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**ANNUAL ENVIRONMENTAL REPORT FOR ASUBIMA AND  
AFRENSU-BROHUMA FOREST RESERVES NEAR AKUMADAN  
IN THE OFFINSO NORTH DISTRICT OF ASHANTI REGION**

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*Prepared by:* **FORM Ghana Limited**

*Submitted to:* **Environmental Protection Agency (EPA), Ghana**

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*2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves*

*This is an Annual Environmental Report for Asubima and Afrensu-Brohuma Forest Reserves near Akumadan in the Offinso North District of Ashanti Region, Ghana.*

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## **INTRODUCTION**

FORM Ghana Limited is a reforestation company established in 2007 with the aim of large-scale reforestation of degraded forest reserves in Ghana, while conserving and restoring natural, riparian forest. FORM Ghana has established plantations within the Asubima & Afrensu-Brohuma Forest Reserves at Akumadan in the Offinso North District of Ashanti Region and the Tain II Forest Reserve in the Berekum Municipality of the Bono Region.

In line with Ghana's environmental requirements for new undertakings of specified scales as contained in the Environmental Assessment Regulations 1999 (LI 1652), FORM Ghana conducted an independent environmental impact assessment on the degraded reserves that were acquired for the plantation establishment. The Environmental Protection Agency operating under the legal mandate of Environmental Protection Agency Act, 1994 (Act 490) granted FORM Ghana an Environmental Permit (CA: 62/LG/PL/03) to continue its operations.

As part of the conditions for the grant of permit, FORM Ghana is expected to annually update the Agency on the status of its operations in the highest standard of technical, environmental and social benchmark as stipulated by the agency and also that of Forestry Stewardship Council™(FSC-C044035) This Annual Environmental Report thus, seeks to meet this requirement. The report specifically presents environmental and production details of the year 2021 in FORM Ghana's Asubima and Afrensu-Brohuma Forest Reserves near Akumadan in the Offinso North District of the Ashanti Region. The report is structured according to the specific requirements by EPA as outlined in the Annual Environmental Report (Form AER1) for Forest and Wood Sector Projects.

## 1.0 COMPANY PROFILE

	Information Required	Information Provided
1.1	Name of Company	FORM Ghana Limited
1.2	Type of Undertaking	Reforestation / Forest Plantation Management
1.3	Year of establishment of Project	2007
1.4	Location (Town/District/Region)	Akumadan / Offinso North/ Ashanti Region
1.5	Contact Person Position Tel. No. Email	Mr. Willem A. Fourie Managing Director +233 544441440 <a href="mailto:w.fourie@formghana.org">w.fourie@formghana.org</a>
1.6	Address of Correspondence	P.O Box SYI 211, Sunyani - Ghana

### 1.7 Permits/Licenses and Certificates obtained

S/N	Institution	Permit		Permit No/License No/Date of Issue/Expiry
		Yes	No	
1	Environmental Protection Agency	X		CA: 62/LG/PL/03 14/08/2021 – 13/08/2024
2	Water Resources Commission	X		FGLID 421/21 01/01/2022 – 31/12/2024
3	Forestry Service Division		X	
4	Wildlife Division		X	
5	Others			
	Ghana National Fire Service Certificate	X		AC21134F 14/06/2021 – 13/06/2022
	Forest Stewardship Council	X		CU-FM/COC-811445 / FSC™ (FSC-C044035) 19/01/2020 – 18/01/2025

### 1.8 Workforce Category

Table 1: FORM Ghana Workforce as at December 2021

Division	General Workers			Management Workers			Total
	Male	Female	Total	Male	Female	Total	
Sunyani (HQ)	4	2	6	7	2	7	15
Akumadan P	115	46	161	10	2	12	173
Akumadan C	78	95	173	0	0	0	173
Allanblakia P	0	0	0	1	0	1	1
Allanblakia C	0	0	0	0	0	0	0
Berekum P	138	43	181	21	7	28	209
Berekum C	236	112	348	0	0	0	348
<b>Grand Total</b>	<b>571</b>	<b>298</b>	<b>869</b>	<b>39</b>	<b>11</b>	<b>50</b>	<b>919</b>
<b>Percentage (%)</b>	<b>65.70</b>	<b>34.30</b>	<b>100.00</b>	<b>78.0</b>	<b>22.00</b>	<b>100.00</b>	
<b>Permanent Staff (P) - 398</b>							
<b>Casual Staff (C) - 521</b>							



## 2.0 SITE DESCRIPTION

### 2.1 Location and Major Landmarks

The Asubima and Afrensu-Brohuma Forest Reserves are found in the northern tip of the Ashanti Region, of the Offinso North District. The Reserves form a contiguous block of forest reserve. Major landmarks within the south-western section of the Reserves are the Ghana Irrigation and Development Authority facility and Agritop’s Green House facility in Akumadan. The nearest towns are Akumadan and Techiman.

### 2.2 Geographical Coordinates of Vertices of the Concession to Define Land Area

The plantations are located within the Asubima and Afrensu-Brohuma Forest Reserves in Offinso North District near Akumadan, in the Ashanti Region. Coordinates (WGS 84 - UTM) for the reserves are:

Point	X-coordinate	Y-coordinate
1	630.857,53	813.998,60
2	628.112,11	822.930,15
3	620.644,40	820.840,93
4	624.388,38	817.874,20
5	622.666,10	815.162,44

### 2.3 Total Land Take of concession

The total land take for the Asubima and Afrensu-Brohuma forest reserves is 3,554.60 hectares GIS area.

### 2.4 Actual Area Forested

The actual area forested by FORM Ghana in the Asubima and Afrensu-Brohuma forest reserves is 3,446.22 hectares. Details of actual forested area are shown in the table below:

RESERVE	LEASE AREA (ha)	AREA PLANTED PER RESERVE (ha)	YEAR	TOTAL AREA (ha)	INDIGENOUS (ha)	TEAK (ha)	NATURAL AREA (ha)
Asubima	1776.5	1,668.63	2001	245.69	192.56	53.13	0.00
			2006	65.10	0	65.10	0
			2008	225.00	0	225.00	0
			2009	512.20	0	511.66	0.54
			2010	595.77	47.68	538.33	9.75
			2012	24.88	0	24.88	0
Afrensu-Brohuma	1778.1	1,777.59	2011	1030.96	181.48	845.57	3.90
			2012	746.64	80.43	666.20	0
			<b>Total</b>	<b>3,446.22</b>	<b>502.17</b>	<b>2,929.87</b>	<b>14.90</b>

### 2.5 Area Under Conservation

<b>Area under conservation</b>	517.07 hectares
<b>Type of Conservation: Strict</b>	14.19
<b>Type of Conservation: Partial</b>	502.17 hectares
<b>List some species found:</b>	Species monitoring within the plantation conservation areas is undertaken within every 5-year interval. From the last survey in 2015 & 2018, the following floral, mammal and avifauna species were identified.
<b>Flora:</b>	<i>Azelia africana</i> , <i>Albizia ferruginea</i> , <i>Antiaris toxicaria</i> , <i>Ceiba pentandra</i> , <i>Hildegardia barteri</i> , <i>Erythrophleum ivorense</i> , <i>Khaya anthoteca</i> , <i>Khaya grandifoliola</i> , <i>Milicia excelsa</i> , <i>Triplochiton scleroxylon</i> , <i>Terminalia superba</i> .
<b>Mammals:</b>	The most frequently observed species were <i>Praomys tullbergi</i> and <i>Crocidura crossei</i> . <i>Lemniscomys striatus</i> and <i>Crocidura juvenetae</i> were the least observed species, with only one sighting of each species. Large quantities of the straw-coloured fruit bat ( <i>Eidolon helvum</i> ) can be observed flying over the plantation area at dusk. In daytime, bats rest on trees at the plantation site.
<b>Avifauna:</b>	The moustached grass warbler was the most frequently recorded species. This is likely to be the result of the abundance of grasses in the area, providing suitable habitat for the moustached grass warbler and other weaver species.

### 2.6 River(s) / Stream(s) Traversing or Within 100 m of the Concession

The Asuasu (Bebui)/Asubima Stream with various affluent flow through the Asubima Forest Reserve. Also, various branches of the Brohuma Stream are found in Afrensu-Brohuma Forest Reserve.

#### 2.6.1 Buffer Distance Maintained Between the Concession and Rivers/Streams

The buffer distance between the teak plantation and the streams, which have about 4-5m wide stream beds is thirty meters (30m).

### 2.7 Approximate Distance of River(s) to Nearest Settlement to the Concession

Kumu village is some 500 metres away from the plantation and some 200 metres from the Asuasu (Bebui) Stream. Nkubem is on the border of the plantation and also on the side of an affluent of the Brohuma Stream. Other villages are more than a kilometre away or not bordering any stream.

### 2.8 Adjacent Land Uses

North	Teak plantation
South	Degraded forest reserve/agriculture /teak plantations
East	Agriculture
West	Agriculture

### 2.9 List of Ancillary Facilities on Site

FORM Ghana has a nursery site located outside of the forest reserves. It is about 3 kilometres away from the nearest point of Asubima Forest Reserve. At the nursery, the following facilities exist: 2 staff houses, 1 guesthouse, 2 office blocks, 1 workshop, 1 training centre, 1 canteen, 1 store, 1 fuel station, 3 greenhouses, 1 sanitary block, 4 lockable sea containers (for storage), 1 kindergarten, 1 security guard house, 1 water pump house, 4 shade sheds with irrigation, 6 hectares of irrigated terrain, 1 fence. On the boundaries of the plantations there are guard shelters, and 4 fire towers inside the plantation.

### 2.10 Distance Between the Concession and the Nearest Town /Village

The nearest major town to the plantation is Akumadan which is about 5 kilometres. Surrounding settlements/villages such as Esereso/Konkomba and Atrensu are within a distance of 1 kilometre to the plantation.

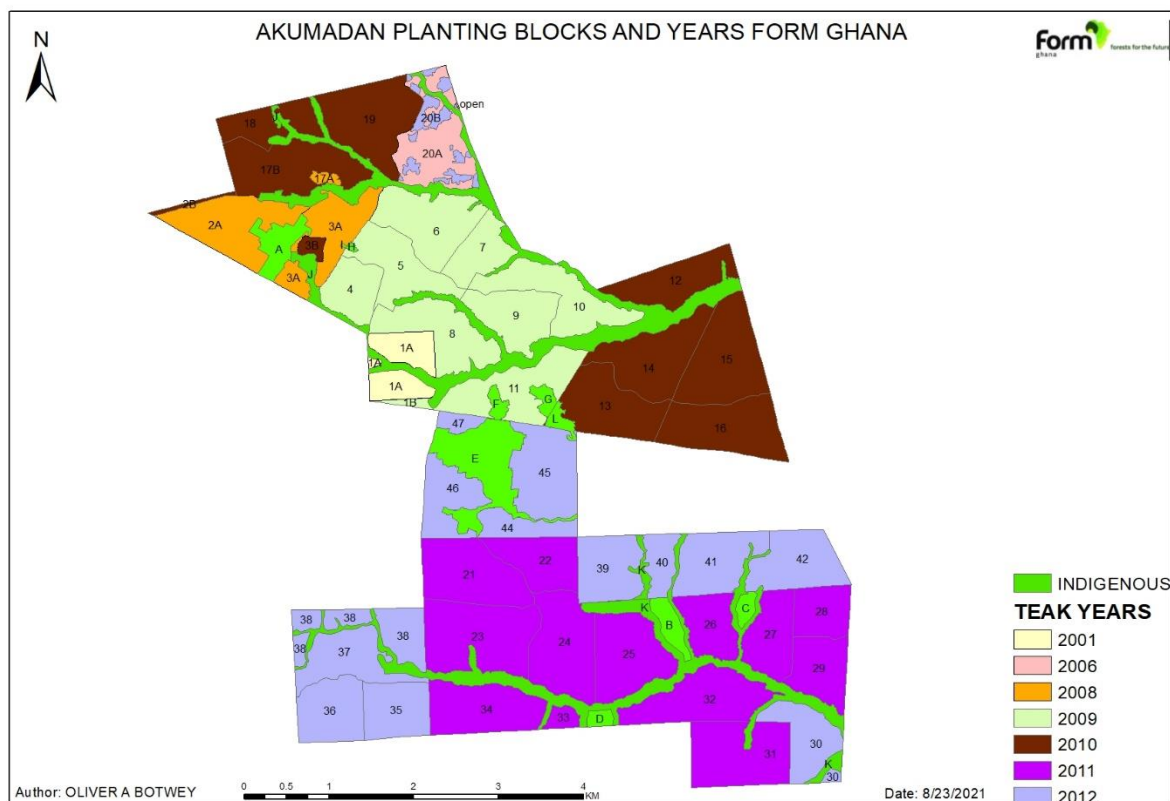


Figure 1: Detailed Map of Asubima and Afrensu-Brohuma Plantations in Akumadan

### 3.0 COMPANY OPERATIONS

#### 3.1 Type of Forestry Development

- 1) **Production Management:** FORM Ghana carries out production of teak and various indigenous seedlings in its nursery facility.
- 2) **Plantation:** FORM Ghana’s has a plantation within the Asubima and Afrensu-Brohuma Forest Reserves.

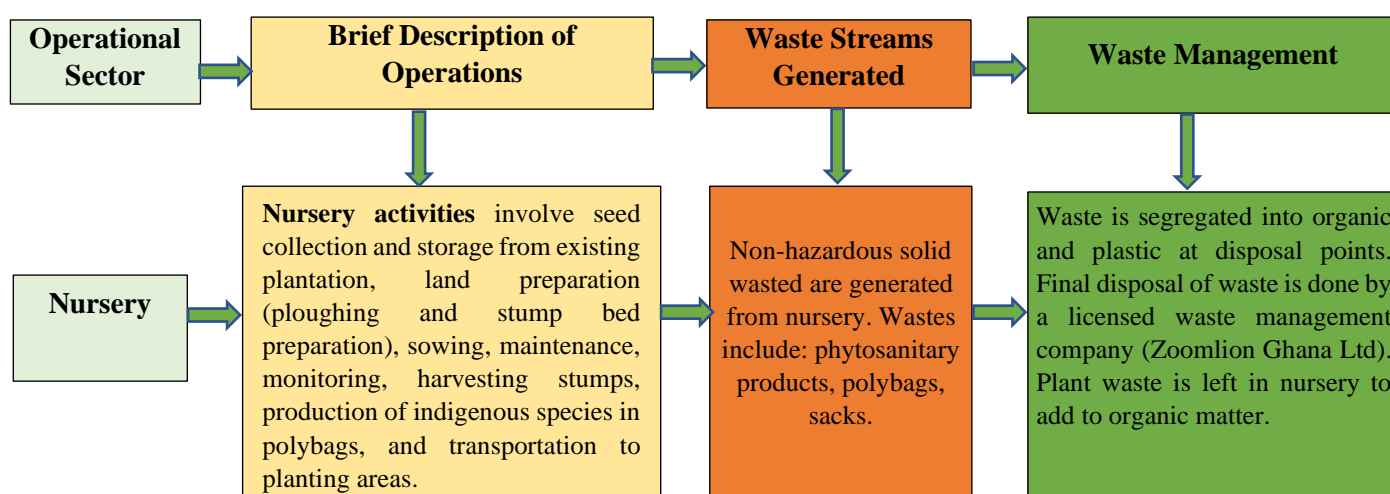
#### 3.2 Section for Forest Establishment

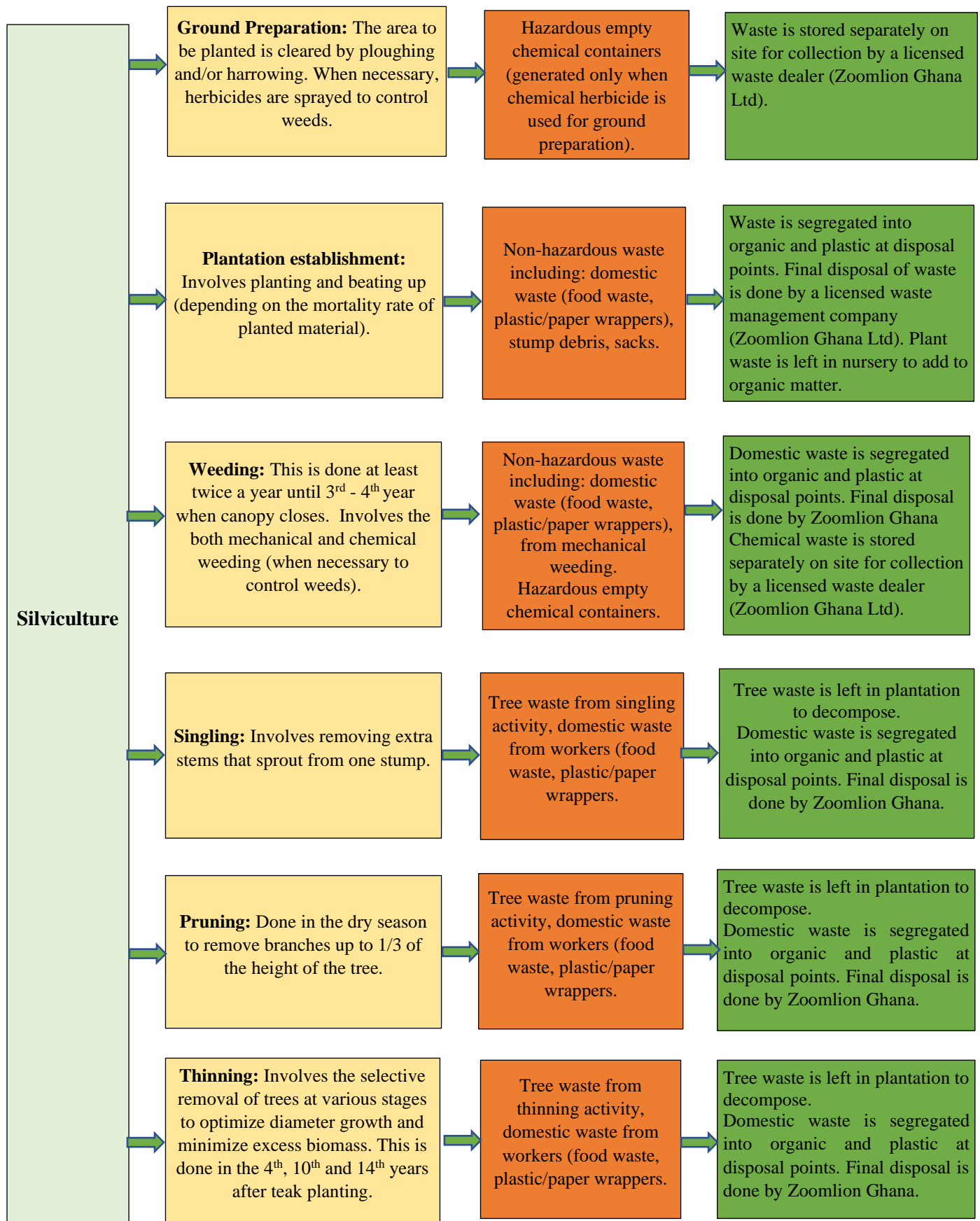
##### 3.2.1 Production Details: Planting Material Information

Species cultivated/Planted	Source	Area (Ha)	Percentage of Planted Area
Teak	Own nursery	2,929.87	85.37%
Indigenous: <i>Ofram, Awiem-fosamina, Kokrodua, Potrodom, Onyina, Emeri, Watapuo</i>	Own Nursery	502.17	14.63%
*The total land lease areas for the Asubima and Afrensu-Brohuma Forest Reserves has been fully established with the available information on the planting material above.			
<b>b) Expected Products from the development</b>		Teak billets/saw logs	
		Teak poles	
		Carbon Credits	

##### 3.2.2 Description of Operations

Below is an environmental-based flow chart describing FORM Ghana’s operations from nursery to harvesting, indicating waste streams and how waste is managed.





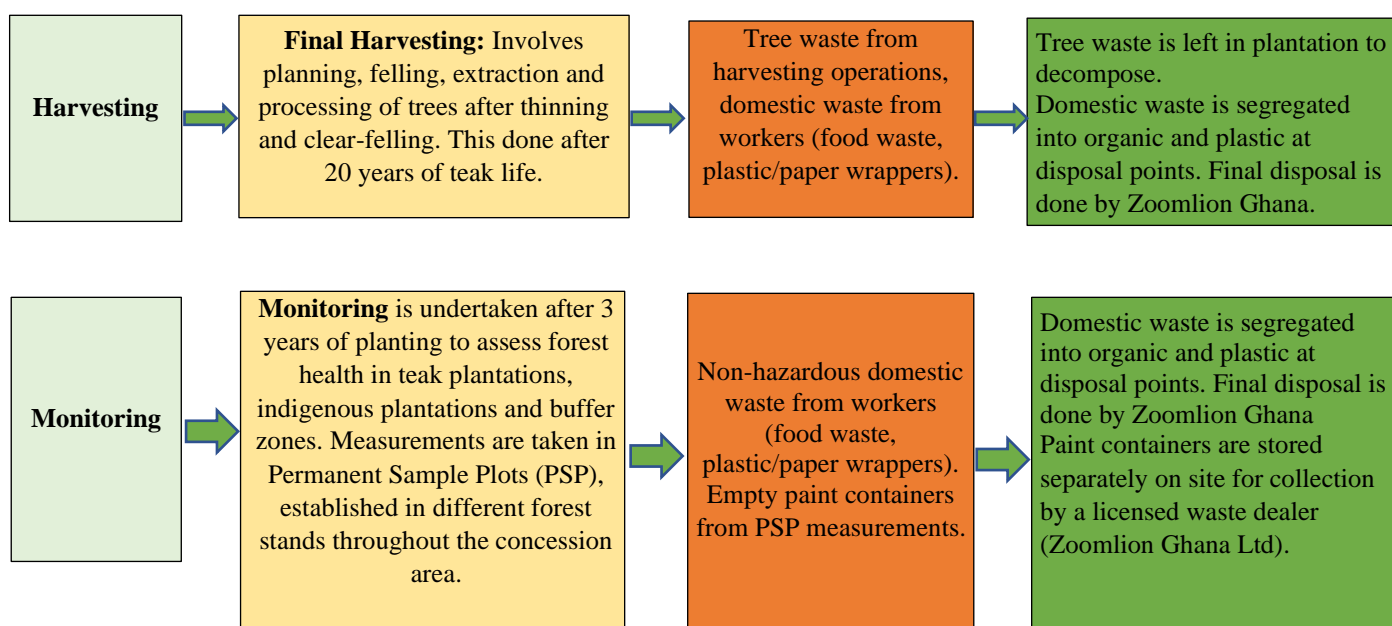


Figure 2: An environmental-based flow chart of FORM Ghana's operations from nursery to harvesting

### 3.2.3 Type, Source, Quantities and Mode of Application of Chemicals (Herbicides/Weedicides)

Table 2: Types, sources, quantities and mode of application of pesticides in 2021

Type	Source	Quantity used	Mode of Application
Glyphosate (Glyphader/ Sidal-rondo 75.7)	Louis Dreyfus Company Ltd, Sam Plus Enterprise	1,058 kg	Manual Foliar application

This chemical product used is a weedicide. FORM Ghana uses FSC™ (FSC-C044035) approved chemical pesticides as contained in the FSC™ (FSC-C044035) Lists of highly hazardous pesticides (FSC-POL-30-001a EN, updated 1<sup>st</sup> May 2019).

\*MSDS for chemical attached in Appendix

### 3.2.4 Planted Area for the Year Under Review

No new area was planted in the year 2021. Planting in the Akumadan plantations ended in 2012.

### 3.2.5 Harvesting and Postharvest Operations

All harvesting operations are preceded by preharvest planning which considers all the actions needed to be completed for the harvesting operation to take place. Such actions include: road network inspection, preharvest weeding, marking for thinning, marking for poles, designing a harvest map, block information and risk assessment. General safety measures are put in place before actual felling of trees using chainsaws in designated plots.

After harvesting, extraction, stacking and transportation. Postharvest operations are undertaken to cover all aspects of the operation under environmental, social and economic aspects. A postharvest checklist is provided for undertaking postharvest assessment.

In 2021, clear felling (harvesting) of Block 1 (compartment 6) commenced in December after training of harvesting staff by CMO. A total area of 799 Ha was earmarked for thinning and clear felling (harvesting). However, only a total land area of 8.83 ha was harvested (clear fell). The volume of timber processed from the 8.83 ha land area was 1004.968 m<sup>3</sup>

### 3.3 Extractive Sector/Production Forest

S/N	Information Required	Information Provided
3.3.1	Type/name of forest	Asubima and Afrensu-Brohuma Forest Reserves / Teak plantation
3.3.2	Type of forestry product collected/harvested.	Teak billets/saw logs, Teak Poles
3.3.3	Quantity of forest product collected or harvested per annum	For 2021, total volume of harvested timber is 1004.968m <sup>3</sup> .
3.3.4	Purpose/use of the forest product	Harvested teak is processed as round logs and sold to clients for export.
3.3.5	Mechanism for collection or harvesting of product	During harvesting, trees are inspected by Forestry Commission. Harvesting operations are carried out by a team. Felling of trees carried out with motor and manual techniques. After felling, extraction is done using tractor/winch combination to the road side.
3.3.6	Mode of operation (manually or mechanical)	Equipment (chainsaws and tractors) are used for felling and extraction.
3.3.7	List of equipment	Husqvarna 365 chainsaws, New Holland 6610S tractor, Igland 5002 Winch
3.3.8	Acreage operated/Size of land area covered	Total area harvested in 2021 is 8.83Ha.

## 4.0 ENVIRONMENTAL, HEALTH AND SAFETY POLICY

### 4.1 Main Environmental, Occupational Health and Safety Policy Objectives for the Year 2021

For the year 2021, FORM Ghana set out to achieve the following objectives on environmental, occupational health and safety policy:

#### ***Environmental Objectives:***

- To ensure that our operational activities throughout 2021 are in conformance with the specified standards by local regulators such as Environmental Protection Agency, Water Resources Commission, Forestry Commission; and International Organizations such as Forest Stewardship Council and African Development Bank.
- To ensure sound environmental practices through periodic monitoring of water quality, biodiversity restoration and conservation in the year 2021.
- To continuously improve waste management system throughout 2021.

#### ***Occupational Health and Safety Objectives:***

- To attain a Disability Injury Frequency Rate of not more than 1.0 by the end of 2021.
- To ensure the regular use of appropriate PPE's by employees throughout the year 2021.
- To conduct monthly Occupational Health and Safety trainings for employees throughout 2021.

### 4.2 Main Environmental, Occupational Health and Safety Policy Targets for the Year 2021

For the year 2021, FORM Ghana set out to achieve the following targets on environmental, occupational health and safety policy:

#### ***Environmental Targets:***

- To achieve minimal environmental pollution from waste and operational activities of the Company throughout 2021.
- Meet all environmental monitoring and reporting timelines for both local and international regulators/ institutions.
- To enhance biodiversity by adopting acceptable practices in 2021.
- A reduction in the number of work-related injuries and incidents throughout the year 2021
- An improvement in the investigation and reporting of accidents (major and minor accidents)
- Increased awareness among employees on Occupational Health and Safety.



## 5.0 ENVIRONMENTAL MANAGEMENT ACTIVITIES

### 5.1 Types and Quantities of Waste Generated through FORM Ghana’s Operations (Liquid, Farm Waste, Plastics)

Table 3: Waste Generation and Management in FORM Ghana

Origin	Type	Reduction	Hazard Classification	Disposal	Tracing	Tracing
<b>Workshop</b>	Tyres	Reduced travel distance	non-hazardous	Stored on site and collected by licensed waste management company (Zoomlion)	Keep waybills	Zoomlion
	Batteries (dry cell)	Use rechargeable batteries.	Hazardous	Stored in a designated container on site and collected by licensed waste management company (Zoomlion)	Keep way-bills	Zoomlion
	Batteries (vehicle) (lead-acid)	Quality brand choice	Hazardous	Stored on site and collected by licensed waste management company (Zoomlion)	Keep waybills	Zoomlion
	Used oil	Scheduled servicing	Hazardous / potential for recycling	Stored on site and returned to supplier/licensed dealers	Keep waybills	Supplier (Total Petroleum Gh. Ltd – Akumadan).
	Oil filters	Scheduled servicing	Hazardous/ partial potential for recycling	Stored in a designated container on site and collected by licensed waste management company (Zoomlion)	Keep waybills	Zoomlion
	Used cables, wreckage and other metal waste (scrap)		Hazardous / potential for recycling	Stored in a designated container on site and collected by licensed waste management company (Zoomlion)	Keep waybills	Zoomlion
<b>Plantation</b>	Non-hazardous domestic waste (plastic)		Non-hazardous / potential for recycling	Stored in a designated container on site labelled Plastic (P) and collected by licensed waste management company (Zoomlion)	Keep waybills	Zoomlion
	Non-hazardous waste (organic waste)		Non-hazardous/ potential for recycling	Stored in a designated container on site labelled Organic (O) and collected by licensed waste management company (Zoomlion)	Keep waybills	Zoomlion
	Hazardous waste (paint, thinner containers)	Reduced use	Hazardous	Stored in a designated container on site and collected by licensed waste management company (Zoomlion)	Keep waybills	Zoomlion

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Origin	Type	Reduction	Hazard Classification	Disposal	Tracing	Tracing
	Hazardous waste (pesticide package/container)	Bulk purchase	Hazardous	Stored separately on site and collected by licensed waste management company (Zoomlion)	Keep waybills	Zoomlion
	Waste from silvicultural/harvest operations	Adopting best silvicultural/harvesting techniques.	Non-hazardous	Left in field to decompose		
<b>Office buildings</b>	Fluorescent and other electric bulbs	Best possible quality.	Hazardous	Stored in a designated container on site and collected by licensed waste management company (Zoomlion)	Keep waybills	Zoomlion
	Used Printer cartridges	Efficient printing practices, use of electronic documents	Hazardous	Stored in a designated container on site and collected by licensed waste management company (Zoomlion)	Keep waybills	Zoomlion
<b>Stores</b>	Plastic waste (containers)	Reusing containers	Non- hazardous / potential for recycling	Stored in a designated container on site labelled Plastic (P) and collected by licensed waste management company (Zoomlion)	Keep waybills	Zoomlion
<b>Nursery</b>	Plastic (Planting bags)	Use of teak stumps for planting	Non- hazardous / potential for recycling	Stored in a designated container on site labelled Plastic (P) and collected by licensed waste management company (Zoomlion)	Keep waybills	Zoomlion
<b>Site Clinic/ First Aid Box</b>	Medical waste		Hazardous	Are stored in a medical waste container on site and collected by a licensed waste management company (Zoomlion) upon request.	Keep waybills	Zoomlion

Table 4: Quantities of Waste Produced

Waste Streams	Quantity Produced in 2021
<b>a) Solid</b>	
• Plastic	65kg
• Organic	1,020kg
• Used vehicle battery (number)	16
• Used tyres (number)	54
• Chemical waste/containers	16.68 kg
• Medical	2.45 kg
<b>b) Liquid</b>	
• Used oil	384.00 litres

### 5.2 Management of Waste Streams Listed in 5.1 Above (Handling, Treatment and Disposal)

FORM Ghana through its operational protocol on Waste Management (Protocol 04) continues to adopt stringent measures in handling and disposal of all forms of waste. In the year under review (2021), a waste haulage and disposal contract with Zoomlion was renewed for all solid waste from FORM Ghana. Reports on quantity and management of all solid waste are produced by Zoomlion periodically. Used oil (liquid) is given back to suppliers (Total Petroleum Ghana Limited – Akumadan) for effective disposal.

Waste stream	Handling/Treatment	Disposal
<b>Solid</b>	Waste is sorted and stored in designated containers on site (Organic, Plastic, Medical, HazMat)	Zoomlion Ghana Limited.
<b>Liquid</b>		
Used oil	Stored separately on site	Total Petroleum Ghana Limited – Akumadan
Run-offs from washing of vehicles	Channelled into a decanter that separates oil and water	Oil is removed and given back to supplier (Total Petroleum Ghana Limited – Akumadan). Waste water is emptied into a septic tank.
Effluents from workforce	Channelled into a septic tank	Licensed liquid waste management company when needed.

### 5.3 Bushfire Prevention, Control of Weeds/Pests and Biodiversity Conservation

a) Measures put in place to prevent bushfires

FORM Ghana has an intensive fire prevention program. The program is based on:

- Awareness raising among the neighbouring villages and the workers
- The creation of fire breaks
- Fire surveillance using four (4) fire towers
- Continuous posting of rapid response teams that have been specifically trained in firefighting.

b) Practices employed to control weeds and pests

The entire teak plantation has reached closed canopy stage and thus, weed growth is naturally suppressed. However, at specific spots where the trees are either young or growth is uneven with grown weeds, both manual and chemical weeding practices are used to control weeds. Regular surveillance in line with an operational protocol on integrated pest management (Protocol 29) guides the control of pest in the plantation. For the year 2021, no pest that required control were identified in the plantation.

c) Practices employed to conserve biodiversity

Biodiversity conservation is ensured by FORM Ghana through the protection of buffer zones within indigenous vegetation, strict control of hunting and through fire prevention. The monitoring of the effect of these conservation measures is undertaken periodically within every 5years (latest report on flora monitoring is available at [www.formghana.com](http://www.formghana.com)).

#### 5.4 Soil Management Practices Undertaken (mulching, soil erosion control etc)

FORM Ghana protects the soil through reforestation practices and erosion control. Erosion control is mainly along the roads.

#### 5.5 Contribution of Soil Management Practices to Increase in Production Levels

No increase in production is detected or expected from soil management practices. However, management practices continue to conserve and stabilize the soil for suitable growth of the plantation.

#### 5.6 Incidence of Disease/Pest Infestation

No disease/pest infestation was experienced in the Asubima and Afrensu-Brohuma Forest Reserves for the year 2021.

##### a) Practices employed to manage admitted farms

No admitted farms are found within the FORM Ghana area in Asubima and Afrensu-Brohuma Forest Reserves.

##### b) Practices employed to manage neighbouring communities

FORM Ghana actively engages neighbouring communities through the organisation of stakeholder meetings, community meetings and sensitisation fora. For the year 2021, stakeholder meetings were organised on the 10/08/2021 and 07/12/2021.

##### c) Practices employed to manage livestock grazing/fire

Livestock grazing is not allowed in forest reserves and no incident of grazing was recorded throughout 2021 in the Asubima / Afrensu-Brohuma Forest Reserves. Fire is managed as discussed under Section 5.3a above.

#### 5.7 Chemical Management Practices to Prevent/Control Discharge of Chemical

##### *Contaminants into the Environment*

##### 5.7.1 Chemical Management

##### a) Quantity of chemicals utilised and final disposal of containers, unused or expired products

Type of Chemical	Source	Quantity used 2021	Disposal of Containers	Qty of unused or expired products
Glyphosate (Glyphader/ Sidal-rondo 75.7)	Louis Dreyfus Company Ltd, Sam plus Enterprise	1,058 kg	Stored separately on site for final disposal by Zoomlion	None

\*MSDS of chemicals attached as appendix

- b) Management practices in place to prevent/ control discharges of chemicals contaminants into the environment

FORM Ghana through its protocols and procedures continues to adopt best practices to prevent/control chemical contaminants from being discharged into the environment. Key practices as outlined in Protocol 05 on Responsible Use of pesticides, Protocol 04 on Waste Management and P16 on Storage of Fuels, lubricants and toxins, include:

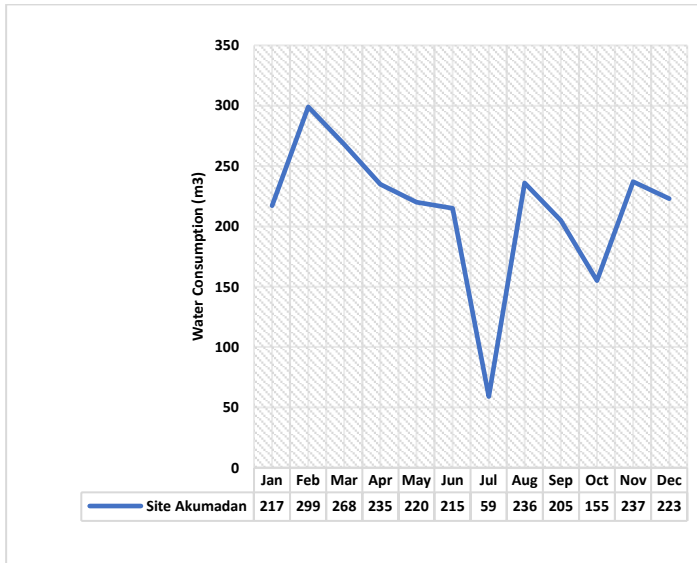
- Chemicals are stored separately from oils, fuels and lubricants in a secured and watertight place.
- In case of a minor leakage of fuels, lubricants or chemicals the spillage is soaked up with sawdust until the floor is dry. The saturated sawdust is disposed of into a designated waste bin for hazardous materials.
- All major spillages drain into ponds and are then collected into containers. The remaining spillage is soaked up with sawdust until the floor is dry.
- All storage areas are furnished with impermeable materials (concretized, metallic) to prevent all spills from contaminating the soil.
- Empty chemical containers/wastes are stored separately on site and disposed of in accordance with acceptable practices.

### 5.8 Resource use (water and energy) for 2021)

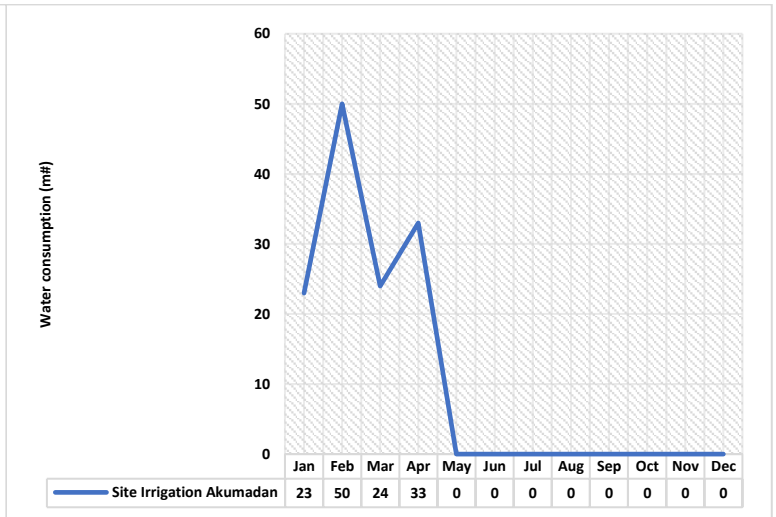
Table 5: FORM Ghana Resource Use for 2021

Type of Resource	Quantity used
<b>Water</b>	
Borehole	3353.00 m <sup>3</sup>
Irrigation	227.00 m <sup>3</sup>
<b>Energy</b>	
Grid Power (VRA/NEDCo) – Purchased	20393.79 kWh
Renewable (Solar) – Company Generated	13304.00 kWh
Diesel	46051.00 litres
Petrol	2851.00 litres
Oil (Lubricants/Engine oil/stroke oil)	1440.30 litres

2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves



Borehole water consumption for 2021



Irrigation water consumption for 2021

Figure 3: Water Consumption for 2021

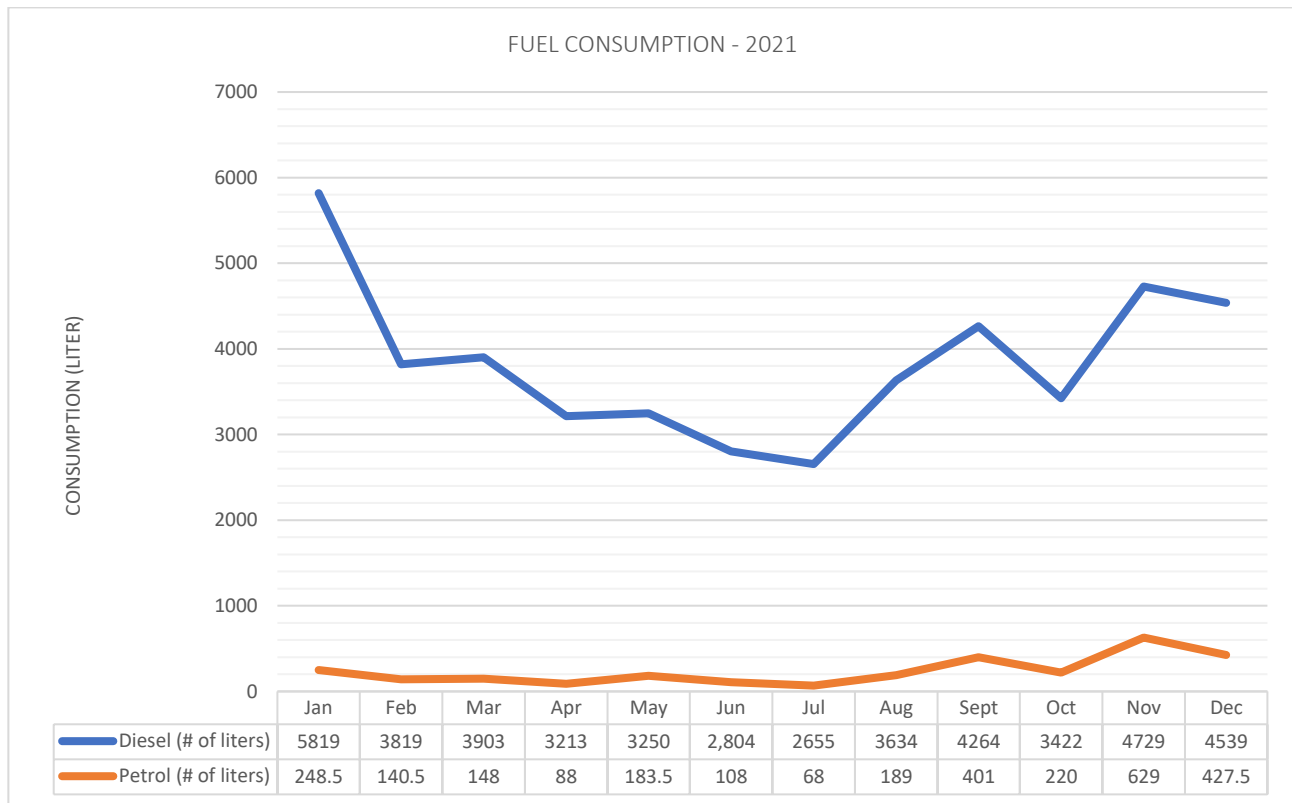


Figure 4: Fuel Consumption for 2021

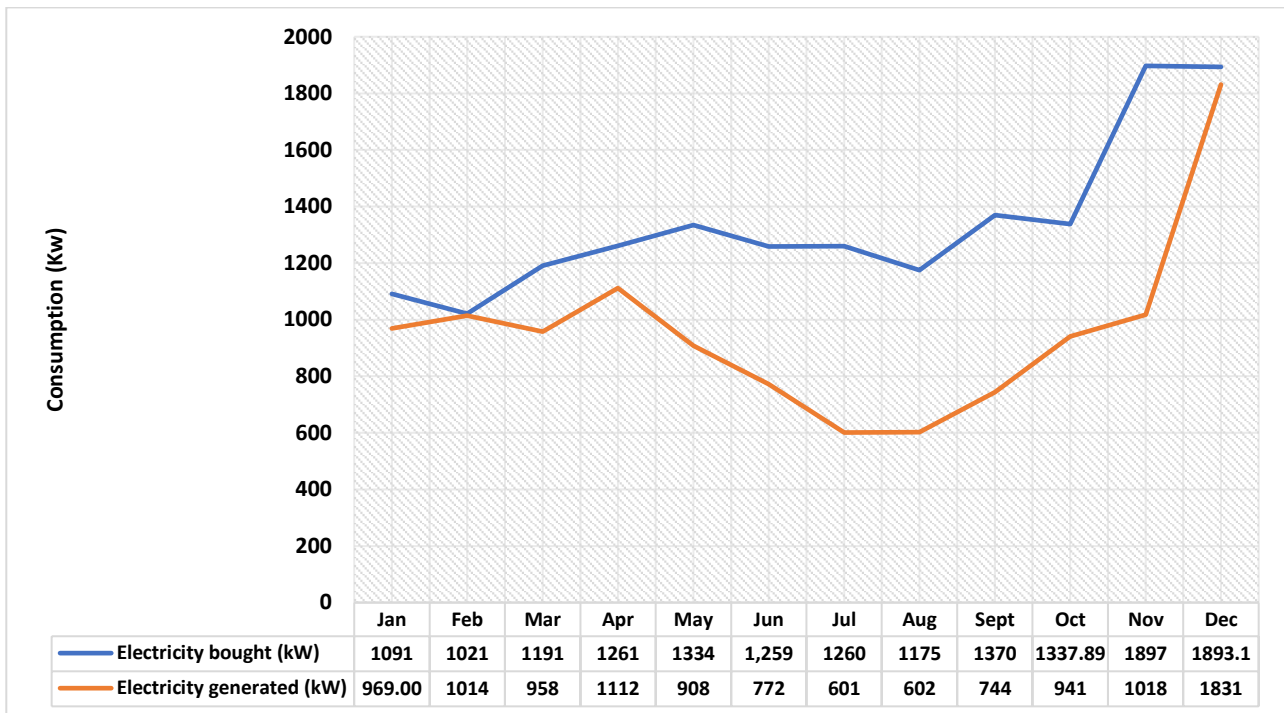


Figure 5: Electricity Consumption for 2021

### 5.9 Reasons for variation (Increase/Decrease) in Trend

#### Water Use:

The variation in water use is largely dependent on seasonal changes. Thus, weather conditions such as raining season and the dry season lessen vis-à-vis increases water demand respectively. From both consumption (borehole water and irrigation dam) graphs (see Figure 1 above), water demand is high between November and March. Water demand for consumption and fire-fighting purposes relatively account for the sharp increase of borehole water consumption in February. This is because, the dry season (April-October) reaches its peak during that period (February) of the year. The workforce demand for drinking water increases at the peak of the dry season due to frequent dehydration in the body. Also, the rate of wildfire incidence at the peak of the dry season increases, thus requiring the use of water for fire-fighting. However, from the onset of the rainy season, atmospheric moisture increased, reaching its peak in July, resulting in low rates of dehydration in the body. Water demand for drinking reduces with increased levels of atmospheric moisture. Thus, the reason for the relatively low volume of water consumption in July.

Irrigation is essential in tree nursery establishment. Nursery seedlings require water for survival particularly, under low moisture conditions. During the dry season, the young nursey seedlings wither due to low or absence of rainfall. Irrigation is also crucial during the early stages of nursery establishment after sowing or transplanting. Thus, water demand for irrigation purposes is highest in February (peak of the dry season) and April (sowing or transplanting) as shown in figure 5.1 above.

There was no irrigation activity from the period of May to December because nursery seedlings were rainfed.

**Fuel Consumption:**

FORM Ghana uses petrol, diesel and oil to power various machinery in its plantation operations. Majority of the machinery in FORM Ghana including operational vehicles and generator are powered by diesel. Diesel usage is high from November to January due to the increased number of operational vehicles for fire management purposes as illustrated in figure 5.2.

Other machines such as motorcycles, chainsaw machines, Bakkie-Sakkies and vehicle washing machine also uses petrol. However, as a result of the clear-felling operations with the use of chainsaw, the consumption of petrol increased during the month of September, November and December. This explains why the consumption of petrol is the second highest in the fuel category. On the other hand, oil (consisting of lubricants, stroke oil, engine oil) are low throughout the year due to interval usage such as during vehicle servicing or during the operation of chainsaws.

**Electricity Consumption:**

FORM Ghana generates its own electricity from solar and complements its power needs from purchase of grid power from ECG/NEDCo. While the consumption of solar power gently changes from month to month, there is a sharp fluctuation in grid power consumption. Weather conditions (such as cloudy weather) coupled with the need for power account for the decline in solar power generated from May to August and increases sharply in December. Grid power was purchased to augment the power generated especially during periods that solar power generated declined. Power from solar together with power purchased from ECG/NEDCo were able to cater for the power needs of the company.



## 6.0 OCCUPATIONAL HEALTH AND SAFETY (OHS)

### 6.1 OHS Trainings Undertaken in 2021

Table 6: FORM Ghana OHS Trainings undertaken in 2021

Date	Topic	Participants
02/02/2021	First Aid refresher training	64 Permanent
26/02/2021	COVID-19 variant	115 Permanent
02/03/2021	Digestive system	112 Permanent, 23Casual
19-23/03/2021	Chainsaw refresher training	1 Permanent
22/03/2021	Waste Management	133 Permanent, 23 Casual
23/03/2021	Transport assessment	12 Permanent
26/03/2021	Kidney and liver function	120 Permanent, 23Casual
14-15/4/2021	Chemical weeding	24 Permanent
20/04/2021	Snake bite	112 Permanent
30/04/2021	Personal Hygiene	137 Permanent
26/04/202	Hepatitis training	124 Permanent
31/07/2021	Safety training	44 Permanent
6&13-08-2021	Harvesting Protocol	32 Permanent
03/09/2021	Chainsaw refresher Training	14 Permanent
22/26-09-2021	Community safety sensitization on harvesting	84 External
01/10/2021	HIV/AIDS awareness and screening	115 Permanent
04/10/2021	Healthcare Policy	125 Permanent
22/10/2021	Transport Policy	14 Permanent
29/10/2021	Miscarriage, still birth & neonatal death leave policy	145 Permanent
10/11/2021	Harvesting safety issues (Protocol 10, 25)	4 Permanent
22-27/11/21	Community sensitization on wild fire	117 External
24/25-11-21	Forest firefighting	20 Permanent
26/11/2021	Urinary Tract Infection	121 Permanent
26,29/30-11-21	Forest firefighting	68 Permanent

### 6.2 Medical Check-up Undertaken for Staff

No medical check-up/screening was carried out within the reporting period.

### 6.3 Registration of Staff Under Health Insurance Scheme

FORM Ghana workers are registered under the National Health Insurance Scheme of Ghana.

### 6.4 Facilities/Equipment Available at Workplace

Washrooms	Four (4) units are available on site for use
Personal Protective Equipment	Specific PPE's are provided for various job roles in line with FORM Ghana's Protocol on Personal Protective Equipment (P10).
First aid kit	Each team in the field has a first aid kit and a trained first aider. All vehicles have first aid kits. In addition to the First aid kits, a clinic is available on site to provide first hand medical services.
Fire extinguisher and other safety equipment	Fire extinguishers are kept at strategic locations on buildings at site. All vehicles are also equipped with fire extinguishers. Other safety equipment includes: smoke detectors, firefighting equipment and an emergency assembly point. Additionally, various emergency evacuation signages are placed on buildings to direct employees in the event of an eventuality.

### 6.5 Accident Records

Table 7: Types of accident and frequency recorded in FORM Ghana for 2021

Throughout 2021, a total of forty-six (46) work related accidents were recorded in the plantation. Minor accidents recorded thirty-nine (39) cases whilst seven (7) major accidents were recorded. Majority (33) of the accidents were recorded during manual weeding, followed by (4) cases during firebelt preparation. The table below gives details of the accident records for the year:

Type of accident	Frequency	Nature of accident (Major/Minor)
Insect bites	18	All minor
Lacerations	27	Minor 20/Major 7
Bruises	1	Minor
Fracture	-	-
Splinter	0	-
<b>Total</b>	<b>46</b>	<p><b>*Major:</b> Accidents requiring suturing either at site clinic or hospital.</p> <p><b>*Minor:</b> Accidents which are managed either with first aid or at the site clinic and do not require suturing.</p>

### 6.6 Causes of Accidents

Accidents from insect bites (18) were often from insects in the plantation while lacerations (27) were mostly as a result of accidental slip-off of machete used in weeding activities.

### 6.7 Management of Accidents

FORM Ghana places priority on Occupational Health and Safety of its workforce. Hence, the company has laid down procedures to conduct investigations on all accidents that causes injury. After investigations are conducted, corrective/remedial actions are put in place to forestall the recurrence of similar accidents. Victims of work-related accidents are usually attended to by trained first aiders and transferred to the site clinic. A trained health practitioner at the clinic assesses the injury and treats the victim or refer to the hospital.

### 6.8 Company's Emergency Response Plan

FORM Ghana has a protocol which outlines the actions to be taken in the case of an emergency. This is Protocol 08 First Aid Procedures & Emergency Evacuation. The protocol makes provisions for first aid training, usage and composition of the first aid kit and handling of accidents.

In addition to the protocol, FORM Ghana has put in place emergency control measures such as installation of smoke detectors, creation of assembly point, posting of warning/caution signages on buildings and equipping every vehicle and building with fire extinguishers.

### 6.9 Community Social Responsibility

As part of FORM Ghana's social sustainability principle, the enhancement of the wellbeing of communities within the fringes of the reserve is key. The Company thus strives to maintain a cordial relationship through regular engagement and aiding in projects as part of its corporate social responsibility. For the year 2021, the table underneath gives details of the various activities carried out in line with the Company's community social responsibility:

<i>Date</i>	<i>Activity</i>	<i>Location</i>	<i>No. of Participants</i>
11/06/2021	Green Ghana Project in partnership with government agencies and schools.	Akumadan	12 institutions
15-24/09/2021	Stakeholders' sensitization on harvesting operations.	Fringe communities	5 communities, 5 institutions
22-27/10/2021	Fire education and social monitoring survey.	Fringe communities	6 communities
10/08/2021	Stakeholder meeting – First stakeholders meeting with fringing Communities, Forestry Commission, Ghana National Fire Service, Chiefs & Elders, Stool Lands, and Farmers.	Akumadan	42 participants
07/12/2021.	Stakeholder meeting – Second stakeholders meeting with fringing Communities, Forestry Commission, Ghana National Fire Service, Chiefs & Elders, Stool Lands, and Farmers.	Akumadan	35 participants

## 7.0 ENVIRONMENTAL MONITORING

### 7.1 Water Quality Monitoring data

Table 8: Water quality monitoring data for Site Borehole – Akumadan

Parameter	Standard Specification	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Total Dissolved Solids	1000 mg/l	19.00	20.00	17.00	21.00
pH	6.5-8.5	6.80	6.30	5.91	6.05
Temperature (°C)	-	30.40	26.20	28.20	28.90
Nitrate (mg/l)	50	1.50	2.80	0.60	4.60
Ammonia (mg/l)	1.5 mg/l	0.00	0.11	0.00	0.12
Phosphate (mg/l)	0.3 mg/l	46.13	3.73	3.73	0.26
Turbidity (NTU)	5	0.00	0.00	2.63	0.00
COD	-	-	38.00	-	12.40

Table 9: Water quality monitoring data for Asubima Stream – Akumadan Plantation

Parameter	Standard Specification	Quarter 1		Quarter 2		Quarter 3		Quarter 4	
		US	DS	US	DS	US	DS	US	DS
Dissolved Solids (mg/l)	-	-	-	34.00	26.00	42.00	33.00	29.00	23.00
pH	6.5-9.0	-	-	8.50	7.30	6.30	6.28	7.00	6.98
Temperature (°C)	-	-	-	26.30	26.30	27.50	28.00	23.70	27.90
Nitrate (mg/l)	-	-	-	16.30	9.00	9.30	7.20	12.00	6.30
Ammonia (mg/l)	0 – 1.0	-	-	0.26	0.14	0.12	0.10	0.17	0.13
Phosphate (mg/l)	-	-	-	9.66	6.78	22.93	13.61	0.64	0.52
Turbidity (NTU)	0 – 75.0	-	-	97.00	72.00	75.00	85.00	55.00	22.14
BOD	-	-	-	39.00	41.00	-	-	6.30	6.75
COD	-	-	-	126.00	130.00	-	-	2.48	26.20

\*US – Upstream; DS – Downstream

Table 10: Water quality monitoring data for Afrensu-Brohuma Stream – Akumadan Plantation

Parameter	Standard Specification	Quarter 1		Quarter 2		Quarter 3		Quarter 4	
		US	DS	US	DS	US	DS	US	DS
Dissolved Solids (mg/l)	-	-	-	31.00	30.00	42.00	33.00	28.00	32.00
pH	6.5-9.0	-	-	7.20	7.00	6.30	6.22	7.05	6.95
Temperature (°C)	-	-	-	26.30	26.32	27.50	27.60	28.00	27.60
Nitrate (mg/l)	-	-	-	12.50	17.40	9.30	9.70	-	-
Ammonia (mg/l)	0 – 1.0	-	-	0.19	0.27	0.12	0.11	0.14	0.16
Phosphate (mg/l)	-	-	-	8.96	10.17	22.93	11.41	2.40	2.36
Turbidity (NTU)	0 – 75.0	-	-	63.00	85.00	75.00	84.00	20.94	19.36
BOD	-	-	-	23.00	17.00	-	-	8.20	9.60
COD	-	-	-	71.00	55.00	-	-	36.60	40.21

\*US – Upstream; DS – Downstream

### 7.2 Variations (trends) Between the Baseline and Current Values of Rivers that Traverse the Plantation

Table 11: Comparison of baseline and current water quality parameters of Asubima Stream

Parameter	Baseline	Current Values 2021							
		Quarter 1		Quarter 2		Quarter 3		Quarter 4	
		US	DS	US	DS	US	DS	US	DS
Dissolved Oxygen	0.80	-	-	6.70	5.78	-	-	-	-
pH	6.72	-	-	8.50	7.30	6.30	6.28	7.00	6.98
Temperature	-	-	-	26.30	26.30	27.50	28.00	23.70	27.90
Nitrate	24.70	-	-	16.30	9.00	9.30	7.20	12.00	6.30
Ammonia	-	-	-	0.26	0.14	0.12	0.10	0.17	0.13
Phosphate	-	-	-	9.66	6.78	22.93	13.61	0.64	0.52
Turbidity	6.15	-	-	97.00	72.00	75.00	85.00	55.00	22.14

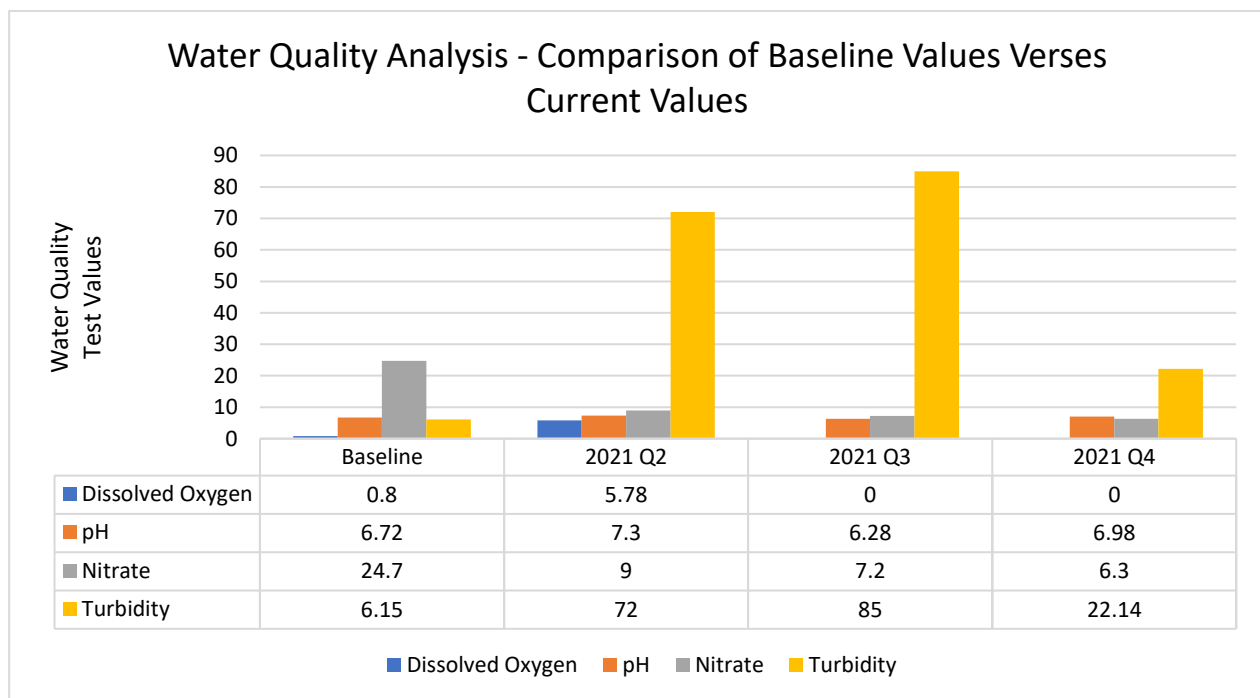


Figure 6: Water quality analyses - comparison of baseline values verses current values

### 7.3 Explanation to Variations Observed

From the comparison, FORM Ghana’s activities in the Asubima Forest Reserve have a positive contribution to the enhancement of water quality parameters especially on dissolved oxygen level and Nitrate. Also, the test values for pH indicate that the pH levels were found within the specified standard range of 6.5- 8.5. However, the turbidity levels were found to be higher compared with the baseline value. This is attributed to the frequent rainfall during the period of sample collection for quality analysis. Variations in parameters can be attributed to conservation practices such as creation of buffer areas along water bodies, restoration of riparian zone vegetation and avoidance of chemical use within buffer zones.

## 8.0 MEASURES TO IMPROVE ON FORM GHANA'S PERFORMANCE

### (ENVIRONMENTAL QUALITY AND OPERATION)

For the ensuing production year 2021, FORM Ghana will continue to improve its performance in conformity with national and international requirements. The Company's Environmental and Social Management Plan (ESMP) and operational Protocols in line with FSC™ (FSC-C044035) Principles and Criteria shall provide a guiding framework for continuous improvement. As part of environmental quality and operational performance measures, the Company shall:

- Continue to ensure strict adherence to standard recommendations for the use of approved pesticides with adequate measures to minimize the impact on biotic and abiotic environmental media.
- Conduct regular trainings on appropriate waste management approaches in line with the Company's protocol on waste management (Protocol 04).
- Continue to enforce periodic monitoring of environmental parameters within the Company's area of influence.
- Continue to conserve biodiversity and assess the impact of conservation measures through a flora and fauna survey.
- Strict adherence on the use of appropriate PPE's in all operations.
- Conduct job specific training/refresher trainings for all category of workers to ensure efficiency and effectiveness in operations.

## **CONCLUSION**

In the year 2021, FORM Ghana continued to enforce strictly all the COVID-19 safety protocols instituted by the central government alongside its COVID-19 safety protocol to avoid the contraction and spread of the COVID-19 pandemic amongst workers.

As part of strategic decisions, conscious efforts were made to ensure that various requirements for environmental, social, and health and safety safeguards were stringently complied with. Guided by operational protocols, FORM Ghana's environmental aspects such as biodiversity conservation, waste management, chemical use, use of appropriate PPE's, resource use and others were monitored. The Company as well undertook projects to fulfil its social responsibility mandate. Also, in line with an OHS Policy, FORM Ghana in the year 2021 pursued the health and safety of its employees through measures such as safety trainings, medical screening, health insurance and provision of safety materials.

**APPENDICES**

Appendix A: EPA Permit

**Tel:** (0302) 664697 / 664698 / 662465

667524 / 0289673960 / 1 / 2

**Fax:** 233 (0302) 662690

**E-mail:** info@epa.gov.gh

**Ghana Post (GPS):** GA-107-1998



**Environmental Protection Agency**

P. O. Box MB 326

Ministries Post Office

Accra, Ghana

**Website:** <http://www.epa.gov.gh>

CA: 62/LG/PL/03

**ENVIRONMENTAL PROTECTION AGENCY**

**ENVIRONMENTAL PERMIT**

**ENVIRONMENTAL ASSESSMENT REGULATION, 1999 L.I. 1652**

**This is to authorize**

**FORM GHANA LIMITED**

To continue operating an existing 3,446.22-hectare Reafforestation Plantation Project located at Akumadan, in the Asubima and Afrensu-Brohuma Forest Reserves in the Offinso North District of the Ashanti Region as per the attached schedule

**Date Issued:** August 14, 2021

**Expiry Date:** August 13, 2024

**EBENEZER APPAH-SAMPONG**  
**DEPUTY EXECUTIVE DIRECTOR/TECHNICAL SERVICES**  
**FOR: EXECUTIVE DIRECTOR**

**NB:** This Permit is only valid with the Seal of the Environmental Protection Agency.



Appendix B: Water Resources Commission Permit

## WATER RESOURCES COMMISSION



**Permit No: FGLID421/21**

### WATER USE PERMIT

This is to certify that a Water Use Permit has been issued to:


### FORM GHANA LIMITED

To abstract raw water from one borehole and a dam at Akumadan  
in the Offinso North District of the Ashanti Region for domestic  
and irrigation purposes as per attached schedule

**Commencement: January 1, 2022**

**Validity Period: 3 Years**

**Expiry Date : December 31, 2024**

  
BEN. Y. AMPOMAH  
EXECUTIVE SECRETARY

This Permit is issued in accordance with the Water Use Regulations  
2001, LI 1692 and is only valid with the Seal of the  
Water Resources Commission

Appendix C: Fire Permit

0011514  MEDIUM

**GHANA NATIONAL FIRE SERVICE**

**FIRE CERTIFICATE**

*This is to certify that*

house number 11 BLOCK H SECTOR 17 of AKOMAOAN, ASH/R has been issued with Fire Certificate for use as POW (OFFICE/WORKSHOP) FORM GHANA COMPANY  
LIMITED

Having upon inspection satisfied the following requirement as Fire Safety:

Means of Escape		
Type	Number	Location
a) <u>MAIN EXIT</u>	<u>A O D</u>	<u>A O D</u>
b) <u>GFN</u>	<u>5</u>	
c) <u>AP</u>	<u>1</u>	
d) _____	_____	_____

Fire Fighting Equipment		
Type	Number	Location
a) <u>CO2 (3/5KG)</u>	<u>1/6</u>	
b) <u>DP (6KG)</u>	<u>4</u>	
c) _____	_____	_____
d) _____	_____	_____

**Fire Hydrant/Source of Water Supply**

HYDRANT \_\_\_\_\_ - NIL

ALTERNATIVE SOURCE OF WATER \_\_\_\_\_ - BOREHOLE

Warning Device(s)		
Type	Number	Location
a) <u>DS (B)</u>	<u>5</u>	
b) <u>CPT</u>	<u>1</u>	
c) <u>SDER</u>	<u>1</u>	
d) _____	_____	_____

AC21134F THIS CERTIFICATE IS VALID FOR TWELVE MONTHS

Dated this 14TH day of JUNE 2021

  
DCFO OBENG DANKWA DWAMENA

for: **CHIEF FIRE OFFICER**



Appendix D: Material Safety Data Sheet for Glyphosate Based Pesticides

*MSDS for Glyphader*

<b>GLYPHADER® 75</b>		Date created : 15/05/07	
<b>MATERIAL SAFETY DATA SHEET</b>		Page 1 / 4	
<b>1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION</b>			
<b>SUPPLIED BY :</b>	SCPA SIVEX INTERNATIONAL 83-85 Boulevard Vincent Auriol 75013 Paris - FRANCE		
	TEL. +33 1 44 06 53 00 FAX. +33 1 44 06 54 66		
<b>PRODUCT :</b>	Glyphosate		
<b>CHEMICAL NATURE</b>	Water Soluble Granule (SG)		
<b>CHEMICAL FAMILY/USE:</b>	Glyphosate 680 g/Kg a.e. = 757 g/Kg Ammonium salt of Glyphosate Aminophosphonic ; Glycine derivative/ Herbicide		
<b>FORMULA:</b>	C <sub>3</sub> H <sub>8</sub> N O <sub>5</sub> P		
<b>CHEMICAL SYNONYMS:</b>	IUPAC: N-(phosphonomethyl) glycine		
<b>2. COMPOSITION/INFORMATION ON INGREDIENTS</b>			
	<b>Ingredients</b>	<b>Content</b>	<b>CAS NO</b>
	<b>Active ingredient:</b> GLYPHOSATE Salt of ammonium :	75.7 % w/w min	1071-83-6
	<b>Other ingredients:</b> Surfactant and formulating ingredients. Sodium sulphite	24.3 % w/w 0.5 % w/w max	
<b>3. HAZARDS IDENTIFICATION EMERGENCY OVERVIEW</b>			
<b>EMERGENCY OVERVIEW:</b> WARNING-POISON. Keep out of reach of children. Avoid contact with skin, eyes and clothing. Do not inhale fumes. Severely irritating to eyes. May cause skin irritation. Harmful if absorbed through the skin. Harmful if swallowed or inhaled.			
<b>EFFECTS OF ACUTE EXPOSURE:</b>			
<b>INGESTION:</b>	Harmful if swallowed. May cause nausea, vomiting, abdominal pain, decreased blood pressure, muscle weakness, and muscle spasms.		
<b>SKIN CONTACT:</b>	May cause slight transient irritation. Overexposure by skin absorption may cause nausea, vomiting, abdominal pain, decreased blood pressure, muscle weakness, and muscle spasms.		
<b>INHALATION:</b>	Contains materials that may be moderately toxic. Vapours could cause headache, dizziness, respiratory irritation and symptoms similar to those from ingestion.		
<b>EYE CONTACT:</b>	Causes severe eye irritation including corneal opacity and irreversible eye damage. Causes redness and tearing. Vapours and mist can cause irritation.		
<b>MEDICAL CONDITIONS AGGRAVATED:</b> Skin exposure may aggravate preexisting skin conditions. Inhalation of mist may aggravate preexisting respiratory conditions.			
<b>PRINCIPLE ROUTES OF EXPOSURE:</b> Eye contact. Skin absorption. Inhalation. Oral.			
<b>CHRONIC EFFECTS/CARCINOGENICITY:</b> No effect			
<b>REPRODUCTIVE TOXICITY:</b> No effect			
<b>GENOTOXICITY:</b> No			
<b>TOXICOLOGICALLY SYNERGISTIC MATERIALS:</b> NA.			
<b>OTHER:</b> None known.			
<b>4. FIRST AID MEASURES</b>			
<b>CROP PROTECTION DEPARTMENT</b>			

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**MATERIAL SAFETY DATA SHEET**

**INGESTION:** Never give anything by mouth to an unconscious person. Get medical attention and show the product label.

**SKIN:** In case of contact, remove contaminated clothing and wash skin thoroughly with soap and water.

**INHALATION:** If inhaled, remove to fresh air and get medical attention or contact a Poison Control Centre.

**EYES:** For eye contact, flush with plenty of water for at least 15 minutes. Get immediate medical attention.

**NOTE TO PHYSICIAN:** Symptomatic treatment.

**5. FIRE FIGHTING MEASURES**

**FLASH POINT:** No object

**CONDITIONS OF FLAMMABILITY:** No Flammable

**FLAMMABLE LIMITS IN AIR - Upper (%):** NA.

**FLAMMABLE LIMITS IN AIR - Lower (%):** NA.

**AUTOIGNITION TEMPERATURE:** NA.

**SENSITIVITY TO MECHANICAL IMPACT (Y/N):** NA.

**SENSITIVITY TO STATIC DISCHARGE:** NA.

**EXTINGUISHING MEDIA:** Dry powder, carbon dioxide, water or foam.

**SPECIAL FIREFIGHTING PROCEDURES:**

Special fire fighting procedures: Isolate fire area. Evacuate the employees and evacuate downwind.

Avoid spreading of contaminated extinguishing agent in the environment. Minimize use of water to prevent environmental contamination. Do not breathe smoke, gases, or vapour generated. Keep fire exposed containers cool by spraying with water. Wear full protective

Firefighters should wear self-contained breathing apparatus and full protective clothing when fighting chemical fires. Minimize and contain water runoff. Equipment should be thoroughly decontaminated after use.

**6. ACCIDENTAL RELEASE MEASURES**

**ACTION TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:**

Use safety equipment and procedures appropriate to the size of the spill. Keep unnecessary people away. Avoid runoff to natural waters and sewers. Surround and absorb spills with inert material such as perlite, sawdust, clay granules, vermiculite, sand or dirt. Contain all affected material in a closed, labelled container for proper disposal. Isolate from other waste materials. Clean contaminated area such as hard surfaces with detergent and water, collecting cleaning solution for proper disposal. Large spills to soil or similar surfaces may necessitate removal of top soil. Clean contaminated floors and objects thoroughly, observing environmental regulations. Do not discharge into the drains/surface water/groundwater. Keep people and animals away.

**7. HANDLING AND STORAGE**

**HANDLING:** Avoid contact with the eyes, skin and clothing and avoid inhalation of product or spray mist. If in eyes, wash it immediately with water. After handling and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water.

**STORAGE:** Store in the closed, original container in a dry, cool, well-ventilated area, out of direct sunlight. Store in locked room or place away from children, animals, food, animal feed, seed and fertilizers. Keep away from all ignition sources and protect from extreme heat and cold.

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

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**MATERIAL SAFETY DATA SHEET**

<b>ENGINEERING CONTROLS:</b>	Use in a well ventilated area. General ventilation with a good source of make-up air recommended as minimum for indoor situations. Ventilation should be adequate to maintain air concentrations below exposure limits.
<b>RESPIRATORY PROTECTION EQUIPMENT:</b>	Use an approved pesticide respirator if ventilation is not adequate or exposure to sprays, mists or vapours is likely.
<b>PROTECTIVE GLOVES:</b>	All types of chemical-resistant gloves for handling chemicals are acceptable, provided that they can be cleaned. Rinse gloves before removal. Gloves are not required for applicator in enclosed tractor or airplane cockpit.
<b>EYE AND FACE PROTECTION:</b>	Goggles or face shield when handling concentrate.
<b>OTHER PROTECTIVE EQUIPMENT:</b>	Long sleeved shirt, long pants, socks and shoes are minimum work clothing. Coveralls or a chemical-resistant apron should also be worn when open pouring from containers greater than 5L. Use other equipment appropriate to specific situation.
<b>VENTILATION:</b>	Use only in well ventilated area.

**9. PHYSICAL AND CHEMICAL PROPERTIES**

<b>BOILING POINT:</b>	> 190 °C
<b>VAPOR PRESSURE:</b>	9 x 10 <sup>-3</sup> mPa (25°C)
<b>VAPOR DENSITY (air = 1):</b>	NA.
<b>FREEZING POINT:</b>	NA.
<b>MELTING POINT:</b>	> 190°C
<b>PHYSICAL STATE:</b>	Slightly yellow to white granular
<b>ODOUR:</b>	Specific odour
<b>COLOUR:</b>	Slightly yellow to white
<b>ODOR THRESHOLD (ppm):</b>	NA
<b>EVAPORATION RATE (butyl acetate = 1):</b>	NA.
<b>SPECIFIC GRAVITY (water = 1):</b>	NAp
<b>DENSITY (20°C):</b>	550 g/L ± 50 (bulk density)
<b>pH:</b>	4.0 – 6.0
<b>SOLUBILITY IN WATER (25°C):</b>	144 ± 19 g/l (pH 3,2)
<b>COEFFICIENT OF WATER/OIL DISTRIBUTION:</b>	K <sub>ow</sub> logP= < - 3.7

Note: Physical data are typical values, but may vary from sample to sample. A typical value should not be construed as a guaranteed analysis or as a specification.

**10. STABILITY AND REACTIVITY**

<b>STABILITY:</b>	Stable.
<b>HAZARDOUS POLYMERIZATION:</b>	Not known to occur.
<b>HAZARDOUS THERMAL DECOMPOSITION/COMBUSTION PRODUCTS:</b>	None known
<b>INCOMPATIBILITY (MATERIALS TO AVOID):</b>	Can induced a reaction with metal (do not store or use this product in iron, galvanized steel or no varnish)
<b>CONDITIONS TO AVOID:</b>	None known.

**11. TOXICOLOGICAL INFORMATION**

<b>ORAL LD50</b>	Rat	4230	mg/kg
<b>DERMAL LD50:</b>	Rat	> 5000	mg/kg
<b>4 HOURS INHALATION LC50:</b>	Rat	> 5	mg/L
<b>EYE IRRITATION:</b>	Rabbit	Mild eye irritant	
<b>SKIN IRRITATION :</b>	Rabbit	Mild skin irritant	
<b>SKIN SENSITIZATION :</b>	Guinea pig	Not sensitizing	

Note : Data are from laboratory studies conducted on **GLYPHOSATE**.

**12. ECOLOGICAL INFORMATION**

**ECOTOXICOLOGICAL INFORMATION:**

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**MATERIAL SAFETY DATA SHEET**

<b>96-HOUR LC50:</b>	Rainbow trout	86	mg/L
<b>96-HOUR LC50:</b>	Bluegill sunfish	120	mg/L
<b>48-HOUR EC50:</b>	Daphnia magna	780	mg/L
<b>LD50:</b>	Bobwhite quail	>3851	mg/kg
<b>ORAL LD50:</b>	Bees	100	µg/bee
<b>CONTACT LD50:</b>	Bees	100	µg/bee

Note : Data on Active Ingredient.

**ENVIRONMENTAL FATE INFORMATION:**

In mammals, following oral administration, glyphosate is very rapidly excreted unchanged and does not bioaccumulate. In plants, slowly metabolised to aminomethylphosphonic acid, which is the major plant metabolite. In soil (field), DT50 1-30 days, depending on edaphic and climatic conditions. In water, DT50 varies from a few to 91 days. Photodegradation in water occurs under natural conditions, DT50 33-77 days; no substantial photodegradation in soil was recorded over 31 days. In a lab. whole system with water and sediment, DT50 27-146 days (aerobic), 14-22 days (anaerobic). The major metabolite in soil and water is aminomethyl phosphonic acid.

**13. DISPOSAL CONSIDERATIONS**

**DISPOSAL METHOD:**

For information on disposal of unused, unwanted product, contact the manufacturer or the provincial regulatory agency. Disposal should be made in accordance with federal, provincial and local regulations. Contact the manufacturer and the provincial regulatory agency in case of a spill, and for clean up of spills. Emptied container retains vapor and product residue. Observe all labelled safeguards until container is cleaned, reconditioned or destroyed. Do not reuse container for any purpose. If applicable, return container in accordance with return program. If a recyclable container, dispose of at a container collection site. Contact local distributor, dealer or municipality for the location of the nearest collection site. Before taking the container to the collection site, triple or pressure rinse the empty container adding rinsing to spray tank, and make container unsuitable for further use. If there is no container collection site in your area, dispose of the container in accordance with provincial requirements.

**14. TRANSPORT INFORMATION**

<b>RAIL/ROAD (RID/ADR):</b>	9
<b>SEA (IMDG):</b>	9
<b>AIR (ICAO/IATA):</b>	9
<b>U.N. NUMBER:</b>	3077
<b>DG CLASS:</b>	NA.
<b>HAZCHEM CODE:</b>	9
<b>PACKING GROUP:</b>	III

**15. REGULATORY INFORMATION**

**NOTICE:** The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations.

**16. OTHER INFORMATION**

**ADDITIONAL INFORMATION:**

Abbreviations used throughout the MSDS are: NA = Not available  
 NAp = Not applicable  
 N/E = None Established.

This MSDS summarises our best knowledge of the health and safety hazard information of the product and how to safely handle and use the product in the workplace. Each user should read this MSDS and consider the information in the context of how the product will be handled and used in the workplace including in conjunction with other products. If clarification or further information is needed to ensure that an appropriate risk assessment can be made, the user should contact this company. Our responsibility for products sold is subject to our standard terms and conditions, a copy of which is sent to our customers and is also available on request.

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**END OF MSDS**

**CROP PROTECTION DEPARTMENT**

**MSDS for Sidal Rondo 75.7SG**



GO FURTHER. TOGETHER

**MATERIAL SAFETY DATA SHEET**

**SECTION 1: Identification of the substance/mixture and of the company/undertaking**

**1.1. Product identifier**

Product name: Glyphosate 75,7% SG

**1.2. Relevant identified uses of the substance or mixture and uses advised against**

Recommended use: Herbicide

**1.3. Details of the supplier of the safety data sheet**

DVA Agro GmbH  
Valentinskamp 70 / EMPORIO TOWER  
D-20355 Hamburg / Germany

TEL.: 0049-40-8222 85 5  
FAX: 0049-40-8222 85 999

**1.4. Emergency telephone number**

+ 32 14 584545

**SECTION 2: Hazard identification**

**2.1. Classification of the substance or mixture**

Acc. to Regulation (EC) 1272/2008	
Hazard class / Hazard category	Hazard statements
Hazardous to the aquatic environment, Chronic category 2	H411

Acc. to Directive 67/548/EEC or 1999/45/EC	
European classification	R-Phrases
Dangerous for the environment	R51/53

**2.2. Label elements**

**Acc. to Regulation (EC) 1272/2008**



GHS09  
Environment

**Signal word:** -

**H statements**

H411 Toxic to aquatic life with long lasting effects.

**P statements**

P273 Avoid release to the environment.

P501 Dispose of contents/container to an authorized waste burning site.

**Acc. to Directive 67/548/EEC or 1999/45/EC**



N



GO FURTHER. TOGETHER

**R phrases**

R51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

**S phrases**

S60 This material and its container must be disposed of as hazardous waste.

S61 Avoid release to the environment. Refer to special instructions/safety data sheets.

**2.3. Other hazards**

No further information.

**SECTION 3: Composition/Information on ingredients**

**3.1. Substances**

This product is a mixture.

**3.2. Mixtures**

Component	CAS No	EINECS No	Classification (1272/2008/EC)	Classification (67/548/EEC)	Content
Glyphosate *	40465-66-5	-	Aqu.Chronic 2; H411	N, R51/53	~75,7%

\* N-Phosphonomethylglycine

**SECTION 4: First aid measures**

**4.1. Description of first aid measures**

**Inhalation**

- Bring affected victim outside away from exposure and provide for fresh air.
- Call for medical advice if there's pain in breathing.
  
- Immediately rinse eyes with plenty of water for 15 minutes ensuring eyelids are held open.
- Obtain medical advice.
  
- Immediately take off contaminated clothing. Wash affected skin with water and soap.
- If irritation persists, seek medical advice.
  
- Immediately drinking of plenty of water.
- Do not induce vomiting.
- Immediately obtain medical advice.
- Never give anything by mouth or induce vomiting to an unconscious person.

**4.2. Most important symptoms and effects, both acute and delayed**

- Symptoms of acute exposure to high doses include nausea, vomiting, diarrhoea, muscle weakness and salivation.
- Signs for eye or skin irritation: burning sensation, redness, swelling.
- Ingestion of similar formations has been reported to produce gastrointestinal discomfort with irritation of the mouth, nausea, vomiting and diarrhoea.

**4.3. Indication of any immediate medical attention and special treatment needed**

- There is no specific antidote. All treatment should be based on observed signs and symptoms of distress in the patient. Treat symptomatically.

**SECTION 5: Fire fighting measures**

**5.1. Extinguishing media**

**Suitable extinguishing media**

- Water (Spray – not splash), extinguishing powder, carbon dioxide, foam.





GO FURTHER. TOGETHER

**Unsuitable extinguishing media**

- No restrictions.

**5.2. Special hazards arising from the substance or mixture**

- Forming of dangerous gases / vapours at decomposition:  
Carbon dioxide, carbon monoxide, oxides of nitrogen, ammonia, oxides of phosphor
- Forming of dangerous gases / vapours in case of a fire in the surroundings possible too.

**5.3. Advice for fire-fighters**

- Use self-contained breathing apparatus when tight next to the fire or in closed rooms.
- Clean equipment after use (Shower, clean and check clothing carefully).
  
- Keep use of water under control according to possible environmental endangering (s. section 6).

**SECTION 6: Accidental release measures**

**6.1. Personal precautions, protective equipment and emergency procedures**

- Pay attention to protective measurements according to section 8.
- Avoid contact with skin, eyes and clothing.
- Provide for good ventilation.
- Keep unprotected people away.

**6.2. Environmental precautions**

- Inform the appropriate authorities if considerable quantities of the product are released.
- Prevent escape into water, drainage, sewer or the ground.

**6.3. Methods and material for containment and cleaning up**

- Take up mechanically or with inert material (sand, earth, absorbing material).
- Collect in a closed, labelled and product-resistant container.

**6.4. Reference to other sections**

- Concerning disposal see section 13.

**SECTION 7: Handling and storage**

**7.1. Precautions for safe handling**

- Keep away from reactive material (see section 10).
- Avoid contact with skin, eyes and clothing.
- Do not eat, drink or smoke at work.
- Wash hands before breaks and after work.
- Thoroughly clean equipment after use.
- Provide for good ventilation.

**7.2. Conditions for safe storage, including any incompatibility**

- Store in closed original packaging.
- Keep container at a dry and well ventilated place.
- Keep away from food, drink and animal feeding stuffs.

**7.3. Specific end use(s)**

- Ask supplier before special use.
- Inform personnel about dangerous product.
- Empty containers retain vapour and product residue.
- Do not contaminate drains, sewers and waterways when depositing of equipment rinse water.

**SECTION 8: Exposure controls/personal protection**

**8.1. Control parameters**

- Occupational exposure limits:  
At the present there are no information regarding exposure limit values.

**8.2. Exposure controls**

- Pay attention to measurements according section 7.
- Install local ventilation when danger of decomposition.



GO FURTHER. TOGETHER

**Personal Protective Equipment:**

- Respiratory protection  
At recommended use no special equipment is necessary.  
When released or in case of intensive or longer exposure use self-contained breathing apparatus. Use only equipment according to international/national regulations.
- Hand protection  
Chemical resistant gloves (EN 374)  
Recommended material: nitrile rubber, chloroprene rubber, PVC
- Eye protection  
Glasses with side protection.
- Skin protection  
Protective workclothings.  
Wear long-sleeve shirts and long pants.

**Hygiene measures**

- Shower and eye shower.
- Do not eat, drink or smoke at work.
- Wash hands before breaks and after work.
- Take off contaminated clothing.
- Wearing of closed clothing is recommended.
- Separate preserving of working clothing.

**SECTION 9: Physical and chemical properties**

**9.1. Information on basic physical and chemical properties**

<b>Appearance</b>	<b>White homogenous cylindrical granule</b>
<b>Glyphosate Amonium Salt(%)</b>	<b>75.7 Min</b>
<b>Glyphosate(%)</b>	<b>68.8 Max</b>
<b>PH Value</b>	<b>3.0-6.0</b>
<b>Persistant Foaming(ML)</b>	<b>40 Max</b>
<b>Insoluble in water(%)</b>	<b>0.2 Max</b>
<b>Moisture (%)</b>	<b>0.5 Max</b>
<b>Formaldehyde(%)</b>	<b>0.1 Max</b>

**9.2. Other information**

**Decomposition temperature:** n.d.

**SECTION 10: Stability and reactivity**

**10.1. Reactivity**

- No special information.

**10.2. Chemical stability**

- Stable under normal conditions of use.

**10.3. Possible hazardous reactions**

- This product can react with caustic (basic materials to liberate heat). This is not a polymerization but rather a chemical neutralization in an acid base reaction.
- Do not mix, store or apply this product or spray solutions of this product in galvanized steel or unlined mild steel containers or spray tanks. Forming of hydrogen, which may form a highly combustible gas air mixture.
- With alkalines forming of ammonia is possible.



GO FURTHER. TOGETHER

**10.4. Conditions to avoid**

- Avoid sources of ignition and extreme heat.

**10.5. Incompatible materials**

- Strong oxidizing agents, strong acids, strong bases.
- Galvanized steel, mild steel.

**10.6. Hazardous decomposition products**

- oxides of nitrogen, ammonia, oxides of phosphorous
- carbon dioxide, carbon monoxide

**SECTION 11: Toxicological information**

**11.1. Information on toxicological effects**

**Acute Toxicity**

- Acute oral toxicity, rat LD 50 > 4640 mg/kg
- Acute dermal toxicity, rat LD 50 > 2150 mg/kg
- Inhalation toxicity, rat LC 50 n.d.

- 4 days slight to moderate irritation to eye. This was evident at 1 day but cleared by 4 days.
- No irritation to skin (rabbits, 4 hours essentially).

- Not a sensitizer (guinea pig, skin).

**Repeated dose toxicity**

Glyphosate

- repeated dermal exposure, rabbit, 21 days NOAEL toxicity > 5000 mg/kg/day
- rat, oral, 3 months, NOAEL toxicity > 20000 mg/kg diet
- Data from Glyphosate laboratory toxicity studies were conducted with a formulation comprised of 62% isopropylamine salt of Glyphosate (MON 0139).

Rabbits – 3 week dermal:

Repeated daily primarily resulted in slight skin irritation.

Dogs – 6 month feeding:

Only slight body weight changes noted.

Rats – 90 days feeding:

No treatment related effects.

Mice – 90 days feeding:

Decreased weight gains at the high dose level group animals.

**Carcinogenicity**

Glyphosate

- mouse, oral, 24 months, NOEL tumor > 30000 mg/kg diet  
NOAEL toxicity ~ 5000 mg/kg diet  
Target organ: liver  
Increase of body weight, histopathological effects
- rat, oral, 24 months, NOEL tumor > 20000 mg/kg diet  
NOAEL ~ 8000 mg/kg diet  
Target organ: eyes  
Increase of body weight, histopathological effects.
- None of the components present in this material at concentrations equal to or greater than 0,1% is listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

**Mutagenicity**

Glyphosate

- In vitro and in vivo mutagenicity test: not mutagenic

**Reproduction toxicity**

Glyphosate

- rat, oral, 3 generations, NOAEL toxicity > 30 mg/kg  
NOAEL reproduction > 30 mg/kg



GO FURTHER. TOGETHER

**Further information**

- Terratogenicity (glyphosate)
  - rat, oral, 6-19 days pregnancy, NOAEL toxicity 1000 mg/kg body weight NOAEL development 1000 mg/kg body weight  
Increase of body weight, decrease surviving range, lost of weight, postimplantation, delayed forming of bones at descendants only occurred in case of maternal poisoning
  - rabbit, oral, 6-27 days pregnancy, NOAEL toxicity 175 mg/kg body weight NOAEL development 175 mg/kg body weight  
Decrease in surviving range

**SECTION 12: Ecological information**

**12.1. Toxicity**

- Fishes:
 

Rainbow trout, LC 50, 96 hours, static	22 mg/l
Rainbow trout, LC 50, 96 hours, dynamic	8,2 mg/l
Bluegill sunfish, LC 50, 96 hours, dynamic	5,8 mg/l
Fathead minnow, LC 50, 96 hours	9,4 mg/l
Channel catfish, LC 50, 96 hours	16 mg/l
Chinook salmon, LC 50, 96 hours	20 mg/l
Coho salmon, LC 50, 96 hours	22 mg/l
- Crustaceans:
 

Daphnia magna, LC 50, 48 hours, aeration	37 mg/l
Daphnia magna, LC 50, 48 hours, w/o aeration	24 mg/l
Gammarus pseudolimnaeus, EC 50, 48 hours	42 mg/l
- Algae:
 

Algae S. Capricornutum, EC 50, 72 hours	2,1 mg/l
-----------------------------------------	----------
- Birds:
 

Bobwhite quail, LC 50, 8 days	> 6300 ppm
Mallard duck, LC 50, 8 days	> 6300 ppm

**12.2. Persistence and degradability**

- Soil field, half life 2-174 days  
Koc 884-60000 l/kg, adsorbs strongly to soil
- Water, aerobic, half life < 7 days  
(Glyphosate)

**12.3. Bioaccumulative potential**

- Lepomis macrochirus hole fish BCF < 1  
(no significant bioaccumulation is occurred)  
(Glyphosate)

**12.4. Mobility in soil**

- No detailed data available.

**12.5. Results of PBT and vPvB assessment**

- No specific data available.

**12.6. Other adverse effects**

- Toxic to aquatic organisms.
- Prevent escape into water, drainage, sewer or the ground.

**SECTION 13: Disposal considerations**

**13.1. Waste treatment methods**

**Product disposal**

- Obey the local and national regulations for recycling.
- Contaminated adsorbents, surplus product, etc., should be burnt in an incinerator, preferably designed for pesticide disposal.
- Dispose at an authorized waste burning site for dangerous goods waste.



GO FURTHER. TOGETHER

**SECTION 14: Transport information**

	Road transport ADR	Railway transport RID	Inland waterway ADN	Maritime transport IMDG	Air transport IATA
<b>14.1.</b> UN No	Not applicable				
<b>14.2.</b> Proper shipping name	Not applicable				
<b>14.3.</b> Class	Not applicable				
<b>14.4.</b> Packing Group	Not applicable				
<b>14.5.</b> Environmental hazards	Not applicable				
<b>14.6.</b> Special pre- caution for user	No further information				
<b>14.7.</b> Transport in bulk acc. to MARPOL 73/78 und IBC Code	No further information				

**SECTION 15: Regulatory information**

**15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture (1272/2008/EC)**

**National regulations**

- Water hazard class WGK: 2 (Germany)

**15.2. Chemical safety assessment**

- No further information.

**16. Other information**

**Latest Update**

Complete revision

**Used abbreviations**

n.a. not applicable  
n.d. no data

**Literature references and sources of information**

EC Directive 67/548/EEC resp. 1999/45/EC in valid version; regulation (EC) No 1907/2006 (REACH) in valid version; National exposure limit values in valid version; Transport regulations according to ADR, RID, ADN, IMDG, IATA in valid version; information from supplier.



GO FURTHER. TOGETHER

**List of relevant hazard statements from section 2 and 3 (GHS classification)**

H411 Toxic to aquatic life with long lasting effects.

**List of relevant R-phrases from section 2 and 3 (EU-classification)**

R51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

These details are based on our today's knowledge. They should describe our products regarding safety requirements and therefore should not assure certain properties.

**Appendix E: Water Quality Analysis Reports**

**First Quarter Water Quality Analysis of Akumadan Site Borehole**

# GHANA WATER COMPANY LIMITED

**Main Bankers:** Social Security Bank  
Ghana Commercial Bank



**Brong Ahafo Region**  
**Post Office Box 88**  
**Sunyani - B/A**

8<sup>th</sup> April, 2021

**My Ref. No.:**.....

**Your Ref. No.:**.....

Attn. FORM GHANA LIMITED, P.O.BOX 211 SUNYANI, BONO-REGION

### **CERTIFICATE OF ANALYSIS**

<b>Sample Description:</b> Boreholes	<b>Expiry date:</b> 30/02/2022
<b>Country of Origin:</b> Ghana	
<b>Net Volume:</b> 1.5L Each	
<b>Name of Community:</b> Berekum	

### **TEST RESULTS**

PHYSICO-CHEMICAL ANALYSIS:				DATE OF ANALYSIS: 30/03/2021	
PARAMETER	TEST METHOD	METHOD DETECTION LIMIT/UNITS	GHANA STANDARD SPECIFICATION	RESULTS	
				Site Akumadan	Head Office Sunyani
Temperature		°C	-	30.40	30.20
pH	Electrometric	-	6.5-8.5	6.00	7.00
Residual free chlorine	Colorimetric	mg/l	0.0	0.00	0.00
Colour	Platinum-cobalt	Pt.Co	0-15	5.00	5.00
Turbidity	Nephelometric	NTU	5	0.00	0.00
Conductivity	Electrometric	µs/cm	-	38.00	266.00
Total Dissolved Solids	Electrometric	mg/l	1000	19.00	135.00
Total Hardness	Titrimetric	mg/l	500	135.00	63.00
Calcium Hardness	Titrimetric	mg/l	-	20.00	20.00
Magnesium Hardness	Titrimetric	mg/l	-	115.00	43.00
Alkalinity	Titrimetric	mg/l	-	16.00	55.00
Chloride	Argentometric titration	mg/l	250	7.00	23.00
Nitrite	Diazotization	mg/l	3.0	0.01	0.01


2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves

Nitrate	Cadmium reduction	mg/l	50	1.50	1.70
Ammonia(Nitrogen)	Nessler	mg/l	1.5	0.00	0.00
Fluoride	Spands	mg/l	1.5	0.36	3.65
Iron	FerroVer	mg/l	0.3	0.09	0.17
Sulphate	Sulfaver 4	mg/l	250	4.00	53.00
Manganese	Periodate oxidation	mg/l	0.4	1.00	1.00
Phosphate	PhosVer 3	mg/l	0.3	46.13	3.55
Aluminium	Aluminon method	mg/l	0.2	0.00	0.00
Cyanide	Pyridine-pyrazalone	mg/l	0.07	0.00	0.00
Arsenic	2822800(EZ arsenic)	mg/l	0.01	0.00	0.00

MICROBIOLOGICAL ANALYSIS:				DATE OF ANALYSIS: 30/03/2021	
PARAMETER	TEST METHOD	UNIT	SPECIFICATION/METHOD DETECTION LIMIT	RESULTS	
				Site Akumadan	Head Office Sunyani
Fecal coliform	Multiple tube fermentation	MPN Index/100mL	<1.1	<1.1	<1.1
E. Coli	Indole Test	Present/Absent (P/A)	Absent	Absent	Absent

REMARKS: Site Akumadan did not meet the standards for pH, Head Office Sunyani did not meet the standards for Fluoride, both samples did not meet the standards for Manganese and Phosphate. pH correction is recommended for Site Akumadan, Fluoride removal is recommended for Head Office Sunyani, Manganese and Phosphate removal are recommended for both water samples.

Note: These results are only applicable to the sample(s) submitted to the laboratory.

Regional WQA Manager  
  
 REGIONAL WQA MANAGER  
 GHANA WATER CO. LTD.  
 SUNYANI BRONG AHAFO  
 {Janet Atebiya}

Board of Directors: Hon Alexander k. Afenyo-Markin (Chairman) , Ing. Dr.Clifford Braimah (. Managing Director) , Mr.Joseph Obeng-Poku ,Mr.Michael Ayesu , Naaba Sigri Gewong, Hon. Kwame Twumasi Amporfo, Mr. Clement Alosebuno Kaba, Prof. Forster Kum-Ankama Sarpong, Madam Maria Aba Lovelace-Johnson,Mr.AlexanderK.B. Bonney, Mrs.Serena Kwakye-Mintah

Registered Office: 28<sup>th</sup> February Road, (Near Independence Square)  
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 Website: [www.qwcl.com.gh](http://www.qwcl.com.gh) E-mail: [info@qwcl.com.gh](mailto:info@qwcl.com.gh)



Second Quarter Water Quality Analysis of Akumadan Site Borehole

## GHANA WATER COMPANY LIMITED

Main Bankers: Social Security Bank  
Ghana Commercial Bank



Brong Ahafo Region  
Post Office Box 88  
Sunyani - B/A

My Ref. No.: .....

14<sup>th</sup> July, 2021

Your Ref. No.: .....

Attn. FORM GHANA LIMITED, P.O.BOX 211 SUNYANI, BONO-REGION

### CERTIFICATE OF ANALYSIS

Sample Description: Boreholes	Expiry date; 24/05/2022
Country of Origin: Ghana	
Net Volume: 1.5L Each	
Name of Community: Akumadan	

### TEST RESULTS

PHYSICO-CHEMICAL ANALYSIS:			DATE OF ANALYSIS: 25/06/2021	
PARAMETER	TEST METHOD	METHOD DETECTION LIMIT/UNITS	GHANA STANDARD SPECIFICATION	RESULTS Site Akumadan
Temperature		°C	-	26.20
pH	Electrometric	-	6.5-8.5	6.30
Total Suspended Solids	Electrometric	mg/l	-	0.00
Dissolved Oxygen	Electrometric	mg/l	-	1.64
Residual free chlorine	Colorimetric	mg/l	0.0	0.00
Colour	HACH 8025	Pt.Co	0-15	4.00
Turbidity	Nephelometric	NTU	5	0.00
Conductivity	Electrometric	µs/cm	-	40.00
Total Dissolved Solids	Electrometric	mg/l	1000	20.00
B.O.D	Manometric method	mg/l		0.98
C.O.D	Reactor digestion	mg/l		38.00
Total Hardness	Titrimetric	mg/l	500	14.00
Calcium Hardness	Titrimetric	mg/l	-	4.00
Magnesium Hardness	Titrimetric	mg/l	-	10.00

2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves


Alkalinity	Titrimetric	mg/l	-	14.00
Chloride	Argentometric titration	mg/l	250	48.00
Nitrite	HACH 10019	mg/l	3.0	0.00
Nitrate	HACH 8039	mg/l	50	2.80
Ammonia(Nitrogen)	HACH 8038	mg/l	1.5	0.11
Fluoride	HACH 8029	mg/l	1.5	0.33
Calcium	Titrimetric	mg/l	-	1.60
Magnesium	Titrimetric	Mg/l	-	2.43
Iron	HACH 8008	mg/l	0.3	0.00
Sulphate	HACH 8051	mg/l	250	0.00
Sulphide	HACH 8131	mg/l	-	0.02
Manganese	HACH 8034	mg/l	0.4	0.30
Phosphate	HACH 8190	mg/l	0.3	3.73
Aluminium	HACH 8012	mg/l	0.2	0.00
Copper	HACH 8026	mg/l	-	0.03
Cyanide	HACH 8027	mg/l	0.07	0.00
Arsenic	2822800 (EZ arsenic)	mg/l	0.01	0.00

2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves

MICROBIOLOGICAL ANALYSIS:				DATE OF ANALYSIS: 25/06/2021
PARAMETER	TEST METHOD	UNIT	SPECIFICATION/ METHOD DETECTION LIMIT	RESULTS
				Site Akumadan
Fecal coliform	Indole Test	MPN Index/ 100MI	<1.1	8.0
E. Coli	Membrane Filtration	CFU/100ml	0.0	11.0
Total Coliform	Membrane Filtration	CFU/100ml	0.0	5.0

**REMARKS:** The water sample met the standards for all the parameters except pH, phosphate and microbial quality. pH correction, disinfection of source water and removal of Phosphate are recommended.

**Note:** These results are only applicable to the sample(s) submitted to the laboratory.

  
Asst. WQA Officer  
{Andrew N. Sadique}

*Board of Directors: Hon Alexander k. Afenyo-Markin (Chairman) , Ing. Dr.Clifford Braimah (. Managing Director) , Mr.Joseph Obeng-Poku ,Mr.Michael Ayesu , Naaba Sigri Gewong, Hon. Kwame Twumasi Amporfo, Mr. Clement Alosebuno Kaba, Prof. Forster Kum-Ankama Sarpong, Madam Maria Aba Lovelace-Johnson,Mr.AlexanderK.B. Bonney, Mrs.Serena Kwakye-Mintah*

*Registered Office: 28<sup>th</sup> February Road, (Near Independence Square)*

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**Website: [www.gwcl.com.gh](http://www.gwcl.com.gh) E-mail: [info@gwcl.com.gh](mailto:info@gwcl.com.gh)**

**Second Quarter Water Quality Analysis of Asubima and Afrensu-Brohuma Streams**

**GHANA WATER COMPANY LIMITED**

Main Bankers: Social Security Bank  
Ghana Commercial Bank



Brong Ahafo Region  
Post Office Box 88  
Sunyani - B/A

My Ref. No.:.....

14<sup>th</sup> July, 2021

Your Ref. No.:.....

Attn. FORM GHANA LIMITED, P.O.BOX 211 SUNYANI, BONO-REGION

**CERTIFICATE OF ANALYSIS**

Sample Description: Boreholes	Expiry date; 24/05/2022
Country of Origin: Ghana	
Net Volume: 1.5L Each	
Name of Community: Asubima	

**TEST RESULTS**

PHYSICO-CHEMICAL ANALYSIS:				DATE OF ANALYSIS: 25/06/2021	
PARAMETER	TEST METHOD	METHOD DETECTION LIMIT/UNITS	GHANA STANDARD SPECIFICATION	RESULTS	
				Asubima Upstream	Asubima Downstream
Temperature		°C		26.30	26.30
pH	Electrometric	-		8.50	7.30
Total Suspended Solids	Electrometric	Mg/l		89.00	50.00
Dissolved Oxygen	Electrometric	Mg/l		6.70	5.78
B.O.D	Colorimetric	mg/l		39.00	41.00
C.O.D	HACH 8025	mg/l		126.00	130.00
Residual free chlorine	Nephelometric	mg/l		0.00	0.00
Colour	Electrometric	Pt.Co		225.00	190.00
Turbidity	Electrometric	NTU		97.00	72.00
Conductivity	Manometric method	µs/cm		66.00	50.00
Total Dissolved Solids	Reactor digestion	mg/l		34.00	26.00
Total Hardness	Titrimetric	mg/l		30.00	14.00

2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves

Calcium Hardness	Titrimetric	mg/l		20.00	12.00
Magnesium Hardness	Titrimetric	mg/l		10.00	2.00
Alkalinity	Titrimetric	mg/l		26.00	16.00
Chloride	Argentometric titration	mg/l		26.00	26.00
Nitrite	HACH 10019	mg/l		33.00	15.00
Nitrate	HACH 8039	mg/l		16.30	9.00
Ammonia(Nitrogen)	HACH 8038	mg/l		0.26	0.14
Fluoride	HACH 8029	mg/l		0.00	0.02
Calcium	Titrimetric	mg/l		8.00	4.80
Magnesium	Titrimetric	Mg/l		2.43	0.49
Iron	HACH 8008	mg/l		3.04	2.26
Sulphate	HACH 8051	mg/l		12.00	6.00
Sulphide	HACH 8131	mg/l		0.24	0.13
Manganese	HACH 8034	mg/l		4.30	2.50
Phosphate	HACH 8190	mg/l		9.66	6.78
Aluminium	HACH 8012	mg/l		1.05	0.18
Copper	HACH 8026	mg/l		0.76	0.40
Cyanide	HACH 8027	mg/l		0.03	0.02
Arsenic	2822800 (EZ arsenic)	mg/l		0.00	0.00

2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves

MICROBIOLOGICAL ANALYSIS:			DATE OF ANALYSIS: 25/06/2021		
PARAMETER	TEST METHOD	UNIT	SPECIFICATION/ METHOD DETECTION LIMIT	RESULTS	
				Asubima Upstream	Asubima Downstream
Fecal coliform	Indole Test	MPN Index/ 100mL	<1.1	>8.0	>8.0
E. Coli	Membrane Filtration	CFU/100ml	0.0	574.0	678.0
Total Coliform	Membrane Filtration	CFU/100ml	0.0	912.0	714.0

**REMARKS:**

**Note:** These results are only applicable to the sample(s) submitted to the laboratory.



Asst. WQA Officer

{Andrew N. Sadique}

*Board of Directors: Hon Alexander k. Afenyo-Markin (Chairman) , Ing. Dr.Clifford Braimah (. Managing Director) , Mr.Joseph Obeng-Poku ,Mr.Michael Ayesu , Naaba Sigri Gewong, Hon. Kwame Twumasi Amporfo, Mr. Clement Alosebuno Kaba, Prof. Forster Kum-Ankama Sarpong, Madam Maria Aba Lovelace-Johnson,Mr.AlexanderK.B. Bonney, Mrs.Serena Kwakye-Mintah*

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**Website: [www.gwcl.com.gh](http://www.gwcl.com.gh) E-mail: [info@gwcl.com.gh](mailto:info@gwcl.com.gh)**

# GHANA WATER COMPANY LIMITED

**Main Bankers:** Social Security Bank  
Ghana Commercial Bank



**Brong Ahafo Region**  
**Post Office Box 88**  
**Sunyani - B/A**

**My Ref. No.:**.....

14<sup>th</sup> July, 2021

**Your Ref. No.:**.....

Attn. FORM GHANA LIMITED, P.O.BOX 211 SUNYANI, BONO-REGION

## CERTIFICATE OF ANALYSIS

<b>Sample Description:</b> Boreholes	<b>Expiry date:</b> 24/05/2022
<b>Country of Origin:</b> Ghana	
<b>Net Volume:</b> 1.5L Each	
<b>Name of Community:</b> Afrenso Brohuma	

## TEST RESULTS

PHYSICO-CHEMICAL ANALYSIS:				DATE OF ANALYSIS: 25/06/2021	
PARAMETER	TEST METHOD	METHOD DETECTION LIMIT/UNITS	GHANA STANDARD SPECIFICATION	RESULTS	
				Afrenso Brohuma Upstream	Afrenso Brohuma Downstream
Temperature		°C		26.30	26.32
pH	Electrometric	-		7.20	7.00
Total Suspended Solids	Electrometric	Mg/l		43.00	69.00
Dissolved Oxygen	Electrometric	Mg/l		6.00	7.10
B.O.D	Colorimetric	mg/l		23.00	17.00
C.O.D	HACH 8025	mg/l		71.00	55.00
Residual free chlorine	Nephelometric	mg/l		0.00	0.00
Colour	Electrometric	Pt.Co		150.00	300.00
Turbidity	Electrometric	NTU		63.00	85.00
Conductivity	Manometric method	µs/cm		61.00	58.00
Total Dissolved Solids	Reactor digestion	mg/l		31.00	30.00

2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves

Total Hardness	Titrimetric	mg/l		24.00	15.00
Calcium Hardness	Titrimetric	mg/l		20.00	8.00
Magnesium Hardness	Titrimetric	mg/l		4.00	7.00
Alkalinity	Titrimetric	mg/l		24.00	20.00
Chloride	Argentometric titration	mg/l		34.00	40.00
Nitrite	HACH 10019	mg/l		22.00	33.00
Nitrate	HACH 8039	mg/l		12.50	17.40
Ammonia(Nitrogen)	HACH 8038	mg/l		0.19	0.27
Fluoride	HACH 8029	mg/l		0.06	0.28
Calcium	Titrimetric	mg/l		8.00	3.20
Magnesium	Titrimetric	Mg/l		0.97	1.70
Iron	HACH 8008	mg/l		2.80	3.20
Sulphate	HACH 8051	mg/l		8.00	13.00
Sulphide	HACH 8131	mg/l		0.13	0.22
Manganese	HACH 8034	mg/l		2.80	3.60
Phosphate	HACH 8190	mg/l		8.96	10.17
Aluminium	HACH 8012	mg/l		0.68	0.41
Copper	HACH 8026	mg/l		0.45	0.09
Cyanide	HACH 8027	mg/l		0.02	0.03
Arsenic	2822800 (EZ arsenic)	mg/l		0.00	0.00



2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves

MICROBIOLOGICAL ANALYSIS:			DATE OF ANALYSIS: 25/06/2021		
PARAMETER	TEST METHOD	UNIT	SPECIFICATION/ METHOD DETECTION LIMIT	RESULTS	
				Asubima Upstream	Asubima Downstream
Fecal coliform	Indole Test	MPN Index/ 100mL	<1.1	>8.0	>8.0
E. Coli	Membrane Filtration	CFU/100ml	0.0	TNTC	803.0
Total Coliform	Membrane Filtration	CFU/100ml	0.0	504.0	302.0

**REMARKS:**

**Note:** These results are only applicable to the sample(s) submitted to the laboratory.



Asst. WQA Officer

{Andrew N. Sadique}

*Board of Directors: Hon Alexander k. Afenyo-Markin (Chairman) , Ing. Dr.Clifford Braimah (. Managing Director) , Mr.Joseph Obeng-Poku ,Mr.Michael Ayesu , Naaba Sigri Gewong, Hon. Kwame Twumasi Amporfo, Mr. Clement Alosebuno Kaba, Prof. Forster Kum-Ankama Sarpong, Madam Maria Aba Lovelace-Johnson,Mr.AlexanderK.B. Bonney, Mrs.Serena Kwakye-Mintah*

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**Third Quarter Water Quality Analysis of Akumadan Site Borehole**

**GHANA WATER COMPANY LIMITED**

Main Bankers: Social Security Bank  
Ghana Commercial Bank



Brong Ahafo Region  
Post Office Box 88  
Sunyani - B/A

My Ref. No.:.....

18<sup>th</sup> October ,2021

Your Ref. No.:.....

Attn. FORM GHANA LIMITED

**CERTIFICATE OF ANALYSIS**

Sample Description: Borehole	Expiry date;
Sample Name: Akumadan Site	Net wt/ volume:
Location: Akumadan	

**TEST RESULTS**

PHYSICO-CHEMICAL ANALYSIS:					DATE OF ANALYSIS: 12/10/2021
PARAMETER	TEST METHOD	METHOD DETECTION LIMIT	UNITS	GHANA STANDARD SPECIFICATION	RESULTS Akumadan site
Temperature			°C	-	28.20
pH	Electrometric	0-14	-	6.5-8.56.30	5.91
Residual free chlorine	Colorimetric	0-5.0	mg/l	0-0.0	0.00
Colour	Platinum-cobalt	-	Pt.Co	0-15	5.00
Turbidity	Nephelometric	-	NTU	0-5	2.63
Conductivity	Electrometric	0-3999	µs/cm	-	36.00
Total Dissolved Solids	Electrometric	0-2000	mg/l	0-1000	17.00
Total Hardness	Titrimetric	-	mg/l	0-500	88.00
Calcium Hardness	Titrimetric	-	mg/l	-	69.00
Magnesium Hardness	Titrimetric	-	mg/l	-	19.00
Alkalinity	Titrimetric	-	mg/l	-	14.00
Chloride	Argentometric titration	-	mg/l	0-250	8.00
Nitrite	HACH 10019	0.002-0.240	mg/l	0-3.0	0.00
Nitrate	HACH 8039	0.3-30.0	mg/l	0-500.60	0.60

2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves

Sulphate	HACH 8051	2-270		0-250	2.00
Fluoride	HACH 8029	0.02-2.00	mg/l	0-1.5	0.00
Iron	HACH 8008	0.02-3.00	mg/l	0-0.3	0.05
Manganese	HACH 8034	0.1-20.00	mg/l	0-0.4	0.90
Aluminium	HACH 8012	0.008-0.800	mg/l	0-0.2	0.12
Phosphate	HACH 8048	0.02-2.50	mg/l	0-0.3	3.37
Nitrogen, Ammonia	HACH 8038	0.02-2.50	mg/l	0-1.5	0.00
Cyanide	HACH 8027	0.002-240	mg/l	0-0.07	0.01
Arsenic	2822800(EZ arsenic)	0-0.5	mg/l	0-0.01	0.00

MICROBIOLOGICAL ANALYSIS:			DATE OF ANALYSIS: 14/10/2021	
PARAMETER	TEST METHOD	UNIT	SPECIFICATION/ METHOD DETECTION LIMIT	RESULTS Borehole
Fecal coliform	Multiple tube fermentation	MPN Index/ 100mL	<1.1	4.6
E. Coli		Present/Absent (P/A)	0.0	0.00
Total Viable Count	Total plate count	CFU	0-3	47.0

**REMARKS:** The water samples as submitted to the laboratory met the standards for all the parameters.

**Note:** These results are only applicable to the sample(s) submitted to the laboratory.



Asst. WQA Officer

Andrew N. Sadique

*Board of Directors: Hon. Alexander K. Afenyo-Markin (Chairman), Ing. Dr. Clifford Braimah (Managing Director), Mr. Noah Tunfo, Mr. Michael Ayesu, Naaba Sigri Gewong, Hon. Kwame Twumasi Amporfo, Mr. Clement Alosebuno Kaba, Dr. Forster Kum-Ankama Sarpong, Madam Maria Ab. Lovelace-Johnson, Mr. Alexander K. B. Bonney, Mrs. Serena Kwakye-Mintah*  
Registered Office: 28<sup>th</sup> February Road, (Near Independence Square)  
Telephone: 233-0302-666781

**Third Quarter Water Quality Analysis of Asubima and Afrensu-Brohuma Streams**

**GHANA WATER COMPANY LIMITED**

Main Bankers: Social Security Bank  
Ghana Commercial Bank



Brong Ahafo Region  
Post Office Box 88  
Sunyani - B/A

My Ref. No.:.....

18<sup>th</sup> October ,2021

Your Ref. No.:.....

Attn. FORM GHANA LIMITED

**CERTIFICATE OF ANALYSIS**

Sample Description: Stream	Expiry date;
Sample Name: Asubima upstream and downstream	Net wt/ volume:
Location:	

**TEST RESULTS**

PHYSICO-CHEMICAL ANALYSIS:					DATE OF ANALYSIS: 12/10/2021	
PARAMETER	TEST METHOD	METHOD DETECTION LIMIT	UNITS	GHANA STANDARD SPECIFICATION	RESULTS	
					UPSTREAM	DOWNSTREAM
Temperature			°C	-	27.50	28.00
pH	Electrometric	0-14	-	6.5-8.56.30	6.30	6.28
Residual free chlorine	Colorimetric	0-5.0	mg/l	0-0.0	0.58	0.00
Colour	Platinum-cobalt	-	Pt.Co	0-15	OMR	450.0
Turbidity	Nephelometric	-	NTU	0-5	75.00	85.00
Conductivity	Electrometric	0-3999	µs/cm	-	85.00	65.00
Total Dissolved Solids	Electrometric	0-2000	mg/l	0-1000	42.00	33.00
Total Hardness	Titrimetric	-	mg/l	0-500	29.00	35.00
Calcium Hardness	Titrimetric	-	mg/l	-	26.00	32.00
Magnesium Hardness	Titrimetric	-	mg/l	-	3.00	3.00
Alkalinity	Titrimetric	-	mg/l	-	24.00	23.00
Chloride	Argentometric titration	-	mg/l	0-250	51.00	19.00
Nitrite	HACH 10019	0.002-0.240	mg/l	0-3.0	32.00	25.00

2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves

Nitrate	HACH 8039	0.3-30.0	mg/l	0-50	9.30	7.20
Sulphate	HACH 8051	2-270		0-250	21.00	29.20
Fluoride	HACH 8029	0.02-2.00	mg/l	0-1.5	0.00	0.00
Iron	HACH 8008	0.02-3.00	mg/l	0-0.3	3.72	3.72
Manganese	HACH 8034	0.1-20.00	mg/l	0-0.4	0.00	0.40
Aluminium	HACH 8012	0.008-0.800	mg/l	0-0.2	0.00	0.11
Phosphate	HACH 8048	0.02-2.50	mg/l	0-0.3	22.93	13.61
Nitrogen, Ammonia	HACH 8038	0.02-2.50	mg/l	0-1.5	0.12	0.10
Cyanide	HACH 8027	0.002-240	mg/l	0-0.07	0.04	0.03
Arsenic	2822800(EZ arsenic)	0-0.5	mg/l	0-0.01	0.00	0.00

MICROBIOLOGICAL ANALYSIS:			DATE OF ANALYSIS: 14/10/2021		
PARAMETER	TEST METHOD	UNIT	SPECIFICATION/ METHOD DETECTION LIMIT	RESULTS	
				upstream	downstream
Fecal coliform	Multiple tube fermentation	MPN Index/ 100mL	<1.1	>8.00	>8.0
E. Coli		Present/Absent (P/A)	0.0	236.0	129.0
Total Viable Count	Total plate count	CFU	0-3	724.0	580.0

**REMARKS:** The water samples as submitted to the laboratory met the standards for all the parameters.

**Note:** These results are only applicable to the sample(s) submitted to the laboratory.



Asst. WQA Officer

Andrew N. Sadique

*Board of Directors: Hon Alexander K. Afenyo-Markin (Chairman), Ing. Dr. Clifford Braimah (- Managing Director), Mr. Noah Tumfo, Mr. Michael Ayesu, Naaba Sigri Gewong, Hon. Kwame Twumasi Amporfo, Mr. Clement Alosebuno Kaba, Dr. Forster Kum-Ankama Sarpong, Madam Maria Ab. Lovelace-Johnson, Mr. Alexander K. B. Bonney, Mrs. Serena Kwakye-Mintah*  
 Registered Office: 28<sup>th</sup> February Road, (Near Independence Square)  
 Telephone: 233-0302-666781

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# **GHANA WATER COMPANY LIMITED**

**Main Bankers:** Social Security Bank  
Ghana Commercial Bank



**Brong Ahafo Region**  
**Post Office Box 88**  
**Sunyani - B/A**

**My Ref. No.:**.....

18<sup>th</sup> October ,2021

**Your Ref. No.:**.....

Attn. FORM GHANA LIMITED

## **CERTIFICATE OF ANALYSIS**

<b>Sample Description:</b> Stream	<b>Expiry date;</b>
<b>Sample Name:</b> Afrensu Brohuma	<b>Net wt/ volume:</b>
<b>Location:</b>	

### **TEST RESULTS**

<b>PHYSICO-CHEMICAL ANALYSIS:</b>					<b>DATE OF ANALYSIS: 12/09/2021</b>	
<b>PARAMETER</b>	<b>TEST METHOD</b>	<b>METHOD DETECTION LIMIT</b>	<b>UNITS</b>	<b>GHANA STANDARD SPECIFICATION</b>	<b>RESULTS</b>	
					<b>UPSTREAM</b>	<b>DOWNSTREAM</b>
Temperature			°C	-	27.50	27.60
pH	Electrometric	0-14	-	6.5-8.56.30	6.30	6.22
Residual free chlorine	Colorimetric	0-5.0	mg/l	0-0.0	0.00	0.00
Colour	Platinum-cobalt	-	Pt.Co	0-15	AMR	AMR
Turbidity	Nephelometric	-	NTU	0-5	75.00	84.00
Conductivity	Electrometric	0-3999	µs/cm	-	85.00	67.00
Total Dissolved Solids	Electrometric	0-2000	mg/l	0-1000	42.00	33.00
Total Hardness	Titrimetric	-	mg/l	0-500	29.00	36.00
Calcium Hardness	Titrimetric	-	mg/l	-	26.00	20.00
Magnesium Hardness	Titrimetric	-	mg/l	-	3.00	16.00
Alkalinity	Titrimetric	-	mg/l	-	24.00	21.00
Chloride	Argentometric titration	-	mg/l	0-250	51.00	32.00
Nitrite	HACH 10019	0.002-0.240	mg/l	0-3.0	32.00	22.00

2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves

Nitrate	HACH 8039	0.3-30.0	mg/l	0-50	9.30	9.70
Sulphate	HACH 8051	2-270		0-250	21.00	12.00
Fluoride	HACH 8029	0.02-2.00	mg/l	0-1.5	0.00	0.00
Iron	HACH 8008	0.02-3.00	mg/l	0-0.3	3.72	5.07
Manganese	HACH 8034	0.1-20.00	mg/l	0-0.4	0.00	0.00
Aluminium	HACH 8012	0.008-0.800	mg/l	0-0.2	0.12	0.03
Phosphate	HACH 8048	0.02-2.50	mg/l	0-0.3	22.93	11.41
Nitrogen, Ammonia	HACH 8038	0.02-2.50	mg/l	0-1.5	0.12	0.11
Cyanide	HACH 8027	0.002-240	mg/l	0-0.07	0.04	0.03
Arsenic	2822800(EZ arsenic)	0-0.5	mg/l	0-0.01	0.00	0.00

MICROBIOLOGICAL ANALYSIS:			DATE OF ANALYSIS: 14/10/2021		
PARAMETER	TEST METHOD	UNIT	SPECIFICATION/ METHOD DETECTION LIMIT	RESULTS	
				upstream	downstream
Fecal coliform	Multiple tube fermentation	MPN Index/ 100mL	<1.1	>8.00	>8.0
E. Coli		Present/Absent (P/A)	0.0	144.0	201.0
Total Viable Count	Total plate count	CFU	0-3	725.0	TNTC

**REMARKS:** The water samples as submitted to the laboratory met the standards for all the parameters.

**Note:** These results are only applicable to the sample(s) submitted to the laboratory.



Asst. WQA Officer

Andrew N. Sadique

*Board of Directors: Hon Alexander k. Afenyo-Markin (Chairman), Ing. Dr.Clifford Braimah (- Managing Director), Mr. Noah Tumfo, Mr. Michael Ayesu, Naaba Sigri Gewong, Hon. Kwame Twumasi Amporfo, Mr. Clement Alosebuno Kaba, Dr. Forster Kum-Ankama Sarpong, Madam Maria Ab. Lovelace-Johnson, Mr. Alexander K.B. Bonney, Mrs. Serena Kwakye-Mintah*  
 Registered Office: 28<sup>th</sup> February Road, (Near Independence Square)  
 Telephone: 233-0302-666781

**Fourth Quarter Water Quality Analysis of Akumadan Site Borehole**

**GHANA WATER COMPANY LIMITED**

**Main Bankers:** GCB Bank Limited  
Societe Generale Ghana  
National Investment Bank



**Brong Ahafo Region**  
**Post Office Box 88**  
**Sunyani - Ghana**  
**West Africa**  
**BS-0492-1921**

**My Ref. No.:**.....

17<sup>th</sup> January, 2022

**Your Ref. No.:**.....

Attn: FORM GHANA LIMITED

**CERTIFICATE OF ANALYSIS**

Sample Description: Borehole	Expiry date: 12/10/2022
Sample Name: Akumadan/ Sunyani	Net wt/ volume: 1.5L
Location:	

**TEST RESULTS**

PHYSICO-CHEMICAL ANALYSIS:					DATE OF ANALYSIS: 12/10/2021		
PARAMETER	TEST METHOD	METHOD DETECTION LIMIT	UNITS	GHANA STANDARD SPECIFICATION	RESULTS		
					Site Akumadan	Head Office	Berekum A24
Temperature			°C	-	28.90	29.80	29.90
pH	Electrometric	0-14	-	6.5-8.5	6.05	7.30	6.18
Residual free chlorine	Colorimetric	0-5.0	mg/l	0.0	0.00	0.00	0.00
Colour	HACH 8025	5-500	Pt.Co	0-15	5.00	5.00	5.00
Turbidity	Nephelometric	-	NTU	5	0.00	0.01	0.00
Conductivity	Electrometric	0-3999	µ/cm	-	42.00	259.00	120.00
Total Dissolved Solids	Electrometric	0-2000	mg/l	1000	21.00	135.00	60.00
Total Hardness	Titrimetric	-	mg/l	500	46.00	82.00	34.00
Calcium Hardness	Titrimetric	-	mg/l	-	27.00	30.00	20.00
Magnesium Hardness	Titrimetric	-	mg/l	-	19.00	52.00	14.00
Alkalinity	Titrimetric	-	mg/l	-	40.00	16.00	134.00
Chloride	Argentometric titration	-	mg/l	250	10.00	22.00	20.00
Nitrite	HACH 10019	0.002-0.240	mg/l	3.0	0.00	5.00	0.00
Nitrate	HACH 8039	0.3-30.0	mg/l	50	4.60	12.70	0.70
Sulphate	HACH 8051	2-270	mg/l	250	0.00	44.00	0.00

*Board of Directors: Hon. Patrick Yaw Boamah (Chairman), Ing. Dr. Clifford A. Braimah (Managing Director), Mr. Noah Tumfo, Mr. Michael Ayesu, Hon. Akwasi Konadu, Chief Kabachewura Ewuntomah Zakaria, Hon. Kwame Amporfo Twumasi, Surv. Prof. Forster Kum-Ankama Sarpong, Mrs. Vida Duti, Mr. Joseph Acolatse, Ing. Hadisu Alhassan*  
Registered Office: 28<sup>th</sup> February Road, (Near Independence Square)  
Telephone: 233-508-300-537  
**Website: [www.gwcl.com.gh](http://www.gwcl.com.gh) E-mail: [info@gwcl.com.gh](mailto:info@gwcl.com.gh)**



2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves

-2-

Fluoride	HACH 8029	0.02-2.00	mg/l	1.5	0.21	0.00	0.00
Iron	HACH 8008	0.02-3.00	mg/l	0.3	0.10	0.12	0.00
Manganese	HACH 8034	0.1-20.00	mg/l	0.4	0.20	0.30	0.40
Aluminium	HACH 8012	0.008-0.800	mg/l	0.2	0.08	0.172	0.026
Phosphate	HACH 8048	0.02-2.50	mg/l	0.3	0.26	0.30	0.26
Nitrogen, Ammonia	HACH 8038	0.02-2.50	mg/l	1.5	0.12	0.11	0.14
Cyanide	HACH 8027	0.002-240	mg/l	0.07	0.00	0.00	0.00
Arsenic	2822800(EZ arsenic)	0-0.5	mg/l	0.01	0.00	0.00	0.00

MICROBIOLOGICAL ANALYSIS:				DATE OF ANALYSIS: 14/10/2021		
PARAMETER	TEST METHOD	UNIT	SPECIFICATION/ METHOD DETECTION LIMIT	RESULTS		
				Site Akumadan	Head Office	Berekum
Fecal coliform	Membrane Filter technique	CFU/100ml	0.0	0.0	0.0	A24
E. Coli	Membrane Filter technique	CFU/100ml	0.0	0.0	0.0	0.0

REMARKS: The water samples as submitted to the laboratory met the standards for all the parameters, except; Site Berekum and Akumadan A24, both of which did not meet the standard for pH. pH correction for both water sources is recommended before use.

Note: These results are only applicable to the sample(s) submitted to the laboratory.



Andrew N. Sadique

Asst. WQA Officer

For: Regional WQA Manager

Board of Directors: Hon. Patrick Yaw Ç (Chairman), Ing. Dr. Clifford A. Braimah (Managing Director), Mr. Noah Tumfo, Mr. Michael Ayesu, Hon. Akwasi Konadu, Chief Kabachewura Ewuntomah Zakaria, Hon. Kwame Amporfo Twumasi  
Surv. Prof. Forster Kum-Ankama Sarpong, Mrs. Vida Duti, Mr. Joseph Acolatse, Ing. Hadisu Alhassan  
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Website: [www.gwcl.com.gh](http://www.gwcl.com.gh) E-mail: [info@gwcl.com.gh](mailto:info@gwcl.com.gh)

## GHANA WATER COMPANY LIMITED

**Main Bankers:** GCB Bank Limited  
Societe Generale Ghana  
National Investment Bank



**Brong Ahafo Region**  
**Post Office Box 88**  
**Sunyani - Ghana**  
**West Africa**  
**BS-0492-1921**

**My Ref. No.:**.....

**Your Ref. No.:**.....

1<sup>st</sup> February, 2022

Attn: FORM GHANA LIMITED

### CERTIFICATE OF ANALYSIS

Sample Description: Borehole	Expiry date; 24/01/2023
Sample Name: Akumadan/ Sunyani	Net wt/ volume: 1.5L
Location:	

### TEST RESULTS

PHYSICO-CHEMICAL ANALYSIS:				DATE OF ANALYSIS: 24/01/2022	
PARAMETER	TEST METHOD	UNITS	GHANA STANDARD SPECIFICATION	RESULTS	
				Site Akumadan	Berekum A24
Temperature		°C	-	28.00	27.50
BOD	5 Day BOD	mg/l	-	2.40	2.60
COD	HACH Reactor Digestion	Pt.Co	-	12.40	12.80

**REMARKS:**

Note: These results are only applicable to the sample(s) submitted to the laboratory.

Andrew N. Sadique

Asst. WQA Officer

For: Regional WQA Manager

*Board of Directors: Hon. Patrick Yaw Boamah (Chairman), Ing. Dr. Clifford A. Braimah (Managing Director),  
Mr. Noah Tumfo, Mr. Michael Ayesu, Hon. Akwasi Konadu, Chief Kabachewura Ewuntomah Zakaria, Hon. Kwame Amporfo Twumasi  
Surv. Prof. Forster Kum-Ankama Sarpong, Mrs. Vida Duti, Mr. Joseph Acolatse, Ing. Hadisu Alhassan*

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**Fourth Quarter Water Quality Analysis of Asubima and Afrensu-Brohuma Streams**

**GHANA WATER COMPANY LIMITED**

**Main Bankers:** GCB Bank Limited  
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National Investment Bank



**Brong Ahafo Region**  
**Post Office Box 88**  
**Sunyani - Ghana**  
**West Africa**  
**BS-0492-1921**

**My Ref. No.:**.....

**Your Ref. No.:**.....

17<sup>th</sup> January, 2022

Attn: FORM GHANA LIMITED

**CERTIFICATE OF ANALYSIS**

Sample Description: Borehole	Expiry date:
Sample Name: Asubima Upstream	Net wt/ volume: 1.5L
Location: Asubima	

**TEST RESULTS**

PHYSICO-CHEMICAL ANALYSIS:					DATE OF ANALYSIS: 12/10/2021	
PARAMETER	TEST METHOD	METHOD DETECTION LIMIT	UNITS	GHANA STANDARD SPECIFICATION	RESULTS	
					Asubima upstream	Asubima Downstream
Temperature			°C	-	27.7	27.9
pH	Electrometric	0-14	-	6.5-8.5	7.00	6.98
Residual free chlorine	Colorimetric	0-5.0	mg/l	0.0	0.00	0.00
Colour	HACH 8025	5-500	Pt.Co	0-15	269.00	156.00
Turbidity	Nephelometric	-	NTU	5	55.00	22.14
Conductivity	Electrometric	0-3999	µ/cm	-	59.00	43.00
Total Dissolved Solids	Electrometric	0-2000	mg/l	1000	29.00	23.00
Total Hardness	Titrimetric	-	mg/l	500	13.00	15.00
Calcium Hardness	Titrimetric	-	mg/l	-	4.00	13.00
Magnesium Hardness	Titrimetric	-	mg/l	-	9.00	2.00
Alkalinity	Titrimetric	-	mg/l	-	55.00	65.00
Chloride	Argentometric titration	-	mg/l	250	10.00	8.00
Nitrite	HACH 10019	0.002-0.240	mg/l	3.0	9.00	4.00
Nitrate	HACH 8039	0.3-30.0	mg/l	50	12.00	6.30
Sulphate	HACH 8051	2-270	mg/l	250	8.00	2.00

*Board of Directors: Hon. Patrick Yaw Boamah (Chairman), Ing. Dr. Clifford A. Braimah (Managing Director), Mr. Noah Tumfo, Mr. Michael Ayesu, Hon. Akwasi Konadu, Chief Kabachewura Ewuntomah Zakaria, Hon. Kwame Amporfo Twumasi, Surv. Prof. Forster Kum-Ankama Sarpong, Mrs. Vida Duti, Mr. Joseph Acolatse, Ing. Hadisu Alhassan*  
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2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves

-2-

Fluoride	HACH 8029	0.02-2.00	mg/l	1.5	0.47	0.37
Iron	HACH 8008	0.02-3.00	mg/l	0.3	1.59	1.17
Manganese	HACH 8034	0.1-20.00	mg/l	0.4	2.50	2.10
Aluminium	HACH 8012	0.008-0.800	mg/l	0.2	0.14	0.11
Phosphate	HACH 8048	0.02-2.50	mg/l	0.3	0.64	0.52
Nitrogen, Ammonia	HACH 8038	0.02-2.50	mg/l	1.5	0.17	0.13
Cyanide	HACH 8027	0.002-240	mg/l	0.07	0.01	0.01
Arsenic	2822800(EZ arsenic)	0-0.5	mg/l	0.01	0.00	0.0

MICROBIOLOGICAL ANALYSIS:				DATE OF ANALYSIS: 14/10/2021	
PARAMETER	TEST METHOD	UNIT	SPECIFICATION/ METHOD DETECTION LIMIT	RESULTS	
				Asubima Upstream	Asubima Downstream
Fecal coliform	Membrane Filter technique	CFU/100ml	0.0	188.0	603.0
E. Coli	Membrane Filter technique	CFU/100ml	0.0	102.0	114.0

**REMARKS:**

Note: These results are only applicable to the sample(s) submitted to the laboratory.



Andrew N. Sadique

Asst. WQA Officer

For: Regional WQA Manager

---

Board of Directors: Hon. Patrick Yaw Ç (Chairman), Ing. Dr. Clifford A. Braimah (Managing Director),  
Mr. Noah Tumfo, Mr. Michael Ayesu, Hon. Akwasi Konadu, Chief Kabachewura Ewuntomah Zakaria, Hon. Kwame Amporfo Twumasi  
Surv. Prof. Forster Kum-Ankama Sarpong, Mrs. Vida Duti, Mr. Joseph Acolatse, Ing. Hadisu Alhassan  
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# GHANA WATER COMPANY LIMITED

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National Investment Bank



**Brong Ahafo Region**  
**Post Office Box 88**  
**Sunyani - Ghana**  
**West Africa**  
**BS-0492-1921**

**My Ref. No.:**.....

**Your Ref. No.:**.....

1<sup>st</sup> February, 2022

Attn: FORM GHANA LIMITED

## CERTIFICATE OF ANALYSIS

Sample Description: Borehole	Expiry date: 24/01/2023
Sample Name: Akumadan/ Sunyani	Net wt/ volume: 1.5L
Location:	

## TEST RESULTS

PHYSICO-CHEMICAL ANALYSIS:				DATE OF ANALYSIS: 24/01/2022	
PARAMETER	TEST METHOD	UNITS	GHANA STANDARD SPECIFICATION	RESULTS	
				Asubima Upstream	Asubima DownStream
Temperature		°C	-	28.00	27.50
BOD	5 Day BOD	mg/l	-	6.30	6.75
COD	HACH Reactor Digestion	Pt.Co	-	24.8	26.20

### REMARKS:

**Note:** These results are only applicable to the sample(s) submitted to the laboratory.

Andrew N. Sadique

Asst. WQA Officer

For: Regional WQA Manager

**Board of Directors:** Hon. Patrick Yaw Boamah (Chairman), Ing. Dr. Clifford A. Braimah (Managing Director),  
Mr. Noah Tumfo, Mr. Michael Ayesu, Hon. Akwasi Konadu, Chief Kabachewura Ewuntomah Zakaria, Hon. Kwame Amporfo Twumasi  
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# GHANA WATER COMPANY LIMITED

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**Brong Ahafo Region**  
**Post Office Box 88**  
**Sunyani - Ghana**  
**West Africa**  
**BS-0492-1921**

**My Ref. No.:**.....

**Your Ref. No.:**.....

17<sup>th</sup> January, 2022

Attn: FORM GHANA LIMITED

## CERTIFICATE OF ANALYSIS

Sample Description: Borehole	Expiry date;
Sample Name: AFRENZO BROHUMA DOWNSTREAM	Net wt/ volume: 1.5L
Location: AFRENZO-BROHUMA	

## TEST RESULTS

PHYSICO-CHEMICAL ANALYSIS:					DATE OF ANALYSIS: 12/10/2021	
PARAMETER	TEST METHOD	METHOD DETECTION LIMIT	UNITS	GHANA STANDARD SPECIFICATION (FOR DRINKING WATER)	Afrenso-Brohuma downstream	Afrenso-Brohuma Upstream
Temperature			°C	-	28.0	27.6
pH	Electrometric	0-14	-	6.5-8.5	7.05	6.95
Residual free chlorine	Colorimetric	0-5.0	mg/l	0.0	0.00	0.00
Colour	HACH 8025	5-500	Pt.Co	0-15	190.00	181.00
Turbidity	Nephelometric	-	NTU	5	20.94	19.39
Conductivity	Electrometric	0-3999	µ/cm	-	56.00	64.00
Total Dissolved Solids	Electrometric	0-2000	mg/l	1000	28.00	32.00
Total Hardness	Titrimetric	-	mg/l	500	28.00	29.00
Calcium Hardness	Titrimetric	-	mg/l	-	10.00	13.00
Magnesium Hardness	Titrimetric	-	mg/l	-	18.00	16.00
Alkalinity	Titrimetric	-	mg/l	-	67.00	82.00
Chloride	Argentometric titration	-	mg/l	250	10.00	11.00
Nitrite	HACH 10019	0.002-0.240	mg/l	3.0	5.00	3.00
Nitrate	HACH 8039	0.3-30.0	mg/l	50		
Sulphate	HACH 8051	2-270	mg/l	250	23.00	2.00

*Board of Directors: Hon. Patrick Yaw Boamah (Chairman), Ing. Dr. Clifford A. Braimah (Managing Director), Mr. Noah Tumfo, Mr. Michael Ayesu, Hon. Akwasi Konadu, Chief Kabachewura Ewuntomah Zakaria, Hon. Kwame Amporfo Twumasi*  
*Surv. Prof. Forster Kum-Ankama Sarpong, Mrs. Vida Duti, Mr. Joseph Acolatse, Ing. Hadisu Alhassan*  
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2021 Annual Environmental Report for Asubima and Afrensu- Brohuma Forest Reserves

-2-

Fluoride	HACH 8029	0.02-2.00	mg/l	1.5	0.22	0.20
Iron	HACH 8008	0.02-3.00	mg/l	0.3	1.34	1.70
Manganese	HACH 8034	0.1-20.00	mg/l	0.4	1.70	1.60
Aluminium	HACH 8012	0.008-0.800	mg/l	0.2	0.00	0.09
Phosphate	HACH 8048	0.02-2.50	mg/l	0.3	2.40	2.36
Nitrogen, Ammonia	HACH 8038	0.02-2.50	mg/l	1.5	0.14	0.16
Cyanide	HACH 8027	0.002-240	mg/l	0.07	0.01	0.01
Arsenic	2822800(EZ arsenic)	0-0.5	mg/l	0.01	0.00	0.00

MICROBIOLOGICAL ANALYSIS:				DATE OF ANALYSIS: 14/10/2021	
PARAMETER	TEST METHOD	UNIT	SPECIFICATION/ METHOD DETECTION LIMIT	RESULTS	
				Afrenso- Brohuma downstream	Afrenso- Brohuma Upstream
Fecal coliform	Membrane Filter technique	CFU/100ml	<1.1	940.0	750.0
E. Coli	Membrane Filter technique	CFU/100ml	0.0	252.0	302.0

REMARKS:

Note: These results are only applicable to the sample(s) submitted to the laboratory.



Andrew N. Sadique  
Asst. WQA Officer  
For: Regional WQA Manager

Board of Directors: Hon. Patrick Yaw Ç (Chairman), Ing. Dr. Clifford A. Braimah (Managing Director), Mr. Noah Tumfo, Mr. Michael Ayesu, Hon. Akwasi Konadu, Chief Kabachewura Ewuntomah Zakaria, Hon. Kwame Amporfo Twumasi  
Surv. Prof. Forster Kum-Ankama Sarpong, Mrs. Vida Duti, Mr. Joseph Acolatse, Ing. Hadisu Alhassan  
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# GHANA WATER COMPANY LIMITED

**Main Bankers:** GCB Bank Limited  
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National Investment Bank



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**West Africa**  
**BS-0492-1921**

**My Ref. No.:**.....

**Your Ref. No.:**.....

1<sup>st</sup> February, 2022

Attn: FORM GHANA LIMITED

## CERTIFICATE OF ANALYSIS

Sample Description: Borehole	Expiry date: 24/01/2023
Sample Name: Akumadan/ Sunyani	Net wt/ volume: 1.5L
Location:	

## TEST RESULTS

PHYSICO-CHEMICAL ANALYSIS:				DATE OF ANALYSIS: 24/01/2022	
PARAMETER	TEST METHOD	UNITS	GHANA STANDARD SPECIFICATION	RESULTS	
				Afrenso Brohuma Upstream	Afrenso Brohuma Downstream
Temperature		°C	-	28.00	27.50
BOD	5 Day BOD	mg/l	-	8.20	9.60
COD	HACH Reactor Digestion	Pt.Co	-	36.60	40.21

### REMARKS:

Note: These results are only applicable to the sample(s) submitted to the laboratory.

Andrew N. Sadique

Asst. WQA Officer

For: Regional WQA Manager

*Board of Directors: Hon. Patrick Yaw Boamah (Chairman), Ing. Dr. Clifford A. Braimah (Managing Director), Mr. Noah Tumfo, Mr. Michael Ayesu, Hon. Akwasi Konadu, Chief Kabachewura Ewuntomah Zakaria, Hon. Kwame Amporfo Twumasi Surv. Prof. Forster Kum-Ankama Sarpong, Mrs. Vida Duti, Mr. Joseph Acolatse, Ing. Hadisu Athassan*  
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**Website: [www.gwcl.com.gh](http://www.gwcl.com.gh) E-mail: [info@gwcl.com.gh](mailto:info@gwcl.com.gh)**



**DECLARATION:**

I \_\_\_\_\_ hereby declare that the information provided on this form is true to the best of my knowledge and shall provide any additional information that shall come to my notice in the course of processing this application.

Signature \_\_\_\_\_ Date \_\_\_\_\_