

### ASSESSMENT OF SANITARY CONDITIONS AND LANDSCAPE DESIGN OF ALAGBAFO NATURAL SPRING, KUBE – ATENDA COMMUNITY, IBADAN

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#### ABSTRACT

This study is aimed at improving the landscape and aesthetics quality of the Alagbafo natural spring, Kube-Atenda community in Ibadan. The present existing conditions of the spring environs in respect of its landscape were assessed, a suitable design was developed while taking into consideration the existing features present without creating a negative impact. To implement the design features, funding is being solicited from philanthropic organisations and societies. The field work involved the site analysis of the spring environs, survey of the selected site and administering of questionnaires. The site analysis revealed, the impact of erosion and flooding leaving the subsoil vivid. A suitable drainage needs to be developed as the existing one is in poor state. Questionnaires administered to the residents during their community meeting revealed 100% showed interest in a landscape being developed around the spring, 90% would let their children leave homes for recreational activity within the spring once the landscape has been developed, 80% indicated to enjoy outdoor recreational activity. To maintain the proposed landscape, 10% trim grass level, 27% to water, 15.75% to prevent entry of destructive animals, 14.18% to keep landscape clean, 3.34% to prune flowers and 29.74% to fertilize. Some 40 questionnaires were administered, 40% filled by males, 60% females with 35%, 30%, 35% having tertiary, secondary and primary level of education respectively. Implementing the design features, will give the Alagbafo natural spring a much

better and appreciable appearance and help minimize the impact of erosion, flooding and improve water quality infiltrating the soil.

**KEYWORDS:** Landscaping, aesthetics, questionnaire, recreational.

## 1. INTRODUCTION

Landscaping refers to any activity which modifies the visible features of an area of land ranging from living organisms, abstract elements and natural elements. The purpose of Landscaping is to improve the aesthetics quality of the environment. It plays a significant role in lowering the release of carbon emissions into the environment under mans' impact. It also helps communities reduce their stressful urban life. Landscaping requires expertise in horticulture and artistic design as well as engineering acumen. However, when one comes to measure or evaluate landscape for a particular purpose, one is immediately confronted by seemingly excessive amount of methodology and technique but no real evidence of utilization of the results obtained (Dunn 1974). Yet it may be argued that landscape should be viewed as an important environmental resource, one which may be approached variously as a renewable, non-renewable, natural, or cultural resource (Moss and Nickling, 1980). Gobster *et al* (2007) explained the scale at which humans as organisms perceive landscapes, what we term the perceptible realm, is particularly important because this is the scale at which humans intentionally change landscapes, and these changes affect environmental processes.

Springs are naturally occurring output of ground water to the earth's surface, either from the force of gravity or hydrostatic pressure (water pressure pushes the water to the surface). Springs are sometimes used as water supplies and can be a reliable and relatively inexpensive source of drinking water if they are developed and maintained properly. Some springs discharge where the water table intersects the land surface, but also, they occur where water flows out from caves or along fractures, fault or rock contacts that come to the surface. Spring may result from karst topography where surface water has infiltrated the earth's surface (recharge area), becoming part of the area's ground water that travels through a network of cracks and fissures/openings ranging from inter-granular spaces to large caves. Springs discharges water from confined aquifers in which the recharge area of the spring water table rests at a higher elevation than that of the outlet.

Alagbafo spring serves as a source of potable water for the residents of Kube-Atenda community. The spring environs are in poor state, in terms of aesthetics both to the

community residents and visitors to the spring. The spring environs have no existing landscape. It is marshy, dirty, in an undulated form and has been impacted upon by erosion and possible flooding. Series of unwanted plants/weeds is seen to be growing around the environs. The spring at times tends to overflow, in which the overflow is impacted upon by the present condition of the spring environs and so reduces the water quality or render the water unsafe and polluted for use.

This is a community of over 10,000 people located within the metropolis of Ibadan. It consists of low and medium income earners. The Alagbafo spring which serves the people within the Kube community and environs is a beautiful source of water, but the spring surroundings is an eyesore. It is marshy, sloppy, and unkempt showing the impacts of erosion. To address the issue of its appearance, there is need to design and develop a befitting landscape around the Alagbafo spring.

Developing an aesthetically effective landscape within municipalities and communities is a good investment, as it can increase community and vitality through civic involvement in beautification projects or beautiful projects represent a sense of pride and value by residents and business (Gardner, 2006). Therefore, landscaping the environs of the Alagbafo natural spring will be of good importance in the followings ways:

- i. The appearance of the Alagbafo spring will be much better and appreciated in terms of aesthetics quality.
- ii. Developing a landscape, will help address the impact of erosion within the environs of the Alagbafo spring.

The landscape to be developed is to add some form of protection to the spring by which the plants help to remove pollutants resulting from rain runoff and flooding thereby improving the quality of water that infiltrate the soil to recharge the aquifer.

Landscaping the environs of the Alagbafo spring, will help promote and increase recreational activities within the spring environs.

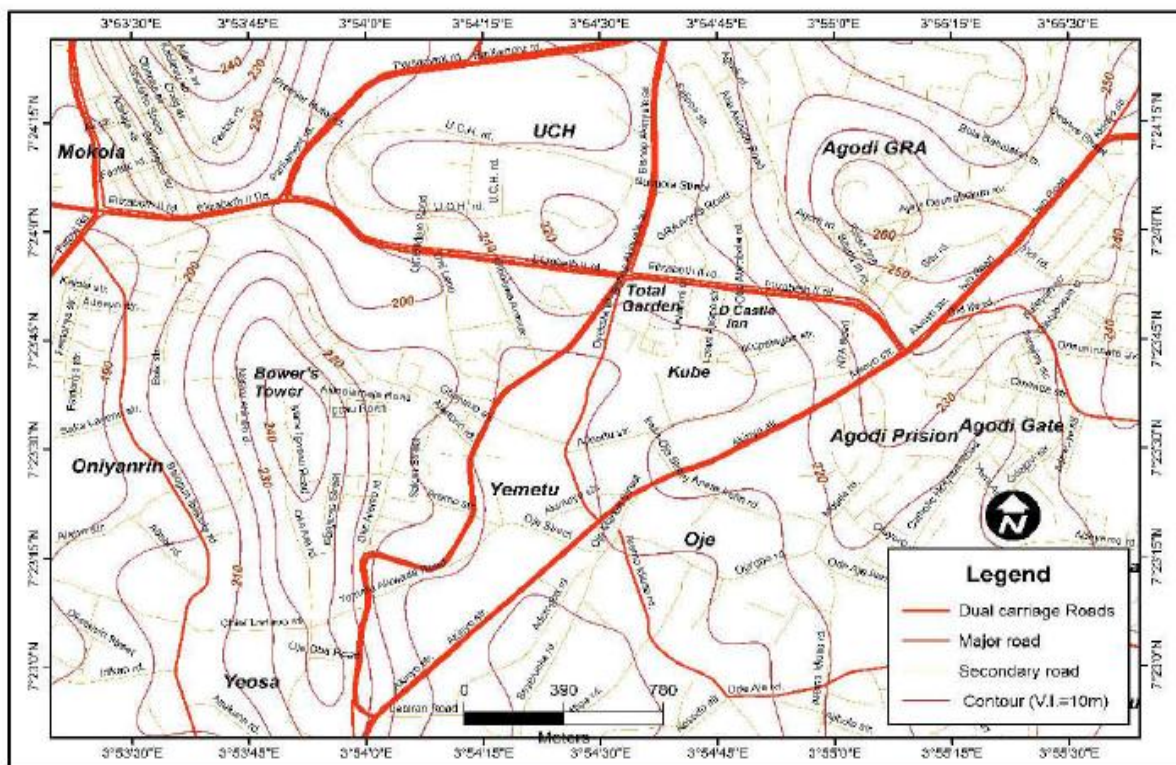
## **2. MATERIALS AND METHODS**

### **2.1 Study Area**

Kube-Atenda community is located within Agodi Vicinity, along Queen Elizabeth II road in Ibadan North Local Government Area of Oyo state. It lies within Latitudes 7°23'0"N and

7°24'15"N and Longitudes 3°53'30"E and 3°53'30"E as shown in Figure 1. The climate of the study area is Tropical climate with mean annual rainfall of 1420.06 mm, 26.46°C mean maximum temperature and 21.42°C of mean minimum temperature and about 74.55% relative humidity (Wikipedia, 2018). The community is a nucleated one with both primary and secondary educational centres. The main occupation of Kube-Atenda people is trading and it has been the major source of their livelihood and has also boosted the economic activity in the community.

Also, few artisans such as Welders, Carpenters, Cobblers, etc. are present in the community. There are also pockets of fertile grassland in the community where the residents' rear animals like goat, sheep, fowl, etc. and grow varieties of crops such as maize, pepper, vegetables and others (Onyemesim *et al.*, 2007). The topography of Kube-Atenda community can be described as generally flat due to the hilly nature of other areas surrounding it. The Alagbafo spring is located behind the Castle Inn, along the road leading downwards into the Kube-Atenda community. The spring is developed, it includes a reservoir which is protected and from which water is withdrawn with the aid of a mechanical hand water pump (Figure 2).



**Figure 1: Topography map of Kube- Atenda**

**Source: Department of Geography, Faculty of The Social Sciences, University of Ibadan, Oyo state.**



**Figure 2: Alagba Natural spring.**

## 2.2 Methods

The methodologies adopted for this work were reconnaissance survey and site analysis of the spring environs, questionnaires evaluation and proposed design of the landscape using Rivet software.

### Sanitary Inspection, Site Inventory and Analysis

Reconnaissance survey was carried out at the study location to understand and assess the sanitary conditions of Alagbafo natural spring and its surrounding landscape. The site inventory provided information relating to the spring environs while the analysis related action was used for its landscaping development. Checklist categorized into soil, topography and water, plants type and placement, views, sun/shade patterns, utilities like type, size, location, irrigation, aesthetics, setback for plant and hardscape, spaces and senses such as its activity area, smell, noise, and maintenance such as problem areas, skill and tools was used to established the analysis as shown in Table 1.

### Area dimension

The dimension of each sides of the land area pegged during survey was noted. In determining the land dimension, each side was measured using long chain surveyor's tape and summed up together, this is called Perimeter of land.

$$P= L+L+L+L \text{ (3.1)}$$

Where:

P= Perimeter of Land (m)

L= Length (m)

m= metres

### **Slope of Land**

In determining the slope of land, an area of the land was selected for this action. Two pegs were pegged into the ground level at some certain distance apart from each on the same elevation. The rope was tied around both pegs and levelled with the aid of a carpenter's leveller. The distance of ground level to where the rope is on the peg was measured then divided by distance of the two pegs apart and multiply by 100, which gave the slope estimate in percentage.

This can be expressed as:

$$s = A/B \times 100$$

Where:

S = slope

A= distance measured from ground level to point of rope on the peg

B= distance apart between the two pegs

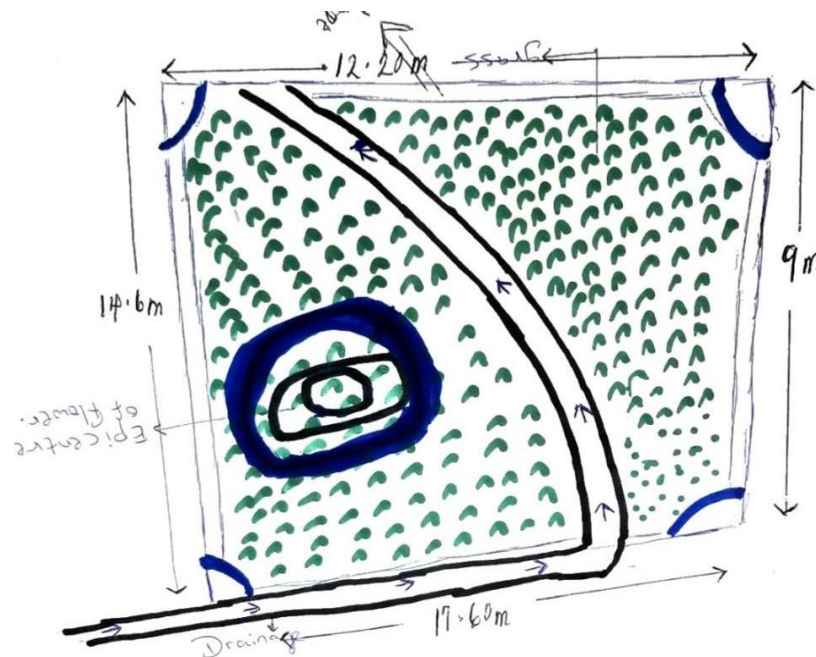
### **Questionnaire Evaluation**

Forty (40) semi-structured questionnaire consisting socio-demographic information, landscape perception and landscape maintenance was developed and randomly administered to residents of Kube-Atenda community. The purpose of the questionnaire was to understand the residents' perception about developing a landscape around Alagbafo natural spring water source.

### **Conceptual Design**

During the duration of carrying out site analysis, a free hand sketch was replicated on an A4 paper (Plate 1) showing the base plan of the area to contain the landscape. This sketch was then colour with available writing materials present. The sketched design is indicated to be simple, as the landscape around the spring would be accessed by the community. The sketched design includes an improved channel for drainage of rainwater runoff, the whole area is indicated to be grassed as shown by the colour of the marking (green) in Plate 1. The blue coloured arcs marking around the base plan edges indicates the presence of flowers and the blue coloured sphere form indicated flower presence. The pale blue marking around the

sketch indicated the boundary. Although provision for hardscape (i.e. paved areas and walkway) was not made on the conceptual design, it was taken into account to be included at the final design which was done with the aid of a computer program called Revit 2016.



**Plate 1: Concept Sketched design for Landscape.**

### **Landscape design, plant selection and maintenance**

The landscape was initially conceptualized using the available data such as base plan of the area with its dimensions. Selection of plants and planting stage are vital to landscape design. Several factors such as climatic conditions, drought tolerance, disease/insect resistance, adaptability to swampy areas, rate of establishment, wear tolerance and level of maintenance needs were considered. Selection of plants to be planted within the Alagbafo natural spring environs, was based on climate adaptation, its ability to perform well in hydromorphic areas, resistance to pests and diseases, drought tolerance and very low maintenance needs. Planting will be done by vegetative propagation, which is simply transplanting small or large plants. Vegetative propagation is favoured to seeding as plants are quickly established compared to seeding as thing takes time, leaving the seeds to compete with weeds and the prospect of possible soil erosion by runoff.

Preservation of landscape after it has been developed for the Kube-Atenda community is essential. For this to be feasible, maintenance of the landscape will be the responsibility of the community residents as contracting to professionals will be of much cost at a long run.

Since this is a community consisting of low to medium income earners, this has been considered what type of maintenance (low maintenance requiring little or no form of special skills) to be carried out. It is advisable that volunteer groups of three are formed to participate in the stated maintenance action.

### 3. RESULTS AND DISCUSSION

#### 3.1 Results

Table 1 shows the analysis from the site and the actions to take during design and at development stage. It was observed that there was no form of existing landscape or landscape feature around the Alagbafo spring, weeds and some form of unwanted plants are the only form of vegetation growing without being controlled. As such, developing a new landscape will involve clearing of the weeds and unwanted plants. It was observed that there was no top soil. This resulted from the impact of erosion making the subsoil to be visible. The subsoil which is the mixture of sand and clay particles with lower percentage content of organic matter and humus.

**Table 1: Site inventory check list and analysis.**

S./N	CATEGORY	ANALYSIS	ACTION ITEM
1	Landscape New Existing	No signs of existing landscape or landscape. Presence of a centre piece (spring reservoir) with series of weeds and unwanted plants seen growing around the centre piece area.	Weeds and unwanted plants will be cleared at the beginning of development stage.
2	Soil Type Condition Percolation	Soil type present is in form of clay and sand particle. This is the subsoil level showing. No top soil. Top soil more idea for idea for plants as it meets its desired requirement in terms of nutrient and habitat for micro-organisms.	Top soil will be required for planting.
3	Topography and Water Drainage Erosion Slopes Water bodies	Drainage is poor as there is no proper channel in which water flow can follow. The area is observed to be showing effects of erosion and flooding after heavy downpour. The land slope is undulating and not totally even. The slope is calculated to be fewer than 10%. There are spring points observed around the spring reservoir.	There will be need to construct a proper channel to let water flow to the main drain in an orderly form and drain under gravity. The land area will need to be leveled to give uniformity and form.



4	Sun and shade pattern Micro-climate	Land area is completely exposed to sunlight providing the maximum requirement of sunlight for plants. No form of trees or any shade.	Trees could be planted to help provide shade to plants.
5	Spaces and sense Activity area Noise level Odour	No known form of offensive odour around the area. Noise level is satisfactory.	
6	Plants Type Health Pest problem	Weeds and unwanted plants are only vegetation seen.	
7	Maintenance Skills Tools		Maintenance will be the duty of the community

**Area dimension (Perimeter of Land)**

From equation 3.1

$$P= L+L+L+L$$

$$P= 53.4 \text{ m}$$

**Slope of Land**

From equation 3.2  $s=AB \times 100$

$$S= 4.79\%$$

**Questionnaire Evaluation**

Questionnaire evaluation results are into three sections namely; socio-demographics, landscape perception and landscape maintenance which are presented in the following.

**Socio-demographics information of residents**

Table 2 shows that a total of 40 People was given the questionnaires to fill showing that there are more female respondents (60%) than male respondents (40%).

According to the respondents filled, the community is made of 60% traders, 15% farmers, 5% mechanics, 5% carpenters, 10% teachers and 5% public servants. The community is predominantly Muslims 80% and 20% were Christians. Most of the respondents were married 75%, single 20% and divorced 5%. 35% of respondents indicated having between 1 to 3 offspring while 30% indicated having between 4 to 7 as offspring and 35% indicated to having none. In terms of level of education, 35% with Primary level education, 35% Tertiary

level and 30% attained Secondary level as their maximum level of Education. Various types of hobbies were indicated by respondents such as, 45% indicating preference for reading, 10% games, 10% music, 5% movies, 5% travelling, 5% making friends, 5% dancing and 15% indicated to have none. The maximum age of respondents were 65 years old while the minimum age was 27years old.

**Table 2: Socio-demographic information of the respondents.**

	<b>FREQUENCY</b>	<b>PERCENTAGE (%)</b>
<b>SEX</b>		
Male	16	40
Female	24	60
<b>OCCUPATION</b>		
Traders	24	60
Farmers	6	15
Mechanics	2	5
Carpenters	2	5
Teachers	4	10
Public servant	2	5
<b>RELIGION</b>		
Islam	32	80
Christianity	8	20
<b>MARITAL STATUS</b>		
Married	30	75
Single	8	20
Divorced	2	5
<b>NO. OF OFFSPRING</b>		
1-3	14	30
4-7	12	35
8 and above	Nil	Nil
None		35
<b>LEVEL OF EDUCATION</b>		
Primary	14	35
Secondary	12	30
Tertiary	14	35
<b>HOBBIES</b>		
Reading	18	45
Games	4	10
Music	4	10
Movies	2	5
Travelling	2	5
Dancing	2	5
Making Friends	2	5
None	6	15

**Landscape Perception**

Landscape perception was the next section after the socio-demographics, this section is to know about respondents view on developing a landscape around the Alagbafo natural spring. Table 3 shows that 100% of the respondents were interested with the idea of landscaping around the Alagbafo natural spring. Some 90% of the respondents indicated that once the landscape has been developed, they will grant their children permission for recreational purpose around the spring while 10% indicated not to allow their children go to the spring for recreational purpose. About 80% of the respondents indicated that they enjoy outdoor recreational activity while 20% do not enjoy outdoor recreational activity.

**Table 3: Landscape Perception.**

S/N	Landscape Perception	YES	NO
1	Community’s interest with the idea of Landscaping, developed around the Alagbafo Natural spring	40(100%)	NIL (0%)
2	Community allowing children leave their homes for recreational purposes around the spring, once the landscape has been developed	36 (90%)	4 (10%)
3	Liking for outdoor recreational activity	32 (80%)	8 (20%)

**Landscape Maintenance**

Table 4 shows the respondents preference to keep the landscape maintained. 10% of the respondents opted for trimming grass level, 27% prefer to water the plants, 15.75% opted to help prevent entry of destructive animals into the proposed landscape, 14.175% prefer to clear the proposed landscape clear of dirt, 3.335% opted for pruning of flowers and 29.74% choose to fertilize.

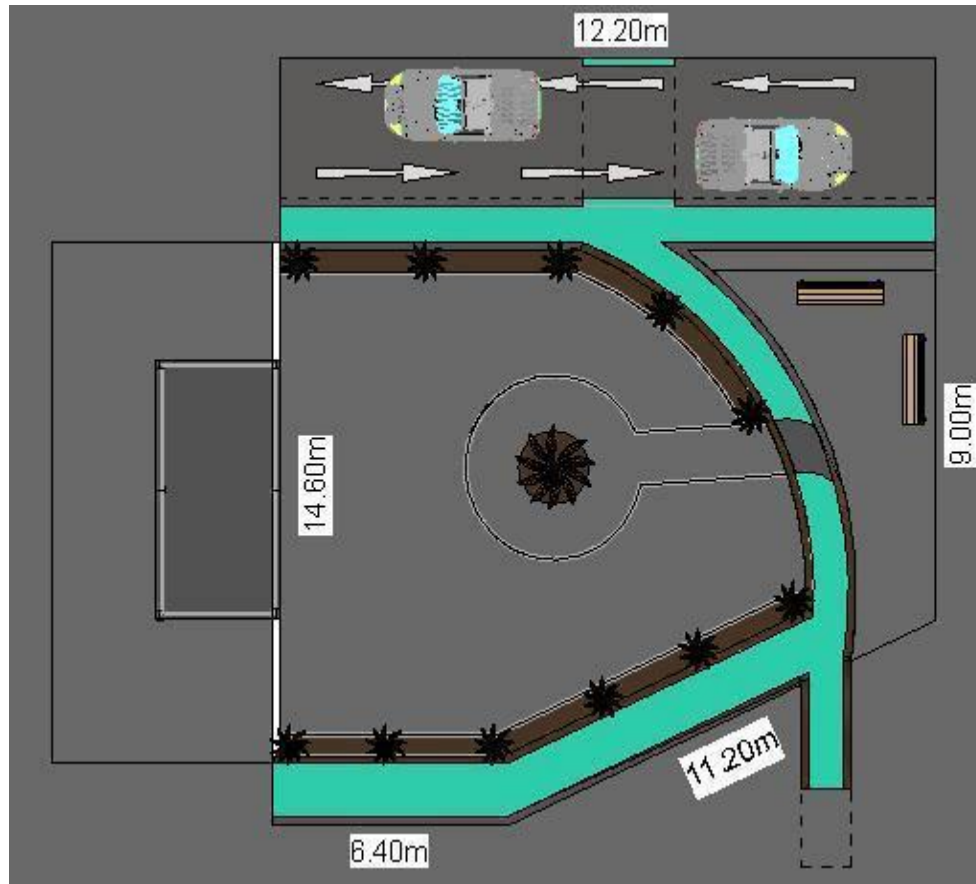
**Table 4: Landscape Maintenance.**

S/N	Landscape Maintenance	Frequency	Percentage (%)
1.	Trim grass level	4	10
2.	Water the Plants	12	27
3.	Prevent entry of destructive animals	10	15.75
4.	Clear the Landscape of dirt	12	14.175
5.	Prune flowers	4	3.335
6.	Fertilize	14	29.74

**Landscape design and Rendering**

Based on the conceptualized design, a suitable design was developed using Revit 2016 software on the computer to produce a more aesthetic appearance. These designs are shown in Figures 3, 4 and 5. The designs reflect dimension sizes, improved sloped channel for drainage of rainwater runoff. Hardscape such as walkway, paved area and park chair are

included, grasses, flowers and a tree at its centre are shown with the Alagbafo natural spring as its reference. Conceptualized design and on-site photograph were used as data to help create a 3D render for the design.



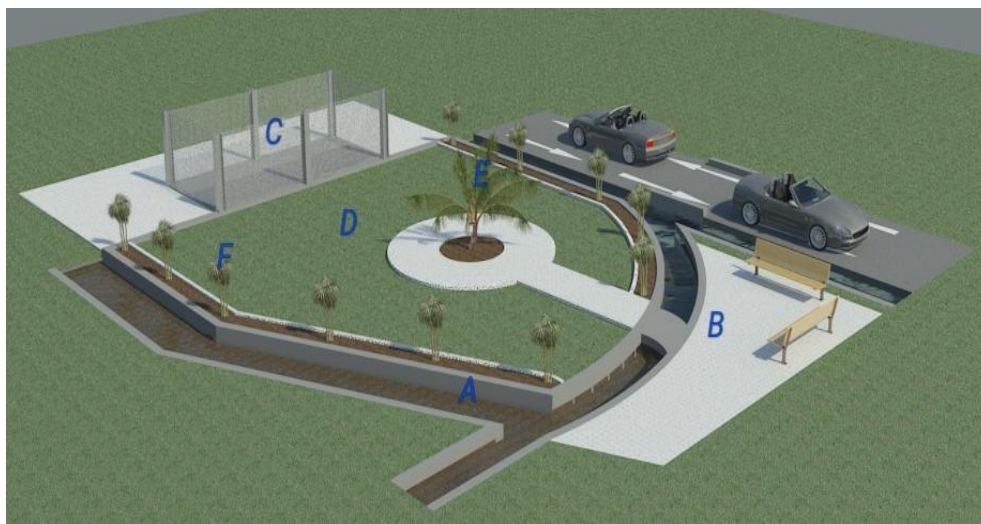
**Figure 3: Plan view with dimension.**





**Figure 4a: 3D Render side view of the Alagbafo Natural spring.**

**4b: 3D Render back view of the Alagbafo Natural spring.**



**Figure 5: 3D Render left side view of the Alagbafo Natural spring.**

Where:

- A. Improved block drainage channel
- B. Hardscape partition (flooring made of interlocks or granite stones)
- C. Alagbafo Natural spring
- D. Lawn grass (*Paspalumnotatum*)
- E. Tree to provide shade (*Lagerstroemia speciose*)

Flowers (*Rhoeo discolor* and *Wire croton*)

## Planting

Table 5 shows suitable plants within the Alagbafo natural spring environs. These plants (grasses, flowers and trees) were selected based on their adaptation to the climate condition, ease in maintenance, ability in retention and infiltration of rainwater runoff and performance against erosion of soil by runoff. For grassing, *Paspalum notatum* is suited as it does well in hydromorphic region, requires little maintenance, holds the soil firmly as its roots are deep, thus reducing the impact of erosion and does well during period of drought. *Lagerstroemia speciosa* tree is suited as it adds aesthetics, provides shade, it is an indigenous tree and performs well in hydromorphic region. *Rhoeo discolor* and Wire croton are flowers suited to be planted within the spring environs.

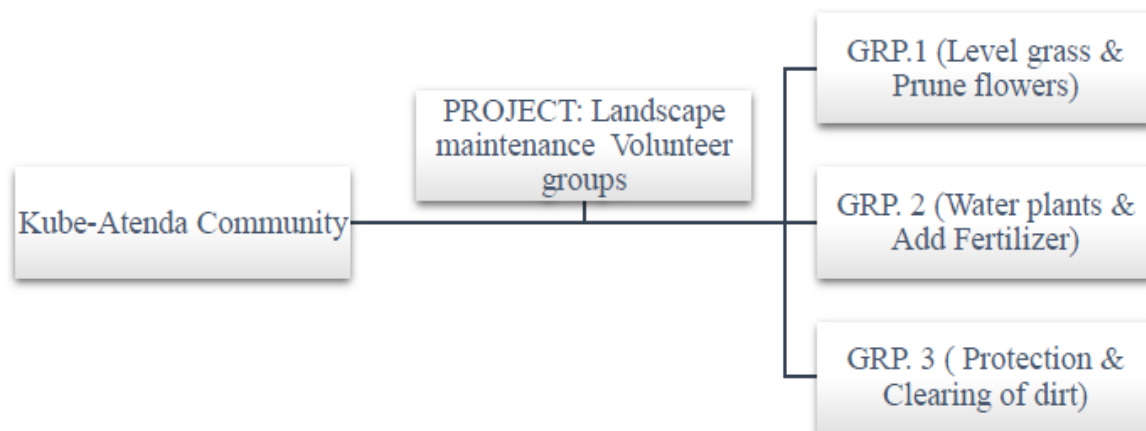
**Table 5: Plants selected to be planted around the spring environs.**

	<b>GRASS</b>	<b>FLOWER</b>	<b>TREE</b>
<b>NAME</b>	<i>Paspalum notatum</i>	<i>Rhoeo discolor</i> and Wire croton	<i>Lagerstroemia speciosa</i>
<b>FEATURE</b>	<b>i.</b> Grows up to maximum height of between 15cm to 20cm.	<b>i. Easy to grow.</b>	<b>i. Good shade tree</b>
	<b>ii.</b> It is a deep-rooted plant.	<b>ii.</b> Good drought tolerance	<b>ii.</b> Fast growing, medium sized tree, usually up to 15 metres.
	<b>iii.</b> Good soil stabilizer.		<b>iii.</b> Performs well on swamp grounds.
	<b>iv.</b> Good drought tolerance.		<b>iv.</b> Adapted to region where air-pollution, poor drainage, compacted and droughts are common
<b>METHOD OF PLANTING</b>	Vegetative Propagation	Vegetative Propagation	Vegetative Propagation
<b>MAINTENANCE</b>		Requires very little maintenance	Requires little maintenance

## Maintenance Structure

Maintenance is an important aspect in landscaping. Once developed, there is a need to preserve the landscape features in Kube-Atenda community. This can be achieved as a collective effort put together by individuals who are residents of the community by creating groups who can participate in the listed maintenance actions. Individuals should select actions based on their interest only and form groups with those of similar interest. Figure 6 shows a defined structure to which these groups are formed. There are three groups with two maintenances

action paired together. Group 1 consists of those with interest in trimming grass level and pruning of flowers while Group 2 consists of interest in watering and addition of fertilizer and Group 3 consists of interest in clearing of dirt within landscape and prevention of destructive animals such as goats from gaining entry within the premises. Although landscape features require very little or low maintenance, some form of maintenance will be taken but only at an interval period of once in quarter of the year. Maintenance action such as, watering of plants can be done once in a month during dry season as the plants are adaptable to survive without water for a long period of time. Trimming of grass level and pruning of flowers can be once in a quarter of the year. Addition of fertilizer can also be done once in a quarter of twice in the year. Maintenance action that will be required more frequent are clearing landscape of dirt and preventing entry of destructive animals. This can be done with aid of providing a wire mesh around the landscape boundary.



**Figure 6: Organogram set up for landscape maintenance.**

### 3.2 DISCUSSION

The study was carried out in stages, starting from the site inventory and analysis which was undertaken to understand the present sanitary condition of the Alagbafo natural spring environs. The next stage after site inventory and analysis was questionnaire evaluation. The aim of the questionnaire evaluation was to understand the community perception about landscaping the environs of the Alagbafo natural spring and to know their interest in participating to preserve the landscape once developed. This was factored into developing an initial design which finished into proper design with the aid of Revit 2016 software on the computer. The selection of plant and planting followed as the next stage and last was developing a structure in which the community should adopt in maintenance of the landscape.

Results of the site inventory and analysis shows the present sanitary and aesthetic condition to be in poor state as the environment is marshy and dirty with series of unwanted weeds and plants seen growing. Clearing the environment is first action to be taken which exposes the ground surface. This is to help understand the site better. It was observed that the sub-soil level is more visible as the top soil (loamy soil) which is most suitable for planting has been washed off due to erosion.

There is need to fill the ground surface with top soil. Filling with top soil can be of much expense, to help reduce its expense laterite soil could be used together with top soil as the laterite soil will be used in filling the undulated portion of the ground surface while top soil is added upon the laterite soil evenly. This way, it reduces the cost of complete filling with top soil. The major challenge observed from the site inventory and analysis is the poor drainage channel which needs to be addressed before developing the landscape.

Results from the questionnaire evaluation shows that the idea of developing a landscape around the Alagbafo natural spring was fully supported by the community as shown in Table 3. Participation in outdoor activities (Table 3) is placed at 80% for Yes and 20% No. This is important as the landscape when developed will act as avenue for such activity. In maintaining the landscape, maintenance action was listed in the questionnaire to know interest of each correspondent. This is used in developing a structure in which community participate in maintaining the landscape after it has been developed. Socio-demographic information from the questionnaire shows that large correspondents are females at 60% and males 40% as seen in Table 2. It places the educational level at 35%, 30% and 35% for primary, secondary and tertiary respectively.

The conceptualized landscape gives the plan view layout of the site with an improved channel for drainage of rainwater runoff and excess water. This sketch design served as base upon which the final design was done with aid of Revit 2016 software on the computer. The final design provides a beautiful layout to display the drainage channel, placement of flowers and tree with a circular theme of hardscape (paved floor) around the centre of the landscape design which is contain the presence of a tree.

Plant selection and planting are based from understanding of the site condition and the community. Plants which require very little maintenance are best suited. These plants are adapted to the weather condition of the environment and thrive well with or without water or



any form of attention. Planting by vegetative propagation is favoured to seeding because seeding takes more time to sprout and this can give way for seeds to compete with weeds. Lastly, maintenance is the responsibility of the community to preserve the landscape features once developed. It is advisable the community participate in doing so. To achieve this, a structure is set up as shown in Figure 6 to help achieve community participation in maintenance by volunteering.

#### 4. CONCLUSION

This study revealed that development of the landscape for the Alagbafo natural spring will increase community development and vitality through civic involvement in beautification projects or beautiful projects represent a sense of pride and value by residents and business. It will help improve the sanitary and aesthetic conditions of the Alagbafo natural spring environs and reduce the impact of erosion within the Alagbafo spring environment by adding some form of protection whereby plants aid in the removal of pollutants from rainwater runoff allowing runoff to infiltrate through soil and recharge aquifer.

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