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# **The new premises of the Tanzanian orphanage Kichijo**

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2011-06-10



**Linköpings universitet**  
**TEKNISKA HÖGSKOLAN**

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# **The new premises of the Tanzanian orphanage Kichijo**

Examensarbete utfört i byggt teknik  
vid Tekniska högskolan vid  
Linköpings universitet

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Norrköping 2011-06-10

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## Summary

In Boma Ng'ombe in the Kilimanjaro Region in Tanzania lies an orphanage that is run by the organization KCJF. The orphanage is known as Kichijo and it is supported by the Swedish non-profit humanitarian organization I Aid Africa.

Children's rights have been given special attention in Tanzania over the last years, and the Social Welfare Department has drawn up guidelines concerning the management of orphanages. Today, the Kichijo does not fulfil these guidelines, and need new premises to do so. The situation would be improved by relocating the orphanage and erecting new buildings in a more fertile area. Such relocation would also be in line with the manageress' wish of being self-supportive. Two suitable plots have become available in a village further up the slopes of Mount Kilimanjaro. One of the plots can hold orphanage buildings and one is intended for farming.

To proceed with the relocation new premises that are in line with all regulations need to be planned. That planning is the purpose of the project that is described here. Regulations are imposed by the social welfare and by national building regulations. Further demands are given by the KCJF and I Aid Africa, and the plots themselves make up some restrictions. Major directing prerequisites have been the number of children at the orphanage and the demands regarding area, gender and age separation that are imposed by the social welfare department.

Drawings and site plans can be seen in appendix A-01.1-01 to A-49.0-04.

In the presented layout common and staff areas are gathered in a main building. Gender separation is accomplished by separate dormitories for boys and girls, with separate rooms for the different age groups. The buildings are adapted to the terrain to avoid increased work and costs.

A suggested utilization of the farm plot can be seen in Figure 24 and in Appendix A-01.1-03. The farm has been given least attention, and only draft plans are presented. The drafts show facilities and disposition that fulfil the demands for the number of animals that the orphanage owns today.

Both I Aid Africa and KCJF want the new premises to have a low environmental impact. Environmental considerations are taken by planning for ecological sanitation and investigating the possibilities of rainwater harvesting.

To aid the client I Aid Africa in the further process, a chapter describing real estate transactions and construction processes is included.

The main obstacle has been that the land intended for the orphanage buildings proved too small to hold buildings that fulfil all requirements. Therefore, the plans presented are based on the assumption that an adjacent plot can be bought. If that transaction cannot be carried through another alternative is to reduce the number of children. The suggested disposition can then easily be remade.

The first steps towards relocating Kichijo have been taken.

# Preface

This thesis concludes our Bachelor of Science diploma in Construction Engineering at the Institute of Technology at Linköping University.

The project stems from our desire to do something meaningful and to achieve personal growth. When contact was made with the non-profit humanitarian organization I Aid Africa, the dream started to become reality. Together with I Aid Africa, a plan to assist the orphanage known as Kichijo was formulated, and in March 2011 the work that is reported here, commenced.

We have chosen to present our results in English, since this make our work more useful to our client I Aid Africa and to the Kilimanjaro Children Joy Foundation. Writing in English rather than in Swedish also makes it possible for students from other countries to take part of, and possibly continue, our work.

The project would not have been possible to carry through without the scholarship from Niras Sweden AB, and the contribution from the Programme Board for Engineering and Design at Linköping University that paid for part of the flight cost.

We are grateful for all the support we have received during the planning and accomplishment of this project. We especially want to thank three persons; our examiner Ingemar Klint at Linköping University for outstanding feedback and guidance, Jon Gunnarsson Ruthman at I Aid Africa for acting as an encouraging sounding board, and finally Mama Lucy Lema for her warm hearted hospitality and inspiring personality.

Boma Ng'ombe  
19<sup>th</sup> of May 2011

Nina Andersson  
Jessica Ljung

# Table of Contents

<b>1</b>	<b>Introduction.....</b>	<b>3</b>
1.1	Background.....	3
1.2	Purpose .....	3
1.3	Delimitations .....	4
1.4	Method and Sources .....	4
1.4.1	Observations, Interviews and Visits.....	4
1.4.2	Literature and electronic documents .....	5
1.5	Report Outline .....	6
<b>2</b>	<b>Project Context .....</b>	<b>6</b>
2.1	The Country Tanzania .....	6
2.1.1	Fast facts.....	6
2.1.2	History .....	7
2.1.3	Present State .....	8
2.1.4	Climate in the Kilimanjaro Region .....	8
2.2	The organization I Aid Africa .....	9
2.3	The Kilimanjaro Children Joy Foundation .....	10
<b>3</b>	<b>Building Programme .....</b>	<b>11</b>
3.1	Prerequisites.....	11
3.1.1	The land intended for the relocation .....	11
3.1.2	KCJF demands .....	13
3.1.3	Social Welfare Regulations.....	14
3.1.4	Building regulations .....	15
3.1.5	Requests and regulations regarding husbandry and cultivation .....	16
3.2	Establishment Operation Analysis.....	16
3.2.1	Orphanage Activities.....	16
3.2.2	Farming activities .....	19
3.2.3	Adaptation to Future Alterations.....	20
3.3	Room Programme.....	21
3.3.1	Room Programme for the Orphanage .....	21
3.3.2	Room Programme for Farming Activities.....	24
3.4	Building Design .....	25
3.4.1	Evaluation of required areas.....	25
3.4.2	Design of the Orphanage Buildings .....	25
3.4.2.1	Main Building .....	26
3.4.2.2	Dormitories .....	31
3.4.2.3	Business facilities.....	33
3.4.2.4	Accessibility for disabled.....	33
3.4.2.5	Emergency Exits .....	34
3.4.2.6	Overarching Material and Finishing Description .....	34
3.4.3	Design of Farming Related Buildings .....	35
3.5	Plot Programme and Design .....	36
3.5.1	The land allocated to orphanage buildings.....	37

3.5.2	The land allocated to farming.....	38
3.6	Environmental Programme.....	39
3.6.1	General Environmental Impact .....	39
3.6.2	Energy Supply and Consumption.....	40
3.6.3	Water Supply.....	40
3.6.3.1	Water consumption .....	41
3.6.3.2	Governmental Water .....	41
3.6.3.3	Rainwater harvesting .....	42
3.6.4	Solid Waste Management.....	43
3.6.4.1	Urine Diverting Dehydration Latrines .....	43
3.6.4.2	Soakage pit solution.....	45
3.6.5	Waste Water .....	46
3.6.6	Building materials and techniques .....	46
3.6.7	Indoor Environment .....	47
3.6.8	Outdoor Environment.....	47
<b>4</b>	<b>Process Descriptions.....</b>	<b>47</b>
4.1	The Building Process.....	47
4.2	To Acquire and Own Real Estate .....	49
<b>5</b>	<b>Conclusion .....</b>	<b>50</b>
5.1	How to Continue the Relocation .....	50
5.2	Ideas for Further Student Assignments .....	51
5.3	Discussion.....	51
	<b>References.....</b>	<b>53</b>
	Bibliography.....	53
	Electronic Documents .....	53
	Unpublished Sources .....	55
	<b>List of Appendices.....</b>	<b>56</b>

# 1 Introduction

## 1.1 Background

The project presented in this report comprises the final thesis of the authors' Bachelor of Science degree in Engineering and is executed on commission from the organization I Aid Africa. Below is the background to the commitment, i.e. the description of why this project is needed.

Children are an exposed group in Tanzania, being the primary victims of poverty and poverty related diseases. Maternal mortality is high and the number of orphaned children is increasing. In 2007, UNICEF approximated the number to 2.5 million.

Tanzania ratified the UN Convention on the Rights of the Child in 1991 and is thereby obligated to observe the human rights of children. The Social Welfare Department is responsible for the well being of children without care providers and supervises orphanages and children's homes. Liable ministries and institutions have cooperated to develop a publication that describes the demands placed on such establishments. The publication is called "National Guidelines for the establishment and management of Children's Homes" (Ministry of Health and Social Welfare, 2006).

In Boma Ng'ombe in the Hai District, Kilimanjaro Region, lies an orphanage run by the organization Kilimanjaro Children Joy Foundation. The foundation is referred to as KCJF, but the orphanage is commonly known as Kichijo. Since 2008, the Swedish non-governmental organization I Aid Africa has been supporting the orphanage, providing economic and humanitarian aid. As the Kichijo does not fulfil the terms listed in the national guidelines mentioned above, the orphanage is under threat of being closed down. I Aid Africa has committed to trying to find a solution. The suggested solution is a relocation of the orphanage, by erecting new premises that fulfil the guidelines on land available to the founder and manageress Lucy Lema. Such relocation has been her long-time dream.

Today, the lack of own resources for food and forage is causing increased expenses. By relocating the orphanage to a more fertile area, the opportunities to cultivate crops and keep livestock will be enhanced. This will improve the economic situation as less food and forage needs to be bought. Relocation and new premises also means that renting costs will be cut.

## 1.2 Purpose

The purpose of this project is primarily to deliver the information needed by the organization I Aid Africa to proceed with the relocation of Kichijo. More explicit, the purpose is to produce and present a building programme and to describe relevant construction related processes. Furthermore, it is to describe the advisable continuation of the relocation as the work presented in this report has been concluded.



## 1.3 Delimitations

Geotechnical investigations will not be included in the material, nor will time schedules or policies for quality management. Neither are constructional drawings included. As for the husbandry, this document will only include prerequisites regarding shelter and space and brief descriptions of premises and intended use. The analysis and the following concretisation is also less extensive for the farming activities than for the orphanage activities. The reason for this is that the farming activities are not the main purpose of this project. At the same time, an overview is valuable for I Aid Africa and some knowledge has been acquired during the project. That knowledge is therefore recapitulated in this report.

In the site plan describing the land intended for the orphanage buildings, see Appendix A-01.1-01, the upper right side of the grounds borders on a public road. The plot continues on the other side of the road, but that part will not be included in the planning process. The area is steep and the manageress wishes to use it for cultivation.

## 1.4 Method and Sources

The decision to carry through this project at site in Tanzania rather than from Sweden, was taken early in the process. It was considered the only way the project could be completed with high quality and focus on the client's needs.

In Tanzania, the work has been conducted in close cooperation with the manageress of the orphanage. This has given thorough knowledge of the needs of the establishment.

Good relations have been established with the local authorities. The focus on relations has enabled efficient information procurement, and laid the foundation for a constructive co-operation as the project of moving Kichijo proceeds.

As the project was initiated, one of the first steps was to make a rough outline, with the purpose of supplying a course for the work at hand. Following this structure, problems have been identified and analysed. It has not been possible to choose a specific way to collect necessary data, as we have had to adjust to the present circumstances. The approach has therefore been to first identify what information is needed, and then try different ways to obtain it. As far as it has been possible, official sources have been used, both verbal and written.

Depending on the subject, the method has been interviews, literature studies and/or visits. In the sections below, the specific sources are described in further detail.

Unless otherwise noted, the photos in the report are taken by the authors.

### 1.4.1 Observations, Interviews and Visits

This section encompasses visits, random observations, spontaneous conversations and specific interviews.

To obtain information about the implementation of rules and regulations, we have visited approved establishments. They are run by, or have been recommended by local authorities and we therefore consider them reliable sources of information. The establishments are the model nursery school Neema Orphanage Centre, and the ideal farm at Tengeru Horticultural Research and Training Institute (HORTI).

Building projects in all phases can be observed in the area. It is common practice to start a building project with limited resources, only to postpone further work when there is no more money. This causes extended construction times and makes it easy to learn from observation. For some examples of on-going projects, see Figure 1.



**Figure 1 - Ongoing construction projects**

Because there are no topographical maps to be obtained, we have visited the grounds to get an idea of possibilities and limitations.

Our main sources of verbal information have been the officers at the social welfare office, the building department office and the manageress of Kichijo, Lucy Lema. To ensure the validity of verbally received information, we have been careful to double check such facts against other sources such as published documents and own observations. The chapters that describe the processes of construction and buying real estate are almost exclusively based on interviews with officers at the Building Department in Boma Ng'ombe.

#### **1.4.2 Literature and electronic documents**

The publication *National guidelines for the establishment and management of Children's Homes* published by the Ministry of Health and Social Welfare, has been a vital source of information. *Byggprocessen* by U. Nordstrand has throughout the project functioned as an aid to structure the process.

To collect information, electronic documents from reliable, official websites have been frequently used. Although the utilized internet sources are considered trustworthy, a critical approach to information gathered online has been maintained.

The architectural drawings have been drawn up using standard solutions from a publication named "*Technical Handbook for provision of Physical Facilities in Secondary Schools*". Where this publication has not given sufficient guidelines, the Swedish booklet "*Rit teknik Utkast nr 6*" by Karin Spets has been used.

The "Secondary School" publication might be questioned as a source as this project concerns a more homelike institution than a school. However, the book was specifically recommended by the liable Building Technician at the Building Department, and is therefore considered applicable.

## 1.5 Report Outline

This report is divided into three sections, and this outline is located at the end of the first section; the introduction. The following two sections comprise the main report (chapter 2-4), and the conclusion (chapter 5). The conclusion encompasses sub-chapters about the continuation of this project and a discussion, and is followed by reference lists and appendices. The structures of the sections are described in the following paragraphs.

The major part of the report consists of four chapters, numbered 2 to 5. In chapter 2 *Project Context*, the reader is introduced to the national and local situation that surrounds this project. Chapter 3 *Building Programme*, is the most extensive chapter. It reviews the process leading up to the presented premises, divided into six sub-chapters. The sub-chapters detail the steps taken to arrive at the final layout solution. This specific structure has been chosen as it reflects the process that has led up to the suggested layout of the premises.

In the fourth chapter, *Process Descriptions*, the processes regarding construction and real estate procurement in Tanzania are described.

Finally in chapter 5 *Conclusion*, the steps that should be taken to continue the project are presented before a discussion over the process is carried through. The discussion contains arguments for the suggested solutions as well as personal reflections.

Reference lists and appendices close the report.

## 2 Project Context

In this chapter, Tanzania and its history is first presented to give the reader a picture of the country where this project has been carried through. The text provides information about the social situation that is the background to the aid efforts made by I Aid Africa and the Kilimanjaro Children Joy Foundation. More information about the two organizations and their connection is given in their respective chapters.

The objective is to supply the reader with the background needed to understand the environment that surrounds the project.

### 2.1 The Country Tanzania

#### 2.1.1 Fast facts

Full name: The United Republic of Tanzania.

Population (2008): 42.4 million (estimated).

Population growth rate average: 3% annually.

GDP per capita: 496 USD (Sweden: 52 035 USD).

Currency: Tanzanian Shilling, TZS.

Exchange rates (March 2011): 1 USD to 1500 TZS, 1 SEK to 238 TZS.

Inflation average: 5%.

Surface area: 945 087 km<sup>2</sup> (Sweden 441 370 km<sup>2</sup>)

Life expectancy at birth: 56.2 years for women, 54.6 years for men (Sweden: 83.0/78.7 years).

Capital: Dodoma

Commercial capital: Dar es Salaam.  
(UN, 2011)

The pictures in Figure 2 show Tanzania's geographic location in Africa, its borders and major cities, and the national flag.

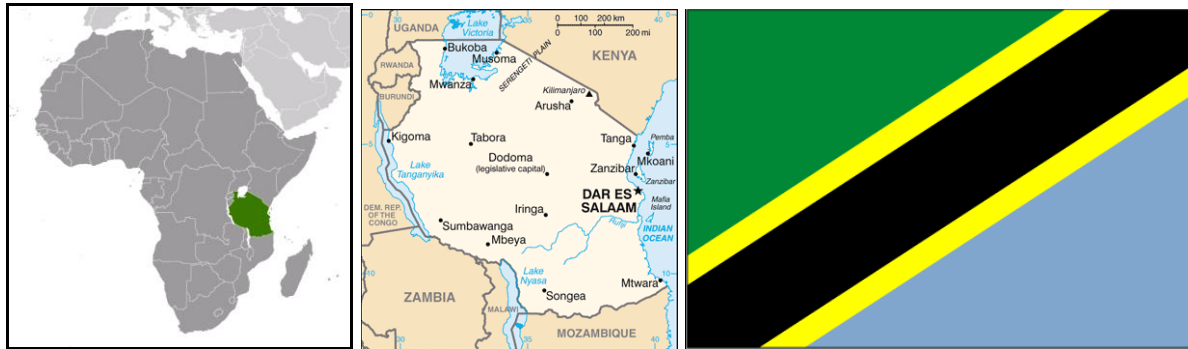


Figure 2 – Africa (CIA, 2011a), Tanzania (CIA, 2011a) and the Tanzanian flag (CIA, 2011b).

### 2.1.2 History

This section aims to give the background to the country's present state as one of the poorest nations in the world, and is not meant as a complete overview of Tanzanian history.

Almost since the day of independence, Tanzania has been aid-dependent. According to the Tanzania National homepage the reason for this is the intent and success of colonialists to quench individual initiative and courage. This reason is debated; Swedish SIDA for example attributes a great deal of the present situation to the Ujamaa experiment, see below (SIDA, 2009 ed. 2010).

The area that now constitutes Tanzania has been under both German and British rule. The Germans developed agricultural industry and infrastructure, and started the production of coffee, rubber, sisal and cotton. The German administration also encouraged education. As a result of World War I, administration and economy was heavily disrupted and Tanganyika and Zanzibar ended up being governed by the British. Progress was made during the 20s' but the depression in the 1930's and the consequent World War II disturbed the positive development. After the war, the main objective was to continue the program for economic development. The struggle for independence continued and in 1961 the party Tanganyika African National Union (TANU) declared Tanganyika independent. The party's leader, Julius Nyerere, was proclaimed president.

When Tanganyika became independent, Zanzibar had been ruled by the British since 1890. Self government was finally attained for the island in 1963 and in April 1964 Zanzibar united with Tanganyika to form the United Republic of Tanganyika and Zanzibar, later renamed The United Republic of Tanzania. Julius Nyerere was elected president of Tanzania in connection to the union declaration. Nyerere remained in office until 1985. (The Tanzania National Website, 2011)

He introduced a socialistic system of society called Ujamaa. Ujamaa means familyhood and the ideology's primary value is that personal accumulation of wealth is anti-social when there is also wide-spread poverty. The Ujamaa plan was adopted in 1967. The goal of Ujamaa was to reduce the dependency on foreign aid and to foster proud Tanzanians with a common mother tongue, Swahili. Nyereres ideas were criticized for being alarmingly close to those of Karl Marx. An unsuccessful relocation of 80% of the population in the 70s caused productivity to drop and the plan was finally abolished when Nyerere in 1985 voluntarily stepped down.

With the result at hand the Ujamaa period was a mixed success. Agricultural productivity plummeted, primarily due to the forced relocation of the population, and the country was still dependent on foreign aid. On the other hand, salary divergence had been reduced and health and education levels increased. Since then, Tanzania's main challenge has been to reduce poverty and deal with corruption issues.

In 1986 the International Monetary Fund carried through what is known as structural adjustment. Civil Service was cut down by a third, and governmental businesses were sold out, the argument being that private actors are more efficient than governmental. In 1992 the present multi party system was introduced, also this part of the structural adjustment. The impact of the restructuring on Tanzanian society is debated, but the negative economic growth rates from the 70s lasted for 25 years. During those years foreign advisors and donors have persuaded the Tanzanian Government to engage in a number of projects that have proven counterproductive. (Fitzpatrick, 2008)

### **2.1.3 Present State**

Tanzania is still receiving aid from a number of governments. The total amount of foreign aid investment and external debt relief was in 2008 466.5 million USD according to the Tanzanian Economic Survey of 2009 (Ministry of Finance and Economic Affairs, 2010, p.60). The Swedish contribution was in 2010 682 million SEK (Utrikesdepartementet, 2010). Note that this does not include private donations. The governmental aid from Sweden is primarily used to facilitate state administration improvements and poverty reduction programmes. In the past ten years Tanzania has made progress in most areas and the trend is now positive for health, education levels and social service. (SIDA 2009, ed. 2010)

Despite the positive trend, a lot of people still suffer from poverty and many children live under extremely exposed conditions. In 2009, the mortality rate for children under 5 years was 107.9 per 1000 (World Bank, 2011a). According to the same source, 35.7 % of the population lives below the national poverty level, and approximately 6 % of the population suffer from HIV/AIDS (World Bank, 2011b). This results in a number of children being denied the care and protection that is necessary for their well-being, and this is where the work of Kichijo and the supporting IAA projects fit in.

### **2.1.4 Climate in the Kilimanjaro Region**

Tanzania is located close to the equatorial line, making the climate tropical at the coast and dry and hot in the inland. There are two seasons of rain each year. The long rains, the masika, last from mid March to the end of May. The time for the short rains, the mvuli, is the end of November to the end of December or beginning of January. Since the Kilimanjaro Region is situated on relatively high ground, the temperatures are lower than in the adjacent lowlands. Because of the altitude, the region receives rainfall all year round, though precipitation is more abundant during the rainy season.

(Tanzania National Website, 2011b; Tanzania Tourist Board, 2010)

The chart in Figure 3 shows the yearly temperature- and rainfall variations in Arusha, one of the major cities in the region. Arusha is located approximately 1300 meters above sea level, only slightly lower than the plot for the new premises. Because of this, the use of statistics from

Arusha for this project means keeping on the safe side, even though the distance between the two locations is around 60 km.

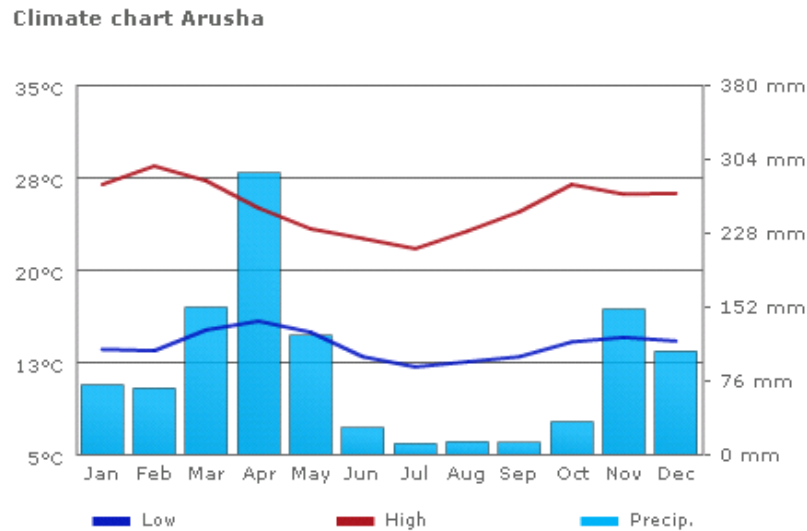


Figure 3 - Climate chart Arusha (Climatedata.eu, 2011)

## 2.2 The organization I Aid Africa

I Aid Africa, IAA, a Swedish non-profit humanitarian organization, was founded in 2006 by the nurse Benjamin Grossman. During his education at The Red Cross University College of Nursing, he got the opportunity to visit a hospital in Tanzania. That visit raised his urge to help exposed people to a better life. See the logotype of the organization in Figure 4 below.

The IAA vision is to help exposed people improve their living condition and outlook.



**I Aid Africa®**

IAA is a small organization and one goal is to keep the costs for administration as low as possible. Focus lay on the charity receiver and not on the organization. The leading idea is that IAA shall act as an intermediary between charity giver and receiver.

Figure 4 - The IAA logotype

Today the organization has several on-going projects in Tanzania. In Boma Ng'ombe in the northern part of the country, IAA has since 2008 been supporting a children's home. The children's home, which is managed by Kilimanjaro Children Joy Foundation (KCJF), receives aid through different IAA projects. The project *Trygghet* (roughly meaning *Security*) is the superior of several aid efforts. In an attempt to ameliorate the future prospects of the children, the project focuses on improving their health and well-being. (I Aid Africa, 2010)

One of the subprojects to *Trygghet* is *Boende* (=Housing). This project aims to create a buffer for oncoming rents. Money that is raised for *Housing* is also used for renovations. To be approved as a children's home by the social authorities, the buildings need to satisfy certain requirements. The goal of the project is also to raise funds so that the buildings can be upgraded to fulfil these demands. As a conclusion one can say that the purpose of *Boende* is to give the children a safer existence by providing appropriate premises. (I Aid Africa, 2011)



The project which is being founded in this thesis is part of a new superior project called *Framtid* (=Future) (Gunnarsson Ruthman, 2011-04-16). The project's origin is the KCFJ manageress' dream of building her own children's home. The part of *Framtid* that this paper comprises has been given the working title *New Kichijo*.

## 2.3 The Kilimanjaro Children Joy Foundation

The head of Kilimanjaro Children Joy Foundation, Lucy Lema (Figure 5 below), has been taking care of exposed children since 1985. She founded the organization in this form in 2006, when the number of children in her custody had exceeded what was possible to manage as a private person. The purpose of the foundation is to help orphans and children that for some reason are in need of support. KCJF aims to care for, sustain, and help the children to an education.



In the beginning of April there were 12 people working at the children's home, six of them working full-time and six part-time. Their salary never exceeds 40 000 TZS per month, equivalent to approximately 180 SEK, and even this they only get when the KCJF has received supplementary allowances. When there is a shortage of money the staff is paid in food and clothes, and receives pocket money for small personal expenses. 40 000 TZS is half of what is set as the minimum wage for uneducated workers by the government. At least some of the staff at Kichijo consider themselves to be doing volunteer work.

**Figure 5 - The manageress of Kichijo, Lucy Lema**

Kichijo completely supports nearly 60 children. 36 of those children are living at the orphanage full time, while the others go to boarding schools and stay at the Kichijo during vacations. Many are orphans who have lost one or both parents to AIDS or have parents that are suffering from addiction or poverty. Others have relatives that for unknown reasons are not capable of caring for them, and for some of the children, no relatives are known.

The future of the KCJF is precarious. In addition to the aid from IAA, the organization irregularly receives small donations from private persons, both abroad and locally. But because of the poverty of the local donors themselves, the KCJF can't rely upon their support. The ambition is to become self-sustaining, thus creating a more stable situation for the children's home. Another goal is to enable all of the children to attend at least primary school. The children with good enough grades are also sent to secondary school. Those who are considered not being able to profit by secondary school education are instead sent to vocational training in fields like tailoring, cookery or carpentry. The ambition is always to give the individual child the ability to provide for him- or herself as an adult and which vocational training is chosen depends on the child's interests and abilities.

According to Lucy Lema, the quality of education is much higher in private schools than in public ones. Unfortunately, private schools are also more expensive. Every child at the KCJF is attending primary school. From time to time there is not enough money to allow all the children that have completed primary school to enrol in secondary. Another problem is that once funds have been raised, the children have to wait for a vacancy at a suitable school. Lucy Lema wants to give the children more than just shelter, food and clothes. By providing for their education she

wants to give them a better future, and most of the children are eager to study. (Lema 2011-04-07)

## 3 Building Programme

### ***The building programme process***

The building programme comprises everything that leads up to the draft of the buildings.

As a starting point, all relevant prerequisites are listed. In this project, there are prerequisites set by the topography and size of the plots, by the KCJF, the Social Welfare Department, and by national building regulations. Following the *Prerequisites* chapter (3.1), the operations of the orphanage are analysed to identify the functions that need to be met in the new premises (chapter 3.2 *Establishment Operation Analysis*). The areas that are derived from the analysis are described in the *Room Programme* (chapter 3.3). Once required areas are known, the rooms and buildings are designed with focus on attaining the desired characteristics. This design process and resulting layout is presented in the chapter 3.4 *Building Design*.

The planned disposition of the land is described in chapter 3.5 *Plot Programme and Design*.

The last chapter in the building programme, 3.6, deals with the environmental aspects of the project. At this stage, it is not possible to produce a complete environmental programme, as for example solutions for electricity and plumbing need to be designed separately. Aspects that are covered are environmental impact during operation and technical solutions regarding sustainable development.

### ***Guiding values for the building programme***

The primary focus of the entire project is functionality, sustainability and low costs, during both the construction process and the continued management. A leading notion is also adherence to Tanzanian building traditions rather than Swedish. There are examples of projects that have installed advanced solutions that are not commonly used in Tanzania, only to see the solutions lose their functions as the knowledge of how to run and maintain them is lost (Sister Regina, 2011-04-01). It is considered important to only implement functions that can be utilized and maintained by the users of the buildings. With these guiding values in mind, the steps that are described in this building programme have been carried through.

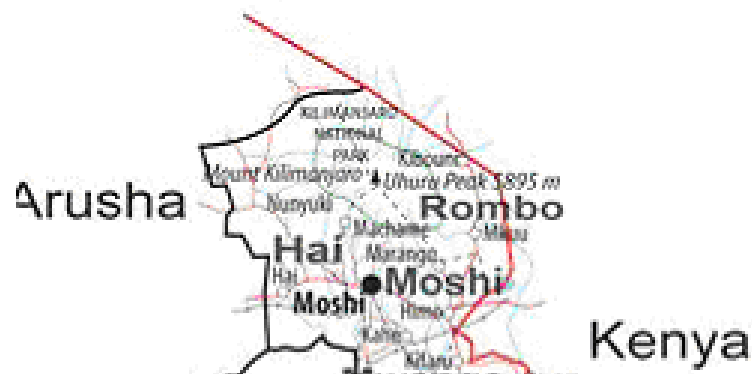
## 3.1 Prerequisites

In this chapter the conditions that must be considered when planning the new premises are presented. As it is probable that the IAA in the future will benefit from knowing the origin of different conditions, they are here presented sorted by their source.

### 3.1.1 The land intended for the relocation

The land that will be utilized by the children's home after the relocation is situated in the Hai District in north-eastern Tanzania. The map below, Figure 6 shows the Hai District. The land is located close to the Machame village in the centre of the map.

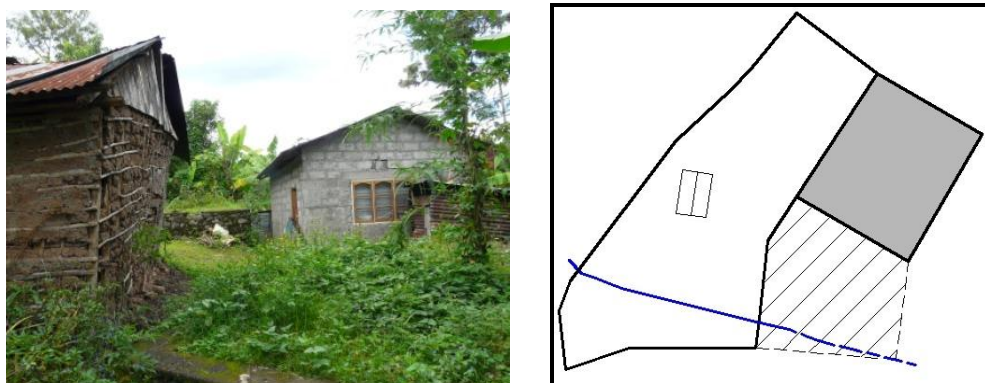




**Figure 6 - North-Eastern Tanzania, Tanzania Private Sector Foundation, 2010**

Three plots play different roles in the planning process, and are described below.

The site that is intended for the orphanage buildings is owned by the manageress' family and must be transferred to the foundation before the building process can commence. It has earlier been used for residence and there are some old buildings that need to be relocated or demolished. One of the demolition objects is shown to the left in the first picture in figure 7 below. The house shown in the first and second picture in the figure is from 2006 and can be kept and re-used after renovations. The location of this building is shown in the site plan, to the right in figure 7.



**Figure 7 - Site plan and photo showing the land intended for the new orphanage premises**

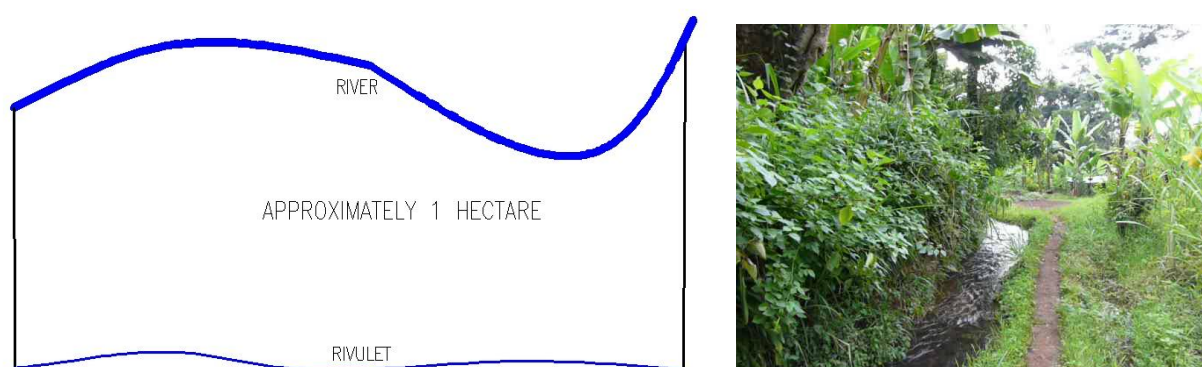
Material from the foundation of an old clay building in the lower parts of the land will be recovered and used for new nearby foundations.

The plot is dense with vegetation which makes it difficult to survey. A rough measuring gives that the continuous piece of land that can accommodate the buildings is approximately 1200 m<sup>2</sup>. Above that, it is undulating, with only a few natural plateaus for building. The topography makes it difficult to place one large single-storey building without extensive excavations. Since excavations are costly, this is an argument for separating functions into different buildings, and maybe to build on terraces.

In addition to the plot that is already intended for the orphanage, an adjacent plot might be available for buying. At least 400 m<sup>2</sup> of it is flat and well suited as an addition to the upper parts of the first plot, but it has not been possible to meet with people who know the exact extensions. Both plots are visualized in the rightmost picture in figure 7 above. The white field shows the first plot and the additional 400 m<sup>2</sup> is the area that is shaded grey. The diagonally hatched section is the probable outline of the additional part of that second plot. The site plan can also be seen in

Appendix A-01.1-01. Since no official maps over the plots can be obtained, the site plan is based on manual measurements.

The third piece of land included in the project is intended for husbandry and crops. It is located close to the main plot but not adjacent, with two properties and a steep road in between. The distance between the boundaries is approximately 100 m along the road. The distance and altitude differences between the plots make it impossible to use the same supply systems regarding water, electricity and sanitation. As this report is concluded, this land is not yet owned by the KCJF, but the transfer was initiated in April 2011. The plot, with an area of approximately 10 000 m<sup>2</sup>, is flat and clearly defined on two sides by a river and a small rivulet. It has previously been cultivated and the vegetation is less dense than in the plot intended for the orphanage buildings. See Figure 8 for a plot sketch and some pictures. The soil is fertile and the watercourses ensure there is plenty of water for animals and crops.



**Figure 8 -Plot sketch and photo from the farming and husbandry plot**

In the Kilimanjaro region, the properties of the soil are well known. Therefore, no soil investigations are required for single-storey buildings (Mollel, 2011-04-11). This makes it economically sensible to plan for single-storey buildings.

### 3.1.2 KCJF demands

After discussions with Lucy Lema and the officers at the social welfare office, the requests and wants listed below have been agreed upon as sensible, at least for the time being. I Aid Africa, as the main donor to the KCJF, supports these demands.

*General guiding demands are:*

- Becoming a licensed children's home
- Taking care of the same number of children as today, which means 36 full time and up to 19 additional during vacations
- Enabling self-supportiveness
- An environmental focus, e.g. by implementing composting latrines and rainwater harvesting
- Using solar cells / solar collectors
- Reducing costs by implementing lean solutions
- Houses being built from a durable, cost-efficient material. E.g. local custom-made bricks.

*Specific demands are:*

- A large kitchen of 15-20 m<sup>2</sup> containing a gas stove, a firewood stove and refrigerators for cold and frozen food.
- A place for administrative work.
- Two staff rooms
- Separate quarters for overnight and long term visitors
- Two rooms for storage
- A functional place for laundry
- A parking lot
- A playground
- An underground storehouse
- Planning for hay storage on top of the stables
- Roof of tiles or corrugated sheeting.

(Lema 2011-01, 2011-04-12)

### **3.1.3 Social Welfare Regulations**

The National Guidelines described in the *Background*, chapter 1.1 encompass physical, psychological, administrative and technical aspects of taking care of children. As this project concerns children's homes buildings, it is primarily the technical aspects of the Guidelines that are of interest. The following is a summary of the significant information in the Guidelines, sorted by the various facilities.

*General demands*

- To become a licensed children's home the institution must provide care for at least 5 children.
- The premises must be located in a suitable area, not near petrol stations, bars or garages, and away from negative influences from the surrounding community.
- The home must have a programme that ensures that every child is given the opportunity of either going to secondary school, or receiving vocational training.
- Dormitories
- Adequate sleeping space and accommodation must be provided.
- Segregation by age and gender must be observed.
- The distance between each bed used by children below 8 years must be minimum 2.5 ft (0.75 m).
- For each child aged 6 years and above there must a floor area of 40 ft<sup>2</sup> (3.6 m<sup>2</sup>) allotted in the bedroom.
- Male children of four years and above must not sleep in the same room as female children of three years and above.
- All beds must have insect repellent impregnated nets.

*Sanitary facilities and hygiene*

- Segregation by gender must be observed.
- There must be a sufficient number of safe, clean and child friendly toilets.
- The premises must be clean both inside and outside and necessary sanitary conditions must be met.

- The water source must be reliable and sufficient.
- The standard of hygiene must be adequate.
- Clothes must be washed and mended regularly.

#### *Kitchen and dining room*

- There must be a suitable kitchen, furnished with necessary utensils.
- The premises must have a clean, spacious and well ventilated dining room with appropriate and adequate furniture.
- Each child must have a set of eating utensils.

#### *Recreational facilities*

- All children's homes must have recreational facilities such as playgrounds and stimulating and educational play material and facilities for all ages.
- The playground must be furnished with play materials for all age groups.
- The playgrounds must be safe.

#### *Other facilities*

- There must be a room for isolation in the premises.
- The premises must be accessible for children with disabilities.
- The premises must be fenced, but with an emergency exit.

These guidelines form the basis of the process of designing the new premises as they are prerequisites for New Kichijo becoming a registered children's home.

### **3.1.4 Building regulations**

Numerous building regulations must be observed when planning for new houses. There are also standard solutions to many design and structural issues.

In the *Technical Handbook for provision of Physical Facilities in Secondary Schools* (Ministry of Education and Culture, 2004), approved solutions can be obtained by scrutinizing example drawings.

The list below contains the more specific regulations that apply to the design of New Kichijo. Additional less significant guidelines will be mentioned in Chapter 3.3 *Room Programme*.

- Staff must have access to sanitary facilities in the vicinity of their sleeping quarters.
- There must be no less than one toilet per 25 children.
- Emergency exits shall be clearly visible and kept unobstructed.
- The fence surrounding the plot must be at least 2 meters high.
- Latrines should be located no less than 100 meters from the water sources in the direction of the water flow.
- Special considerations must be taken regarding the accessibility for people with disabilities.
  - Door openings should not be less than 0.82 meters.
  - There should be an allowance of at least 0.5 meters on both sides of the entrance door to ease the navigation of a wheel chair.
  - Ramps should be straight, with a maximum slope of 5-7 %, and not longer than 6 meters.

- Ramps higher than 150 millimetres and / or longer than 1.8 meters must have handrails.
- Toilet rooms should have enough space for an assistant.
- Toilets must have swinging double armrests.
- Hand wash basins should be placed at 0.8 meters above floor level.
- The preferred height for electric switches is 0.9-1.20 meters.

(Kiusa, 2011-04-19; Ministry of Education and Culture, 2004)

### 3.1.5 Requests and regulations regarding husbandry and cultivation

The manageress wants to keep husbandry and grow crops to provide food for the orphanage.

According to the officers at the Agricultural Department in Boma Ng'ombe (visit on the 20th of April), there are no specific rules regarding the well-being of animals. It is recommended that animals should have sufficient space not to suffer, but the only actual rule is that they must have free access to drinking water. The visit to HORTI in Arusha gave more specific guidelines and the layout presented in chapter 3.4.3 *Design of farming related buildings* is based on that visit.

## 3.2 Establishment Operation Analysis

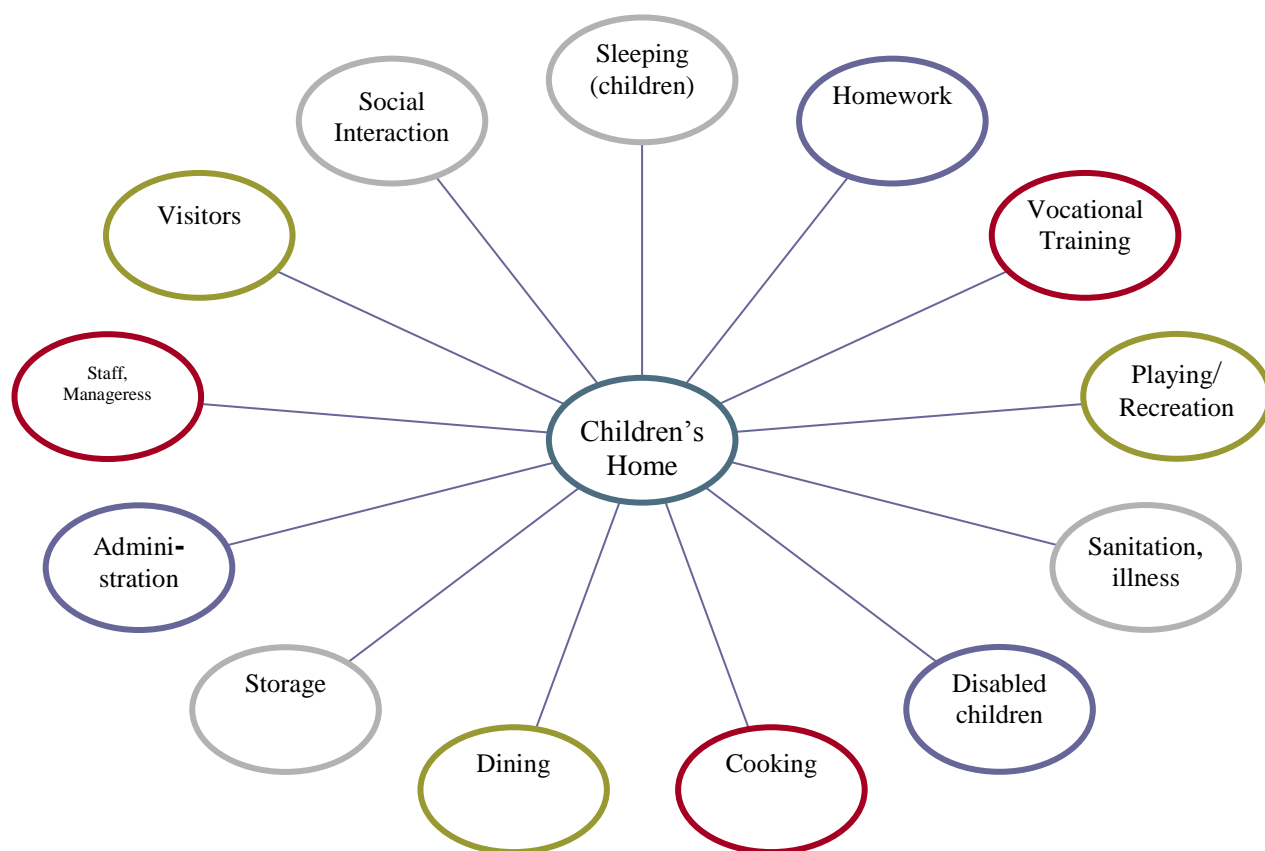
To ensure that all aspects of the orphanage management are taken into account, the actual design process is preceded by an operation analysis. The analysis is performed in two parts, one covering the actual orphanage activities and the other farming related activities. The aim is to identify all functions, needs, and areas that form an orphanage well suited to its purpose.

The manageress Lucy Lema firmly believes that physical safety needs to be combined with love and care as well as education. Her philosophy is that a stable and loving childhood will help the children develop into responsible adults who can provide for themselves. At the Kichijo, this combination of values is achieved by operating the orphanage more like a family home than an institution.

Analysed aspects are staff, organization, equipment, daily and recurrent activities and their area demands. Applicable laws and regulations, concerning for example work environment and building standards, are also considered.

### 3.2.1 Orphanage Activities

The premises that are designed in this project will be used as an orphanage. The main building will also function as Lucy Lema's permanent residence. The manageress has thorough knowledge of what functions, activities and rooms constitutes the running of an orphanage. With her input the parameters visualised in Figure 9 have been identified.



**Figure 9 - Aspects of running an orphanage**

The different ovals in Figure 9 are described in the following text.

### ***Sleeping***

As described in the prerequisites, children must be separated by age and gender. Only in the group 0-3 years, boys and girls are allowed to share dormitory and bathroom facilities. (Mahundi, 2011-04-05). The size and composition of the children's group fluctuates and it is difficult to predict the future situation. The premises are planned to accommodate the present children's group. The design should be flexible enough to meet upcoming changes.

For the division among the children at Kichijo, see Table 1 below.

**Table 1 - The children at the Kichijo per 2011-03-31**

Age	Number of girls fulltime	Number of boys fulltime	Additional girls during vacations	Additional boys during vacations
0-3 years	0	2	0	0
4-8 years	7	2	4	4
9-18 years	6	19	3	8

There is a significant increase in the number of children staying at the orphanage during vacations. These children also need accommodation that fulfils the prerequisites.



### ***Homework***

To enhance the children's possibilities of succeeding in school, a suitable place for homework is needed. Of the 36 children who are staying fulltime at the orphanage, 34 attend school or pre-school and might be assigned homework. 9 of these children are 4-8 years old and finish school earlier in the day than the older children. Thus, at the most 25 children simultaneously need a place for homework.

### ***Vocational training***

For those children who lack the qualifications needed to profit from higher education, efforts are made to facilitate vocational training, e.g. cooking or tailoring. One vision is to hire a chef and a tailor. The chef can do both the daily cooking for the orphanage and educate interested children, and the tailor can make school uniforms as well as give tailoring training. Another aspect to consider is that several persons need to work simultaneously to prepare food for 40-60 people. A tailoring business requires a place for sewing machines and fabrics. The area should allow a couple of children working at the same time as the tailor.

### ***Playing and recreation***

To improve the mental and physical health of the children, playing is encouraged both indoors and outdoors and space should be made available for this purpose. Suitable playgrounds are needed for all age groups, as well as storage room for toys.

### ***Sanitation, illness and disabled children***

The number of toilets is dimensioned for the number of children and adults that are staying at the orphanage during school vacations. At the moment, this means 55 children, four staff members and the manageress. There is also need of a place for toilet and potty training close to the nursery. Today, there are limited possibilities for showering at the orphanage; washing is normally done using buckets. Areas for showers or at least for washing are needed close to all sleeping quarters according to the manageress.

Many children lead to lots of dirty clothes, bedclothes are changed regularly and laundry is done every day. Hence, a large and functional place for washing is required. This place can be located outdoors, but should be in the vicinity of the kitchen to facilitate the flow of work.

Children sometimes get hurt and need to have their wounds dressed, they might get sick and need to be isolated. For these purposes, a sick bay is needed. The sick bay must have a place for the ill child to lie down and a place for the caregiver to sit, as well as a place to store basic medical supplies. It should also feature sanitary facilities.

Only one disabled child is living at the Kichijo today, but nevertheless, the regulations mentioned in the prerequisites regarding accessibility for disabled must be followed. Regarding sanitation, this means that one toilet must be adjusted for disabled.

### ***Cooking, dining and storage***

The kitchen should have the capacity of providing food for 36 to 55 children plus staff, and should allow lessons in cookery, also see the above heading *Vocational Training*. Four persons

should be able to work in the kitchen at the same time. 60 persons, which is the number of people staying at the orphanage during school vacations, should be able to dine simultaneously.

A pantry adjacent to the kitchen is a necessity to store provisions. There is also a need of storage for e.g. bedclothes, toys and cleaning equipment.

### ***Administration***

One part of running an orphanage is administrative work. In addition to book keeping there are e.g. applications for schools, records of the children and monthly reports to the Social Welfare Department. There is a demand for a functional office to help improve the administrative routines. The office should have room for one administrative officer and two visitors at the same time.

### ***Staff, manageress and visitors***

The staff is about to be reduced to four persons. One of the demands from the KCJF is two bedrooms for interns or night staff (Lema, 2011-04-28). In addition to these staff rooms, the manageress needs a private bedroom since this orphanage is her permanent home. This room should meet the need of a relaxed and private place for conversations with the children.

Volunteers, students and donors visit the orphanage regularly, and need a place to stay for overnight or prolonged visits. Since there are no guest houses in the village surrounding the new plot, accommodation outside the orphanage is not an alternative. It should be possible for the visitors to prepare food for themselves, and they should have access to a private bathroom. This is important especially for long term visitors. Looking back at the history of volunteers and visitors at the orphanage, it is seen that two separate bedrooms with room for two persons in each, would be of use.

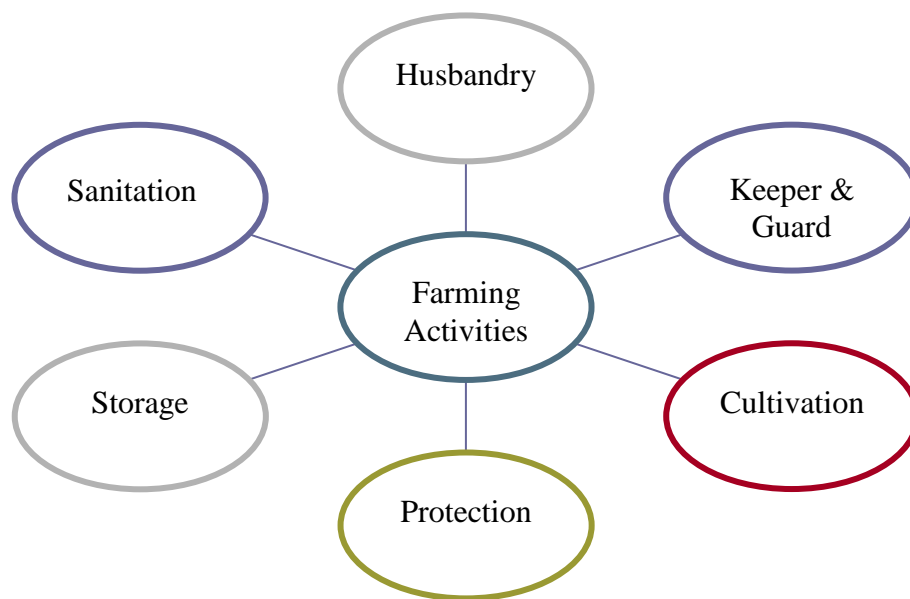
### ***Social interaction***

At the orphanage, there should be a place to receive and entertain callers. The same place could then be used for gatherings and overall interaction between those who live at the home more permanently. This is in line with the manageress' desire to keep the orphanage as homelike as possible. The place should provide pleasant seating with dining possibilities and free floor area for multiple purposes, like the children's games and performances.

## **3.2.2 Farming activities**

To become more self-supporting the Kichijo need to produce both food and forage. With the present facilities as a starting point, the needs of the future husbandry and cultivation are analysed. With input from the manageress Figure 10 below has been compiled.





**Figure 10 - Aspects of running a farm**

The intention with having husbandry is to produce meat, milk and eggs for the orphanage. For that purpose the Kichijo today own eight cows, eight goats, 30-40 chickens and 10 rabbits. The plan is to shortly reduce the number of cows to five. Approved shelters, fresh water and enough food must be provided for the animals. The shelters need to be kept clean and sick animals must be taken care of.

The cultivation is supposed to generate food both for the orphanage and the animals.

A keeper is needed to take care of the animals and answer for the cultivation. To prevent theft a night time guard and a fence is required. As for buildings the employees need a place to stay during work hours, and outbuildings are required for storing tools, seeds, crops, forage and straw. A dunghill is also needed, to utilize the manure from the animals in an efficient way. The stables for the animals, the keeper lodgings, and the storage facilities should all be located inside the enclosure.

The recommendations regarding stable and pasture dimensions in the chapter 3.3.2 *Room Programme for Farming Activities*, are based on the present number of animals at the Kichijo. Regarding the cows, the areas are suited for five animals.

### **3.2.3 Adaptation to Future Alterations**

#### ***The orphanage***

The desired development of the orphanage is expansion. Lucy Lema is hoping to be able to care for twice as many children in the future. This progress is however difficult to facilitate with the present conditions. Even the solution presented in this report depends on acquiring adjacent land. However, in the planning process, a possible expansion is facilitated by separating the main building from the dormitories. This way it will be possible to build new dormitories without redesigning the main building. Should there be need for a new dining room, this can also be achieved by erecting a detached building.

Should the orphanage close down, it is probable that the buildings' continued use will be for permanent residence. As the layout of an orphanage resembles that of a normal home, it will be easy to convert the premises even if no extra consideration is taken in the design process.

### ***The farm***

Should the orphanage close down, the probable outcome is that the running of the farm will continue but be taken over by someone else. The area where the plots are situated is rural, and there are few opportunities to earn a living that does not involve cultivation and husbandry.

## **3.3 Room Programme**

The room programme describes how the prerequisites and the functions identified in the operations analysis are enabled in terms of areas. The chapter follows the same order as the analysis in chapter 3.2.

### **3.3.1 Room Programme for the Orphanage**

To model the orphanage buildings, the area requirements for each function need to be known. Information from the prerequisites in chapter 3.1 and comparisons with solutions in the Secondary School publication (Ministry of Health and Education, 2004) are combined, and a functional analysis is performed. The result is required rooms and/or areas for each function. The results are presented in the texts below.

### ***Sleeping***

To meet the demand of no less than 3.6 m<sup>2</sup> allocated to each child, the areas illustrated in Table 2 are needed to accommodate the present children's group.

**Table 2 - Number of children and required areas (2011-03-31)**

<b>Age</b>	<b>Total number</b>	<b>Required area (m<sup>2</sup>)</b>
<i>Girls</i>		
0-3 years	0	0
4-8 years	11	40
9-18 years	9	32
<i>Boys</i>		
0-3 years	2	7
4-8 years	6	22
9-18 years	27	97

See detailed layout of the sleeping quarters in the chapters 3.4.2.2 *Dormitories* and 3.4.2.3 *Business facilities*.

## **Homework**

If each child is granted 60 cm of a table and children are seated on both sides of the tables, 7.5 meters of table is needed to seat 25 children. The standard width of a table is 70 cm, which means 5.3 m<sup>2</sup> of tables. To sit, an additional area of 60x70 cm is needed for each child (Sjöström Larsson & Wergeni-Wasberg, 2001, p. 89). That is equivalent to a total sitting area of 10.5 m<sup>2</sup>. To move around the room, more space is needed and for this purpose roughly 10 m<sup>2</sup> is considered sufficient. In all, a room with a floor area of 26 m<sup>2</sup> will be functional as a study room at the orphanage. This room is planned in detail in chapter 3.4.2.1.

## **Vocational training**

The vocational training that needs separate facilities is the tailoring. 10 m<sup>2</sup> is sufficient for three workplaces (one tutor and two children), storage of materials and dressing room. The suggested area is a conclusion from observations made during visits to tailoring businesses in Boma Ng'ombe.

Regarding vocational training in cookery, see the heading *Cooking, Dining and Storage* below.

## **Playing and recreation**

There should be no less than 9 m<sup>2</sup> of free space in the living room of any building, to allow dancing and other activities (Lanne, 2008). Since this is a recommendation for a family home, this area should be larger in the orphanage. 15 m<sup>2</sup> is estimated to be enough, especially since the area for homework can be utilized for games as well. Close by the areas for games, there should be storage facilities for small playing materials like duplo and yarn for crocheting, preferably in a couple of cabinets or closets.

There is also a need for storage of larger playing materials; bolls, skipping ropes and the like. 1 m<sup>2</sup> is enough for this purpose.

For information about playing and recreation outdoors, see 3.5.1 *The Land Allocated to Orphanage Buildings*.

## **Sanitation, illness and disabled children**

### *Sanitation*

As stated in the prerequisites, there must be no less than one toilet per 25 children. In table 3 below, the required number of toilets, showers and their areas are listed by the group they serve.

**Table 3 - Facility and area demands**

Group	Number of people	Number of toilets	Size of the toilets (m <sup>2</sup> )	Number of showers	Size of the showers (m <sup>2</sup> )
Staff	4	1	1.2 <sup>2</sup>	1	0.63
Manageress	1	1	1.2 <sup>2</sup>	1	0.63
Disabled	1	1	4.8 <sup>1</sup>	1	2.0 <sup>3</sup>
Visitors	0-4	1	1.2 <sup>2</sup>	1	0.63
Sick children	-	1	1.2 <sup>2</sup>	1	0.63

Children 0-3	2	1	1.2 <sup>2</sup>	1	0.63
Girls 4-18	20	1	1.2 <sup>2</sup>	1	0.63
Boys 4-18	33	2	1.2 <sup>2</sup>	2	0.63

<sup>1</sup> Sjöström Larsson & Wergeni-Wasberg, 2001, p.90. The area include washbasin.

<sup>2</sup> Ministry of Health and Education, 2004, drawing 11:119.

<sup>3</sup> Statens Planverks Författningssamling, 1980, p. 494.

By each toilet, there must be facilities for hand hygiene. Recommended area around the washbasin is 0.9x1.1 m (Sjöström Larsson & Wergeni-Wasberg, 2001, p.90).

#### *Laundry facilities*

The area for laundry at the present premises is 20 m<sup>2</sup>, which is scarcely enough. The new premises should therefore provide a larger area. 30 m<sup>2</sup> is enough to fit in two concrete vats for washing and rinsing, with room left for hanging.

#### *Illness*

A sick bay of 6.5 m<sup>2</sup> would have space enough for a bed, a table and a chair and some storage furniture. There should also be a separate bathroom, see Table 3 above for area requirements.

#### *Disabled children*

Disabled children does not require any specific areas, apart from an adapted bathroom, see Table 3 above, and free space in general to navigate a wheelchair. This is taken into consideration when planning the physical premises, and is described in chapter 3.4.2 *Design of the Orphanage Buildings*.

### **Cooking, dining and storage**

The kitchen should be equipped according to the demands specified in the prerequisites, and at least four people should be able to work simultaneously. A comparison to the kitchens in the Secondary School Handbook (Ministry of Health and Education, 2004, p. 11:113) leads to the conclusion that the kitchen should not be less than 10 m<sup>2</sup>. The manageress' wish is to have a kitchen of 15-20 m<sup>2</sup> is therefore not in conflict with applicable regulations, and is taken into consideration in the design of the buildings.

The identified necessity of a place to sit down and dine together is fulfilled with a dining room that seats 60 persons. The Secondary School Handbook recommends 40 cm table-width available to each child. With 70 cm deep tables and 35 cm deep benches on both sides it is possible to seat 60 persons simultaneously at 12 meters of table, equivalent to 8.4 m<sup>2</sup>. The area to sit is 0.4x0.7 m for each child, which gives a total of 16.8 m<sup>2</sup> for 60 persons. With approximately 15 m<sup>2</sup> to move around, 60 persons can be seated in a dining room of roughly 40 m<sup>2</sup>.

Linen, mattress covers, additional clothing, toys and other applicable items can be stored in a 7 m<sup>2</sup> storage room. This area doubles the present storage capacity and is considered sufficient by the manageress. Observations made at the present premises indicate that a pantry of 5 m<sup>2</sup> is adequate.

### **Administration**

An office of 8 m<sup>2</sup> can hold the equipment necessary for administrative work; a grand desk with room for both a computer and paperwork, a couple of visitors' chairs, and shelves for paperwork (Sjöström Larsson & Wergeni-Wasberg, 2001, p.87, 89).

### **Staff, manageress, and visitors**

#### *Staff*

It is possible to fit in a bed, a bedside table, some storage and a pallet on an area of 7 m<sup>2</sup> (Sjöström Larsson & Wergeni-Wasberg, 2001, p.88). Since the staff rooms are not intended for permanent residence, but rather for temporary interns and night staff, there is no need for additional space. Since two rooms are demanded by the KCJF, the total area required for staff rooms is 14 m<sup>2</sup>.

#### *Manageress*

The manageress' bedroom needs to be slightly larger than the staff rooms to fill the identified functions. A room of 13 m<sup>2</sup> fulfil all demands and is by the manageress considered spacious enough for long time residence.

#### *Visitors*

A separate section should be planned for visitors in accordance with the KCJF demands. The area of the visitors' bedrooms should be 5.4 m<sup>2</sup> each, and the shared area for socialisation approximately 10 m<sup>2</sup> (Sjöström Larsson & Wergeni-Wasberg, 2001, p.87-89). The areas required for toilet, shower and washbasin are described under the heading *Sanitation, illness and disabled children*, above.

### **Social intercourse**

Adjoining the free floor area described under the heading *Playing and recreation* above, it should be possible to place a multi-piece suite and additional chairs or pallets. Storage should also be supplied. An area of roughly 30 m<sup>2</sup> fulfils all these requirements (Sjöström Larsson & Wergeni-Wasberg, 2001, p.87-89).

### **3.3.2 Room Programme for Farming Activities**

As mentioned before, in 1.3 *Delimitations*, the chapters regarding farming activities are less comprehensive than the chapters regarding orphanage activities. No floor plans will be presented over the farm buildings, and the descriptions and areas are to be regarded as information and recommendations.

Based on the number of animals the Kichijo owns or plans to own, and on the visit to the HORTI centre, the areas below have been calculated.

The stable should house five cows (35 m<sup>2</sup>), 30-40 hens (15 m<sup>2</sup>) and 10 rabbits (6 m<sup>2</sup>), and also hold an area for storing tools (10 m<sup>2</sup>). There should be openings in the stables with direct access to the pastures. The pastures fulfil the recommendations if they are, for the cows: 75 m<sup>2</sup>; for the hens: 22 m<sup>2</sup>; for the rabbits: 9 m<sup>2</sup>. The goats, for which the recommended shelter is a shed rather than a stable, can preferably be kept alongside one of the stable sides. The area allocated for 8 goats should be 8 m<sup>2</sup> under roof, and 12 m<sup>2</sup> pasture. The stable should preferably be a 1½ storey building, with room for hay and straw on the upper floor. The present storage capacity for hay

and straw is  $125 \text{ m}^3$  and the same volume should be available at the new premises. The manure from the animals should be placed in a dunghill for mouldering. Based on the number of animals and comparisons to the solutions at HORTI, the required floor area of the dunghill is fixed to  $30 \text{ m}^2$ .

The demand of a place to stay for the farm workers can be met by a room of  $10 \text{ m}^2$ . That area is enough for a table, a couple of chairs or pallets, a bed and an area for basic food preparation. The sanitary facilities; shower and toilet, should have the same dimensions as at the orphanage buildings, i.e. no less than  $0.9 \times 1.3 \text{ m}$  for the toilet,  $0.7 \times 0.9 \text{ m}$  for the shower and  $0.9 \times 1.1 \text{ m}$  for the washbasin.

There should also be a room for storing planting seeds,  $10 \text{ m}^2$  is enough for this purpose. An underground storehouse of roughly the same size, intended for harvested crops, should also be erected. These areas are sufficient according to the manageress.

In chapter 3.4.3 *Design of Farming Related Buildings*, a suggested layout of the stables, sheds, storage rooms and keeper lodgings can be seen in Figure 22. Appendix A-01.1-03 *Farming Enclosure* shows the entire enclosure.

## 3.4 Building Design

In this chapter the area requirements from the *Room Programme* (3.3) are used to specify the layout of specific rooms and then to design buildings using these rooms. The buildings should fulfil all the functions listed in the analysis, as well as give a homelike and welcoming impression. The flow between different rooms and functions should be facilitated and simplified.

### 3.4.1 Evaluation of required areas

When it comes to the orphanage buildings, the areas that are required to fulfil all prerequisites are so large that the placement of them on the undulating plot constitutes a major problem. A solution could have been to plan for two-storey buildings, but as it has already been discovered, that is a disadvantage economically (see chapter 3.1.1). Given the size of the required areas, it will be difficult to create an entity and a sense of wholeness even with two-storey buildings. Another solution is to plan the premises with the assumption that the adjacent land described in chapter 3.1.1 will be acquired. This course of action has been approved by I Aid Africa, and in the following chapters, the addition is reckoned with. The disposition of the land with this addition is described in detail in chapter 3.5.1.

### 3.4.2 Design of the Orphanage Buildings

In addition to the demands that must be met by each room and building, there are more overarching aspects to take into consideration in the design process. From a general point of view the premises should provide a safe environment, suitable for children and accessible for disabled people. Abundant daylight indoors is important both to reduce electricity consumption and supply a pleasant environment, and should be ensured by plenty of windows. A straight forward layout simplifies cleaning and maintenance, an advantage in places where many children are active.

The sum of all the required areas is approximately  $455 \text{ m}^2$ . Even with the land addition of  $400 \text{ m}^2$ , such large building area means that it is sensible to separate functions into different buildings. The main reason for this apart from the enormity of a  $455 \text{ m}^2$  building, is the layout of the plot, see also the reasoning in chapter 3.1.1.

To enhance the homelike characteristics of the premises, it would be appropriate to create a main building containing the common functions of the orphanage, and separate dormitories. Since the dormitories need to be gender separated, another obvious division is into separate buildings for girls' and boys' dormitories respectively. Another function that is convenient to set apart is the tailoring premises. The tailor should be able to receive customers and have free access to the workplace. This said, it is economically more sensible to erect fewer larger buildings than multiple smaller ones. In the design process, the aim is thus to erect as few buildings as possible, while considering the impositions the plot topography constitutes. More can be read about the plot topography and its consequences in chapter 3.1.1.

The resulting site plan is described in chapter 3.5.1 *The Land Allocated to Orphanage Buildings*.

### **3.4.2.1 Main Building**

Efforts are made to combine area requirements for different functions, thus creating multifunctional rooms and saving building area (which in turn reduces expenses). As stated above, gathering the common rooms in one building would contribute to the desired feel of the premises. Another consideration is that the dining room should be located close to the kitchen.

Since the children in the nursery require most attention, it is convenient to place the nursery close to labour intensive activities like cooking and washing. For the same reason, staff rooms and sick bay should be close by.

As to the areas for administrative work, visitors and manageress quarters, it is an advantage if they are located close to the functions mentioned above. The manageress need to be at hand, and visitors will probably want to take part in the daily activities at the orphanage. At the same time a certain amount of seclusion is an advantage for these functions. The manageress should be able to withdraw to her private quarters, as should visitors. The area for administration should be located close to the reception, as some guests are probable to have errands regarding administration. Also, it will be convenient for the manageress to have her office nearby.

Below are more detailed descriptions of the rooms in the main building. For the layout, see Appendix A-40.1-01 *Floor Plan Main Building*.

#### ***Entrance hall***

The entrance hall, with generous areas to give a welcoming impression, is given a central position in the building. The welcoming air is amplified by wooden double doors and two large windows facing the verandah.

The entrance hall will function as a reception for visitors and supply the orphanage with an area for social intercourse. In the hall is room for a multi-piece suite as well as free space for children's activities; gaming, dancing, performing and the like. To optimize the use of the area, closets can be placed along one of the walls.

#### ***Dining- and study room***

The required area for the dining room is 40 m<sup>2</sup>, but the full capacity will only be utilized during vacations. To save space, this area is reduced to seat the 36 fulltime children and the staff. 24 m<sup>2</sup> is needed for that purpose. The consequence is that during vacations 16 m<sup>2</sup> extra is needed for dining. The entrance hall and the spacious kitchen provide this area. In Figure 12 below, the room

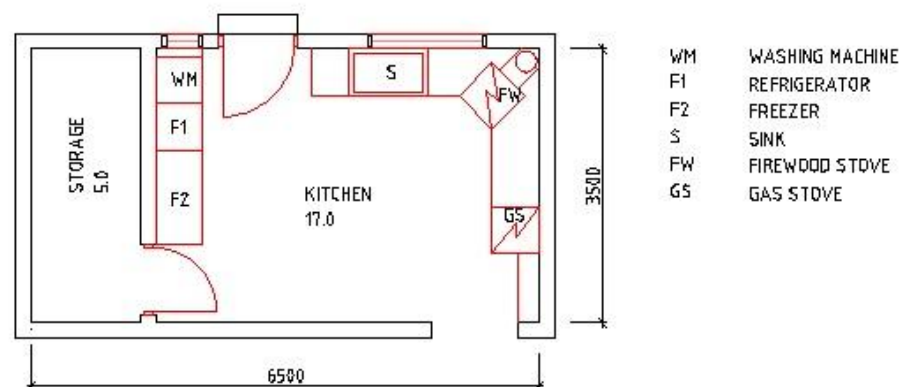
is shown with the furniture planned for dining in accordance with the recommendations regarding available space from the Ministry of Health and Education (2004, p. 11:113). To maximize the versatility of the room, it will be furnished with detached benches and tables.

The dining room can also function as the study room. The analysis gave that 26 m<sup>2</sup> was required, but the detailed planning showed that 24 m<sup>2</sup> is enough. Should more than 25 children need to utilize the room, homework hours can be scheduled.

This room is possible to close with a door, providing a quiet and undisturbed environment for studies. Windows in two quarters ensures plenty of light.

### ***Kitchen and adjacent pantry***

The kitchen is accessed directly via the entrance hall and close to the dining room. It is supplied with proper workspace and plenty of cabinets. It will be equipped with running water and a generous sink, refrigerators for chilled and frozen food, a washing machine, gas stove, firewood stove and adjacent space for firewood. The area allows 4 cooks to work simultaneously and is generous enough to make it possible to teach cookery to the children. There is no door between the kitchen and the entrance hall, which will ensure a close connection to the centre of the building, and thereby make it possible to supervise the younger children while cooking. The kitchen also features an extra outer door, intended to give easy access to the laundry site, facilitating the flow of work. Inside the kitchen is a 5 m<sup>2</sup> pantry for storage of provisions and kitchen utensils. The kitchen will be 17 m<sup>2</sup>, with the layout shown below in figure 11. The top of the low refrigerator, freezer and washing machine will be used as workspace.



**Figure 11 - Kitchen layout**

### ***Laundry area***

The laundry area is placed at the back of the main building and is accessed via the kitchen door. Tarpaulins and a frame can be used to construct a roof that can be unfolded when it's raining. The floor consists of a concrete slab.

### ***Nursery***

Following the regulations regarding minimum floor area allocated to each child, the nursery can accommodate 6 children. The room is primarily intended for children of 0-3 years.



At the moment, the composition of the children's group makes it necessary to use part of this room for boys 4-8 years. During the semesters, the room can be easily partitioned off, supplying one area for the two toddlers, and one for the boys aged 4-8. During vacations, the whole room is needed for boys 4-8. The toddlers should then be accommodated in the staff's or manageress' rooms. The nursery is furnished with three bunk beds and two cots with bars.

In addition to windows in the outer wall, this room has a half-glazed wall facing the entrance hall. The reason is primarily to simplify the caretakers' supervision, but the resulting daylight inlet into the entrance hall will add to the desired welcoming and open feel of the premises. The half-glazed wall should be equipped with a blackout curtain, to make seclusion possible during for example nap hours.

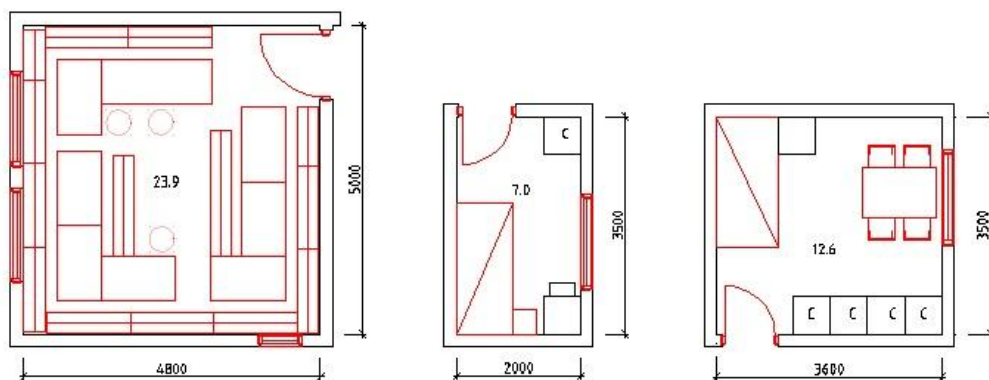
The children in the nursery will primarily use the toilet in the sick bay. See also the sick bay section of this chapter. Potty training will take place inside the nursery, where there is also room for a nursing table and a comfortable chair for bottle feeding.

### ***Staff rooms***

One of the staff rooms will be located close to the nursery and the sick bay. The suggested furnishing allows use of either a single or a bunk bed, see Figure 12. The staff rooms are located in the more private part of the main building, an advantage if they are used to accommodate interns. There is also room for a cot with bars, should a toddler need to stay in the same room.

### ***Manageress quarters***

The manageress' room can be furnished with a bed (single or bunk), a table that seats four persons, chairs and closets. There is room for the table in front of the large window, a layout that offers a relaxed and informal place for private interviews, e.g. with the children. See figure 12. This room is also located in the more private parts of the main building. The staff bathroom is also intended for the manageress.



**Figure 12 - Dining room, staff room, and manageress quarters**

### ***Visitors quarters***

To fulfil the request of seclusion, the visitors' quarters is planned as a wing to the main building, with a separate entrance.

The wing contains a shared bathroom and a likewise shared sitting room. The sitting room will be equipped with a kitchenette for basic food preparation. There are two bedrooms that can be furnished with single or bunk beds, making it possible to house up to 4 guests simultaneously. A closet and a desk can be fitted into each bedroom. The planned disposition is shown in figure 13 below.



**Figure 13 - Visitors quarters**

### ***Sick Bay***

The sick bay is the room for tending children being ill. The room contains a bunk bed, shelves for storage of basic medical supplies, and a bathroom. Here children can be tended without being disturbed and without exposing others to infection. The bathroom features an Asian toilet, and when the room is not used as a sick bay, the toilet is used by the nursery children for toilet training. See the photo to the left in Figure 14 below. The Asian toilet is considered more child friendly than the European one. The sick bay is 6.4 m<sup>2</sup> and the en suite bathroom has an area of 2.5 m<sup>2</sup>.



**Figure 14 - Asian and European toilets**

### **Staff bathroom**

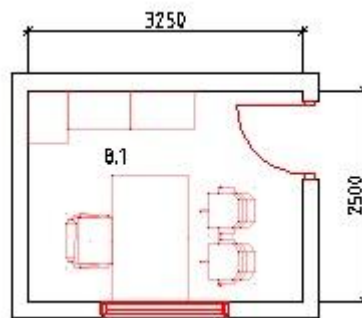
The bathroom intended for the staff is adapted for disabled and located next to the staff quarters.

The water closet is equipped with swinging arm-rests, enough room to turn a wheelchair around and to allow a helper. The toilet in this bathroom is of European model (see Figure 14 above).

The bathroom is 6.3 m<sup>2</sup>. This is slightly less than the 6.8 m<sup>2</sup> listed in the room programme (3.3.1), but since the areas for shower, washbasin and toilet can overlap, the requirements are still met.

### **Office**

The office is the room for administrative assignments and business meetings. With a generous window, this room will offer a suitable environment for all business activities. Its intended layout is visualized in figure 15. The office is located in one of the wings of the main building.



**Figure 15 – Office layout**

### **Storage**

Located next to the office, this proper 7 m<sup>2</sup> storage room can hold everything that is not related to cooking (there is a separate storage room for kitchen facilities adjoining the kitchen). The storage room has no windows and the walls will be covered with shelves and cabinets.

### **The building in its entirety**

The floor plan showed in figure 16 can also be found in scale 1:100 in Appendix A-40.1-01 where the rooms are furnished according to requirements. See also the appendices A-49.0-01 *3D model Main Building* and A-40.3-01 *Elevations Main Building* for further specifications.

The final layout of the main building is a manor-like house with two wings. One of the wings contains the quarters for visitors; the other wing contains rooms for administrative work and storage. A two meter deep verandah encircles the courtyard that is created by the building.

The building, apart from the wings, is divided up into one more public and one more private part. The public part is to the left and contains study/dining room, kitchen, entrance hall with areas for social intercourse and the nursery. To the right is the semi-private part, containing the manageress' bedroom, the staff bathroom, the staff rooms and the sick bay. These rooms are reached via a hallway that is possible to screen off from the public areas with drapes or similar.

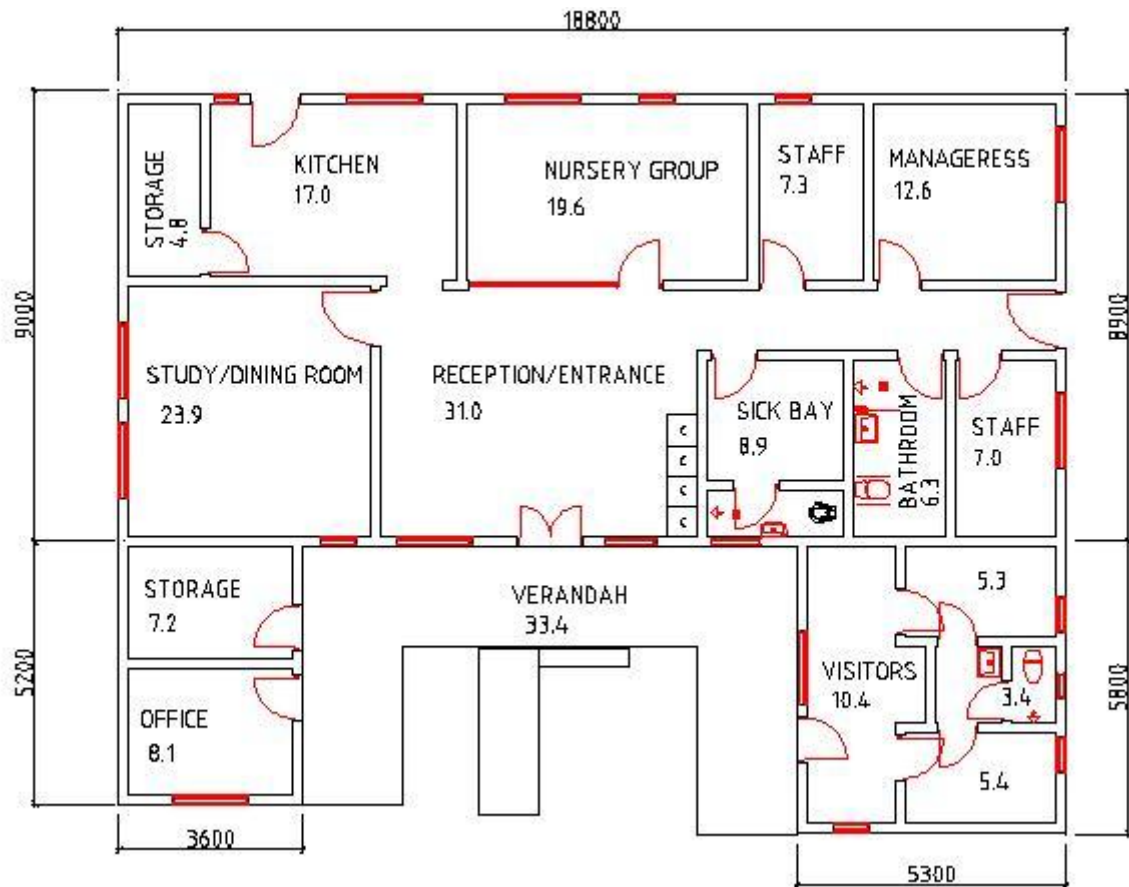
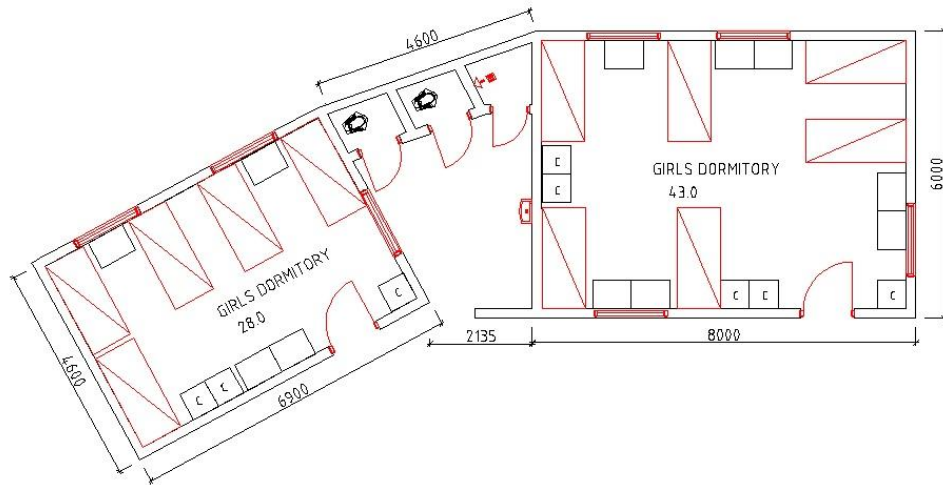


Figure 16 – Floor plan over the main building

### 3.4.2.2 Dormitories

Four dormitories that house 8-12 children each have been designed. There are two dorms for girls, and two for boys. The layouts and sizes are shown in figure 17 and 18 below. The primary reasons for the layout of the dormitories are the topography and shape of the plot. The secondary reason is the economic advantage of re-using an existing building. The dorms are furnished with bunk beds and cabinets for personal belongings.

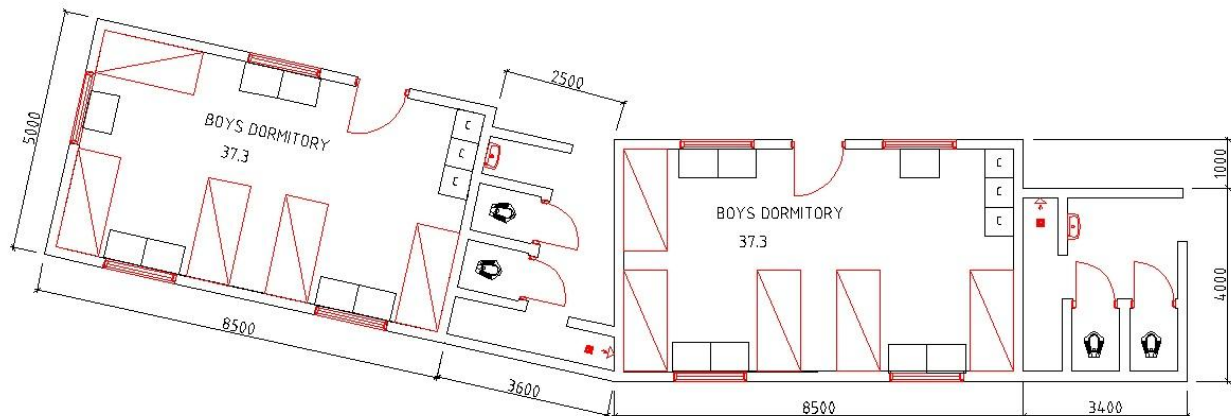
The dorms for girls are 43 and 28 m<sup>2</sup>, supplying accommodation for the age groups 4-8 and 9-18. The 28 m<sup>2</sup> dorm is the existing building. According to the list in chapter 3.3.1, heading *Sleeping*, the required area is 32 m<sup>2</sup>, but as one of the girls in this age group is gravely mentally retarded, she stays with the younger girls. The area requirements are thus fulfilled.



**Figure 17 - Girls' dormitories**

Both dorms for boys are 37 m<sup>2</sup>. They are intended for 9-18 year old boys who are staying full time at the orphanage. The boys that return during school vacations are accommodated in the tailoring building, see chapter 3.4.2.3 *Business facilities*.

The age group 4-8 will be accommodated in the nursery, see the heading *Nursery* above.



**Figure 18 - Boy's dormitories**

Should the age groups change so that smaller rooms are needed, it is easy to partition off part of the dorms.

The floor plans above, elevations and 3D models of the dormitories can be seen in detail in the following appendices.

A-40.1-02 *Floor Plan Girls' Dormitories and Sanitation*

A-40.1-03 *Floor Plan Boys' Dormitories and Sanitation*

A-40.3-02 *Elevations Girls' Dormitories and Sanitation*

A-40.3-03 *Elevations Boys' Dormitories and Sanitation*

A-49.0-02 *3D model Girls' Dormitories and Sanitation*

A-49.0-03 *3D model Boys' Dormitories and Sanitation*

### **Sanitary facilities**

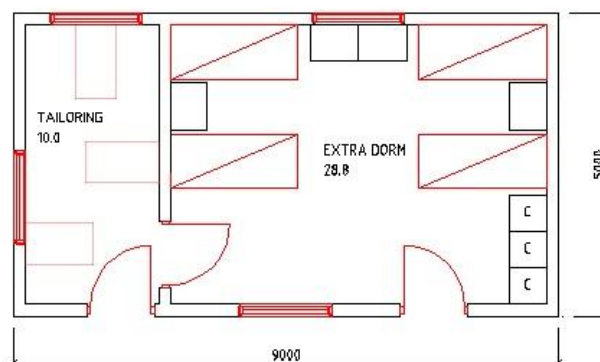
The toilets for the children will be gender separated and located close to the dormitories. Because of the nature of these toilets, there need to be two sets to use alternately. More can be read about this in chapter 3.6.4 *Solid Waste Management*. As the actual need is two toilets for boys and one for girls, there will be four toilets for boys, and two for girls, but only one set will be used at the same time. The showers and washbasins will be placed together with the toilets.

The sanitary facilities for the girls are located between the two dormitories. The boys' facilities are located in two places, one in between and one to the right of the dormitories. See the floor plans in figure 17 and 18 above. To follow the local tradition, to keep costs low and to ease cleaning, Asian toilets will be installed.

The floors should consist of concrete slabs just as the laundry area floor. The roof construction should be simple, with a gap between the upper side of the walls and the lower side of the roof to let in daylight and ensure good ventilation.

### **3.4.2.3 Business facilities**

The tailoring business should be located in a separate building close to the main gates. The required area is 10 m<sup>2</sup>, but it would be well suited to the purpose to have a separate dressing room. This is supplied by planning for a building with two rooms. As there is also need for an extra dorm during school vacations, one of the rooms is made large enough to accommodate the 8 boys 9-18 who attend boarding schools. The required area for the boys' accommodation is 29 m<sup>2</sup>, and thus the building area will be 39 m<sup>2</sup>. The layout is shown in figure 19.



**Figure 19 - Tailoring and extra dormitory for boys**

The details of the building can be seen in the following appendices:

A-40.1-04 *Floor Plan Tailoring/Extra Dorm*

A-49.0-04 *3D Model Tailoring/Extra Dorm*

A-40.3-04 *Elevations Tailoring/Extra Dorm*

### **3.4.2.4 Accessibility for disabled**

Designing a single-storey building entails avoidance of stair accident risks, and eases adjustment to disabled. A simple layout without narrow passages and with free space for e.g. navigating a wheelchair makes the premises appropriate for disabled.

In addition to the design of the staff bathroom, disabled children will be taken into consideration by planning for an entrance ramp, widening door openings to 82 cm (this width is prescribed by authorities), and allowing free space to navigate a wheelchair in the planning of the main part of the premises.

### 3.4.2.5 Emergency Exits

Local buildings are designed with focus on keeping intruders out, rather than easing escape routes. Windows may or may not be covered with glass, but are always furnished with permanent lattice, as is entrance doors. Common practice is to secure the doors with padlocks at night. This can seem unsuitable as it means that escape routes are barred. The problem can be circumvented by keeping the padlock keys close to the doors or maybe by trying to implement solutions with bolted bars. However, bolts are not commonly used in this society and the solution might be discarded by the users. In buildings with only one door, e.g. the dormitories, escape routes can be enabled through openable window lattice.

### 3.4.2.6 Overarching Material and Finishing Description

The following table (Table 4) lists the commonly used construction and finishing materials. For some materials, details regarding the design and work execution are added. This information is deemed important for anyone who is taking part of this project who is not from Tanzania or familiar with the construction process.

**Table 4 - Material specification**

Building sections	Material/Specification
Foundations	Concrete or stone, three existing boulder plateaus may be reused. Upper face 500 mm above ground level.
Floor slab	Concrete, 100 mm, with 50+150 mm binding and gravel layers underneath.
Framework (loadbearing and not)	Locally fabricated bricks, custom made.
Roof trusses	Timber treated with pyrethrine or similar.
Roof	Corrugated galvanised iron sheets.
Ventilation	Special blocks over each door and window, see figure 20.
Windows	Frame preferably metal. Equipped with mosquito gauze. Height 1500 mm.
Window lattice	Minimum $\varnothing$ 16 mm metal bars at no more than 15 cm apart or freely formed welded iron. Painted. For example, see figure 20.
Doors	Wooden doors, the frame mounted directly against the bricks, see figure 20. Stained.
Door lattice	Minimum $\varnothing$ 16 mm metal bars at no more than 15 cm apart or freely formed welded iron fulfilling the same distance demands.
Exterior wall finishings	Concrete grout, preferably lightly coloured.
Interior wall finishings	Three sections of paint with different quality. See figure 20.
Ceiling	Hardboard, 4-5 mm. Nailed to the brandering. Painted.



Flooring	Painted concrete in the main building Painted or dust-bind treated concrete in the dormitories Raw concrete in sanitary facilities and laundry area
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Detailed descriptions of structural solutions can be found in the publication *Development Grant for Secondary Schools - Technical Handbook for provision of Physical Facilities in Secondary Schools* (Ministry of Health and Education, 2004).



**Figure 20 - Doorframe, lattice entrance door, window lattice and ventilation block, painted wall.**

### **3.4.3 Design of Farming Related Buildings**

The design of the buildings at the farm site is inspired by the existing rural buildings in the village and the visit to the HORTI Centre in Arusha. The buildings are kept simple to keep costs low. Material from existing buildings will be used for part of the animal shelters (Lucy Lema, 2011-04-12). All buildings on the farming plot are located inside the enclosure (see chapter 3.2.2 and 3.5.2).

The leading priority in the design of the stables has been the wellbeing of the animals. The minimum area for pastures and stables has been enlarged to allow free movement, and weather protected feeding grounds are provided. The animals have free passage between stable and pasture. The dunghill is located just outside the stables and surrounded by a concrete wall to prevent leakage of nutritious substance. Figure 22 shows the layout of the animal shelters. The storage room for hay is located on top of the stables, under a heightened roof with open sides. It is common in the area to store hay in constructions with open walls and simple screens as roofs.

The pictures below in figure 21 show examples of approved solutions.

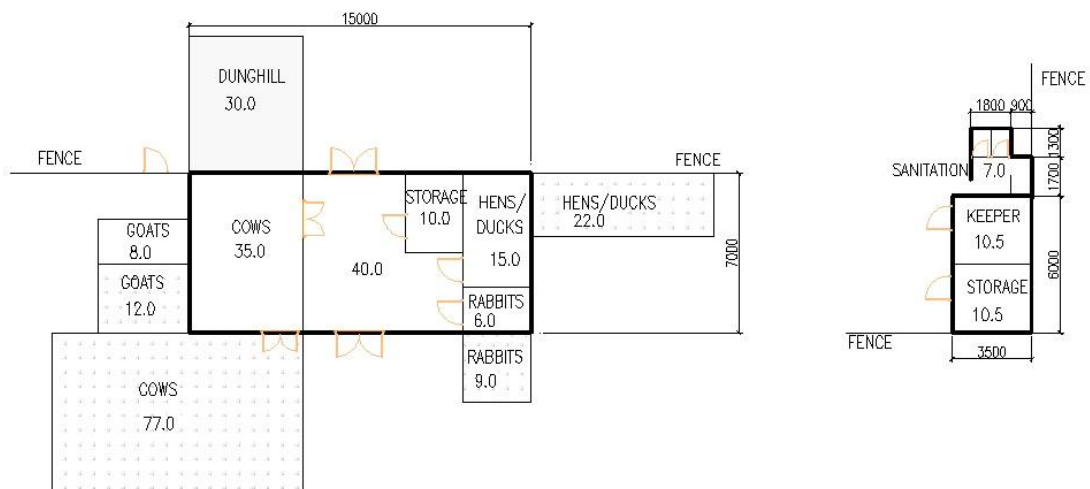




**Figure 21 -Concrete forage basins, cattle enclosure, goat shed and forage storage**

In addition to buildings, see also the site plan over the enclosed part of the farming plot, Appendix A-01.1-03.

The keeper accommodation is designed with focus on functions. It should supply an area for basic food preparation, a place to rest, and sanitary facilities. The area for sanitation is located in a separate section to the side of the building, se figure 22. There are two composting latrines to use alternately, one shower and a washbasin.



**Figure 22 - Animal shelters, keeper accommodation and storage rooms**

Next to the keepers room is a storage room for seeds and tools. It is a rationalized solution to avoid multiple buildings. In addition, an underground storehouse of approx. 10 m<sup>2</sup> should be erected, see the site plan in Appendix A-01.1-03.

### 3.5 Plot Programme and Design

In this section it is described how the plots are arranged; how the buildings are placed, the extent of enclosures and how the remaining land is disposed. For the functions that are located outdoors, like the playgrounds, there are no specific area demands. Because of this, the concretisation of areas (i.e. the plot programme) and the layout of the land (i.e. the plot design) are presented in this same chapter. See Appendix A-01.1-01 *Site Plan I* for the drawing showing the land

allocated to the orphanage buildings, and chapter 3.1.1 Figure 8 for a rough illustration of the farming plot.

### 3.5.1 The land allocated to orphanage buildings

The placement of the premises on the plot is shown in Appendix A-01.1-02 *Site plan II*. The buildings are placed with focus on creating a sense of wholeness and on utilizing the land in the most appropriate way.

As stated in the establishment analysis, the buildings need to be surrounded by sturdy fences and a lockable gate. There is an approved type of fence, see figure 23 below. The second picture in Figure 23 shows a typical gate. Because of the large area enclosed with fences, there need to be two entrances to the premises. One is facing the adjacent road, for car deliveries and visitors, and the other one is located close to the boys' dormitories.



**Figure 23 – An approved fence, a typical gate and the climbing wall**

The main building, the house for tailoring and the girls' premises are gathered around a courtyard. The boys' premises are located at the lower parts of the plot on the only remaining plateaus. The distance between the main building and the boys' dorms is 65 m along the paths. The dorms are angled to maximize the use of the land and minimize the need of excavations.

The need of areas for playing and recreation is met in several ways. There will be a playground close to the administrative wing of the main building. The playground is located on one of the terraces that constitute part of the courtyard. The terrace is 42 m<sup>2</sup>, and a seesaw and a carousel will be placed there. The open area close to the main gate is primarily intended for ball games, although it is possible to park several cars there. A small climbing wall will also be available to the children. The climbing wall is to be relocated from the present orphanage in Boma Ng'ombe and placed between the tailoring building and the new girls' dormitory. An elevated roof sheet protects the wall from precipitation. The plot itself with its abundant vegetation is a paradise for children's imagination and games.

Bushes surround the verandah of the main building and the playground to create a pleasant environment. Existing trees are kept and included in the layout as far as it is possible. One specific tree grows in the planned playground. It is a mango-tree that was planted by the manageress 45 years ago. As it carries a history and also provides the playground with refreshing shade, it is well worth saving. Other trees that should be spared are shown in the site plan. Apart from these specific trees, as much vegetation as possible should be saved to prevent erosion.

The paths around the plot have double functions. Their winding appearance adds to the desired informal feeling of the premises, and by constructing them with rough stone material they supply

robust walk-ways even during rainfall. Their geographic location is chosen due to the plot's topography.

In the plot design, disabled children are taken into consideration by making paths wide enough for wheel chairs and by avoiding narrow turns and passages.

A parking lot for two cars is prepared outside the fence, next to the main gate.

The remaining part of the land, once all the above have been placed, is steep and not suited for other purposes than cultivation. In these parts the idea is to plant banana trees, beans and different types of fruit, for forage and food.

### 3.5.2 The land allocated to farming

The farm buildings are gathered in an enclosed area of approximately 700 m<sup>2</sup> placed in one corner of the site; see Figure 24. The enclosure is shown in detail in Appendix A-01.1-03 *Farming enclosure*. The placement on the plot is merely a suggestion since the characteristics of the farming site have not been thoroughly evaluated. The keeper accommodation and the adjacent storage room are located in a corner of the enclosed area, about 8 m to the right of the main gate. To the left of the gate the underground storehouse is placed next to a 40 m<sup>2</sup> vegetable garden. An additional vegetable garden of 12 m<sup>2</sup> is located between the keeper accommodation and the henhouse. The distance from the keeper accommodation to the main entrance of the stable is 15 meters. The stables and pastures necessitate approximately 240 m<sup>2</sup> of the enclosed area; the rest of the 700 m<sup>2</sup> is needed for keeper accommodation, storage and yard.

The fence that surrounds the buildings has two entrances; a large main gate, and a smaller door close to the stable. A double back door in the stable also leads out to the fields. The size of the main entrance allows a big vehicle to pass and there is room to park several cars in the farmyard. The dunghill is placed just outside the enclosure at the back of the stable and is accessed via the nearby openings.

All exits should be equipped with lattice doors and padlocks for security reasons.

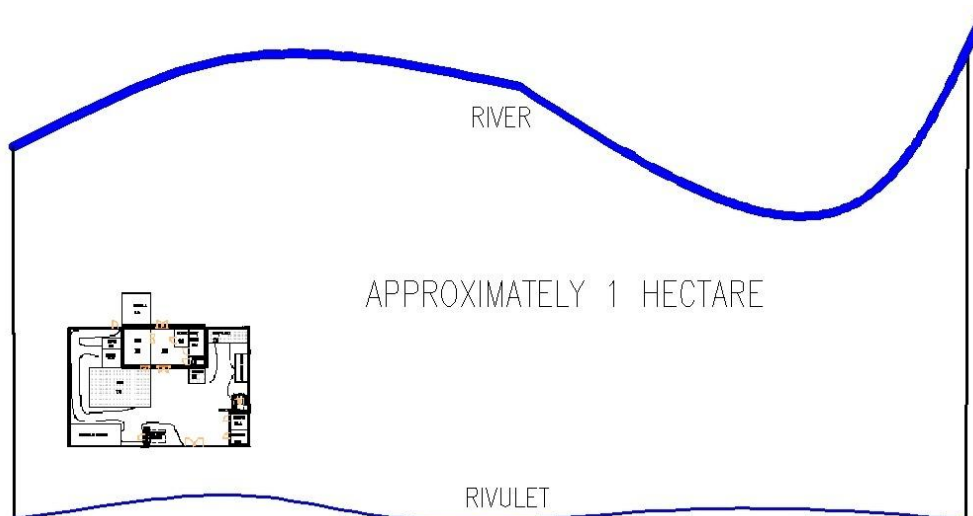


Figure 24 - The plot intended for farming, with planned enclosure

The area outside the enclosure is approximately 10 000 m<sup>2</sup> and is intended for cultivation. The main objective is to keep as much area as possible available for crops. The orphanage will rely on its own produce for food and it is therefore important to maximize the yield. Planned crops are carrot, potatoes, tomatoes, cucumber, avocado, beans, sugar cane, maize, green bananas, and different types of fruits. Some of these crops can be seen in Figure 25 below.



**Figure 25 -Elephant grass, green bananas, avocado tree, sugar canes**

The plot will be surrounded by elephant grass, see Figure 25. This plant is perennial and forms 4-5 meter high tufts. It is well suited to mark the boundary of the plot and can also be used as forage for the animals.

## 3.6 Environmental Programme

The IAA and the manageress of the Kichijo want the new premises to be as environmentally friendly as possible.

This chapter describes the environmental approaches and goals for the relocation. An attempt has been made to evaluate both small and large scale aspects. However, more thorough analyses are required to get a complete picture of the environmental impact. An environmental focus regarding water supply and solid waste management is a specific request from the KCJF. Therefore solutions regarding water and latrine have been given most attention.

### 3.6.1 General Environmental Impact

The environmental impact of the relocation can be said to consist of three parts, each described below. Only after each part has been scrutinized will it be possible to make a well-informed decision about which solutions, materials, and operations should be chosen to minimize the impact. The main priority during this project has been to find the solutions that would benefit the orphanage the most.

One part of the impact is caused by the chosen solutions regarding water, latrine and electricity supply. When it comes to the latrines, there is solid support for the recommended solution being more advantageous than available alternatives (Müllegger, 2008; Raphael, 2011-04-18; WaterAid, 2011; Morgan, 2005). Regarding water supply, the picture is not as clear and a life cycle analysis should be performed before the final decision is taken. More can be read about water supply in chapter 3.6.3 *Water Supply*.



Another part of the impact is caused by the materials used. Globally, a number of sustainable house building techniques have been developed, but locally, very few alternatives are seen. More can be read about materials under the heading *Building materials and techniques* in this chapter.

Last but not least. The operation of any building during its entire lifespan is normally what causes the greatest part of the environmental impact (Ågren, 2010, p. 9). Here is room for improvement. As an example, the orphanage today lacks the routines to use manure and faeces for fertilizing and vegetable remains for forage.

As one can see, it is hard to predict the overall environmental impact of the relocation. More facts and more analysis is needed to make a substantiated statement. Efforts have been made during the planning process to facilitate environmental considerations.

### 3.6.2 Energy Supply and Consumption

The orphanage will be connected to the mains electricity, and the aim for the future is to install solar cells as a complement. Since solar cells are expensive and require competent personnel for their operation, the installation of such should be specifically evaluated.

Electricity being expensive, the energy used for cooking will come from gas and wood. The possibility to use biogas might also be investigated. Gas is to prefer, as 70% of the present deforestation problem in Tanzania is estimated to be due to fuelwood harvest (UNEP, 1997).

Efforts have been made to minimise the use of electricity for lighting by placing windows to let in a satisfying amount of daylight. In the continued planning and construction process, the illumination in a room should also be adjusted to suit the activities the room is intended for. Unnecessarily strong light should be avoided.

When it comes to hot water, no definite solution has been designed in this project. Today there is no water heating system in use at the orphanage, but the manageress wish to install solar panels for that purpose.

When it comes to energy consumption the behaviour of the user is an important factor. By trying to increase the knowledge about energy issues and choose solutions that encourage energy efficient behaviour, the consumption might be lowered. One example is installing electrical sockets with on/off switches, thus increasing the awareness.

### 3.6.3 Water Supply

There is plenty of accessible water in the Machame area where the new premises are planned. As can be seen in Appendix A-01.1-01 *Site plan* and Figure 24; one river and two smaller rivulets cross the sites. The water sources are the Mount Kilimanjaro glacier, snow fields on the upper parts of the mountain and rainfall. In addition to the meltwater the annual precipitation in the area is high due to the mountain's altitude. Figure 3 in chapter 2.1.4 presents a climate chart for Arusha that also is applicable to the Machame region. The chart shows that the annual precipitation is around 1000 mm. This can be compared with the annual precipitation in Sweden which is about 700 mm (SMHI, 2011).

Pipes providing governmental water are connected to the site intended for the orphanage buildings. This water origin from higher up on the Kilimanjaro slopes. It is purified and chlorinated and can be used for drinking and cooking (Raphael, 2011-04-18).

But still, water is scarce in many parts of Tanzania and therefore the National Water Policy encourages implementation of rainwater harvesting systems in adequate areas, i.e. where there is sufficient rainfall. (Ministry of Water and Livestock Development, 2002, p.35) There is also a future uncertainty for the areas around Mount Kilimanjaro since researchers fear that the glacier will be gone in about 20 years due to the global warming (Water for Life, 2011).

With sustainability as guiding value, implementing rainwater harvesting at the Kichijo is recommended and the possibilities to do so should be evaluated.

### 3.6.3.1 Water consumption

According to the Tanzanian National Water Policy the actual use of water in rural areas range from 5 to 30 liters per capita per day. The consumption varies with the scarcity of water, but the consumption used for calculations is 25 l/capita/day. (Ministry of Water and Livestock Development, 2002, p.34). According to the district water engineer that volume is too high to reflect the consumption at the Kichijo (Raphael, 2011-04-18). The manageress of the Kichijo estimates that the consumption is approximately 15 l/capita/day (Lema, 2011-05-09). This can be compared to the Swedish consumption of 180 l/capita/day. (Sydvatten, 2010). The calculation below is made with the assumption of 50 persons staying at the Kichijo, each using 15 liters of water per day.

*Annual water consumption:*

$$15 \text{ l/person/day} \cdot 50 \text{ people} \cdot 365 \text{ days} = 273\,350 \text{ l}$$

The water use of the new Kichijo is planned as shown in Table 5 below.

**Table 5 - Water use and planned supply at the new Kichijo**

Water use	Water supply <sup>1</sup>
Drinking and cooking at the orphanage site	Governmental water
Sanitary facilities in the main building	Governmental water
Washing	Rainwater harvesting
Sanitary facilities at the dormitory buildings	Rainwater harvesting
Drinking water for the animals	Rainwater harvesting / Water from the river
Sanitary facilities at the farm site	Rainwater harvesting
Drinking and cooking at the farm site	Governmental water <sup>2</sup>

<sup>1</sup> Due to topography and distance between plots, it is not possible to take water from the river for purposes at the orphanage premises, see also 3.1.1.

<sup>2</sup> To avoid the cost associated with connecting water pipes to the farm site, drinking and cooking water will be tapped at the orphanage and stored in a tank.

### 3.6.3.2 Governmental Water

As mentioned above there is governmental water connected to the orphanage site. In the left picture in Figure 27 the location of the connection is marked with a blue W in front of the main building. The right picture shows the connection. The pipes must be extended to three different places in the main building; one in the kitchen, one to the staff and sick bay bathrooms and one for the visitors section. The water system is constructed to have a pressure of 5 meters of water

column whereby no pump is needed to pressurize the water (Raphael, 2011-04-18). The waste water will be led to a soakage pit, read more in chapter 3.6.4 *Solid Waste Management*.



Figure 26 – Water connection

### 3.6.3.3 Rainwater harvesting

Rainwater harvesting means that rainwater is collected and stored to be used e.g. for washing, cooking and even drinking. Water can be collected both from roofs and from the ground. To keep the solution as simple as possible without using complex purification techniques, and since there is already governmental water at the site, rainwater will not be used for drinking and cooking at the Kichijo. The suggested solution is only roof catchment since land surface catchment often means lower water quality. (GDRC, 2011)

In the following text a brief description of the rainwater harvesting system is given.

The rainwater harvesting system consist of three parts; the catchment area, the conveyance system and the collection device.

The catchment area will be the roofs of the main building, the dormitories and the keeper building. The rain that falls on the roofs will be collected in gutters along the edges of the roof and led to down-pipes. It is important that the roof is clean and consists of a non-toxic material. Corrugated galvanized iron sheets that will be used at the Kichijo are acceptable. There must not be any trees close to the buildings and the roofs, the gutters and the down-pipes shall be cleaned regularly.

As for the conveyance system there are different solutions, but often some kind of pipe is attached to the down-pipe leading the water from the catchment area to the storage tanks.

Cylindrical ferrocement tanks are commonly used for storage of the collected water. The tanks can be placed both above and below ground. It is important that the tank is protected from any kind of environmental contamination and it can preferably be fenced. To prevent breeding of mosquitoes and algal growth the tank should have tightly fitted lids at all openings.

The whole system shall have several grates and strainers to prevent debris from getting into the tank. (GDRC, 2011)

In the text below some approximate calculations for the rainwater harvesting at the Kichijo are made. They will give a hint of how much water it is possible to collect during one year.

*Catchment area:*

Main building 220 m<sup>2</sup>, girls' dormitories 60 m<sup>2</sup>, boys' dormitories 85 m<sup>2</sup>, keeper and storage 20 m<sup>2</sup> gives a total area of 385 m<sup>2</sup>.

*Annual precipitation:*

Approximately 1000 mm = 1000 l/m<sup>2</sup>

Not all the precipitation can be collected as some will evaporate and some might not end up in the gutter. A run-off coefficient of 0.75 reduces the volume. (Knowledge for rural development, 2011).

*Total catchable volume per year:*

$1000 \text{ l/m}^2 \cdot 385 \text{ m}^2 \cdot 0.75 = 288\,750 \text{ l}$

Since the total consumption is calculated to be 273 350 l/year the rainwater harvesting hypothetically could provide all water that is needed. It is a rough calculation but since governmental water will be used for drinking and cooking it is reasonable to believe that the rainwater harvesting can cover the rest of the consumption. The water for the animals will probably be taken from the river but there will be a possibility to use rainwater for them as well.

The determinant of a rainwater harvesting system is the storage volume. Calculations based on statistics have showed that a total volume of 150 m<sup>3</sup> would be sufficient to collect all rainfall (Center for Rainwater Harvesting, 2006). The largeness is due to the uneven precipitation. As governmental water will be used for cooking and drinking, the actual need is lower and the volume can thus be decreased. Using additional governmental water during the dry period might also be considered, making it possible to reduce volumes even more. The actual specifics of the implementation need further evaluation.

Several installations must be done for the use of the harvested water. At the main building the laundry area must be provided with water. At the dormitories the tanks will be connected to the sanitary facilities. By placing a tank on the roof and use a hand driven pump to fill it from the main tank, pressure can be created in the taps. The same system is appropriate at the farm.

The rainwater harvesting system requires careful and regular maintenance and it is important that the system is kept clean. As with the UDD solution for the latrines, this approach requires that the users are trained and feel motivated. Rightly used, the system will be an advantage both for the orphanage's economy and its environmental impact.

### **3.6.4 Solid Waste Management**

Two different toilet solutions are implemented on the premises. One is the urine diverting dehydration toilets that will be installed by the dormitories and at the farm site. The other solution is a soakage pit for infiltration.

#### **3.6.4.1 Urine Diverting Dehydration Latrines**

Urine Diverting Dehydration Latrines are also known as UDD toilets, and will be referred to as such in this text. A UDD toilet diverts the urine to a storage vessel, for later use as plant fertilizer.



The excreta are either left to dry or transferred to a compost heap for mouldering. In both cases, it is intended for soil improvement after a certain amount of time has passed (Mülleger, 2008; Morgan, 2005).

Using human excreta for cultivation is an advantage both environmentally and economically. Economically, using excreta means that less fertiliser need to be bought and that the cost of emptying pits is reduced. From an environmental point of view, collecting and treating excreta reduces the risk of ground water contamination.

One obstacle might be culturally based resistance against solutions that involve handling human excreta. This problem is probable to diminish as proper training is given. Also, the last few years various ecological sanitation solutions have appeared on the market, and the awareness of the advantages with this type of latrine is growing (Mollel; Raphael, 2011-04-18).

### ***The design of a UDD toilet***

The toilet inset in a UDD toilet is what makes its' function possible. The inset has two sections, one that is open to the chamber intended for faeces, and one in the shape of a bowl that collects and leads away urine. The inset is mounted in a concrete slab that is located on top of a two-piece brick or concrete chamber. This design makes it possible to use both paper and water for anal cleansing without disturbing the system, a specific request from the manageress of Kichijo. One chamber is intended for faeces and the other for the urine vessel. Anal cleansing paper goes into the faeces chamber, and cleansing water into the urine bowl. The dormitory toilets have been planned to allow 1.3 m<sup>3</sup> for faeces and urine. This volume is divided into 0.7 m<sup>3</sup> for the urine vessel, and 0.6m<sup>3</sup> for faeces.

The volume has been divided up using the following calculation:

An adult normally pees 1.5-2 litres/day (Sjukvårdsrådgivningen, 2011). The assumption is made that 1.5 litres/person and day is on the safe side since most of the users are children. At most, 20 people will be using one latrine which gives a total of 30 litres per day. With the same volume of additional fluid from cleansing, a vessel of 0.6 m<sup>3</sup> is estimated to take 10 days to fill. Since both numbers are on the safe side, the vessel will probably have to be emptied only twice a month.

The chambers have sealable openings on the side for emptying. The urine vessel will also be equipped with a tap to pour out urine into smaller storage vessels. On top of the concrete slab a superstructure is erected.

### ***Aspects of using the latrines***

It is important that no fluid is poured into the faeces chamber. After each dropping, a decilitre of a mixture of ash and soil should be added the excreta in the faeces chamber. More about this mixture is described under *Odour control* below.

The most maintenance demanding aspect of a UDD toilet is removing and replacing the urine vessels. To minimize the work that has to be put into the system, the vessel containing urine is dimensioned to be emptied once every 10<sup>th</sup> day. The urine should then be stored for one month before it can be used as a fertilizer on forage, and for six months before it can be used on crops intended for human food.

One toilet can be used until the faeces chamber is full. It is then closed off and the contents are left to process for six months. After that time, the faeces can either be sifted and used for soil improvement, or added to the dung hill for further mouldering (Mülleger, 2008). Not having to

deal with the excreta until it has been reduced both in volume and odour is one way of easing the users' acceptance of the solution.

Should the faeces chamber become full before the adjacent toilet can be utilized again, i.e. before 6 months have passed, it is possible to compost the material separately. A shallow pit with a simple lid works very well. The compost should be located at the farm, as that is where the resulting humus will be used and because there is a shortage of space close to the orphanage buildings. The compost should be watered regularly and is ready to use after six months.

Before this type of toilet is taken into operation, the users should be trained. It is vital that all users understand the benefits and approve of the utilities. Especially important is the adults' acceptance, as they act as role models for the children. Written documentation with illustrate drawings should be supplied, and preferably posted in each toilet.

### ***Odour and fly control***

The chamber intended for faeces needs to be ventilated, both to reduce odour and to remove moisture. Good ventilation is facilitated by constructing a ventilation pipe that goes from the chamber straight up through the roof, thus using natural differences in air pressure to propel the ventilation. It is important that the side opening in the storage chamber is as air tight as possible, to make sure the ventilation works as intended. The top and bottom end of the ventilation pipe must be covered with insect net to ensure its' continued function.

The mixture of ash and soil that is to be added after each dropping will help reduce odour and make the deposits unattractive for flies. It should have the ratio of 1:3. Should the faeces be processed in the dung hill or the compost, the added mixture will also help speed up the mouldering process.

### ***How to use the excreta***

Once the processes described under the heading *Latrine operation* have been completed, the faeces can be used for soil improvement just as the manure from the dunghill. The urine should be diluted with water, ratio 1:5, and can then be used to water the growing crops.

There are numerous examples of successful use of treated excreta in Müllegger (2008) and WaterAid (see *References*).

## **3.6.4.2 Soakage pit solution**

The soakage pit should, as is mentioned in the *Building Process* (chapter 4.1), be chosen from a list of approved solutions. Since there are standard solutions to this type of sewage management, it is only given a very brief description.

The soakage pit is not intended to be emptied regularly, but rather is a way to ensure natural infiltration and sedimentation before the sewage reaches the surrounding underground.

Figure 27 shows a schematic soakage pit.

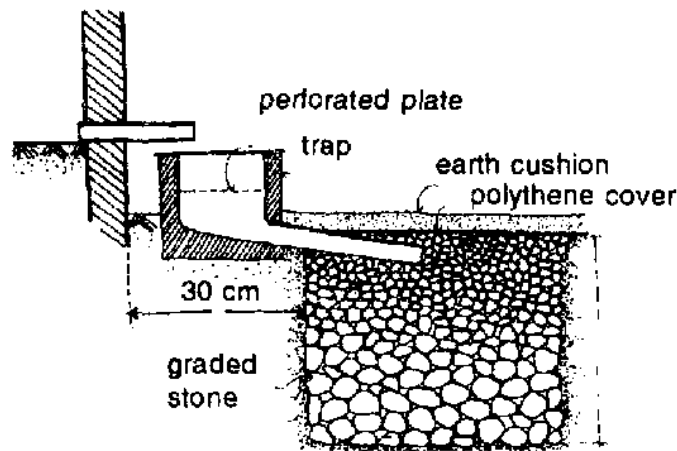


Figure 27 - A schematic soakage pit (collections.infocollections.org)

After several years, the pit will fill up, causing the contents to flow over. Normal procedure when this happens is to open the pit, dig it out and refill it with graded stone, re-do the piping and continue the use (Mollel, 2011-04-11). More information about soakage pits can be obtained at the building office in Boma Ng'ombe.

By installing soakage pit-serviced facilities in the main building miss-use of the UDD toilets by untrained users, i.e. visitors and toddlers, is avoided. Additional advantages are that the sick bay can be equipped with a bathroom, and that work environment regulations are fulfilled by a staff bathroom close to the staff rooms (Mollel, 2011-04-11).

### 3.6.5 Waste Water

The grey water from the wash basins, the showers and the laundry area will be led into the ground for infiltration and natural purification. The waste water from the kitchen will be led to the soakage pit, as will the sewage from the three toilets and showers in the main building.

### 3.6.6 Building materials and techniques

Preferably, the buildings should be constructed using sustainable materials and techniques that result in a building with a long lifespan. In the current geographic area, it is common to use locally produced material, e.g. bricks for the framework, which is an advantage since transports are minimized. If possible, the materials should be re-usable if the house is demolished or rebuilt. The design of the house is kept simple and straight forward to avoid unnecessary use of material.

More specific; the roof must not emit any toxins, especially since it will be used for rainwater harvesting. Also, wooden material should be avoided if possible, due to the deforestation problem in Tanzania (Wanted in Africa, 2010). When wood is needed the use of soft wood (fast growing) should be encouraged.

Eco-labelled materials should be used to enhance the environmental profile and impact of the orphanage. However, it might be difficult to obtain such materials without resorting to imports from the west. This fact should be weighed against the aim of using local entrepreneurs and materials. Should the option of import be considered, the environmental impact of the transports should also be evaluated.

### 3.6.7 Indoor Environment

The aim is to obtain pleasant and functional areas in the house. Furniture, texture and colours should be chosen carefully. Satisfying ventilation and mosquito nets should be available to improve the indoor environment. The windows should be constructed so that they can be used to regulate the room climate regarding light, temperature and ventilation. The described construction materials result in a semi-heavy building. Such a building will store thermal energy, releasing coolness from the night during the hot hours of the day and vice versa during the night. Thus the framework aids in supplying a more balanced indoor climate. (Energilotsen, 2009)

### 3.6.8 Outdoor Environment

The plots will undergo major changes due to the new premises. The aim is to avoid excavations and other modifications of the surroundings. As much vegetation as possible should be left untouched. Except that the vegetation is visually appealing and supplies food and forage, it also prevents erosion. In areas of the plots where it is advisable, large trees should be planted. Such considerations are in line with the goal to stop deforestation, albeit in a small way.

As part of the construction process, the need for trenches around the premises should be evaluated.

## 4 Process Descriptions

The texts below are intended as information to I Aid Africa. Since the organization's intention is to finance and carry through a building and real estate project to relocate Kichijo, overviews of relevant processes are valuable, and have been specifically demanded.

### 4.1 The Building Process

This section is based on interviews with the officers Mollel and Mwarabu at the Building Office in Boma Ng'ombe on the 11<sup>th</sup> of April, 2011. It gives an overview over aspects that need to be considered when constructing new buildings in Tanzania in general and, for some subjects, the Kilimanjaro area in particular.

#### ***Geotechnical investigations***

If the area is not geotechnically well known, a so called soil investigation has to be performed. A soil investigation is the same as a geotechnical ditto. If a soil investigation is needed in this area of Tanzania, it can be performed by a department at Arusha Technical College. But, the underground is considered well known in the Kilimanjaro Region, and soil investigations are therefore normally not required for single-storey buildings.

#### ***Structural solutions***

The structural drawings have to be professional, and they have to be approved by the Building Office before starting construction. The required level of detail depends on the complexity of the planned building. Regarding sewage, there are standard solutions. Depending on the number of people that will be using the facilities, size and type is chosen from an approved list.

### **Costs**

Architectural- and structural drawings are delivered to the Quantity Surveyor for cost estimates. The Building Department staff includes Quantity Surveyors, but the service they supply can also be bought from private companies. The price of a cost estimate from a private company, based on structural drawings, is related to the estimate itself. It generally amounts to 1-2% of the expected total. Another advantage of planning for a single-storey building is that it should be possible to make the cost estimate from merely architectural drawings. Because of the nature of this particular project, the interviewed officers at the building office have promised to supply this service free of charge.

### **Building permit**

To acquire a building permit, an application containing 3 copies of the following must be handed in to the Building Office

- Block plan
- Site plan
- Floor plan including references to sections and elevations
- Structural section(s)
- Elevations of all faces
- Ground plan
- Roof plan
- Structural drawings
- Sewage description

When the required documents have been handed in to the Building Office, two forms are added.

The first form contains information about:

- The owners' name and address
- Plot identification number
- Block
- Area of use

The second form is the actual building permit. This document also stipulates what conditions must be met during the building process. The conditions are:

- Two days before construction commences, a written notification has to be delivered to the District Engineer at the Building Office.
- Construction must be initiated no more than 6 months after receiving the building permit.
- After finishing construction, the premises must be approved by the authorities before they are utilized.

When the two forms have been added and properly filled out the bundle is sent to the Land Office. The Land Office controls the ownership of the land and evaluates the suitability of the buildings and the intended operation. When the Land Office has finished with the documents, they are forwarded to the Town Planning Office for processing. Finally the bundle is sent back to the Building Office, where a Building Engineer reviews the application and finally approves or rejects it.

### ***During Construction***

During the construction process, the building site must be available to inspection. Officers from the Building Office perform such inspections randomly. If structural solutions are changed during the process, this has to be reported to and approved by the Building Office before the changes are implemented.

## **4.2 To Acquire and Own Real Estate**

This chapter is based on the same interviews as the preceding section about the building process, i.e. with Mr. Loishiye Mollel and Mr. Dennis Mwarabu (2011-04-11).

1 acre is 4047 m<sup>2</sup> and for residence it is normal to divide that area up into 6 or 7 plots. If one acre is divided into six plots, the price for one of them should be approximately 3 million TZS in economically developed areas like Boma Ng'ombe. The prices should be considerably lower in Machame as that area is not considered as developed.

When the seller and the buyer of a plot have agreed on a price, they make an appointment with the village leadership of the village where the plot is located. The Swahili name for this leadership is Serikali ya kijiji. The Serikali keeps documentation about land ownership and verifies that there are no conflicts at hand regarding the ownership. If the papers are in order, the transaction can take place. The seller and buyer are responsible for the contents of the contract, but the Ward Executive Office (Mtendaji wa kata) at the Serikali ya kijiji has the competence to aid them. The Mtendaji wa kata also has the governmental authority to witness the transaction, and it is recommended to use his services. No lawyer is needed if the Mtendaji wa kata is present.

The Serikali ya kijiji charges up to 10% of the purchase-price for its services. The buyer and the seller decide between themselves who supplies these fees, but it is common practice for the buyer to pay the additional costs.

The Certificate of Occupancy, also known as the Title Deed, is issued once the plot has been surveyed. In rural areas, it is not common to have plots surveyed and the lack of a title deed is not a hinder for the transaction. However, it is recommended to procure a title deed as that is the strongest evidence of real estate ownership. A title deed is also required for any other use of the land than private residence. The building permit for buildings with other purposes than private residence, i.e. orphanage activities, will not be issued unless there is a title deed. As part of the title deed proceedings, a deed plan is produced.

The present owner of the real estate initiates the survey. The cost varies with the size of the plot, the topography and the distance to a fixed point. The standard cost for surveying a plot of 2000-6000 m<sup>2</sup> is 1.5-2 million TZS for the survey, and roughly 1 million TZS for additional costs. The cost can be estimated beforehand by officers from the land department, who can visit the land for a fee.

If there is a title deed issued over the plot, the deed is transferred to the new owner by the Serikali ya Kijiji at the time of the purchase.

Once a title deed has been drawn up, the village government claim a yearly fee. For agricultural plots, that fee is 600 TZS/2000 m<sup>2</sup>, and for establishments and operations it is 5000 TZS/plot. A deed plan is included in the title deed.

## 5 Conclusion

### 5.1 How to Continue the Relocation

This report presents the first step towards a relocation of the Kichijo. To reach the goal several further steps need to be taken. The suggested project progress is described in the following text.

Since this text is primarily intended for the board of I Aid Africa and their knowledge of building engineering is unknown, construction specific terminology has been avoided.

As with everything else in this report, the focus in the text below is on the orphanage buildings. Regarding the buildings at the farm ground (stables/keeper accommodation etc.); the same procedure is applicable once architectural drawings have been generated. Required drawings would be elevations, floor plans, sections and site plan.

The first consecutive step from where this paper leaves off is the plot transfer from the relatives of Lucy Lema to the KCJF, to buy the plot intended for the farm, and hopefully to buy the adjacent plot (grey shaded in Appendix A-01.1-01). The circumstances are further described in chapter 3.1.1. Once the plot-issues have been settled, the consecutive step is to order a survey and obtain a title deed for both areas, see chapter 4.2.

The adjacent plot that is planned to hold the main building (see Chapter 3.3.1) had not been acquired by the KCJF at the end of May 2011. The owners had in fact not made their final decision about selling or keeping the land. If they decide not to sell, it will be impossible to continue the project with the solutions presented in this report. With the conditions mentioned in chapter 3.1 taken into account, it is not realistic to plan approved premises for 60 children on the available land. The only way would be by erecting two-storey buildings, with all the drawbacks that are mentioned in chapter 3.1.1, as well as more complicated structural drawings, dearer foundation design, and loss of the general impression. A two-storey solution is strongly dissuaded. Another possible solution would be to reduce the capacity of the orphanage to approximately 20 children. With such a change, the present drawings can be remade and adjusted to the plot, still fulfilling all demands.

With or without the adjacent land, the next step would be to use the present or remade architectural drawings to get a rough cost estimate for the building project. As described in chapter 4.1 under the heading *Costs*; the quantity surveyor can use the architectural drawings for the estimate for a project with this low level of complexity. This means that the IAA does not have to order and pay structural drawings before getting an idea of the project total.

The following course of action, should it be decided that a continuation is possible, would be to obtain structural drawings. Structural drawings and technical descriptions can be ordered from a building engineer attached to a local contractor. It might also be possible to engage one of the engineers at the building office in Boma Ng'ombe; they occasionally take on private assignments. As part of this process, details regarding the installations of water and electricity should be considered, as well as interior finishing and furniture.

When the deed plan has been produced (see chapter 4.2) it is possible to finalize the placing of the buildings, both on the land intended for the orphanage and on the farm plot. Once the buildings' definite locations are determined, ground reviews are required to identify where there is need of stabilizing walls and reinforcements.

The next step is to obtain the building permit. For required documents and application procedure, see chapter 4.1 under the heading *Building permit*. From here on, a contractor should be hired to help with both the process and the construction. Before choosing a company, several contractors should be asked to give a price. The contractor's ability to communicate in English should be evaluated. Good communication between the funding organization (IAA) and the hired company's representative is vital. It would be a good idea to have someone skilled in construction representing I Aid Africa at the site during all phases of the construction. This person should also be able to draw up time schedules and economic calculations and to follow-up on these.

Good relations with the officers at the Building Office and Water District Office have been established during the work with the project presented in this paper. Efforts should be made to maintain these relations, as help from the officers is valuable for the progress of the relocation.

## 5.2 Ideas for Further Student Assignments

Most of the remaining work regarding the relocation of the Kichijo should be performed by local operators under supervision of IAA personnel. Domestic rather than international companies will have the necessary knowledge of local building tradition, available materials and governing regulations.

On the other hand, a number of minor undertakings remain; tasks that could suitably be executed by students. Student projects are a way to keep costs low for IAA. Projects that are carried out at site also have the benefit of the students acting as IAA representatives for the period of their stay.

Student assignments might be:

- Structural drawings of buildings – possibly aided by a local engineer.
- The need of slope reinforcements and suitable solutions – resulting in structural drawings.
- Water solutions – cost comparison of governmental supply versus rainwater harvesting, and detailed descriptions.
- Choice of materials – environmental impact, costs, supply, maintenance need and functionality should be considered.
- Operating costs – including maintenance, electricity, water supply, gas and firewood etc.

## 5.3 Discussion

Although this last chapter concludes both the report and the project it describes, the superior project of relocating Kichijo is far from completed. Much work remains to fulfil the manageress' dream of her own children's home. During the process, plenty of reasoning has been conducted, and there is much thought behind every suggested solution.

Some choices that have been made during the project can be discussed in further detail than we consider it reasonable to do in the respective chapters. Additional explanations and arguments regarding certain subjects are therefore given here. A discussion is also carried through regarding the impact that cultural differences have had on the process.

From early on in this project, it was obvious that the plot intended for the new orphanage buildings was not optimal. But it was not until the plot had been roughly measured and a site plan had been generated, that the extent of the difficulties became known. It proved impossible to carry the project through with the given prerequisites. The solution, of course approved by both



IAA and KCJF, became to plan for acquiring additional land. A convenient adjoining plot was mentioned as available. Unfortunately, later in the process, it became known that the particular plot was probably not going to be sold, at least not shortly. This information was received on the 16<sup>th</sup> of May, the same day this paper was due, and has therefore not been incorporated in the report. The piece of news leaves the project in a troublesome situation. Without acquiring the adjacent plot, the suggested disposition is not possible. Other plots might become available over time, but irrespective of where, it means the disposition has to be remade. However; the purpose of this project has been wider than the disposition of a single plot and most parts of the result is still highly serviceable for any continuation of the Kichijo relocation.

Throughout the process, efforts have been made to adjust the design to Tanzanian ways. The premises will be used here, maintained here, and thus should be planned according to the ways here. Sometimes, this has felt natural and obvious and at other times difficult to accept because of the great difference to the way we have been taught. This has especially been the case regarding safety measures and environmental considerations. One example is entrance doors. In Sweden, entrance doors open outwards to allow escape from fire. Here, they always open inwards. The construction is favoured as it allows easy installation of lattice doors that act as protection against burglary.

Regarding the decision to dimension the dormitories for the present number of children and their present ages; it might have been possible to predict the composition of the children's group in one year or so. However, in two years seven children will have turned 18 and left the orphanage. As new children are to be admitted by the social welfare based on the present need of support, there is no way of telling neither their gender, nor their age.

One of the solutions that might be questioned is the rainwater harvesting system. The relocated orphanage will have access to governmental water, and in this particular region, water is not a limited resource. To this fact should be added the cost of implementing the system and the challenges regarding maintenance posed by a less common solution. Some of these objections are met in the Environmental Programme (3.6). In addition, the IAA, the KCJF as well as the officers at the District Water Office strongly favour the idea. According to the IAA, the environmental profile might also enhance the possibilities of receiving SIDA-funding for the completion of the construction project.

As to the co-operation with local authorities, it has worked out better than could ever have been expected. Competent and helpful officers have supplied valuable information and offered their aid in the future process.

Regarding time; time is given slightly less importance here than in the western countries. An appointment for a specific hour might just as well be an hour later, or so. This mentality also affects the attitude towards problem solving; if something cannot be dealt with today, there is always time another day. With humbleness to the fact that we have been visitors in Tanzania and with constant alternative courses of action, these differences have not posed a problem during the project.

Finally. The work has been a stimulating balance act between demands from several parties and the limitations formed by the plots. We are satisfied with the result and hope to be able to return to the Kichijo in the future. Maybe to stay in the visitors' quarters we have ourselves designed.

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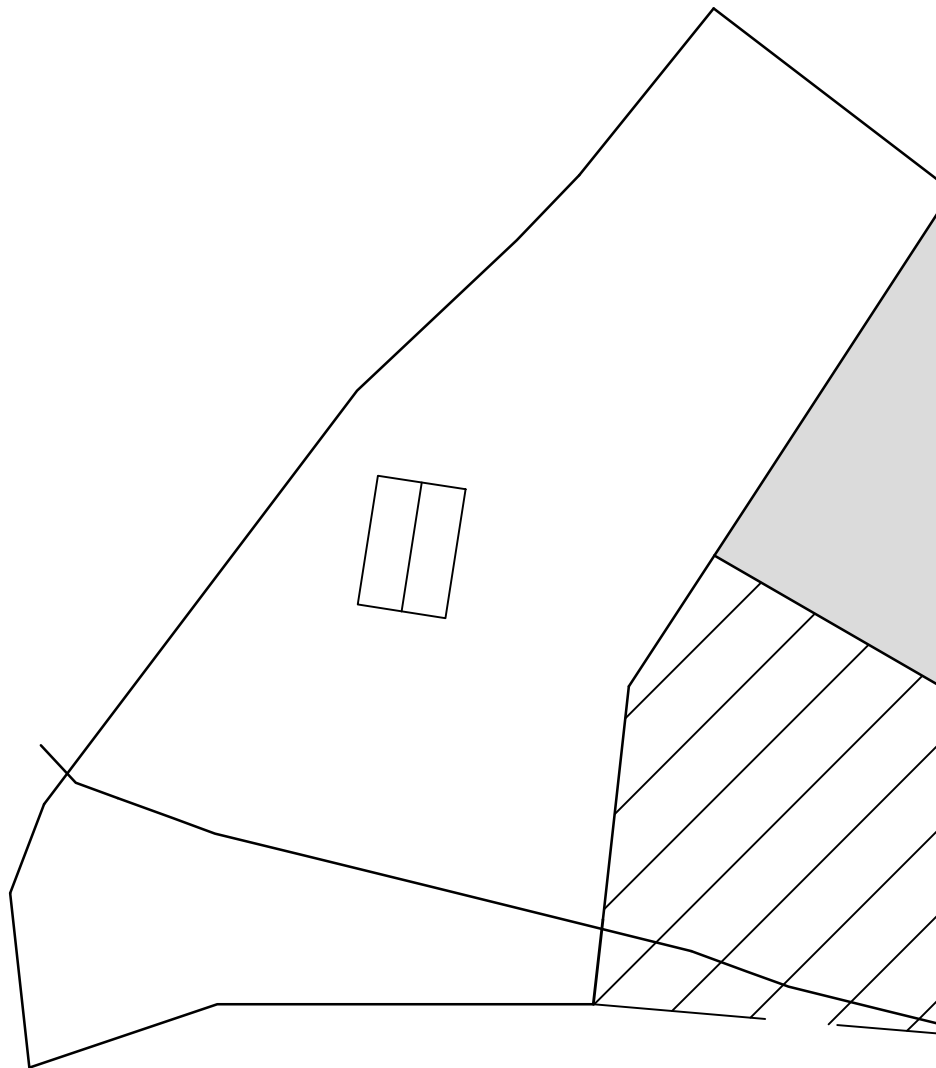
# List of Appendices

Appendix A-01.1-01 Site plan I  
Appendix A-01.1-02 Site plan II  
Appendix A-01.1-03 Farming Enclosure

Appendix A-40.1-01 Floor Plan Main Building  
Appendix A-40.1-02 Floor Plan Girls' Dormitories and Sanitation  
Appendix A-40.1-03 Floor Plan Boys' Dormitories and Sanitation  
Appendix A-40.1-04 Floor Plan Tailoring/Extra Dormitory

Appendix A-40.3-01 Elevations Main Building  
Appendix A-40.3-02 Elevations Girls' Dormitories and Sanitation  
Appendix A-40.3-03 Elevations Boys' Dormitories and Sanitation  
Appendix A-40.3-04 Elevations Tailoring/Extra Dormitory

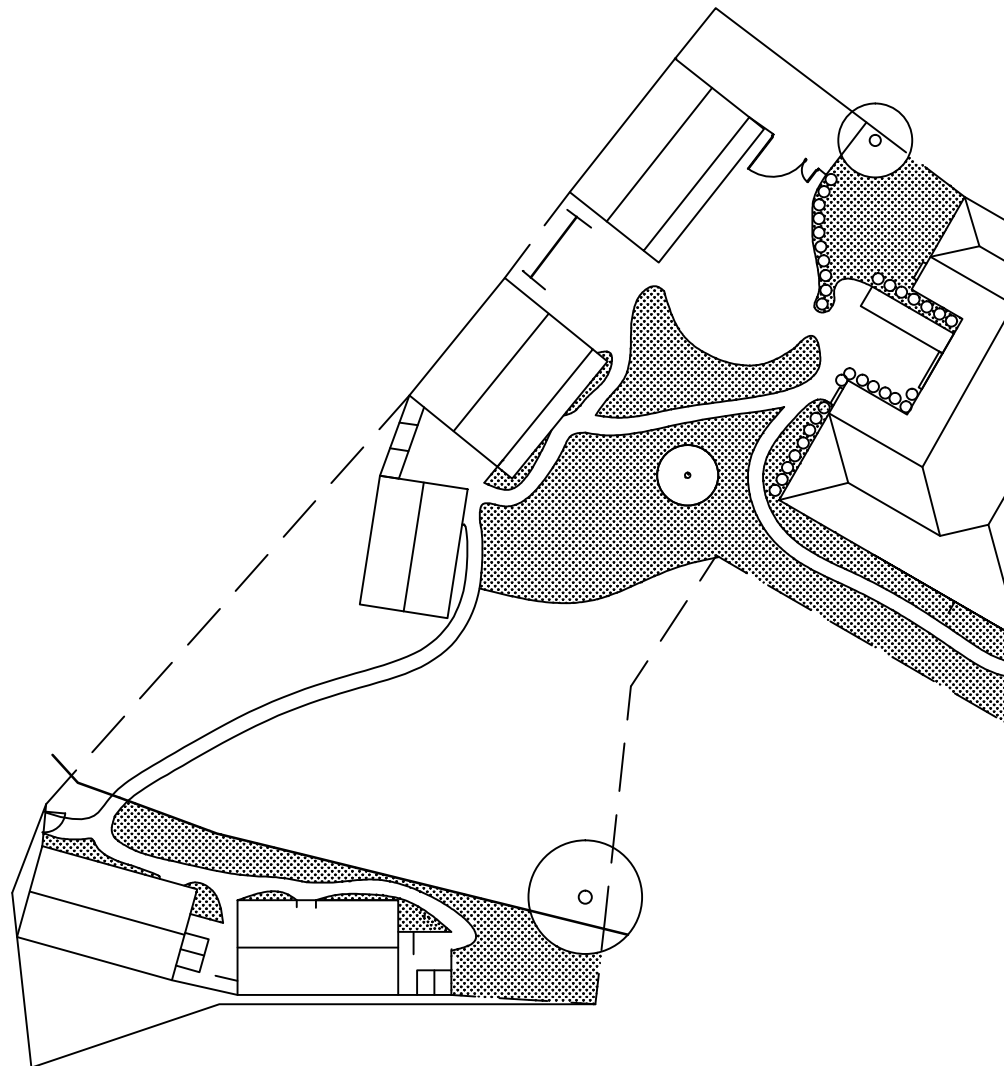
Appendix A-49.0-01 3D model Main Building  
Appendix A-49.0-02 3D model Girls' Dormitories and Sanitation  
Appendix A-49.0-03 3D model Boys' Dormitories and Sanitation  
Appendix A-49.0-04 3D Model Tailoring/Extra Dormitory



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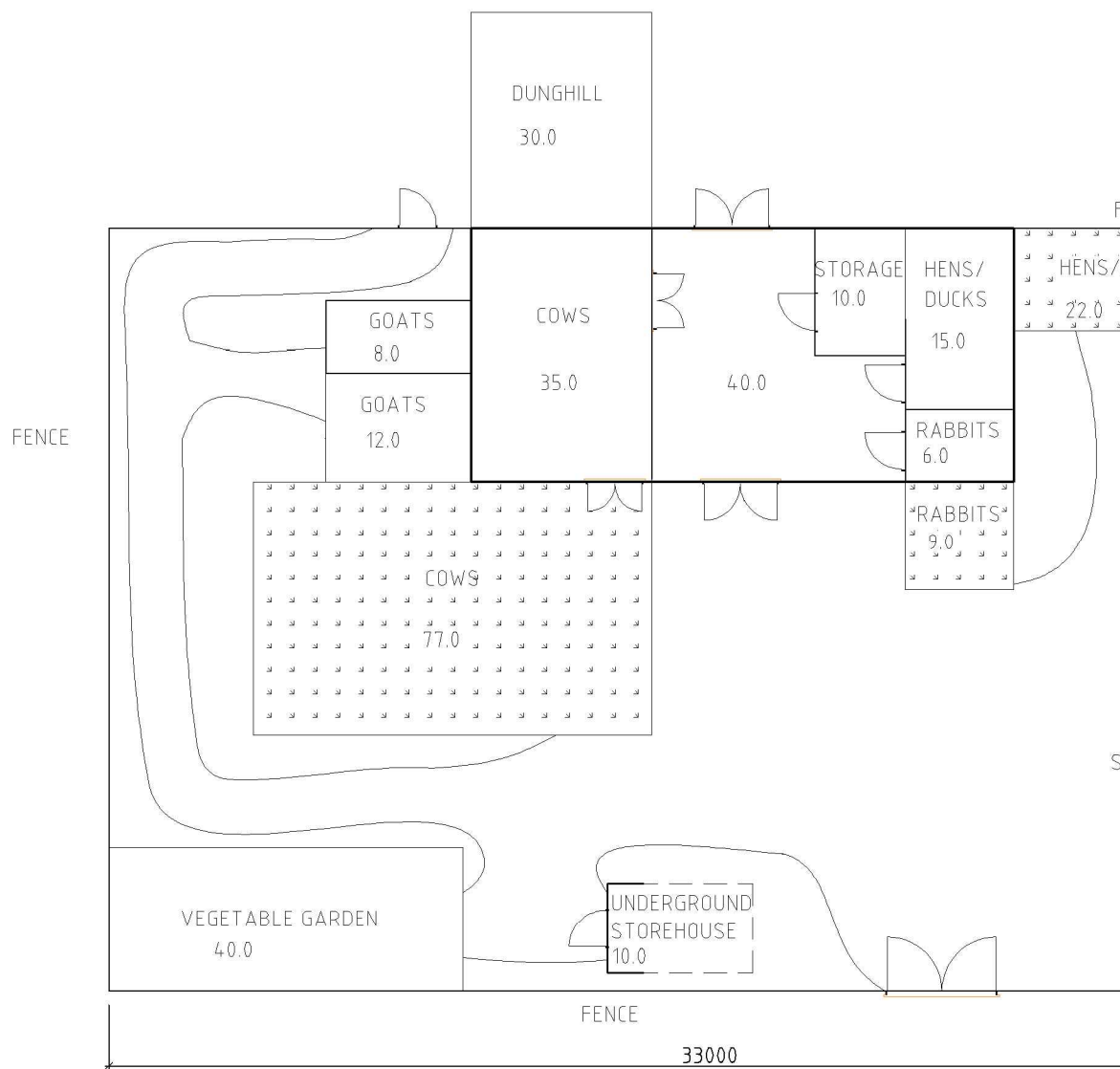
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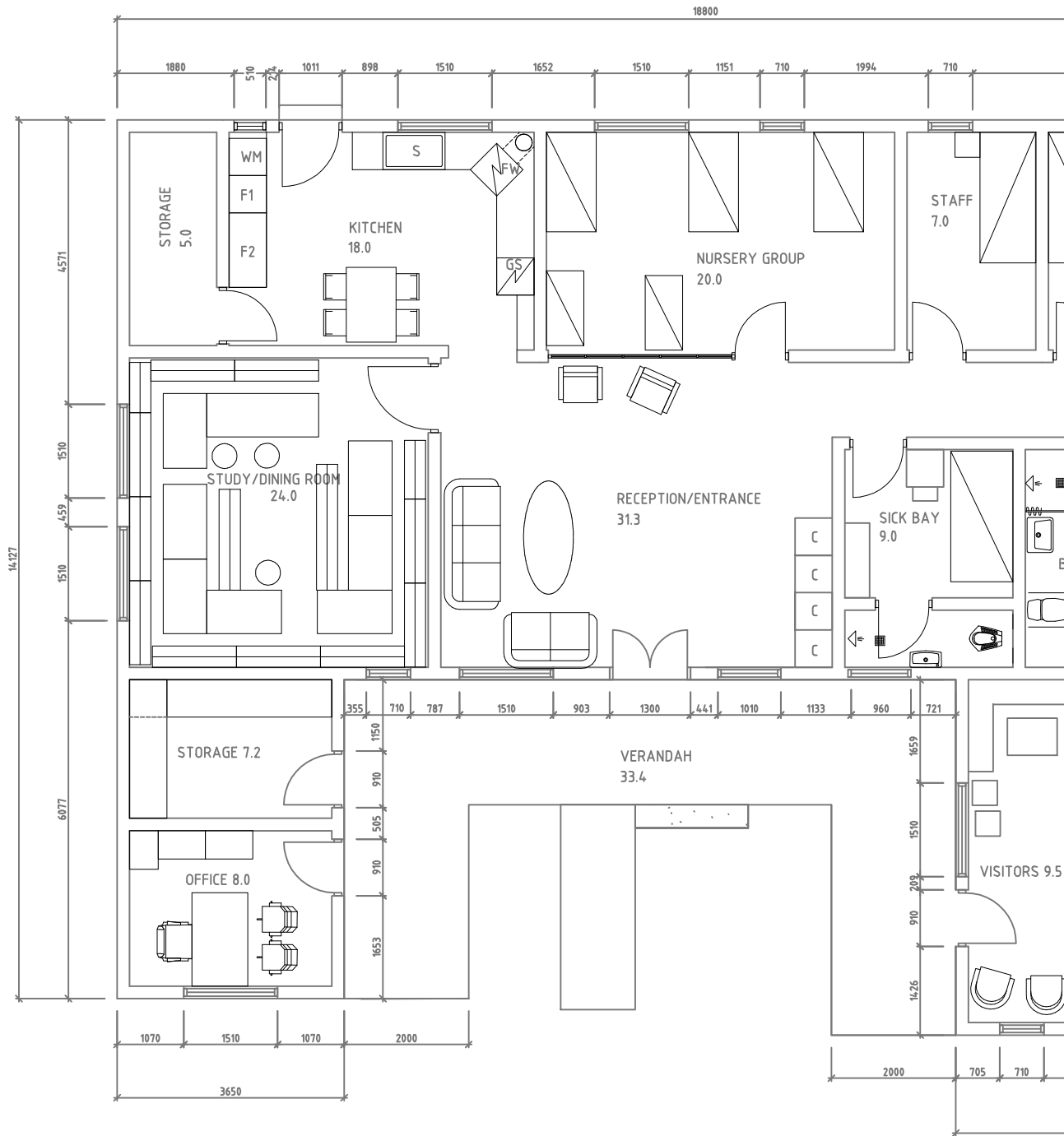




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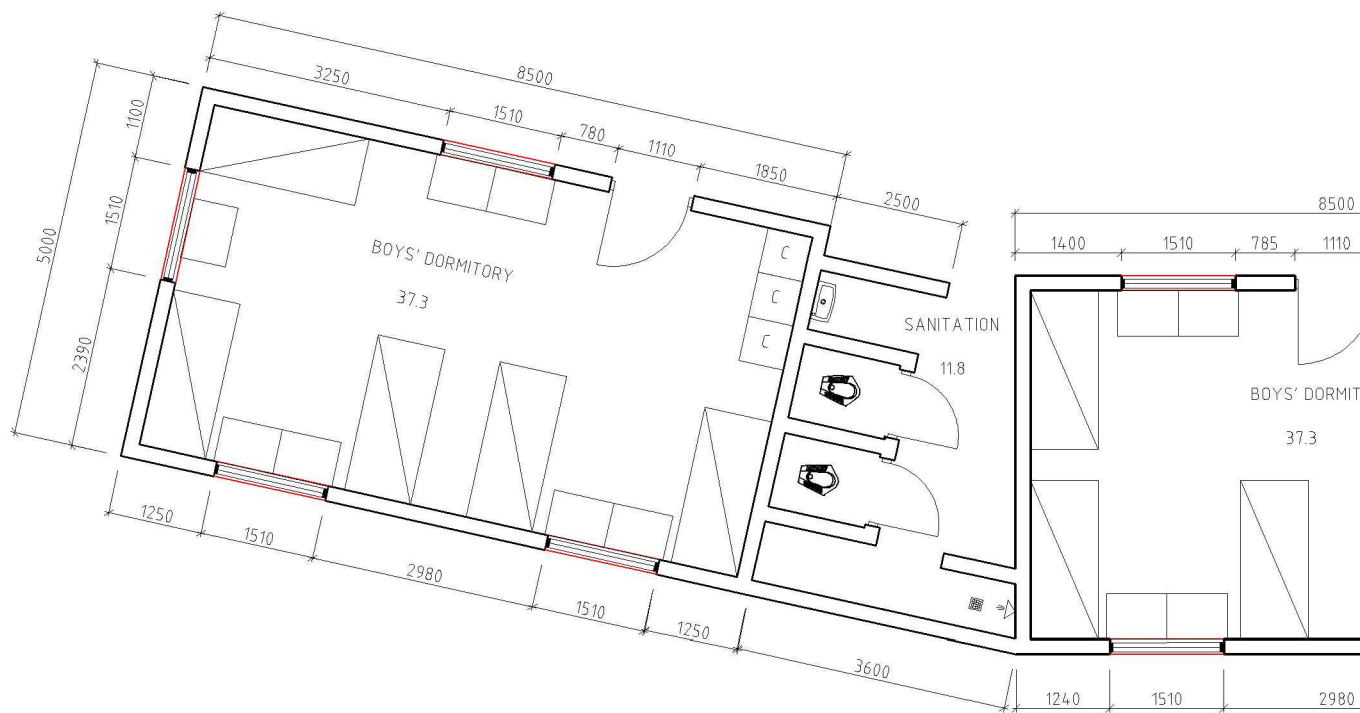
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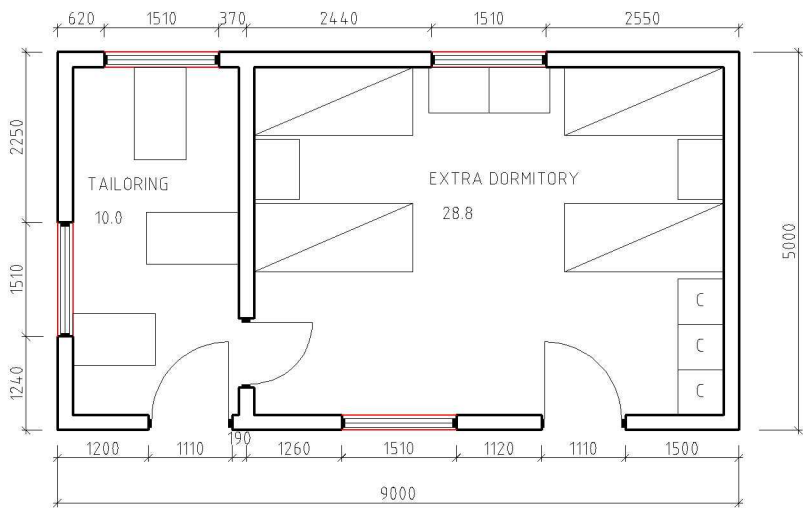


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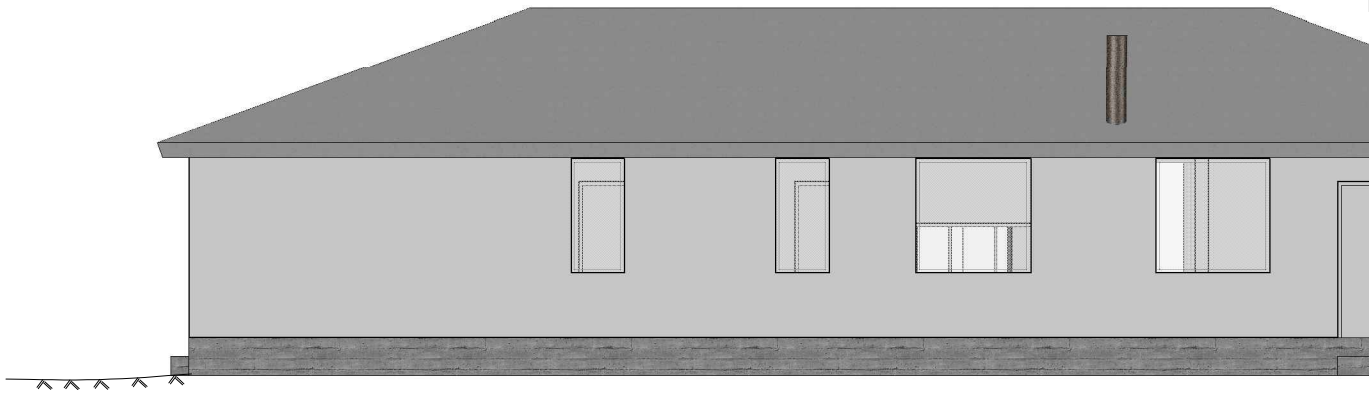


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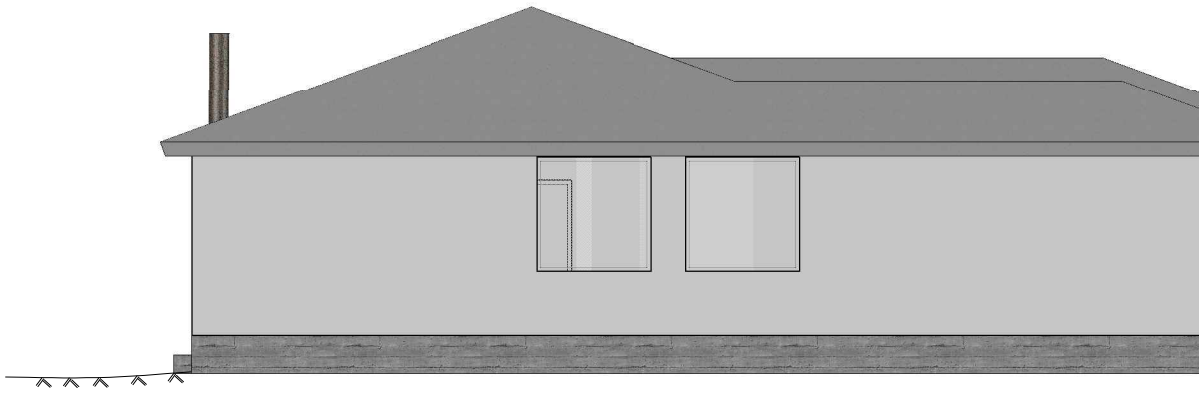


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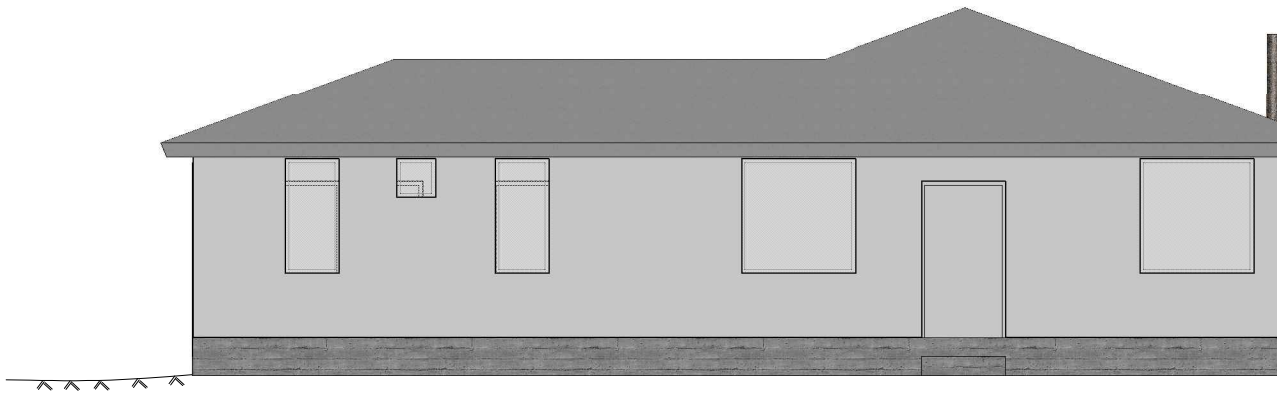
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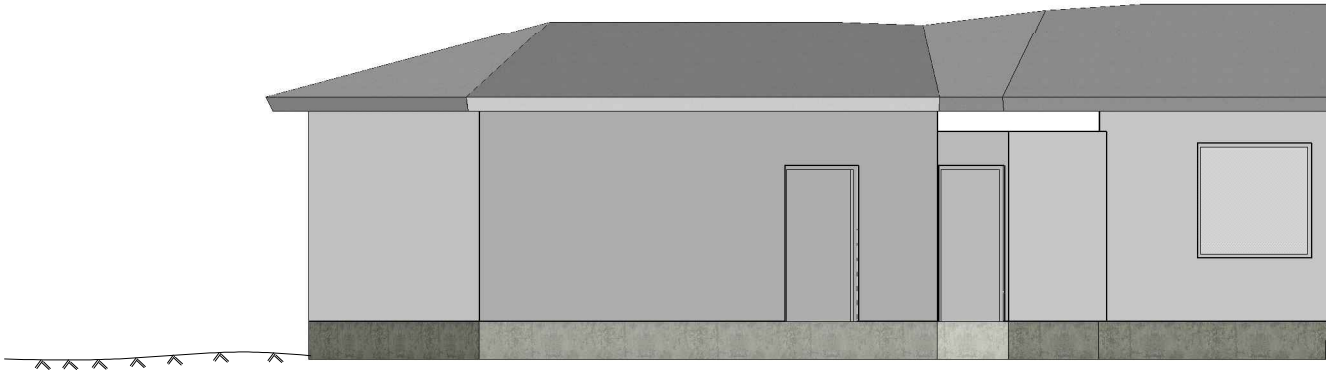
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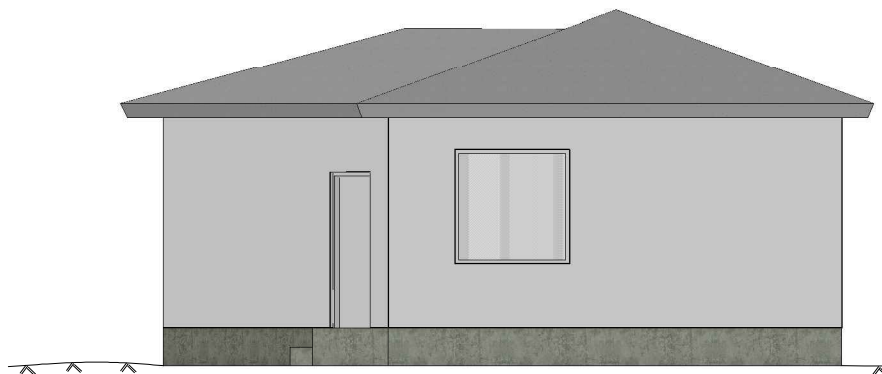
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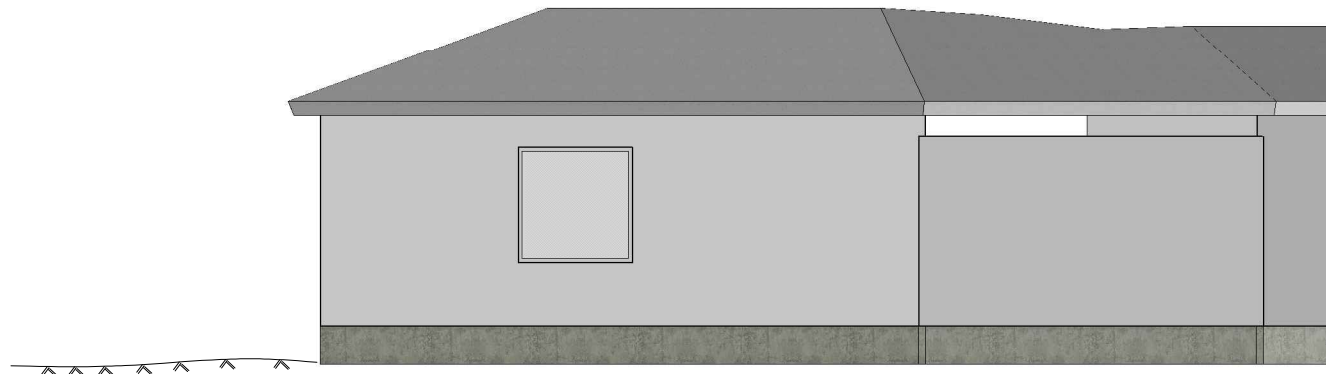
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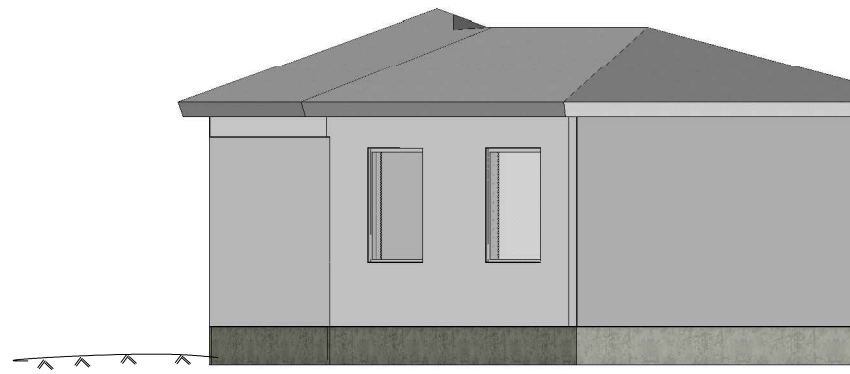
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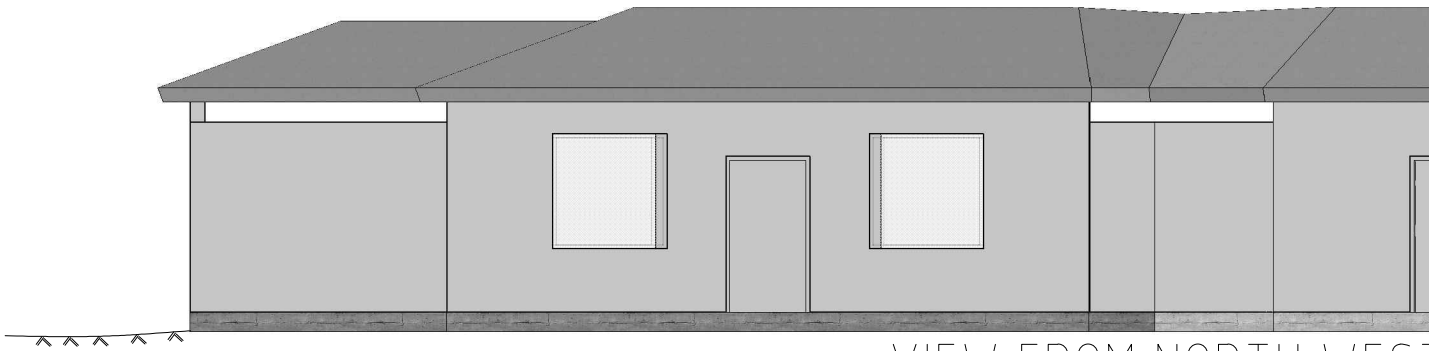


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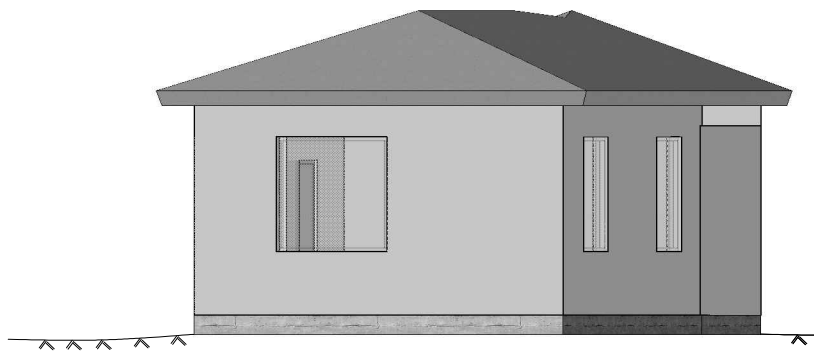
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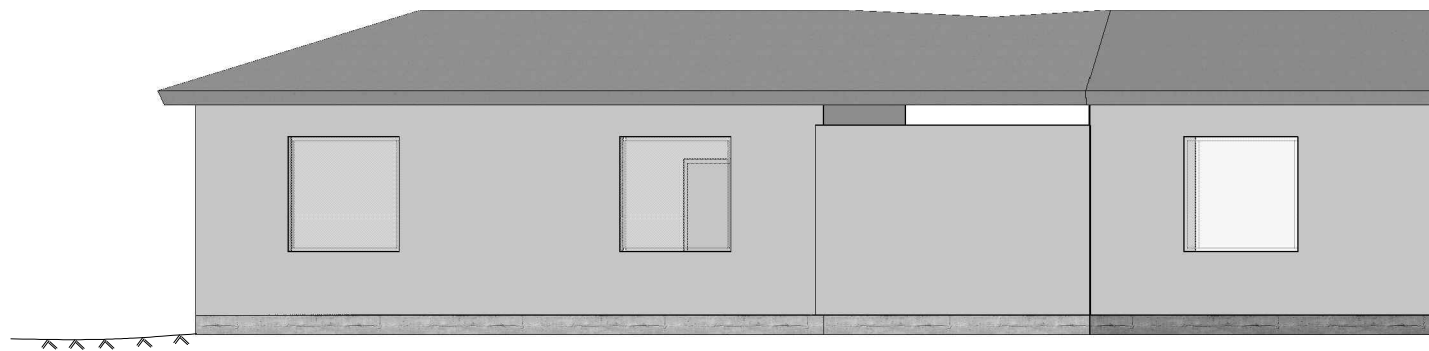




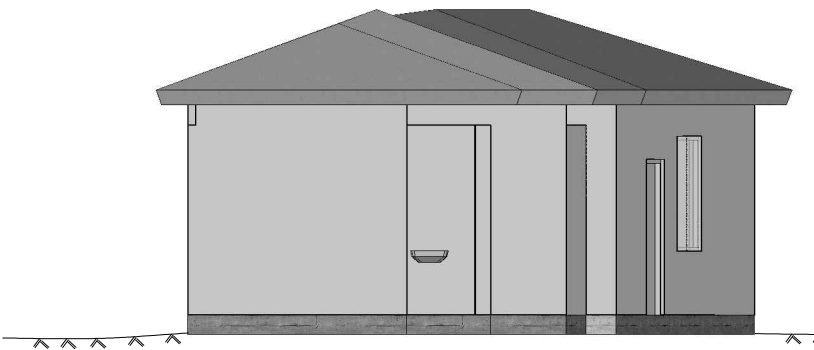
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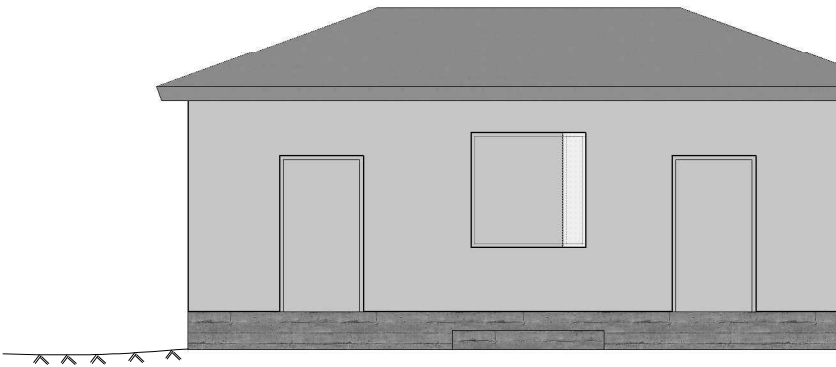


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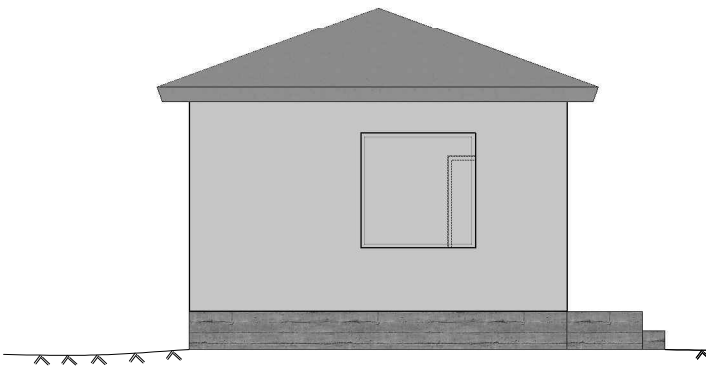
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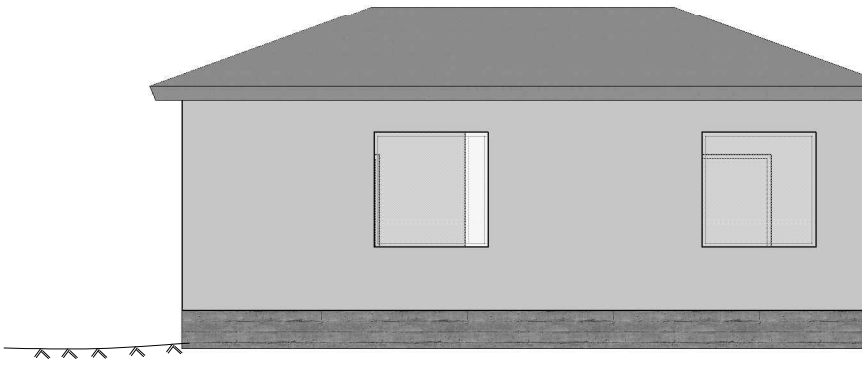
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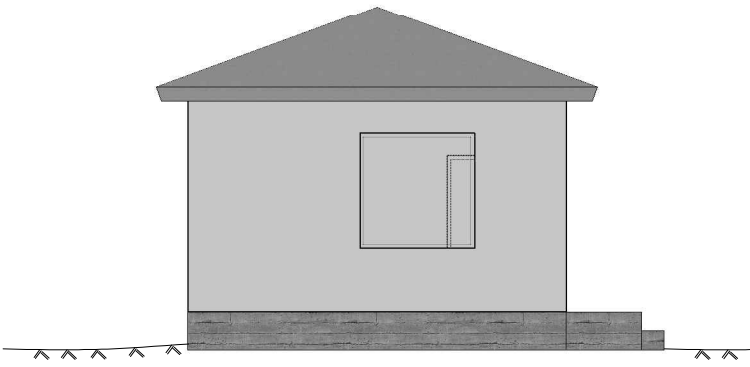
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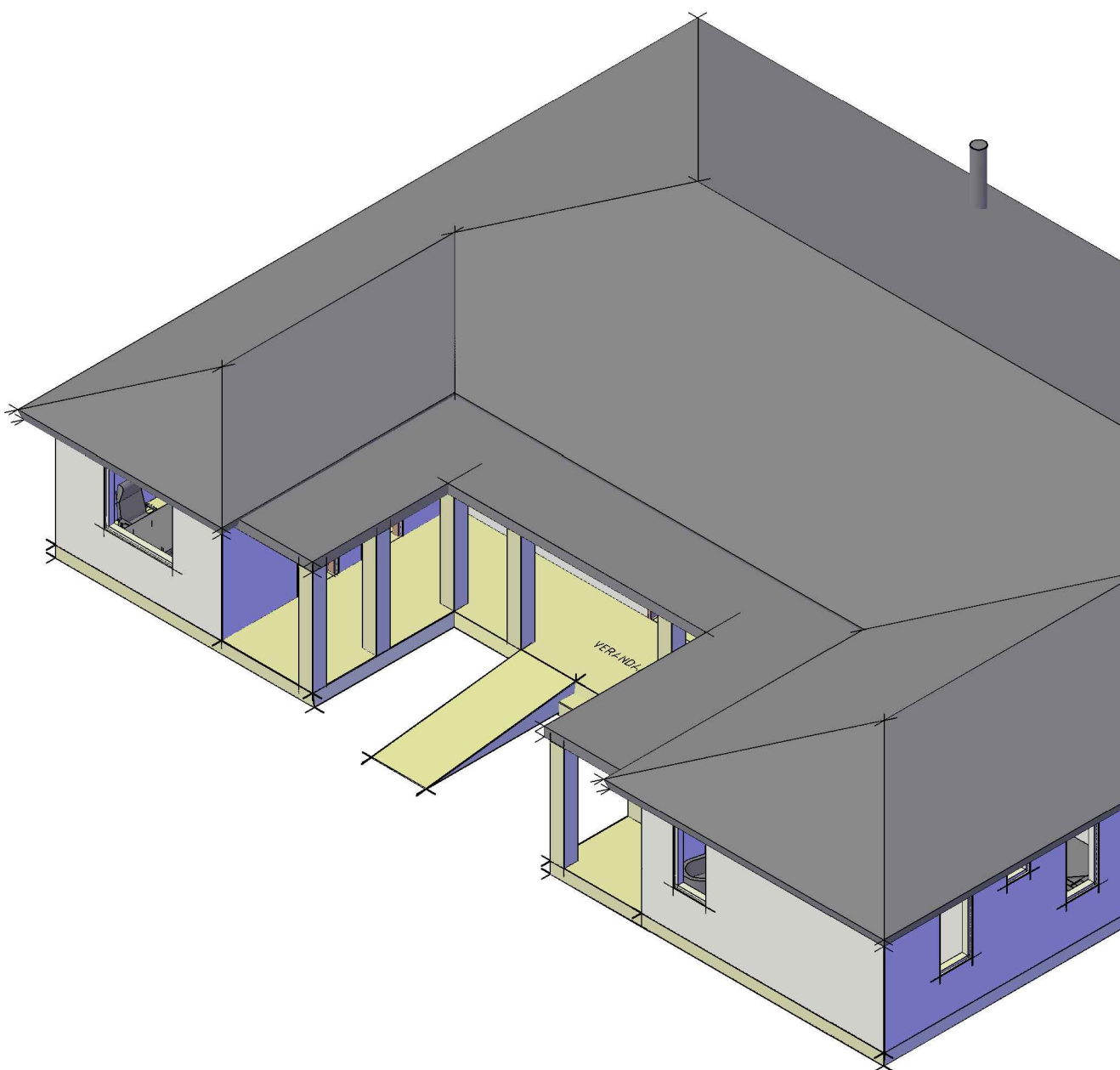
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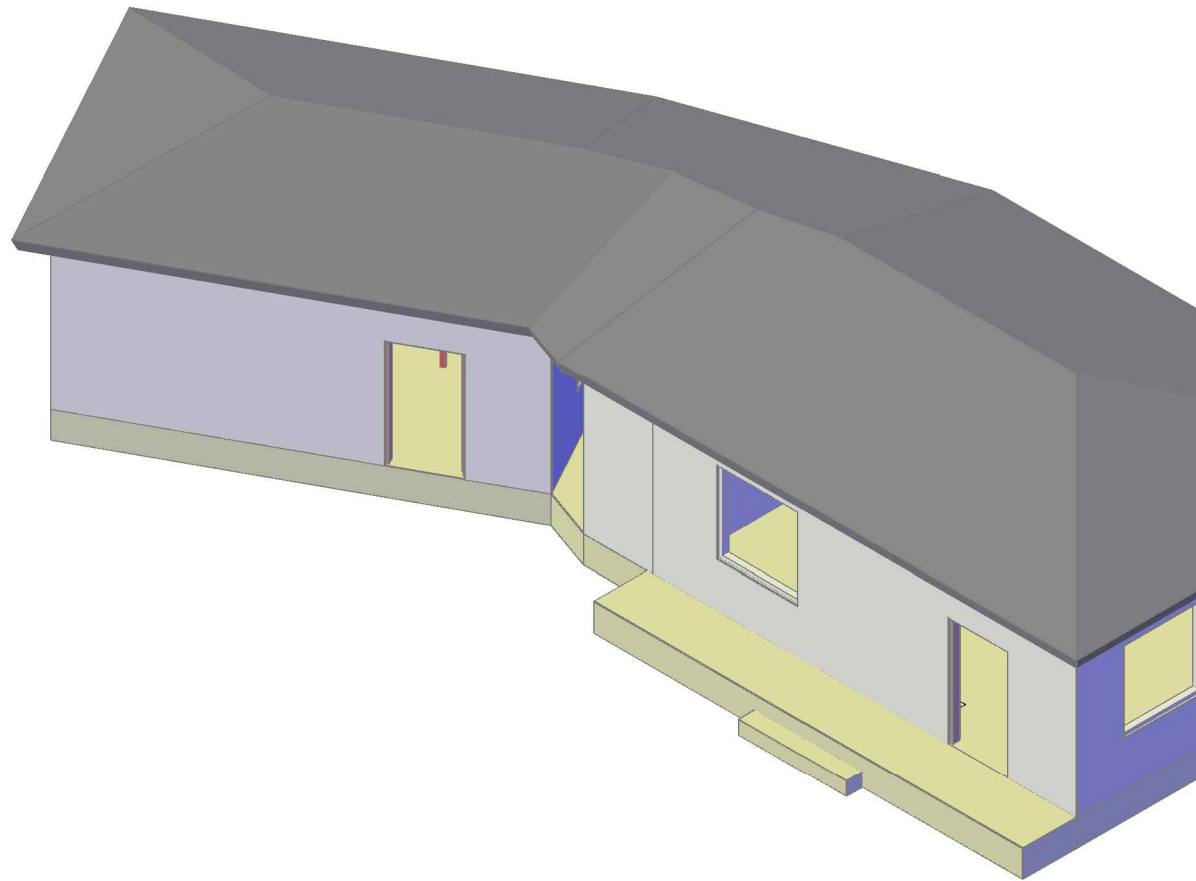


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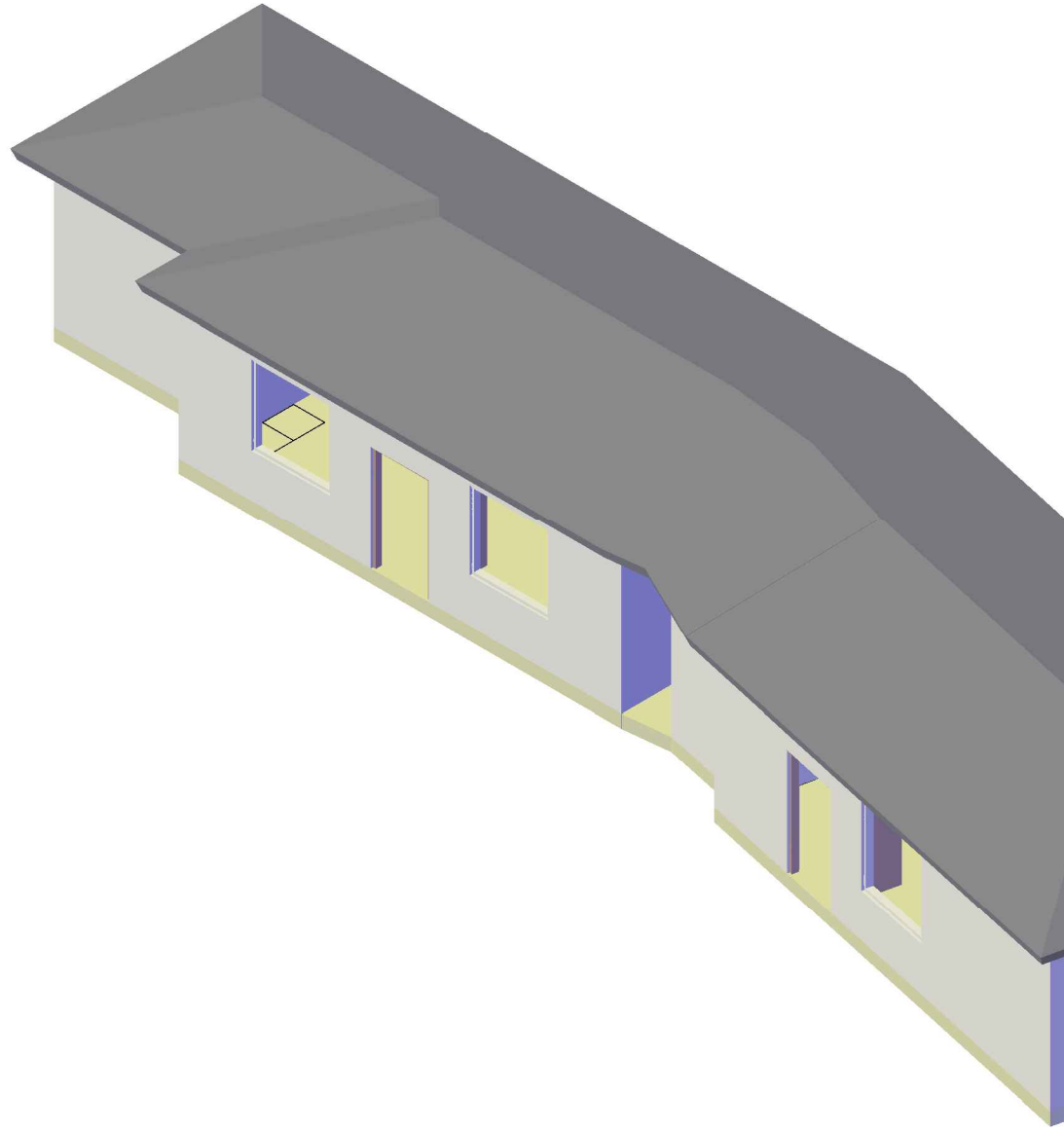




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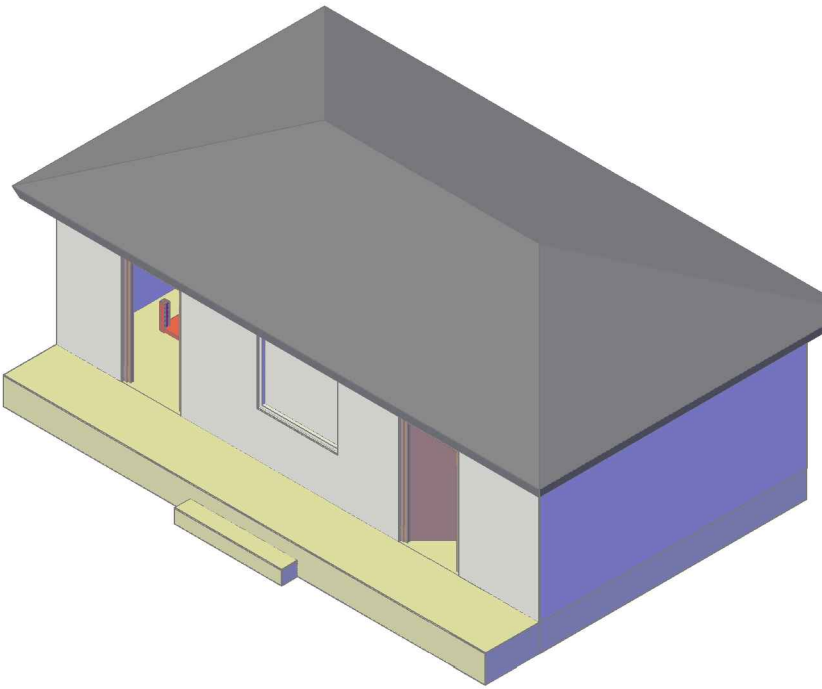
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