
- IF ON SKIN: Wash with plenty of water.
- IF INHALED: Call a POISON CENTRE or doctor/physician if you feel unwell.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- If exposed or concerned: Call a POISON CENTRE or doctor/physician.
- If eye irritation persists: Get medical advice/attention.
- Take off contaminated clothing and wash it before reuse.

7.6.2. First-aid measures

- **Immediate actions:** If exposed or concerned: Call a POISON CENTRE or doctor/physician.

- **Actions to be avoided:** DO NOT eat, drink or smoke when using this product. AVOID release to the environment.

- **Inhalation:** AVOID breathing dust, fume, gas, mist, vapours, spray. IF INHALED: Call a POISON CENTRE or doctor/physician if you feel unwell. Take off contaminated clothing and wash it before reuse.

- **Skin Contact:** KEEP AWAY FROM clothing. DO NOT get in eyes, on skin, or on clothing. Wash skin thoroughly after handling. Wear protective gloves, protective clothing, eye protection, face protection. IF ON SKIN: Wash with plenty of water.

- **Eye Contact:** DO NOT get in eyes, on skin, or on clothing. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

- **Ingestion:** DO NOT get in eyes, on skin, or on clothing. IF SWALLOWED: Call a POISON CENTRE or doctor /physician if you feel unwell.

Protection of first-aiders and notes for attending physicians

- **Physician notes:** Get medical advice / attention if you feel unwell.

7.6.3. Fire Fighting

- **Protection of fire-fighters:** KEEP AWAY FROM clothing. AVOID breathing dust, fume, gas, mist, vapours, spray. Fight fire with normal precautions from a reasonable distance.

7.6.4. Accidental release measures

- **Personal precautions, PPE:** Wear protective gloves, protective clothing, eye protection, face protection. KEEP AWAY FROM CLOTHING

- **Environmental precautions:** AVOID release to the environment. Collect spillage.

7.6.5. Safe Handling and Storage

- **Safe handling:** DO NOT get in eyes, on skin, or on clothing. DO NOT eat, drink or smoke when using this product. AVOID release to the environment. Wear protective gloves, protective clothing, eye protection, face protection.

- **Additional information:** Eating, drinking and smoking in work areas is prohibited. Remove contaminated clothing and protective equipment, and wash hands after use and before entering eating areas.

7.6.6. Exposure controls and personal protection

- **Engineering controls:** No data available.

- **PPE:**

    - **Respiratory:** Use respiratory protection

    - **Hand/Arm:** Handle with gloves approved under appropriate government standards.

    - **Eye/Face:** Face shield and safety glasses. Use equipment for eye protection tested and approved under appropriate government standards.

    - **Skin/Body:** Wear protective clothing

    - **Hygiene:** Handle in accordance with good hygiene and safety practice. Wash hands before and after handling.

    - **Special conditions posing a hazard**

    - Keep away from clothing.

7.6.7. Stability and reactivity

- No data available.

7.6.8. Disposal

- Refer to section 7.3.1 for the waste disposal restriction

- **Safe, environmentally preferred disposal:** Dispose of contents/container to an approved facility in accordance with all applicable regulations and landfill requirements per this safety data sheet's relevant section (Section 13).

- **Additional information:** Do not fly tip. Do not dispose into sewer, stormwater, or environment. Do not burn unless by means of compliant incineration practices.

8. CHEMICAL AND TECHNICAL SPECIFICATIONS – PRE-BENEFICIATION

Chemical analysis: Interpretation of results in terms of leachability potential, contamination of soils and the risks identified with the hazards of the waste for human health and the environment.
Refer to:

- Attachment 3a: Certificate of Analysis,
- Attachment 3b: Waste Assessment and Classification and
- Attachment 3c: Safety Data Sheet - SDS.

for the full details of the analyses and assessments.

8.1. Introduction

Prior to being beneficiated, the filter cake chemical and physical composition is represented in the laboratory analyses data (TC and LC). The basis of the leachability tests on the filter cake was in anticipation of the disposal into the environment of the landfill site with putrescible waste and hence to low pH conditions. The leachability test was done with leaching liquid at pH 5. The leachate pH of the filter cake is 4,6, hence it is low.

Research show that generally low pH conditions are conducive to easier leaching out of metallic components from their salts/minerals.

Total concentrations for the filter cake were determined as per NEM:WA - National norms and standards for the assessment of waste for landfill disposal. The data obtained represent the hazard risk to all stakeholders when exposed directly to the filter cake. These exposures have been given toxicity values. The GHS classification for the hazard of filter cake is presented in table 2: Summary of filter cake GHS hazard classification. Based on this, the filter cake was given a hazardous classification for people's health. There was no effect on the environment, based on the laboratory analyses.

The results for the Total Concentration (TC) and the Leachability Concentration (LC) are presented in Table 4: LC and TC laboratory results, assessment and classifications for the GSC filter cake. These were used for the Framework for the Management of Contaminated Land database of the Guideline Soil Screening values. The Soil Screening Values (SSV) are the soil quality values, expressed as mass of contaminant per mass of soil, that are:

For SSV1: protective of **both human health and ecotoxicological risk for multi-exposure pathways, inclusive of contaminant migration to the water resource**. Soil

Screening Values 1 are applicable to all land-uses, and thus represent an 'acceptable-risk' situation, with no adverse effects on human health and the aquatic environment.

For SSV2: that are **protective of risk to human health in the absence of a water resource.** Soil Screening Values 2 are land-use specific and have been calculated for three key land-uses namely, standard residential, informal residential settlements and commercial/industrial land-uses.

This approach was followed because mill has the intention of supplying the filter cake to farmer for the use on their agricultural land as a fertilizer. Hence this provides a valuable tool to assess the risks and the management of the activity and material to the land and the people that handle the filter cake. It also provides an "acceptable risk" situation for human health and the aquatic environment in "all land-uses". It also presents risks to human health in the absence of a water resource for land specific use for three types of land uses:

- residential,
    - standard,
    - Informal.
- commercial/industrial.

The filter cake will be:

- loaded at the mill,
- transported to the farmer's site,
- offloaded,
- possibly stored,
- spread onto the land,
- immediately ploughed in.

so, information is needed on the potential risks to the people and to the environment to manage this material for safety.

8.2. Laboratory results

No Sample date provided.
Date sample received 17/09/2021.
Report date: 28/10/2021

Table 4: LC and TC laboratory results, assessment and classifications for the GSC filter cake

Chemical	**LC (**mgX/l)	**TC** (mgX/kg)
Aluminium	**-**	3211
Antimony	<0,05	<5
Arsenic	**<0,08**	<8
Barium	0,52	23
Beryllium	-	<16
Boron	<0,16	<16

Cadmium	<0,17	<17
Calcium	-	8361
Chromium Cr^{+3}	<0,16	<16
Hexavalent Chromium	<0,0031	0,039
Cobalt	<0,17	<17
Copper	<0,17	<17
Iron	-	3180
Lead	**0,18**	<8
Manganese	**22**	249
Mercury	<0,0031	**1,1**
Molybdenum	<0,31	<31
Nickel	<0,18	<18
Selenium	**<0,63**	<63
Silver	-	2,9
Sodium	-	<38
Strontium	-	<17
Tin	-	<2
Titanium	-	60
Thallium	-	<2
Uranium	-	3,59
Vanadium	<0,02	5,11
Zinc	1,84	27
Zirconium	-	2,43
Chloride	94	-
Cyanide (Total)	<0,01	<10
Flouride	<0,06	<0,6
Nitrate	<0,25	-
Sulphate	<2,5	-
TDS	**8877**	-
CV Mj/kg	4,9	
Flashpoint at 22 C	No Flash	
FP at 60 C	No Flash	
FP at 93 C	No Flash	
pH (Aq Leach)@25	4,6	

Moisture	71 %m/m	
TOC	69 % g/g	
Sample description	Wet dark brown sludge cake	
Odour	Sweet sugary odour	
GN R636 (5)	Disposal Prohibitions, Restrictions	*(1)(b), **(1)(q)(ii)
	Future Prohibitions, Restrictions	(1)(r)(iv)
GN R636	Overall Waste Disposal to Landfill	• Type 0 Waste | Prohibited Waste (per GN R636 (5) above): ○ *(5)(1)(b), Waste with a pH value of <6 or >12.. ○ pH: Analytical value of: 4.6 pH. ○ **(5)(1)(q)(ii) Waste with a moisture content >40% or that liberates moisture under pressure in landfill conditions, and which has not been stabilised by treatment. ○ Analytical value of: 71 %
GN R635 (7)	Waste Type (Chemistry only)	Type 3 Waste
GN R636 (4)(1)	Landfill Class (Chemistry only	Class C Landfill (GLB+)
SANS 10234:2019	GHS Classification	Hazardous: H315. H319.
SANS 10228:2012	Dangerous Goods (Road & Rail)	Not regulated

Note:

- Bold analytical results exceed at least the lowest applicable concentration threshold per Appendix 1 of the T and T analytical report. for the assessment of waste to landfill.
- Where the laboratory detection limit for a test is higher than the required specification limit, the raw data is reviewed and the detection limit highlighted in bold font if outside of specification. Hence the figure is given as the very upper limit of the instrument detection limit. The implication of this is that the real figure is most likely much lower than the reported concentration.

8.3. Total concentration and leachable concentration of components in filter cake as a characterisation of the hazard nature of the filter cake.

The GHS classification for the hazards that the filter cake would pose in terms of its physical nature, health and environmental hazards were made based on the oxides of each component for hazardous risk as given in Table 3: Inorganic composition or information of ingredients in filter cake. The filter cake was determined to be hazardous to human health considering the different routes of exposure. The risks presented to human health if exposed were:

- skin irritation and
- Serious eye irritation

There was no risk to the environment as assessed by the GHS method. These health hazards are mitigated using the management measures as outlined in the Safety Data Sheet to protect human health.

The waste is:

- CHEMICALLY assessed as low hazard -Type 3 waste when assessed for landfill.
- OVERALL waste assessment is very high risk - Type 0 waste, due to the prohibitions in place for high moisture content: 71%.
    - Subject to waste treatment and re-assessment per GN R634, the prohibition or restriction may be excluded.

There is thus a need to be aware of the effect of these components in the filter cake on the receiving environment. The following are the sources of information for the possible effects that may be encountered to assess the risk of these components:

- Department of Environmental Affairs: Framework For the Management of Contaminated Land. May 2010.
- Department of Environmental Affairs, Government Notices.
    - R. 634: National Environmental Management: Waste Act (59/2008): Waste Classification and Management Regulations.
    - R. 635: National norms and standards for the assessment of waste for landfill disposal.
    - R. 636: National norms and standards for disposal of waste to landfill.

8.4. Soil Screening Values as a basis for developing risk assessment and risk management plans.

The remediation of contaminated land is being used as a base from which to determine the effects on the environment and related stakeholders.

This work is used to show the values used to assess the risk to the affected areas when the filter cake is applied to the fields.
This approach will be a useful tool to manage the filter cake and areas where it must not be used.

Table 5: Summary of the TC and LC values when compared to the soil screening values for protection of water resources. Metals only; shows the soil screening values required to achieve DWA Water Quality Guidelines levels for aquatic ecosystems protection and domestic water use. (Framework for the Management of Contaminated Land. 2010. p 33). The highlighted values are the guideline values that are exceeded by the TC values obtained. No LC values were exceeded.

Table 5: Summary of the TC and LC values when compared to the soil screening values for protection of water resources. Metals only. (Note, the highlighted numbers from these thresholds represent exceedances of the components in their total concentration and/or their leachable concentrations. NO leachable components were exceeded)

Parameter	SSV1	SSV2	SSV2	SSV2	Protection of water Resource	
	All Land-Uses Protective of the Water Resource (mg/kg)	**Informal Residential** (mg/kg)	**Standard Residential (mg/kg)**	**Commercial / Industrial (mg/kg)**	**Protection of Human Health (Drinking water usage) (mg/kg)**	**Protection of Ecosystem Health (mg/kg)**
Metals and metalloids						
Aluminium	-	-	-	-	-	-
Antimony	-	-	-	-		-
Arsenic	**5,8**	23	48	150	**5,8**	580
Barium	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-
Boron	-	-	-	-	-	-
Cadmium	**7,5**	**15**	32	260	**7,5**	37
Calcium	-	-	-	-	-	-
Chromium Cr^{+3}	46000	46000	96000	790000	N/A	N/A
Hexavalent Chromium	6,5	6,5	13	40	19	260
Cobalt	300	300	630	5000	-	22000
Copper	**16**	1100	2300	19000	200	**16**
Iron	-	-	-	-	-	-
Lead	20	110	230	1900	20	100
Manganese	740	740	1500	12000	10000	36000
Mercury	**0.93**	**0,93**	**1**	4,5	**1**	4,1

Molybdenum	-	-	-	-	-	-
Nickel	91	620	1200	10000	91	1400
Selenium	-	-	-	-	-	-
Silver	-	-	-	-	-	-
Sodium	-	-	-	-	-	-
Strontium	-	-	-	-	-	-
Tin	-	-	-	-	-	-
Titanium	-	-	-	-	-	-
Thallium	-	-	-	-	-	-
Uranium	-	-	-	-	-	-
Vanadium	150	150	320	2600	2000	-
Zinc	240	9200	19000	150000	3700	240
Zirconium	-	-	-	-	-	-
Anions	**SSL (mg/kg)**					
Chlorides	12 000		No leachates exceeded these SSV1 and 2 limits.			
Fluorides	30					
Nitrate/Nitrite	120					
Sulphates	4000					

Note: Bold highlighted analytical results exceed at least the lowest applicable concentration threshold per for SSV guidelines.

Two tiers of Soil Screening Value have been defined as follows:

- **Soil Screening Value (SSV) 1** represents the lowest value calculated for each parameter from both the Human Health and Water Resource Protection pathways calculations as detailed under the preceding sections. SSV1 values are not land-use specific.
- **Soil Screening Value (SSV) 2** represents the land-use specific soil value calculated following the methods as detailed under the preceding sections. SSV2 values are land-use specific and are appropriate for screening level site assessment in cases where protection of water resource is not an applicable pathway for consideration.

The indication here is that the total concentration values presented some exceedances, but no leachable components were exceeded. Hence caution needs to be exercised in exposure of the material to people in all residential areas and the water sources for all-land use, as well as the ecosystem. The use needs to be protective of people and the environment, away from water sources.

Using the assessments for human and environmental health in the GHS classification, the filter cake is hazardous in human use, however can be mitigated by correct procedures outlined in the SDS to follow.

8.5. Long term stability and functionality

The SDS indicated that there were no issues with the stability and reactivity of the filter cake. The filter cake is very moist and must be kept moist to prevent dust formation.
The filter cake will thus have long term stability and hence its functionality will remain stable.
There is not data for incompatible materials for filter cake however general care is needed when handling it.

8.6. Reactivity with environmental factors

The following section gives an indication of the responses of the receptors to the concentrations of the exceeded components in the filter cake in leachate. The system in total remains stable under natural environmental conditions.

8.7. Leaching potential showing long term stability and functionality, reactivity with environmental factors.

The leachability testing is done as per requirement for waste management at a landfill site. The sample was subjected to an Australian Standard Leaching Procedure (ASLP2 Acetate pH 5.0 (P/NP)) as per National Environmental Management Waste Act 59 2008, for the National norms and Standard for the assessment for waste for landfill disposal. The resultant leachate was analysed for various components. However, the requirement is for the filter cake to be used as a fertilizer on sugar canefields as a fertilizer. The pH of the filter cake is very low, most likely due to the processing inputs but possibly also due to some possible fermenting taking place in storage on site, if allowed to sit for a while. The optimum pH of fertilizers applied to the sugar cane fields would be 5.5 to 6.5 pH units, hence under the management of a suitably qualified and experienced agronomist the pH would need to be adjusted to suit the needs of the crop. The slightly higher pH values would reduce the leachability of the heavy metals into the environment. It is also uncertain the adsorption and absorption of the metals would be onto the soil particles over time of the applied filter cake. However, this would be factored into the soil monitoring of the fields over time.

The practical implications of the leachability test in the laboratory would be a conservative approach to what may be presented to the environment. This is because the leachability of the waste is done with fluid submerging the waste for 24 hours. This is not the case in the fields. The soils would at best be kept moist and not wet. This would prevent the heavy metals from migrating to the water sources, and to the outside environment through water borne means.

The leachable components from the leachability testing were not exceeded in the SSV1 and SSV2 test thresholds. However, caution is needed because of the potential to leach out arsenic, lead, manganese and selenium. There was total concentration exceedance for mercury. This implies that the filter cake would need management to reduce any potential impacts. The GHS assessment did not indicate a concern.

9. CHEMICAL AND TECHNICAL SPECIFICATIONS – POST-BENEFICIATION

Once the filter cake has been applied to the soil, it is anticipated that it will be assimilated into the soil through natural biological processes to produce good sugar cane crop. The

effect on the environment will be minimised as well as managed to not impact human health. The filter cake is to be a low risk waste stream to be used in agricultural fields. The application onto the fields must be done under the supervision of an agronomist.

9.1. Intended users of the waste stream

The intended use of the waste filter cake is solely for the purpose of soil fertilizer / soil enhancer. The recipients of these waste streams are primarily private growers. The fields would need be away from any human locations and the correct management would be in place to prevent any run-off into natural water courses. The users would be utilising the services of a qualified agronomist.

9.2. Long term stability and functionality

The filter cake remains stable throughout their useful life.

9.3. Reactivity with environmental factors

No adverse reactivity nor instability were noted in the SDS report. Caution is noted for the exceedances given in the SSV chart. However, when applied to the fields and ploughed into the soil, the would be a diluting effect from the filter cake being dispersed into the soils.

The consideration must be made for filter cake brought into the fields and stored. If the filter cake is allowed to be in the fields untouched for a long time, then it can dry out, increasing the fibres exposure to the fermentation temperatures and start to smoulder. This presents a fire risk in the sugar cane fields, or wherever the filter cake is stored. Hence no excess filter cake should be kept in the fields which is not ploughed into the soils and dispersed well.

Should repeat applications be made onto the fields, the monitoring by the agronomist of the soil conditions should ensure an environment in the soils which is not hazardous to water sources through leaching and to the surrounding environment.

10. IDENTIFICATION OF POTENTIAL RISKS AND THE MANAGEMENT THEREOF

Refer to: Attachment 4: Risk assessment filter cake Gledhow Mill and Attachment 5**:** Risk management plan filter cake Gledhow Mill

11. REFERENCES

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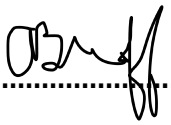
7. DEA. (May 2010). *Framework for the Management of Contaminated Land.* Pretoria: Deptartment of Environmental Affairs.

12. DECLARATION BY SPECIALIST – ANNE BINDOFF

All information and instructions provided in this report in respect of the Risk Assessment and Risk Mitigations/Management Plan substance is given in terms of the provisions of the National Environmental Management: Waste Act (59/2008): Regulations regarding the exclusion of a waste stream or a portion of a waste stream from the definition of waste. Information and data is based on available information given by Illovo Gledhow Sugar Company and is the best information available through general research based on this information as at the date of this report. It is presented in good faith, to be correct.

Name: Anne Bindoff

Signature: .....  ..... **Date:** 28th June 2023.