Ministry of Education, Science and Technology
The Republic of Malawi

PREPARATORY SURVEY REPORT

ON

THE PROJECT FOR RE-CONSTRUCTION AND EXPANSION OF SELECTED COMMUNITY DAY SECONDARY SCHOOLS (CDSSs)

IN

THE REPUBLIC OF MALAWI

SEPTEMBER 2010

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MATSUDA CONSULTANTS INTERNATIONAL CO., LTD

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey on the project for re-construction and expansion of selected community day secondary schools (CDSSs) in the Republic of Malawi, and organized a survey team headed by Taizo Shishido of Matsuda Consultants International Co., Ltd between September, 2009 and September, 2010.

The survey team held a series of discussions with the officials concerned of the Government of Malawi, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Malawi for their close cooperation extended to the survey team.

September, 2010

Nobuko Kayashima
Director General,
Human Development Department
Japan International Cooperation Agency

SUMMARY

1 Overview of the Country

The Republic of Malawi (hereinafter referred to as "Malawi") that gained independence from the United Kingdom in 1964 is a landlocked nation elongated from north to south in southeast Africa. The nation covers an area of 118,000 square kilometers (30% of Japan). The Lake Malawi occupies more than 15 percent of the national land and the total water area including lakes and rivers accounts for about 20 percent of the land. The country has a population of 14.28 million with an increase rate of 2.5 percent (according to the World Bank in 2008). It is one of most densely-populated Sub-Saharan African countries. Malawi is mostly situated in the tropical savanna climate zone with a rainy season from December to April, a cool season from May to August, and a dry season from September to November. The annual precipitation varies from place to place between 800 millimeters in the lowland area in the south and more than 2,000 millimeters.

Malawi is traditionally an agrarian country, with about 80 percent of labor force engaged in farming and its related industries. Tobacco, tea, sugar and other farm products account for 80 percent of exports. Because foreign currency income and expenditure heavily depends on their international market prices, its economy is on a fragile footing. Stable food security is an economic challenge of the country. Its economy has been good recently as a result of the successful governmental subsidy program for fertilizers. Its economic growth rate in 2008 was 9.7 percent, with the total GNI of 4,100 million USD and per capita GNI of 290 USD, being one of the poorest Sub-Saharan African countries. The annual inflation rate in 2008 was 8.7 percent below 10 percent as it was in the previous year. The primary, secondary and tertiary industries account for 35.5 percent, 19.9 percent, and 44.6 percent of its GDP, respectively, (2009 estimate).

2 Background, History and Outline of the Requested Japanese Assistance

The Government of the Republic of Malawi regards education as a critical sector in its national development strategies, "Vision 2020" and "Malawi Growth Development Strategy 2006-2011" and takes the improvement of access to and quality of education as a priority issue in its "Policy and Investment Framework". It places the improvement and expansion of basic education[1] for achieving the Millennium Development Goals as a priority issue in its "National Education Sector Plan 2008-2017", while it also places increase in enrollment in secondary education, ensuring fairness, improvement of educational infrastructure, and promotion of its efficient use as priority issues. The government has established such specific numerical targets. They include: ① increase in enrollment in secondary education (30% increase by 2012 an 90% increase by 2017[2]), ② increase in classrooms at public secondary schools (3,754 to 6,348), ③ improvement of

[1] Primary education, pre-school education, non-formal education

[2] Comparison with figures in 2007

enrollment rate of female students (male-female ratio: 1 to 1), ④ decrease in the number of students per teacher at community day secondary schools (CDSSs) (1:104 to 1:60), and ⑤ improvement of passing rate of the certificate examination to prove completion of secondary education (38.6% to 65%).

The introduction of a free primary education system (FPE) in 1994 by the Government of Malawi resulted in a sharp increase in enrollment in primary and secondary education. The government has coped with the shortage of facilities caused by the enrollment increase in secondary education by upgrading adult education facilities built by communities to CDSSs. However, still, there is not sufficient facility to accommodate the increase in enrollment. For the last five years from 2003 to 2008, the number of public secondary school increased only by 23 percent (from 623 to 769) and the number of classrooms increased only by 17 percent (4,400 to 5,136) in comparison to the enrollment increase of 78 percent (131,000 to 233,000). The shortage of secondary school infrastructure is a serious problem across the nation. CDSSs that account for 80 percent of public secondary schools are not fully equipped with facilities essential for secondary schools, which include regular classrooms as well as science laboratories and libraries. Although the demand for advancement to secondary schools is on a rise every year, the shortage of facilities prevents the continuance of education. In 2007, for example, 66,000 students advanced to secondary schools in fiscal year 2008 although 166,000 students completed primary education in the previous fiscal year (education continuance rate[3]: 40%). Against the backdrop, the Government of Malawi formulated a secondary school improvement plan for the improvement of CDSSs and requested the Government of Japan for grant aid for implementing the plan.

3 Outline of the Survey Results and Contents of the Project

Japan conducted a preparatory study (outline design and field surveys I and II) from September to December 2009 and confirmed the relevance of upgrading of secondary school facilities based on the grounds that there is not sufficient secondary school facilities to cope with the growing enrollment demand in secondary education. Although the Government of Malawi originally requested the upgrading of CDSSs at 21 locations across the country, we agreed to implement the project at the six locations in the central and western and southern parts of the country as shown in the table below and give priority to rural schools with many students who cannot commute to school in response to Malawi's request and select schools in accordance with the priority order when the plan needs to be scaled down due to restrictions of the project.

[3] (Number of students in year one in secondary school − number of repeaters in the year in 2008) ÷ number of students in year 8 in primary school in 2007

Table Six Project Sites

Priority Order	School Name	Education Division	Priority Order	School Name	Education Division
1	Chikhwaza CDSS	Shire Highlands	4	Namalomba CDSS	Southeast
2	Dziwe CDSS	Southwest	5	Nanjiriri CDSS	Southwest
3	Mseche CDSS	Central and west	6	Nankumba CDSS	Southwest

We then conducted analysis based on the survey results and prepared an outline design, project cost estimate and project plan before discussions and confirmation through local briefing of the outline design (field survey III) from April 25 to May 7, 2010. About two months later, from July 4 to 16, we conducted interim study (field survey IV-1) for producing reference materials for bidding document to be prepared by local consultants by contract. From August 31 to September 10, we conducted briefing on the reference materials for bidding document (field survey IV-2). We compiled a preparatory study report on the project for re-construction and expansion of community day secondary schools based on the discussions.

The Project is implemented with the fund of grant aid scheme for community empowerment. Efforts are made for cost reduction and better efficiency in comparison to regular grant aid projects by construction based on local standard specifications and design and active use of local companies and materials and machinery and equipment and improving competitiveness. The outline of the Project compiled upon the discussions is as follows.

1) Project components

The Project components are standard facilities and equipments installed in and utilized by conventional secondary schools (CSSs) in Malawi and top priority is given to those. Facility/equipment plans should be prepared in which the facilities/equipments do not cause excessive burden and their management and maintenance is sustainable.

- Top priory is given to facilities (classrooms, administration blocks, laboratories, libraries and sanitation facility) and equipments (school furniture and laboratory materials) that are of minimum requirements for operation and curriculum implementation of secondary education.
- Top priority is also given to girls' hostels (dormitories, halls and kitchens) for female students who have no other choice but to commute a long distance because they live far from the nearest school in rural areas.
- Second top priority is given to staff houses and lot splitting is studied in accordance with site priority level in order to make adjustment to changes of project budget.
- Although the component plan will be made in accordance with secondary school facility plans of other donors (World Bank (WB) and African Development Bank (AfDB)), it should be improved in consideration of sustainable operation and maintenance.
    - Equipments (school furniture and laboratory materials) will be selected in consideration of past projects by other donors, current curriculum and syllabus, and

operation and management cost.

2) Construction plan/furniture plan and laboratory teaching materials plan

Although the facility is planned basically in accordance with the secondary school facility plans of other donors (World Bank: WB and African Development Bank: AfDB), efforts for improvement are made for sustainable management and maintenance.

The table below shows the target schools, Project components, and facility scale. Because it is a grand aid project for community empowerment, the final decision of the scope is made in the project implementation stage.

Table Facility Components and Area (m^2) by Site

Priority Order	Site Name	Structure/Major Exterior Finish	Facility Components	Area(㎡)	Total Area
1	Chikhwaza	One-storied house built of concrete blocks Roof: IBR color steel sheet, t=0.6mm Exterior wall: SSB fair face masonry work Windows: Steel frame + top-hinged out-swinging, burglar bar shall be installed at equipment storages. Doors: Steel frame + wooden framed, burglar bar door shall be installed at equipment storages. Perimeter: Pre-cast concrete paving slabs	Classroom Block (4 rooms, 2 bldgs)	328.86	
			Adm./Library Block (1 bldg)	269.01	
			Laboratory Block (2 rooms, 1 bldg)	291.06	
			Toilet Block (5 bldgs)	95.76	
			Hostel (2 bldgs)	708.84	
			Kitchen/Hall (1 bldg)	617.40	
			Staff House (8 houses, 4 bldgs, outdoor toilet)	883.88	
			Guard House (1 bldg)	7.09	3,201.90 ㎡
2	Dziwe	Ditto	Ditto		3,201.90 ㎡
3	Mseche	Ditto	Ditto		3,201.90 ㎡
4	Namalomba	Ditto	Ditto		3,201.90 ㎡
5	Nanjiriri	Ditto	Classroom Block (6 rooms, 3 bldgs)	493.29	
			Adm./Library Block (1 bldg)	269.01	
			Laboratory Block (2 rooms, 1 bldg)	291.06	
			Toilet Block (8 bldgs)	155.52	
			Guard House	7.09	1,215.97 ㎡
6	Nankumba	Ditto	Classroom Block (4 rooms, 2 bldgs)	328.86	
			Adm./Library Block (1 bldg)	269.01	
			Laboratory Block (2 rooms, 1 bldg)	291.06	
			Toilet Block (8 bldgs)	95.76	
			Guard House	7.09	991.78 ㎡
Total Area of 6 Sites					15,015.35 ㎡

Table Quantity of School furniture

Classification	Equipment Name	Use	Quantity
Classroom Block, Laboratory Block	Set of student's desk and chair	For classroom	1,040
	Stool	For laboratory/Preparation Room, Store in Classroom Block	554
	Set of teacher's desk and chair	For classroom	13
Administration/Library Block	Set of headmaster's desk and chair, set of reception sofa	For headmaster’s office	6
	Set of deputy headmaster's desk and chair, set of reception sofa	For deputy headmaster’s office	6
	Teacher's desk and chair, reception furniture	For staff room	6
	Reading desk and chair, set of computer table and chair	For library	6
Hostel	Bunk bed	For dormitory	224
	Steel locker	For dormitory	448
Hall	Steel framed chair	For hall	1,280
	Reading table	For hall	152
	Stool	For students’ shop	4
Other	Steel cabinet	For administration rooms	48
	Low table (large)	For administration rooms	56
	Low table (small)	For administration rooms	30
	Litter bin	For administration rooms	20

Table Science Laboratory Equipment

Classification	Equipment Name	Use	Quantity (set)
Biology	Microscope	Learning of characteristics of living things and observation	72
	Dissecting set	Dissection of small animals	36
	Hand lens	Observation of living things	72
	Human skelton	Learning of structure of the body and breathing	6
	Teeth model	Learning of teeth structure, nutrition and digestion	6
	Eye and ear models	Leaning of function of eye and ear	6
	Photosynthesis apparatus	Learning of photosynthesis	6
Natural science	Thermometer, hygrometer	Learning of basic laboratory technique for experiments	72
	Stop watch	Ditto	72
	Bar magnet	Learning of magnetic force and field	36
	Spring balance	Basic experiments of mechanics	36
	Optical lens set	Basic experiments of light	36

	Bunsen burner	Basic techniques of chemical synthesis	72
	Pulley set	Learning of mechanical enlargement	36
	Voltmeter, ammeter	Electricity practice	36
	Table balance	Weight and specific gravity of material	36
	Periodic table	Learning of chemical rhythm	6

3) Implementation structure

The Government of Japan and the Government of Malawi will conclude an Exchange of Note (E/N) concerning the implementation of the Project as a grant aid for community empowerment and JICA and the Government of Malawi will sign a Grant Agreement (G/A). Based on the G/A and the Agreed Minutes on Procedural Details (A/M), an attached document of the E/N, the Government of Malawi will consign the work to a Japanese Procurement Agent by means of an Agent Agreement (A/A). The Agent will carry out the Project on behalf of the Government of Malawi to ensure a smooth implementation; it will oversee the project fund, contracts with the construction supervising consultant, contractors and suppliers of school furniture and laboratory equipment, and the progress of the Project. The two governments will establish a consultative committee as a forum for discussion and coordination of the Project contents and targets. The committee will consist primarily of members from the Ministry of Education, Science and Technology (MoEST) of Malawi and the JICA Office in Malawi. As necessary, working groups, to be presided by personnel on the Malawi side, will be established as sub-organizations of the committee. Representative from the Procurement Management Agent will also take part in the committee as an advisor.

The construction will be supervised by local consultants commissioned by the Japanese consultants who formulated the outline design. The facility management unit under the education planning bureau of the Ministry of Education, Science and Technology of Malawi shall provide technical assistance necessary for procurement management.

4 Project Schedule and Project Cost Estimate

The construction of educational facilities and dormitories (classroom block, administration block and library, laboratory block, toilet block, students' hostels, kitchen, hall and exterior) is estimated to require 20 months (18 months for construction of main unit) and another 9.5 months for staff houses. Procurement of school furniture and laboratory equipment is estimated to require 15 months each for all the six sites. Time required for bidding from preparation to bidding evaluation, negotiations and contract agreement is 6.5 months for construction and 4.0 months for machinery and equipment procurement as well as 5.5 months for staff houses.

Construction companies and equipment suppliers are selected in accordance with the priority order of the bidding. In consideration of the construction capacity of local companies, scale of construction work and reduction of construction cost, construction of education facilities and

dormitories is given the bidding order 1 (divided into 5 lots: Nanjiriri and Nankumba as 1 lot and other sites are 1 lot each). About 7.5 months later, school furniture (1 lot) of the bidding order 2 and laboratory equipment (1 lot) of the bidding order 3 will be begun concurrently. Four months later, bidding preparation for staff houses of the bidding order 4 will start. The feasible scale of the Project will be adjusted in accordance with the priority order by staff house site based on the need for fund adjustment.

Preparation and coordination of each bidding is carried out one after another while securing a minimum time period for each in order to shorten the overall schedule and a total of 27.5 months is estimated.

The costs to be borne by the Malawi side will be approximately 13 million yen under the total project cost estimation.

5 Project Evaluation

1) Relevance

The Project aims to improve CDSS educational infrastructure through the development of the school facilities with an overall goal to improve access to secondary education and its quality. There is no sufficient secondary education facility to accommodate rapidly increasing enrollment in secondary education in accordance with the spread of primary education. There is an urgent need to eliminate the major factors that hinder the improvement of access by developing secondary school facilities and the urgency of the Project is high. The Project contributes to the achievement of expansion of access and fairness and the increase in total enrollment in secondary education by expanding access from 23.5 percent in 2012 to 30.5 percent in 2017 that are goals of Malawi's overall plan, Vision 202, and the overall educational plan, National Education Sector Plan 2008-2017 and the Five-Year Implementation Plan 2009-2013.

Facilities to be developed in the Project are in accordance with the standard design of the projects implemented by other donors (WB and AfDB) under the Ministry of Education, Science and Technology and no advanced skills for their management and maintenance are needed. Existing facilities developed in similar specifications are used actively with necessary funds and proper staff allocation. The facilities to be provided in the Project will be also managed and maintained sufficiently with funds, human resources and skills of the Malawi side.

The Project is implemented based on the grant aid scheme for community development and the construction work heavily depends on skills of local construction companies as local resources are utilized effectively. However, design and supervision of bidding management for the implementation, quality control and schedule and cost management are performed by Japanese consultants by contract under the Procurement Management Agent and thus their skills and advantages will be exerted in a similar manner to general grant aid projects.

2) Effectiveness

[Quantitative effect]

The outputs of the Project listed below are expected to have quantitative effects.

Table Expected Quantitative Effects

Indicator	Standard (2009)	Target (2017)	Note
Increase in enrollment of target schools	1,113	2,153	
Increase in ratio of female students of target schools	42.0%	50%	Only four schools where students' hostels are built
Increase in ratio of qualified teachers of target schools	38.6%	50%	Only four schools where staff houses is built

[Qualitative effects]

The outputs of the Project listed below are expected to have qualitative effects.

- Increase in classroom capacity will increase the enrollment of students and improve the education continuance rate in the target areas.
- Development of educational facilities necessary for secondary education will help improve the internal efficiency (lowering of repetition and dropout rates) and improve the result of the certificate examination to prove completion of secondary education (passing rates of the certificate examination to prove completion of first half and second half of secondary education).
- Construction of students' hostels for girls will help increase the enrollment of female students in the target areas as well as internal efficiency (lowering of repetition and dropout rates of female students).

The Project is expected to have the effects described above and contribute to the goals of the overall education plan of the country, National Education Sector Plan 2008-2017-- expansion of access to and fairness of education, improvement of quality and social nature of education, and improvement of governance and management capacity. Therefore, it is fair to conclude that the Project is highly relevant and effective.

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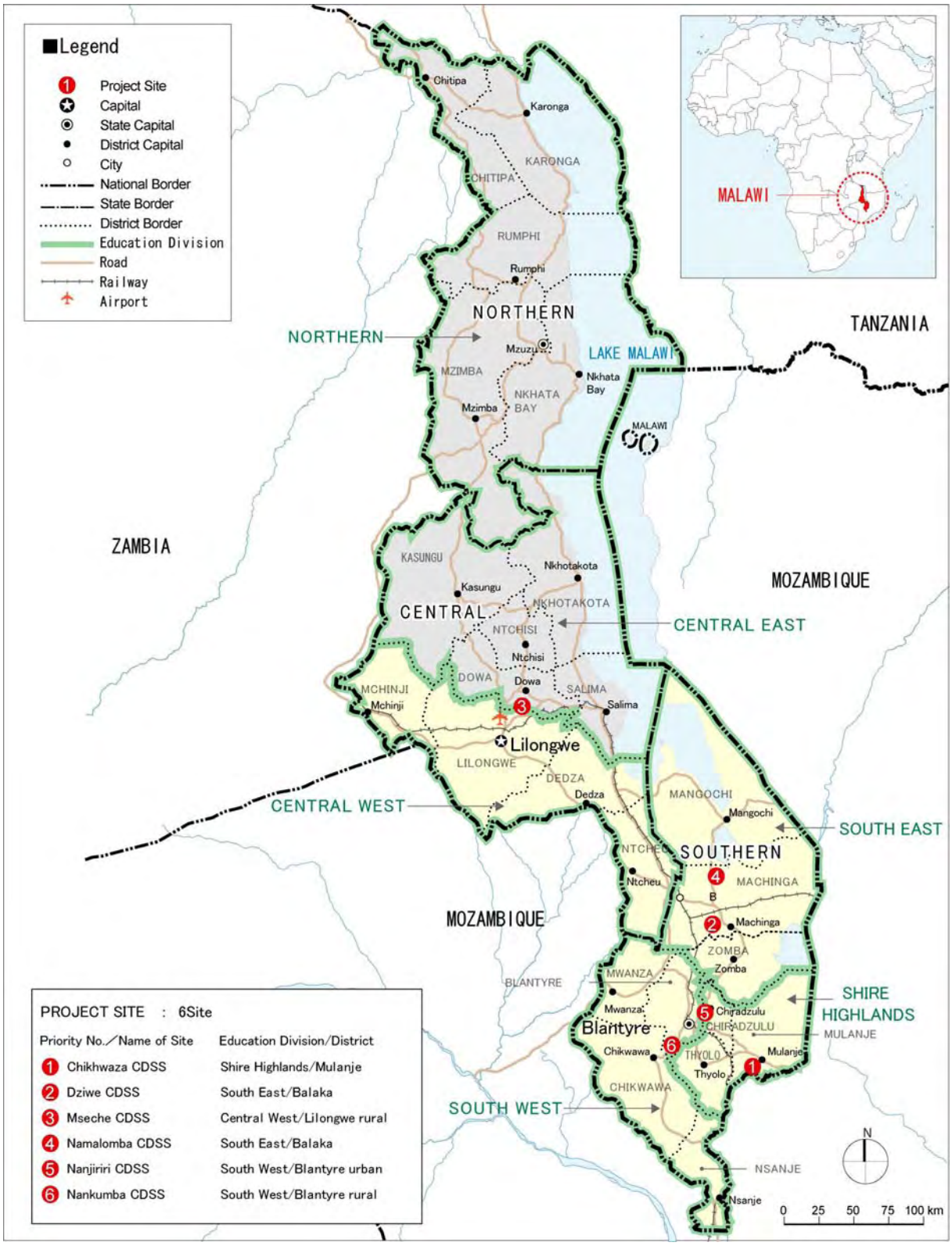


Rendering

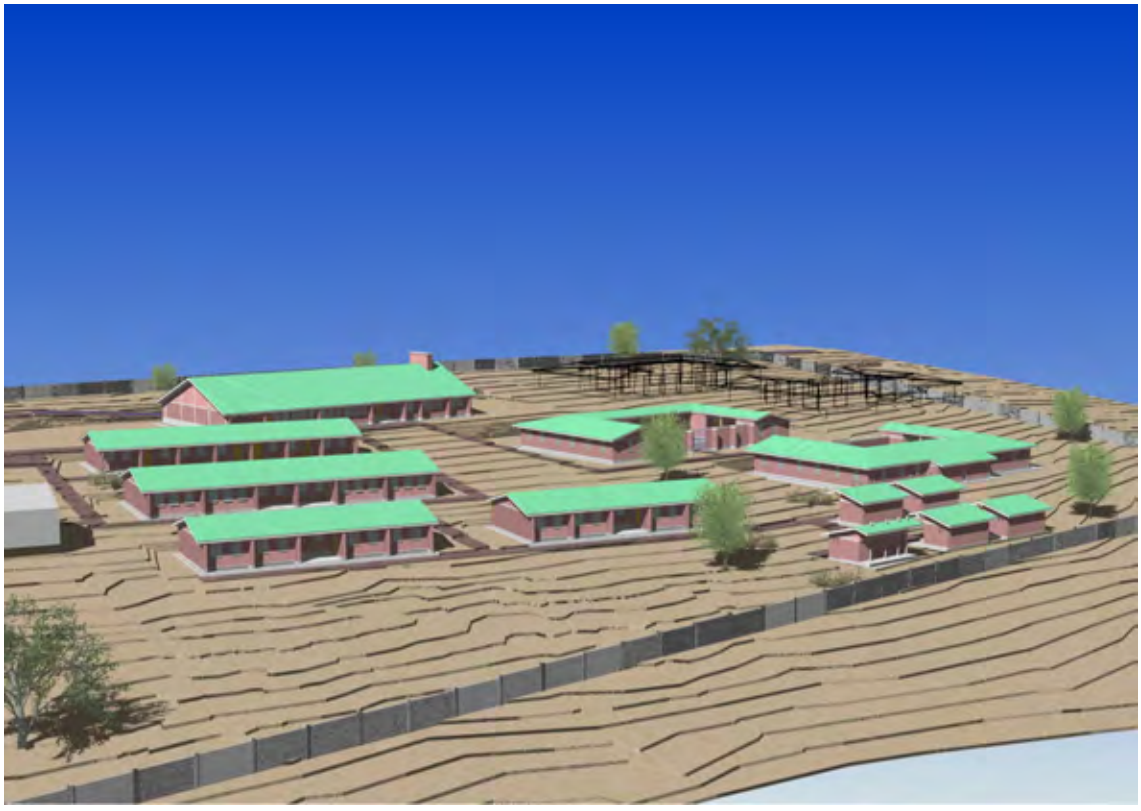
Dziwe CDSS

Bird’s-eye View

Downward View from the East Side

Mseche CDSS

Bird’s-eye View



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Abbreviations

A/A	Agent Agreement
A/M	Agreed Minutes on Procedural Details
AfDB	African Development Bank
BQ/BOQ	Bill of Quantity
BS	British Standard
CDSS	Community Day Secondary School
CSS	Conventional Secondary School
DEC	Distance Education Center
EDMU	Education Development Management Unit
EFA	Education for All
EFA-FTI	Education for All-Fast Truck Initiative
EIMU	Education Infrastructure Management Unit
E/N	Exchange of Note
EMAS	Education Method & Advisory Services
EMIS	Education Management Information System
ESIP	Education Sector Implementation Plan
FORM -ST14	FORM-Sur Tax 14
FPE	Free Primary Education
G/A	Grant Agreement
GER	Gross Enrollment Ratio
GPF	General Purpose Fund
HIV/AIDS	Human Immune-Deficiency Virus/ Acquired Immune-Deficiency Syndrome
INSET	In-Service Education and Training
IPC	Internal Procurement Committee
JCE	Junior Certificate Examination
JICA	Japan International Cooperation Agency
JICS	Japan International Cooperation System
JV	Joint Venture
Kw	Kuwacha
MASAF	Malawi Aide Support Association Fund
MBS	Malawi Bureau of Standard
M/D	Minutes of Discussion
MDGs	Millennium Development Goals
MGDS	Malawi Growth Development Strategy
MoEST	Ministry of Education, Science and Technology
MRA	Malawi Revenue Authority
MSCE	Malawi School Certificate Examination
NCIC	National Construction Industry Council
NESP	National Education Sector Plan
OS	Open School
PIF	Policy and Implementation Framework
PSLCE	Primary School Leaving Certificate Examination

PTA	Parent-Teacher Association
QS	Quantity Surveyor
SABS	South African Bureau of Standard
SDF	School Development Fund
SEP	Secondary Education Project
SSB	Stabilized Soil Block
TRF	Textbook Revolving Fund
TTC	Teacher Training College
VAT	Value Add Tax
WB	World Bank

Chapter 1 Background of the Project

Chapter 1 Background of the Project

1-1 Background and Overview of the Project

The Government of the Republic of Malawi (hereinafter referred to as "Malawi") regards education as a critical sector in its national development strategies, "Vision 2020" and "Malawi Growth Development Strategy (MGDS) 2006-2011" and takes the improvement of access to and quality of education as a priority issue in its "Policy and Investment Framework (PIF)". It places the improvement and expansion of basic education[1] for achieving the Millennium Development Goals as a priority issue in its "National Education Sector Plan 2008-2017", while it also places increase in enrollment in secondary education, ensuring equitable access, improvement of educational infrastructure, and promotion of its efficient use as priority issues. The government has established such specific numerical targets. They include: ① increase in enrollment in secondary education (30% increase by 2012 and 90% increase by 2017[2]), ② increase in classrooms at public secondary schools (3,754 to 6,348), ③ improvement of enrollment rate of female students (male-female ratio: 1 to 1), ④ decrease in the number of students per teacher at CDSS (1:104 to 1:60), and ⑤ improvement of passing rate of the certificate examination to prove completion of secondary education (38.6% to 65%).

The introduction of a free primary education system in 1994 by the Government of Malawi resulted in a 50-percent increase in enrollment in the following year and the enrollment exceeded three million in 2008. As the number of those who complete primary school students increased, that of secondary school students also increased from 50,000 in 1993 to 233,000 in 2008. In these circumstances, Malawi has coped with the shortage of facilities caused by the enrollment increase by upgrading adult education facilities built by communities to community day secondary schools (CDSSs).

However, during the last five years (2003-2008), the enrollment in secondary education increased by 78 percent (from 131,000 to 233,000), whereas the number of public secondary schools increased by 23 percent (623 to 769, 620 of which are CDSSs) and the number of classrooms increased only by 17 percent (from 4,400 to 5,136). The shortage of secondary school facilities is serious across the country. CDSSs that account for 80 percent of public secondary schools are not equipped with basic facilities required as secondary schools in addition to the shortage of classrooms, unable to provide sufficient educational environment for students. In spite of the increasing demand for advancement to secondary schools year by year, the shortage of educational facilities hinders the continuance. For example, only 66,000 of 166,000 students who completed primary education in 2007 advanced to secondary schools in the following year (education continuance rate[3] 40%).

Many of the CDSSs cannot provide even the minimum level of education due to a shortage of classrooms, underdevelopment of laboratories and libraries and ageing of buildings. However,

[1] Primary education, pre-school education, non-formal education
[2] Comparison with figures in 2007
[3] (Number of students in year one in secondary school in 2008 – number of repeaters in the year) ÷ number of students in year 8 in primary school in 2007

they cannot renovate their buildings in full scale by themselves due to a lack of school operation fund. Because the budget of the Government of Malawi is also limited, it is not easy to renovate CDSS facilities. Against the backdrop, the Government of Malawi formulated a secondary school improvement plan for renovation and improvement of CDSSs in order to achieve the goals in the NESP, which include increase in enrollment in secondary education and provision of equal opportunities of education, and requested the Government of Japan for grant aid for implementing the plan.

Japan conducted a preparatory study (outline design and field surveys I and II) from September to December 2009 and confirmed the relevance of upgrading of secondary school facilities based on the grounds that there is not sufficient secondary school facilities to cope with the growing enrollment demand in secondary education. Although the Government of Malawi originally requested the upgrading of CDSSs at 21 locations across the country, we agreed to implement the project at the six locations in the central and western and southern parts of the country as shown in Table 1-13 and give priority to rural schools with many students who cannot commute to school in response to Malawi's request and select schools in accordance with the priority order when the plan needs to be scaled down due to restrictions of the project.

Table 1-1 Six Project Sites

Priority Order	School Name	Education Division	Priority Order	School Name	Education Division
1	Chikhwaza/ Mulanje	Shire Highlands	4	Namalomba/ Balaka	Southeast
2	Dziwe/Balaka	Southwest	5	Nanjiriri/ Blantyre City	Southeast
3	Mseche/Lilongwe Rural-E	Central and west	6	Nankumba/ Blantyre Rural	Southwest

We then conducted analysis based on the survey results and prepared an outline design, project cost estimate and project plan before discussions and confirmation through local briefing of the outline design from April 25 to May 7, 2010. About two months later, from July 4 to 16, we conducted interim study (field survey IV-1) for producing reference materials for bidding document to be prepared by local consultants by contract. From August 24 to September 3, we conducted briefing on the reference materials for bidding document (field survey IV-2). We compiled a preparatory study report on the project for re-construction and expansion of community day secondary schools based on the discussions.

1-2 Natural Conditions

(1) Climate

Malawi is situated in the tropical savanna climate zone with a dry season from September to November, a rainy season from December to April, and a cool season from May to August. The target sites of the study are located between 500 meters and 1,100 meters above sea level and there is no significant climate difference among them.

The rainy season may affect the construction of the project. Thus, the construction should be

launched after April after the end of the wet season.

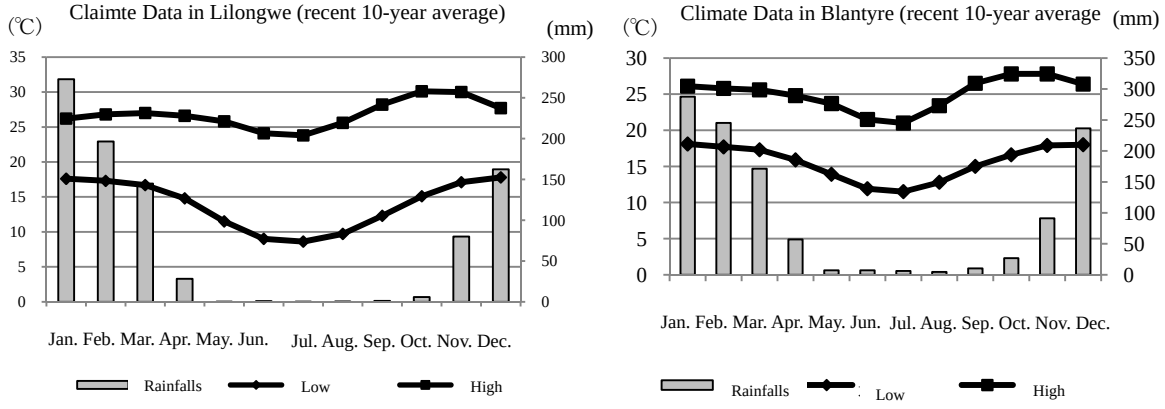


Figure 1-1 Climate Data in Malawi

(2) Topography and Geology

The Nyasa Rift Valley located at the southwestern end of the Great Rift Valley lies along the Lake Malawi. The basement composed of Precambrian and Paleozoic crystallized mineral under lies most of Malawi. It is covered with a variety of surface sediments accumulated later over a long time in the complex process of sedimentation, epeiric movements and lake formation. The majority of surface soil consists of clay, late rite and sandy soil.

Because the two sites in the southwestern region (Nankumba and Nanjiriri) are situated on a hillside and the area where construction can be conducted is limited, the components are restricted.

Because expansive soil distributes widely on the two sites in Balaka in the southeastern region, the soil needs to be removed and replaced with gravel before construction.

(3) Disasters

1) Earthquake

The Nyasa Rift Valley that traverses East Africa lies along the Lake Malawi and earthquakes often hits the country. Thus, observation instruments are installed at six locations (Zomba, Lilongwe, Mzuzu, Malindi and Chileka) and the geological observation bureau of the Ministry of Natural Resources, Energy and Environment collects data of seismic activities. Combined with data obtained by other observation bodies, the data enables confirmation of statistics of seismic data from 1901. There is no major earthquake in southern and central parts of the country where the Project is planned. Although a 6.0-magnitude earthquake was recorded along the Lake Malawi (near Salima) in 1989, there is almost no data of earthquakes with a bigger scale than magnitude 6.0 in data in the last 100 years in Malawi.

Because there was no sign of damage caused by earthquakes at even old schools where the field survey was conducted and because all the buildings planned in the Project are one-story buildings, no seismic force is taken into consideration in the standard design.

2) Flood

We discovered in interviews with concerned members on each project site that they have never

had flood damage. According to the result of the percolation test we commissioned locally, water drainage is good on the sites. However, a layout plan needs to be made carefully to secure proper floor height and bleeding channel because the area is subject to temporary torrential rains.

(4) Natural Conditions Survey

1) Ground Survey

A ground survey commissioned to the Central Materials Laboratory of The Ministry of Transport and Public Infrastructure was conducted. The laboratory is the only laboratory in the country with geological engineers and testing instruments and laboratories. A standard penetration test (up to the depth of 5 meters) was conducted at three points on each site before the composition test (particle size distribution, water content, specific gravity) of sample soil, tri-axial compression test, and Atterberg limit test in order to study the dynamic regular properties of soil on each site. A percolation test was also conducted on each site in order to examine the drain permeability of the ground.

Because the soil of Dziwe and Namalomba sites in Balaka expands and shrinks significantly when it contains water, it needs to be replaced with gravel partially.

2) Site Survey

We obtained an estimate from two experienced and reliable companies according to interviews with construction companies and consultants and we commissioned the site survey to a private survey company, Surveys (Malawi) Limited. They conducted GPS survey for plane survey and leveling and plotted existing buildings, facilities and obstacles as well as major trees on the six target sites.

3) Water Source

Of six sites, city water can be supplied on two sites. However, well water is used as the water source on the remaining four sites. All the sites are existing schools and they have (hand-pumped) wells on or around their premises. However, new wells need to be built in order to secure water in necessary volume and water source. According to boring data around the sites obtained from the Ministry of Irrigation and Water Sources, water sources can be secured within GL-40 meters to GL-60 meters.

Before the project implementation, a physical survey with radar measuring instruments is planned to be conducted and, based on the result, appraisal drilling will be conducted on each site. Because the survey should be conducted in the dry season between September and November, it will be conducted before the distribution of bidding document for construction work in accordance with the envisioned project schedule. (The cost is posted as technical administration cost in Consultant Supervision Service Fee.) The Central Water Laboratory is capable of testing whether well water is adequate as drinking water.

1-3 Environmental and Social Consideration

(1) Natural and Social Environmental Impacts to be Caused by the Project

The Project is the reconstruction of CDSS facilities, which were built by the communities with the Malawi Social Action Fund (MASAF) in the period from 1976 to 2005, based on the allocation plan strongly linked with existing schools buildings (2 to 3 buildings of 2 classrooms per building) that were deemed to be usable in the future. All the six target sites are in rural or urban areas next to an unpaved access road (the width of less than 6 meters) branching off from a national route. School grounds and adjacent grass fields and arable lands are provided as the construction sites for the expansion by the communities. The site area varies as follows: 1 site (Nanjiriri) with around 1.6 hectare, 4 sites (Chikhwaza, Dziwe, Mseche and Namalomba) with 3 to 4 hectares and 1 site (Nankumba) with around 5 hectares. All the sites but the Chikhwaza site has gentle slope lands (around 1/8 to 1/12) and their surrounding areas are also in similar natural environment.

Because the Project involves a partial modification of natural environment on the premises and their surrounding areas, which includes the cut and fill earth work of the slopes on the premises, the installation of rainwater and wastewater treatment facilities, and the construction of border walls necessary for safety, the following issues are taken into consideration in order to minimize adverse effects on the environment.

- The site development will be limited to an area necessary for the construction and cut and fill earth is planned to make them well-balanced as much as possible in order to minimize the amount of soil to be carried out of the premises.
- Facilities will be arranged to make the most use of the current geographical condition and level the soil in accordance with the natural law without building a retaining wall in order to blend in with the surrounding natural environment.
- Continuous side ditches will be installed to lead rainwater and wastewater to an appropriate permeation pit in order to prevent occurrences of soil runoff or ground erosion by rainwater.
- Wastewater will be designed to be treated as absorption method on the premises in order to prevent external impacts. The septic-tank system will be introduced for flush toilets to improve the quality of treated water and prevent contamination of the underground water vein.
- Facilities will be built without affecting existing trees and water veins as much as possible in consideration of protection of natural environment and ecosystem on and outside the premises.

Because the construction sites are on existing school premises or unused arable land, the Project will not cause the relocation of local residents or much change in their living environment, and hence it is not expected to cause negative impacts on their living. The Project is the construction of school facilities that benefit the local residents and it helps the improvement of

local communities and environment.

Based on the above idea, the Project is categorized as a project that has minimum or little impact on environment and society.

(2) Application for Environmental Impact Assessment

Application for environmental impact assessment is required for the construction of plants and commercial facilities in Malawi. However, because the Project is the facility expansion plan of existing schools, no such application is required. There is a set of guidelines for city planning and development called Town and Country Planning Standard and Guidelines for Development. An application of construction permit needs to be submitted for the Nanjiriri CDSS site. Other sites will be designed in accordance with the guidelines for the safety of their buildings and a plan needs to be reported to the district commissions of physical planning in each district in advance.

Chapter 2 Contents of the Project

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

(1) Overall Goal and Project Goal

The Government of Malawi regards education as a critical sector that contributes to its social, economic and industrial development. With its overall goals to provide equal opportunities for its people to receive education and improve quality of education, the Government has formulated "Vision 2020", "Malawi Growth Development Strategy (MGDS) 2006-2011, "Policy and Investment Framework (PIF)" and "National Education Sector Plan (NESP) 2008-2017" that is the action plan for the policy in order to promote the development of various fields. As the increased demand for secondary education as a result of the introduction of free primary education (FPE) in 1994, the Ministry of Education, Science and Technology (MoEST) converted the distance education centers (DECs) in the community across the nation into the community day secondary schools (CDSSs) in 1998 in order to overcome a shortage of schools, which was a main obstacle for students to advance to the secondary school, as well as transferred primary school teachers to secondary schools on promotion basis rapidly to offset a significant shortage of teachers. However, the country still faces a serious shortage of secondary school facilities, low transition rate from primary to secondary schools, increase of unqualified teachers, increasing in dropout and repetition rates and worsening quality of education.

The purpose of the Project is to improve the teaching and learning environment of secondary education in target areas by reconstructing and expanding the facilities of CDSSs with urgent need based on the overall goal of the Government of Malawi that intends to improve the access to and quality of secondary education.

(2) Basic Concept of the Project

The Government of Malawi has CDSS reconstruction and expansion plans 2009 to 2013 that cover 94 schools. The Project selected six existing CDSSs in four education divisions based on the selection criteria and the priority order of components out of 21 candidate sites requested by the Government. It consists of the construction of Malawi's standard school facilities (classrooms, laboratories, libraries, administration blocks, toilets, girls' hostels, halls/kitchens, staff houses and other necessary facilities such as elevated water tanks and septic tanks) and provision of school furniture and laboratory materials with Japan's Grant Aid for Community Empowerment. This is expected to expand the capacity of secondary education facilities and thus increase enrollment of students in secondary schools and provide good a quality educational environment with required facilities for the education.

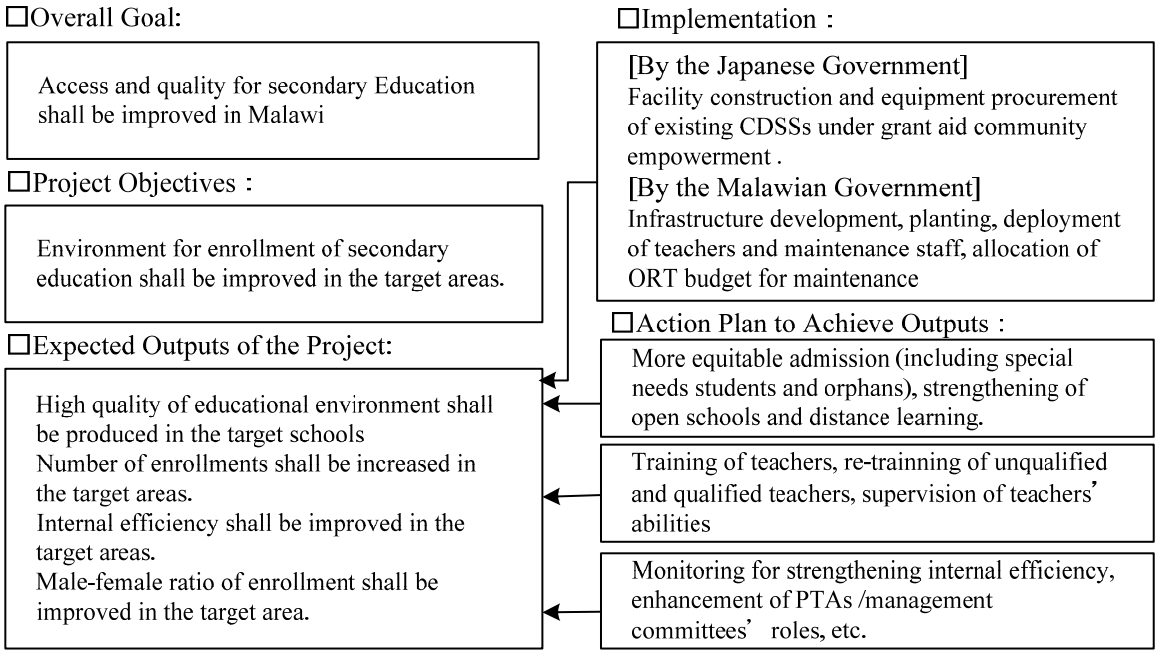


Figure 2-1　Target Program and Cooperation Project

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

The Project will be financed by Japan's Grant Aid for Community Empowerment. The scale of the Project will be appropriately determined in accordance with the technical capacities, past experiences and management capacities of local construction companies and equipment suppliers to formulate a facility and equipment plan based on local construction methods and specifications as a sustainable project.

1) Selection of Target Sites

As shown in Table 2-1, Selection Process of Target Schools, in the field survey I, 21 CDDSs nationwide requested by the MoEST were studied to narrow down to nine sites in four educational districts in central western region, southwestern region, southeastern region and the Shire Highland, all south of Lilongwe. Later, the field survey II was conducted to choose six final candidate sites that meet all the site selection criteria in Table 2-2. The priority order given by the Government of Malawi (give priority to rural areas) is taken into consideration to formulate an outline design.

Table 2-1 Selection Process of Target Schools

Education Division	Request Letter (Sept. 11,2008)	Reviewed Request (Sept.15, 2009)	Minutes of Preparatory Survey I (Sept.28,2009)	Order of Priorit	Minutes of Preparatory Survey II (Nov.30,2009)	Order of Priorit
Northern	Champira/Mzimba	Chindindindi/Mzimba N				
	Chindindindi/Mzimba	Rukuru/Mzimba N				
	Rukuru/Muzimba N	Chisenga/Chitipa				
	Chisenga/Chitipa					
Central East	Parachut/Salima	Mpando/Dowa				
	Liwalazi/Ntchisi	Manyani/Kasungu				
	Ngodzi/Salima	Mkaika/Nkhotakota				
	Ngala/Nkhotakota	Kayoyo/Ntchisi				
Central West	Kabuthu/Lilongwe	Mkwichi/Lilongwe U	Bilira/Ntcheu	A-4		
	Golomoti/Ntcheu	Bilira/Ntcheu	Kang'oma	A-5		
	Gowa/Ntcheu	Mseche/Lilongwe R	Mseche/Lilongwe R	B-4	Mseche/Lilongwe R	3
	Nambuma/Dowa					
South West	Mzamba/Blantyre	Nankunba/Blantyre R	Nankumba/Blantyre R	A-3	Nankumba/Blantyre R	6
	Phanda/Mwanza	Mfera/Chikwawa	Nanjiriri/Blantyre U	B-2	Nanjiriri/Blantyre U	5
	Chifunga/Mwanza	Phokera/Nsanje	Chifunga/Muwanza	B-3		
South East	Sacred Heart/Zomb	Naizi/Zomba	Dziwe/Balaka	A-2	Dziwe/Balaka	2
	Naizi/Zomba	Dziwe/Balaka	Namalomba/Balaka	B-1	Namalomba/Balaka	4
	Namalomba/Balaka	Tsekwele/Mangochi				
		Namalomba/Balaka				
Shire Highlands	Namalamba/Chiradzulu	Muhasuwa/Chiradzulu	Chikhwaza/Mulanje	A-1	Chikhwaza/Mulanje	1
	Chikonde/Mulanje	Misanjo/Mulanje				
	Lipho/Thyolo	Lipho/Thyolo				
		Chikwaza/Mulanje				
Taget	21 CDSSs	21 CDSSs	9 CDSSs		6 CDSSs	

Note) Dark grayed CDSSs are requested originally on Sept.11,2008 by the request letter. Light grayed CDSSs are reviewed on Sept.15,2009 during Preparatory Survey I.

Table 2-2 Site Selection Criteria

1) The MoEST (or Divisional Education Office) can present (an) effective official document(s) that verify its ownership or land-use right over the site.
2) There is no other plan of renovation/rehabilitation/extension of the candidate schools, which is supported either by the Malawian Government or other development partners.
3) There is no serious risk of being damaged by natural disasters (or no record of such damages) and no security concerns around the site.
4) There are no hindrances or difficulties for construction and supervision in terms of physical access to the site, working space, geographical conditions, etc.
5) Enrollment demand for the candidate school is high enough to be considered for re-construction or extension.
6) The MoEST can make a commitment on securing sufficient government budget and allocate it to the candidate schools.

2) Priority Order of Components

The Project components are standard facilities and equipments installed in and utilized by conventional secondary schools (CSSs) in Malawi and top priority is given to those. Facility/equipment plans should be prepared in which the facilities/equipments do not cause excessive burden and their management and maintenance is sustainable.

- Top priory is given to facilities (classrooms, administration blocks, laboratories, libraries and sanitation facility) and equipments (school furniture and laboratory materials) that are of minimum requirements for operation and curriculum implementation of secondary education.
- Top priority is also given to girls' hostels (dormitories, halls and kitchens) for female students who have no other choice but to commute a long distance because they live far

from the nearest school in rural areas.

- Second top priority is given to staff houses and lot splitting is studied in accordance with site priority level in order to make adjustment to changes of project budget.
- Although the component plan will be made in accordance with secondary school facility plans of other donors (World Bank (WB) and African Development Bank (AfDB)), it should be improved in consideration of sustainable operation and maintenance.
- Equipments (school furniture and laboratory materials) will be selected in consideration of past projects by other donors, current curriculum and syllabus, and operation and management cost.

(2) Policy on Natural Conditions

1) Geography and Climate

Five sites are located on slopes and rainwater needs to be treated in heavy rains in the rainy season (December to April). The following issues are given special consideration:

- Rain and wastewater will be treated on site.
- Although buildings will be constructed on the east-west axis to block the west sun, priority will be given to the building arrangement to make them parallel to the contour of the slope in order to minimize the amount of fill earth.
- As for the three sites (Mseche, Nanjiriri and Nankumba) with sharp slopes, the buildings will be rationally arranged and their floor level will be rationally designed and priority will be given to cut earth in order to minimize the amount of fill earth.

2) Geology

The soil foundation of the construction site will be gneiss at all the target sites. The surface soil consists of clay, laterite and sandy soil. Caution is needed in the Balaka district because expansive soil is heavily distributed in the area.

- On the two sites (Dziwe and Namalomba) where distribution of expansive soil is confirmed, the soil will be replaced with gravels under the continuous footing and earth floor. Concrete underground beams will be also built and earth slabs will be replaced with structural slabs.
- Replacement of expansive soil with gravels and protection of permeation layer with nonwoven fabric will be examined for the perforated pipe layer and latrine pit absorption part of septic tanks in the two sites.

3) Earthquakes

An earthquake with a magnitude of greater than 6 on the Richter scale was recorded in Lake Malawi and coastal area (near Salima) in Malawi. Although earthquakes with magnitudes of 4 to 5 occurred in the lake and coastal areas, southern to central regions where the project sites are located have been rarely hit by earthquakes.

- The Great Rift Valley runs somewhere along Malawi Lake and earthquakes have been recorded. However, the seismic energy was not big and there was no trace of damage by earthquakes at even old schools visited in the field survey. In the Project plan, the horizontal force in earthquakes will be calculated based on the story shear force coefficient

(Ci) at 0.08 in earthquakes in order to compare it with the wind load horizontal force.

(3) Policy on Social Conditions

There have been many reports of hand pump parts of shallow community wells (leading lode of channel pipes) being stolen in Malawi. Two similar incidents have been reported on the target sites. Careful attention needs to be paid to safety management and environmental conservation.

- External wall fences are indispensable for safety management of facilities and thus are covered in the Project.
- Anticrime device needs to be installed for the management of each room. Door locks will be installed at the entrance of rooms where equipment will be stored and other necessary areas and steel grills will be installed on the opening windows and doors.
- All target CDSSs have existing classrooms, staff houses, shallow community wells and trees and attention needs to be paid to the conservation of existing environment.

(4) Policy on Construction and Procurement

1) Permit and Building Standards

The city assembly of Malawi has the Town and Country Planning Standard and Guidelines for Developments and application for building permit is needed. The guidelines cover a wide range of issues, including land use, building surface area, access, parking space, building materials, water supply and drainage, electricity service, sanitation, accessibility of persons with disabilities, fire protection and property lines. Reasonability of location in accordance with the city plan, building safety, sanitation condition, impacts on surrounding environment are mainly examined. The followings are basic policies:

- Application for building permit is submitted the Nanjiriri CDSS that is the only Project site located within the city assembly zone. (The applicant is the MoEST and the application is submitted to the City Council for Building Permission of Blantyre. In addition to drawings, structural calculation sheets are required to be submitted in some cases.) It usually takes two months to obtain approval. Compared to other sites with students' hostels and staff houses, the Nanjiriri CDSS is small (about half the size) and thus the Project can be carried out within the overall project term even if the Project is launched two month later than other sites.
- Although no building permit is needed for other rural sites, they need to be designed in accordance with the Guidelines for building safety and the plan needs to be reported to the district commissions of physical planning of each area prior to the Project is commenced.
- Because Malawi does not have sufficient building standards of its own, the design should be in accordance with the British Standard as well as Japanese standard when necessary.
- Because there is no fire protection code in Malawi, there is no standard for the installation of fire prevention devices. Consultation with the local fire department is needed for each project. Based on the consultation result, fire protection devices of equivalent specifications to similar projects conducted by other donors will be installed.

- The Town and Country Planning Standard and Guidelines for Developments require the accessibility of persons with disabilities. Toilets and shower rooms for such persons will be installed and entrances will be level in the Project. Their specifications shall be equivalent to those in the similar projects and they enable such persons to act without difficulties with the assistance from caretakers.

2) Construction and Procurement

Major materials, including imported materials, necessary for the construction can be procured in Malawi. Cement, aggregate, lumber and plywood are main locally produced materials and most of other materials are mainly imported from South Africa. Thus, building companies tend to directly import such materials when they are needed in bulk. In the Project, local products as well as general imported materials shall be used as much as possible for stable material procurement.

(5) Policy on Use of Supervising Consultants

There are few general consultants with structure, equipment and quantity surveyor (QS) sections in addition to construction section in Malawi, which are usually segmented in their own specialty field. Thus, a joint venture (JV) is usually formed for design. The National Construction Industry Council (NCIC) manages the registration of consultants and construction companies. Although there are 10 architectural consulting companies, 26 engineering consulting companies and 11 QS consulting companies being registered, they are not classified. For registration, the number of qualified engineers and past achievements are mainly examined. The architect, engineer and QS associations have a qualification system of individual qualifications for architects, engineers and QSs, respectively. The screening criteria are the past experience and achievement and there is no objective numerical criteria.

The proposal method (technical evaluation and price appraisal) was used to select local consultants who assist the preparation of reference materials for tendering document and an outline design was produced. Japanese consultants who were in charge of the outline design will continue to be involved to supervise construction in order to ensure consistency with the outline design. Local consultants will be utilized to perform supporting work such as fulltime supervision on each site in order to ensure efficient construction management.

(6) Policy on Use of Local Construction Company (Contractor)

Construction companies in Malawi are categorized into nine classes based on the allowable contract amount under the supervision of NCIC. When one site is considered as one lot, 27 construction companies with the allowable contract amount of over 5 million Kwacha (Kw) are expected to be candidates. As a result of the Study, the construction companies registered with NCIC in no limit class were confirmed to be generally equipped with sufficient technical and financial capacities for the Project.

- Because no special construction method or machinery and equipment are used in the Project, these companies are believed to have sufficient technical capacities. However, because the main cause of delays is the suspension of construction work due to delayed

payment, their financial conditions, including capital, amount of received orders and amount of completion as well as cash flow, need to be carefully examined in the prequalification screening.

- International competitive bidding will be conducted for the plan in accordance with the JICA's Procurement Guidelines of Japan's Grant Aid for Community Empowerment.

(7) Policy on Use of Equipment Supplier

The equipments included in the plan are categorized into two groups of school furniture and laboratory materials. Orders are placed with expertise suppliers separately from the building construction work. There are a number of school furniture suppliers, including large furniture makers in Malawi and suppliers that import products from third countries. The country also has laboratory material suppliers. According to the past experiences of educational facility improvement projects implemented by other donors, there is no supply capacity problem and 1-lot order placement for all sites is deemed possible. Laboratory materials can be ordered in the same method. For the selection of equipment procurement, the supply capacity will be examined based on tender entry qualifications to ensure the implementation of the Project.

(8) Policy on Handling of Operation and Maintenance

Target CDSSs have received part of the fund necessary for school operation from their respective education districts as ordinary expenses. However, the government revenues account for a small portion (7 to 17%) of all revenues and most funds come from tuition and other fees paid by students' parents and thus resources allocated to facility maintenance and management are limited. The project buildings will be designed to be robust not to require special maintenance techniques based on specifications of local general construction methods and materials in order to minimize financial burden to be imposed on each school.

(9) Policy on Grade Establishment of Facility and Equipment

The facility plan will be based on the local design and specifications and use of local companies and materials will be encouraged actively. The project cost is aimed to be reduced significantly compared to other general grant aid projects by taking advantage of competition.

(10) Policy on Construction and Procurement Methods and Project Term

Although there are only six target sites, the Project has a wide variety of components. Appropriate lot-splitting, early launch of major lots with priority, coordination with overall fund management and gradual and concurrent materials procurement with other lots are needed in order to arrange an efficient project schedule based on the priority order of the sites and facilities. The rainy season needs to be taken into consideration for proper arrangement of the construction period of each lot and site.

2-2-2 Basic Plan (Construction Plan / Equipment Plan)

2-2-2-1 Examination of Target Sites, Components and Scale of the Project

A basic plan will be formulated based on the site order of priority mainly in rural areas among

the existing six CDSSs for which both the Malawi and Japan sides agreed to implement the Project shown in the following table. Although the Government of Malawi originally requested for an aid project to be implemented for 21 existing CDSSs, the six schools were selected based on the scheme of Japan's Grant Aid for Community Empowerment, experiences and capacities of local construction companies, and narrowing down to appropriate project scale.

Table 2-3 Target Sites and their Order of Priority

Order of Priority	School Name	District	Education Division
1	Chikhwaza CDSS	Mulanje	Shire Highlands
2	Dziwe CDSS	Balaka	Southeast
3	Mseche CDSS	Lilongwe Rural East	Central and west
4	Namalomba CDSS	Balaka	Southeast
5	Nanjiriri CDSS	Blantyre Urban	Southwest
6	Nankumba CDSS	Blantyre Rural	Southwest

- Target sites: Six existing CDSSs above are target sites chosen based on the full consideration of their natural conditions (including geology, geography), infrastructure (including electricity, water supply), project components and assumed project scale.
- Order of priority of sites and components: Appropriate lot-splitting will be examined in accordance with the order of priority of sites and components in order to cope with fluctuations of project budget.
- Determination of project scale: The scale of facilities of target schools will be examined based on the operation, enrollment within the commuting distance, and enrollment demand.

(1) Analysis and Evaluation of Operation of Target Schools

The following table shows the school operation, educational indicators, enrollment within commuting distance, secondary school enrollment at the district level and their analysis and evaluation. These factors are used to determine the scale of facilities in the outline design.

Table 2-4 School Operation for Last 3 Years

Priority	Project site	Education Division / District	Year	Number of Students							Teachers		Classrooms		Class Composition
				F1/girls	F2/girls	F3/girls	F4/girls	total	boys	girls	total	Qualified	total	Permanent	
1	Chikhwaza CDSS	Shire Highlands Mulanje	2009	60/31	66/17	16/4	18/6	**160**	102	58	10	5	4	4	1
			2008	46	54	17	15	**132**	86	46	7	1	4	4	1
			2007	57	45	19	14	**135**	90	45	-	-	-	-	1
2	Dziwe CDSS	South East Balaka	2009	55/25	59/23	44/18	35/13	**193**	114	79	7	4	4	4	1
			2008	62	41	42	0	**145**	82	63	6	2	4	4	1
			2007	50	53	0	0	**103**	50	53	-	-	-	-	1
3	Mseche CDSS	Central West Lilongwe Rural-E.	2009	30/16	53/29	24/11	25/4	**132**	72	60	6	2	4	4	1
			2008	53	76	32	17	**178**	101	77	7	0	4	4	1
			2007	36	50	27	19	**132**	82	50	-	-	-	-	1
4	Namalomba CDSS	South East Balaka	2009	35/17	43/25	20/6	26/11	**124**	65	59	9	4	4	4	1
			2008	38	43	26	0	**107**	58	49	7	1	3	2	1
			2007	40	55	0	0	**95**	47	48	-	-	-	-	1
5	Nanjiriri CDSS	South West Blantyre City	2009	101/49	80/38	68/29	59/24	**308**	168	140	25	9	6	6	F1/2- 2 F3/4 -1
			2008	88	110	76	76	**350**	178	172	18	4	6	6	ditto
			2007	133	105	83	86	**407**	163	244	-	-	-	-	ditto
6	Nankumba CDSS	South West Blantyre Rural	2009	67/31	58/30	33/12	38/21	**196**	102	94	13	3	4	4	1
			2008	57	53	38	31	**179**	94	85	12	3	4	4	1
			2007	54	50	33	42	**179**	102	77	-	-	-	-	1
% of each Forms except Nanjiriri			2009	30.7	34.7	17.0	17.6	**100.0**	455	350					
Average % of each Form of 6 CDSSs			2009	31.3	32.3	18.3	18.1	**100.0**	623	490	70	27	26	26	

Souces: Year of 2007, 2008 are from EMIS、Year of 2009 is based on answer of the Questionnaires and Interviews.

- Class management: As shown in Table 2-4, all target schools except for Nanjiriri, a cluster leader school in the urban area, are single-stream schools (1 class per grade). Nanjiriri with high enrollment demand is a double-stream (2 classes per grade) only in the junior secondary (F1 and F2) under the secondary education.[1]
- Number of existing classrooms: As shown in Table 2-4, the number of existing classrooms that are considered to be usable continuingly matches the class management explained above. Only Nanjiriri has six classrooms and other schools have four classrooms—one for each grade.
- Selection of students: Of students who have passed the national Primary School Leaving Certificate Examination (PSLCE) at the completion of primary education[2], 50 students of the feeder school are selected per class in the order of their achievement in the test. Schools where there is not enough F1 students for the capacity or where the number of students is declining in Table 2-4 have larger ratio of students who decline the enrollment or who drop out of the school due to insufficient facility, a shortage of quality teachers and financial

[1] Secondary education: consisting of four grades of Form 1 to 4 (F1 to F4). Junior secondary and senior secondary include F1 and F2, and F3 and F4, respectively.

[2] Primary education: consisting of eight grades of Standard 1 to 8 (Std1 to Std8) starting at age 6. It has been provided free of charge since 1994.

difficulties (cancellation of scholarship (Bursary), etc.).

- Distribution of enrollment by grade: As shown in Table 2-4, the rate of the number of students of junior secondary years (F1 and F2) of five single-stream schools except of Nanjiriri is 65.4% (30.7% in F1 and 34.7% in F2), which account for more than 50 percent of all students. This is because dropout due to financial and health problems, pregnancy and marriage as well as repetition for failing the Junior Certificate Examination (JCE) after the completion of F2. The rate of the number of students of senior secondary years (F3 and F4) is lower at 34.6% (17.0% in F3 and 17.6% in F4).

Table 2-5 Target Schools' Educational Indicators and other Operation Issues in 2009

Priority	Project Site	Education Indicator（2009）								Other administrative situation
		Ratio of Girls					Students/ Teacher		Students /Classroom	
		F1	F2	F3	F4	All Forms		Qualified		
1	Chikhwaza CDSS	31/60 (51%)	17/66 (26%)	4/16 (25%)	6/18 (33%)	58/160 (36%)	15.6	31.2	39.0	Self-boarding during the examination period only: Partial students
2	Dziwe CDSS	25/55 (45%)	23/59 (39%)	18/44 (41%)	13/35 (37%)	79/193 (41%)	27.6	48.3	48.3	Self-boarding: approx.20 students Open school: 30 students
3	Mseche CDSS	16/30 (53%)	29/53 (55%)	11/24 (46%)	4/25 (16%)	60/132 (45%)	22.0	66.0	33.0	Self-boarding: 78 students
4	Namalomba CDSS	17/35 (49%)	25/43 (58%)	6/20 (30%)	11/26 (42%)	59/124 (48%)	13.8	31.0	31.0	Self-boarding: Approx.20% of all the students
5	Nanjiriri CDSS	49/101 (49%)	38/80 (48%)	29/68 (43%)	24/59 (41%)	140/308 (45%)	12.3	34.2	51.3	Cluster Leader School Open school: 350 students
6	Nankumba CDSS	31/67 (46%)	30/58 (52%)	12/33 (36%)	21/38 (55%)	94/196 (48%)	15.1	65.3	49.0	Open school: 45 students
Total(6 CDSSs)		169/348 (49%)	162/359 (45%)	80/205 (39%)	79/201 (39%)	490/1113 (44%)	15.9	41.2	42.8	

Source: Based on answer of the Questionnaires and Interviews.

- Enrollment demand: As shown in Table 2-5, there are three schools (Dziwe, Nanjiriri and Nankumba) that provide open school programs for students who failed the selection in order to ensure their opportunity to receive education. After regular class schedule, open schools classes are taught. The total hours of classes is about half of regular curriculum. The interview revealed that the number of qualified school-age children doubled that of the selected within the commuting distance, which shows the number classrooms is definitely too few.
- Ratio of female students: As shown in Table 2-5, 44% of students of the six schools are girls in 2009. However, the ratio drops sharply to 39% in senior secondary years (F3 and F4). This is mainly because of dropouts due to difficulty in commuting a long distance, failing in JCE at the completion of F2, pregnancy and marriage.
- Self boarding: Self boarding (voluntary boarding at prefabricated facility on school premises and around the school) for students who cannot commute a long distance is common mainly

at rural schools. As shown in Table 2-5, three (Chikhwaza, Dziwe, Mseche and Namalomba) of the six target schools have self boarding and some students of one school (Chikhwaz) have self boarding during the term-end examination period.

Table 2-6 Enrollment within Commuting Distance of Target Schools

Priority	Project Site	(Education Division)	Distance	Pupils in 2008(Primary schools)				Students in 2009		Transition Raito
				Total	Girls	Std 1	Std 8	Total	F1	F1/Std8
1	Chikhwaza CDSS	(Shire H.L)			(47%)	(27%)	(5%)	160	60	12.5%
	Feeder Schools:	9 schools	2-12km	9,375	4,467	2,524	479		(38%)	
2	Dziwe CDSS	(South E)			(50%)	(22%)	(7%)	193	55	18.4%
	Feeder Schools:	5schools	0.5-10km	4,419	2,224	982	299		(28%)	
3	Mseche CDSS	(Central W)			(51%)	(27%)	(5%)	132	30	15.0%
	Feeder Schools:	6schools	0.3-15km	4,404	2,231	1,195	200		(22%)	
4	Namalomba CDSS	(South E)			(46%)	(25%)	(5%)	124	35	15.4%
	Feeder Schools:	6schools	0.3-25km	4,800	2,201	1,225	228		(26%)	
5	Nanjiriri CDSS	(South W)			(49%)	(13%)	(7%)	308	101	8.2%
	Feeder Schools:	10schools	0.5-2km	17,085	8,411	2,295	1,226		(19%)	
6	Nankumba CDSS	(South W)			(52%)	(20%)	(4%)	196	67	17.3%
	Feeder Schools:	12schools	0.1-8km	10,262	5,285	2,130	387		(34%)	

* Number of Pupils in Primary Schools are from EMIS、Number of students of secondary schools are based on answer of the Questionnaires and Interviews.
* Distance from Feeder Schools are based on answer of the Questionnaires and Interviews. Averaged linier distance on tha maps are approx. rudius10-15km.

- Internal efficiency of primary education: As shown in Table 2-6, pupils from five to twelve primary schools come to each of the target schools, with the number ranging from about 4,400 to 17,100 students. Because of the low internal efficiency of primary education (nationwide survival rate to the final year[3] is 52.1% according to 2008 educational statistics), the number in the final year is from 200 to 1,226 (2008) that is a mere 4% to 7%. Of these pupils, those who have passed the PSLCE are selected to advance to secondary schools.
- Transition rate from primary to secondary schools: The transition rate to secondary schools within the commuting distance is estimated to be 12% to 18% at five schools except for Nanjiriri when the number of students who repeat F1 and who go to a private school is not taken into consideration, as shown in Table 2-6. When the fact that 32.9% of all students go to private schools (average of target education districts in 2008) is taken into consideration, the rate corresponds to around 19% to 28%, which is lower than the national average at 40%. Because Nanjiriri is located in a city area, more students go to private schools and CSSs and thus the transition rate to CDSSs is low at 8.2%.

[3] Survival rate at final year: The ratio of students who advance to the final primary school year of Std8 among those who started the first year of Std1.

Table 2-7　Secondary School Enrollment by District

Education Division	(※1) Administrative District / Educational District	Population (National Census 2008) All ages	Population (※3) School aged population 14years-17years	GER No. of Students in Secondary School in 2008	GER (※4) GER in 2008	Transition Ratio to Secondary Education No. of Std 8 in primary schools	No. of F1 students in Secondary Schools 2008	Repetors	(※2) New Entrants	(※5) Transition Raito to Secondary
Central W	Lilongwe Rural	1,230,834	105,055	16,089	15.3%	12,043	4,772	74	4,698	39.01%
	LL Rural East			6,603		5,184	1,965	47	1,918	37.00%
	LL Rural West			9,486		6,859	2,807	27	2,780	40.53%
	Lilongwe City	674,448	55,149	9,507	17.2%	6,085	2,648	88	2,560	42.07%
	Ntcheu	471,589	42,120	10,819	25.7%	6,681	3,061	28	3,033	45.40%
South E	Balaka	317,324	27,205	6,085	22.4%	4,200	1,915	11	1,904	45.33%
South W	Blantyre Rural	340,728	30,607	7,257	23.7%	5,353	2,024	32	1,992	37.21%
	Blantyre City	661,256	55,190	18,664	33.8%	7,402	4,588	26	4,562	61.63%
Shire HL	Mulanje	521,391	40,848	9,260	22.7%	5,757	2,869	28	2,841	49.35%
(※1) Whole Country (Official Announce EMIS 2008)		13,077,160	1,112,580	233,573	21.0% (19%)	166,170	66,874	782	66,092	39.77% (40%)

(※1) Number of students and repeaters (whole country and individual district) are referred from EMIS 2007 and 2008.

(※2) Estimated school aged population is caluculated by the following formulations and correcting ratio utilizing spot data of National Censu

(※3) School aged population is the final data of National Census 2008.

(※4) Secondary Education GER＝Number of Students in 2008/School Aged Population in 2008 (14years-17years)

(※5) Transition Raito to Secondary Education=(No. of F1 in 2008－No. of Repeators)/No. of Std 8 in 2007

- Gross secondary school enrollment rate: As shown in Table 2-7, the rates are below the government target figure (PIF: 30%) in all education districts except for Blantyre City where the rate is high partly because state-run schools, good private schools and grant-aided schools[4] that bring students from all over the nation concentrate.
- Transition rate to secondary school: As shown in Table 2-7, the rates are around 40 to 50% except for Blantyre City, lower than the government target (MGDS: 70%). In the site survey, there are many open schools that provide education for students who are not selected and enrollment demand is very high.
- Secondary school enrollment demand forecast: The number of student enrollment of primary schools is increasing nationwide and the survival rate to the final year (Std8) is also improving rapidly from 26.1% in 2005 to 52.1% in 2008. Of 115,000 students who passed the national PSLCE in 2007, only 66,000 were able to advance to secondary schools, which shows a serious shortage of secondary school classrooms. The number of secondary school enrollment was 46,000 in 1993 before the primary education became free of charge. This grew to 233,000 in 2008, a fivefold increase over the years. According to an estimate of the Ministry of Education (NESP2008), the number of Std8 students is expected to increase by more than 50% from 2008 to 2012 and the enrollment demand for secondary schools is assumed to increase accordingly.

[4] Grant-aided school: Schools that receive subsidies to cover part of labor and operation costs from the government

(2) Project Site Field Survey Evaluation Results

The following table shows the evaluation results of existing and new facilities when conditions of individual site are taken into consideration based on their analysis. Facility components of each site are determined in consideration of the project cost estimated by the Japan side based on the evaluation results.

Table 2-8 Existing Facilities and Facilities to be Expanded (components) on Target Sites

Priority	Project Site	Area	Classroom (A)		Lab. Block	Admini./Library Block	Toilet Block	Boys' Hostel	Girls' Hostel	Dining Hall/Kitchen	Head Teacher's House		Teachers' Houses	
			Existing	Extended	Newly Constructed	Newly Constructed	Extended	Newly Constructed	Newly Constructed	Newly Constructed	Existing	Extended	Existing	Extended
1	Chikhwaza CDSS SH.ED	Rural	4	4	(A)	(A)	(A)	(C)	(A)	(A)	1	-	4	(B) 4～8
2	Dziwe CDSS SE.ED	Rural	4	4	(A)	(A)	(A)	(C)	(A)	(A)	0	-	3	(B) 4～8
3	Mseche CDSS CS.ED	Rural	4	4	(A)	(A)	(A)	(C)	(A)	(A)	0	-	1	(B) 4～8
4	Namalomba CDSS SE.ED	Rural	4	4	(A)	(A)	(A)	(C)	(A)	(A)	0	-	1	(B) 4～8
5	Nanjiriri CDSS SW.ED	Urban	6	6	(A)	(A)	(A)	-	-	-	0	-	0	(C)
6	Nankumba CDSS SW.ED	Rural	4	4	(A)	(A)	(A)	-	-	-	0	-	0	(C)

- Evaluated as (A): Highest priority as essential facility
- Evaluated as (B): Second highest priority as necessary facility
- Evaluated as (C): Third highest priority as necessary facility

1) Planned Number of Classrooms

The enrollment demand in the target areas is quite high when the fact that open schools are operated for students who are not selected for secondary schools with a class size of 50 students based on their performance in the PSLCE. There is almost twice as many students who are qualified but not chosen for the secondary schools as the selected children within the commuting distance. This is supported by the estimated figure[5] of the necessary number of classrooms in NESP 2008. Construction of additional classrooms at all sites is the top priority of the Project and thus is an essential component.

- Five schools in rural areas currently have one class per grade (capacity: 40 students per

[5] NESP 2008 estimated required number of classrooms: The estimated number of 3,818 for public secondary education in 2008 is projected to increase by 20% to 4,597 by 2012 and by 166% to 6,348 by 2017.

class x 4 = 160). The number of class per grade will be increased to two (capacity: 320) and there will be eight classrooms--four existing and four new ones.

- The school in the city area (Nanjiriri) currently adopts double stream for each in F1 and F2 and single stream for each in F3 and F4 which are overcrowded (2009: 68 F3 students and 59 F4 students, last 3 year average: 76.6 F3 students and 73.6 F4 students). Based on such a condition, all grade will have three classes (capacity: 480) and there will be 12 classrooms—six existing and six new ones.

2) Science Laboratory

Natural science (physical science and biology) are required subjects and scientific experiments are included in the Malawi School Certificate Examination (MSCE) students take at the completion of the four-year secondary education. Thus, science laboratories where students can perform experiments are essential in secondary education. It is given the top priority as a component.

- Establishment of two laboratories (one for physical science and one for biology) will be examined based on the curriculum, syllabus, number of classes per year and use of similar facilities.

  <<Number of classes per week based on curriculum>>

  Secondary education curriculum in Malawi basically consists of 45 classes per week (9 40-minute classes/day x 5 days). There are four physical science and four biology classes in F1 and F2 years and five each in F3 and F4 years, which totals 18 physical science and 18 biology classes (4＋4＋5＋5) in the four-year program school-wide.

  <<Operation rate with 2 science laboratories>>

  If physical science and biology classes are taught in science laboratories, their operation rate will be 80% (18 classes/week x 2 classes / 45 classes/week x 100% = 36/45 x 100% = 80%). This means that the laboratories will be occupied seven to eight classes of nine classes per day. In other words, because they will not be occupied one or two classes per day, schedule allotment can be arranged in accordance with the syllabus for all years.

  <<Operation rate with 1 science laboratory>>

  Lecture-style classes in general classrooms that do not involve experiments account for around 40% of all science classes. When they are excluded, the operation rate will be around 45% to 50%. If there is one science laboratory (for both physical science and biology), the operation rate will become 96% (18/week x 2 classes/year x 2 subjects x 0.6/45 week/classes x 100%). This does not allow the arrangement of schedule allotment that accommodate 2-continuous class arrangement in accordance with the syllabus.
- Nanjiriri with three classes per grade will also have two science laboratories like other schools with 2 classes per grade. In this case, the operation rate will become 120% (18/week x 3 classes/year /45 classes/week x 100%). If lecture-type science classes are not taught in science laboratories, the operation rate will be 70% to 75%, which means that they are occupied six to seven classes of nine classes per day. Because they will not be

occupied for two or three classes per day, this will allow the arrangement of schedule allotment in accordance with the syllabus.

3) Administration Block/Library

As facilities essential for school operation, it is the top priority of the Project at all sites. Libraries will be added to the administration blocks of the CDSS project of Africa Development Bank (AfDB).

4) Students' Hostels

Because priority is given to satisfying the transition demand within the commuting distance (15km), the schools will not be 100% boarding schools. In rural areas where students' hostels are needed, girls' hostels will be given priority in accordance with the policy of the Government of Malawi.

- The capacity of students' hostels will be 112 (56 x 2 buildings) of target schools (capacity is 320) in accordance with existing girls' hostels of CDSSs managed by the Government of Malawi.
- The Government of Malawi will consider the construction of boys' hostels in rural areas as a future issue and their construction site will be secured in the facility layout plan.
- Dining halls and kitchens will be included as components for sites where students' hostels are planned.

5) Staff House

According to 2008 Education Management Information System (EMIS), less than 50% of teachers of public secondary schools (CDSSs, CSSs and open schools) are qualified teachers. This shows that deterioration of education quality is unavoidable. Of 5,102 teachers of CDSSs, the targets of the Project, in the country, only 1,361 are qualified teachers, which account for only 25% of all teachers. In 2009, about 3,000 new teachers were recruited to improve the shortage, however, only 60% of the number was actually employed. It is mainly because of insufficient teacher's housing. Insufficient incentive for teachers to be allocated to schools in remote areas was reported.

- Staff housing will be given the second priority, B, because it is essential for schools in remote rural areas where it is difficult to commute. Minimum staff housing will be planned to accommodate about 50% of all teaching staff together combined with existing staff housing.
- Staff housing will be given third priority, C, for two schools (Nanjiriri and Nankumba) in the city or suburban areas where it is not difficult to commute, which will not be included in the Project.
- Headmaster's housing will not be included in the Project and will be included in the regular staff housing.
-

(3) Exterior and Infrastructure Development

1) Exterior Wall Fence

Minimum level of exterior wall fence will be included for safety reasons in the formulation of detailed plan of each site. Because such a fence is usually borne by the Recipient, it is given the second priority.

2) Infrastructure Development and Work Borne by the Recipient

As for sites where the installation of electricity and city water service pipes is considered to be possible based on the field survey (electricity on four sites and city water on two sites), the Malawi side shall be responsible for the installation work and the Japanese side will be responsible for solar power generators and deep wells on other sites.

(4) Equipment Components

1) School Furniture Provision

School furniture necessary for the school operation in classroom blocks and administration block will be provided. Furniture for the staff houses will not be included in accordance with provisions of the Ministry of Education (each teaching staff's responsibility). The grade will be determined based on CDSS assistance projects by AfDB (Education IV, V) and other similar projects.

2) Laboratory Materials Provision

Based on similar projects by AfDB and the list of science laboratory equipment provided in the Project for Secondary School Teacher Training Facility Improvement at Domashi College of Education, a grant aid project by the Government of Japan, laboratory materials will be provided in accordance with the current curriculum and syllabus of physical science and biology. Textbooks, sports gear, chemical agents and other consumables will not be included in the Project.

A list of project components by Project site is shown in the following page:

Table 2-9 List of Project Components by Project Site

Candidate Schools (in order of priority)			Buildings								External Works			Infrastructures					Equipment	
			Classroom 2 rooms /Block	Laboratory 2 rooms /Block	Administ -ration /Library	Toilet /Latrine	Boys' Hostel 56 persons /Block	Girls' Hostel 56 persons /Block	Dining Hall /Kitchen	Staff House 2 houses /Block	Wall Fence/ Path & Pave.	Sports Ground	Planting	Power Supply	Solar Panel	City Water Connectio n	Deep Well	Other incidental facilities, equipment	Educational Furniture	Laboratory Equipment
1	Chikhwaza CDSS /SH.ED	Priority	A	A	A	A	C	A	A	B	B	GoM	GoM	GoM	—	—	A	A	A	A
		(No. of Blocks)	(2)	(1)	(1)	(5)	(2)	(2)	(1)	(4)										
2	Dziwe CDSS /SE.ED	Priority	A	A	A	A	C	A	A	B	B	GoM	GoM	GoM	—	—	A	A	A	A
		(No. of Blocks)	(2)	(1)	(1)	(5)	(2)	(2)	(1)	(4)										
3	Mseche CDSS /CW.ED	Priority	A	A	A	A	C	A	A	B	B	GoM	GoM	—	A	—	A	A	A	A
		(No. of Blocks)	(2)	(1)	(1)	(5)	(2)	(2)	(1)	(4)										
4	Namalomba CDSS /SE.ED	Priority	A	A	A	A	C	A	A	B	B	GoM	GoM	—	A	—	A	A	A	A
		(No. of Blocks)	(2)	(1)	(1)	(5)	(2)	(2)	(1)	(4)										
5	Nanjiriri CDSS /SW.ED	Priority	A	A	A	A		—	—	C	B	GoM	GoM	GoM	—	GoM	—	A	A	A
		(No. of Blocks)	(3)	(1)	(1)	(8)		—	—	—										
6	Nankumba CDSS /SW.ED	Priority	A	A	A	A		—	—	C	B	GoM	GoM	GoM	—	GoM	—	A	A	A
		(No. of Blocks)	(2)	(1)	(1)	(5)		—	—	—										

Remarks: A : Highest priority as essential facility.
B : Second highest priority as necessary facility.
C: Third highest priority as necessary facility.
GoM : To be covered by Malawian Government

2-2-2-2 Construction Plan

The Ministry of Education, Science and Technology (MoEST) of Malawi has developed a number of secondary schools with WB and AfDB loans. Although the development projects were implemented at different times, the design has been improved after each project. Although there is no official standardized design or specifications or standards for educational facilities in Malawi, models or specifications as standard design are being established through the past projects. The outline is described below.

- Buildings are one-story buildings and facilities are divided into such blocks of administration, classrooms, laboratories, library and toilets.
- There is a hallway on one side of the building or open space with the piloti style to enter each room. The corridor connects each block.
- The library is twice as large as general classrooms, consisting of a reading room, stock room and administration room.
- There are two laboratories, one for physical science and one for biology. Water supply, drainage and gas supply are installed also for students' lab bench.
- The gate and wall fence, flag pole, planting, slope protection and other exterior are developed to match school buildings to create a good educational environment.
- Because the absolute number of secondary school facilities is in short, some schools are equipped with students' hostels and kitchen to improve opportunity in and access to education.
- Some schools are equipped with dining halls that can be used as halls for school and community gatherings.
- Staff houses are developed in order to secure qualified teachers.
- All passages and entrances including the exterior are equipped with slopes for persons with disabilities for flat design.

Based on the design and specifications of many educational facilities that have been already developed, optimal construction design will be created in accordance with the criteria of Japan's grant aid projects and based on survey results and technical considerations. It is also designed to meet relevant regulations and based on consultations and instructions of concerned organizations of Malawi.

(1) Layout Plan

The facility layout will be designed in accordance with the principles below properly in consideration of unique conditions (area size and shape of premises, slope, connecting road conditions and existing buildings on the premises) of each site.

- Buildings will be arranged on the east-west axis to avoid strong sun directly entering the

building in the morning and evening. Deep eaves will be built on the north side along the corridor to avoid the sun from the north during the day.

- Buildings will be arranged to leave existing trees as much as possible because they are essential for good educational environment.
- A guard house will be built near the entrance gate and minimum space for parking and turnaround drive will be secured for maintenance and visitors.
- The ground of the premises is clay, which makes it difficult to travel between buildings in the rainy season. Thus, the corridor to connect buildings will be built.
- Proper space will be secured between buildings in accordance with the site conditions in order to prevent interference of classes. Rooms will be arranged in an order manner symmetrically on both sides of the connecting corridor for ensuring an efficient flow line.
- Toilets will be situated in an area accessible from all buildings.
- Buildings will be arranged in consideration of space for future expansion, especially for additional construction of students' hostels.

(2) Floor Planning

The project investment effect is intended to be enhanced by improving the floor plan of each building as described below mainly from the viewpoint of cost reduction based on the standard design[6]. The floor plan will be properly designed in consideration of roles of each room based on the following policies:

- Standard structure in Malawi is masonry buildings with bricks or stabilized soil blocks (SSBs). However, there is no major brick production plant and the Government does not encourage it for protection of forestry because brick production consumes firewood. The buildings in the Project will have SSB masonry structure and the construction capacity will be improved by introducing span arrangement to match the module.
- The floor plan will be based on the latest plan of AfDB in which SSBs are used. However, WB plans that include students' hostels and kitchen also will be used as the base if the AfDB plans do not include these components.
- The buildings will be in planar shape with one-side corridor to allow entry of natural sunlight from both sides of classrooms.

The room size will be designed as explained below in accordance with the furniture layout to meet the activities of each rooms based on the above policy. The floor area will be calculated as area based on the center line of column and the room area will also be calculated as area based on

[6] Plans of WB and AfDB that have developed a number of secondary schools are used as standard design. Although there are differences in components and materials between the projects of the two entities, they are designed based on general construction methods in Malawi.

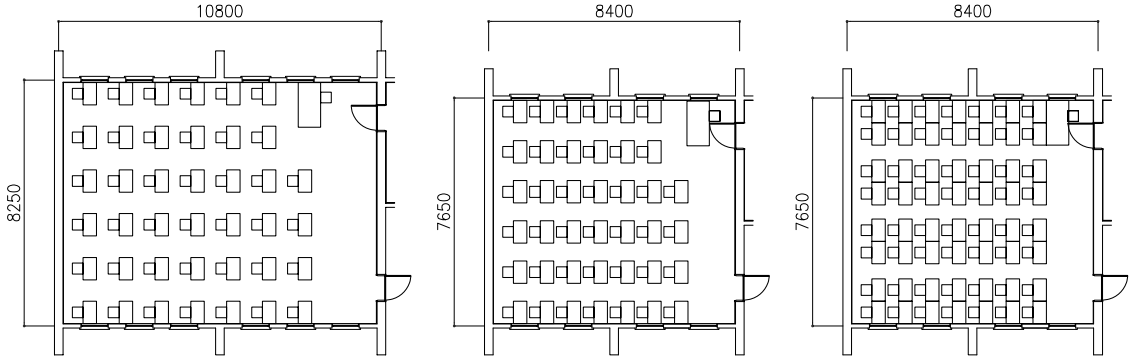
the center line of column or wall.

a. Classroom

The classroom size of AfDB with capacity of 40 is 89.10m^2 (10.80m×8.25m), which allows 2.23m^2 per students and realizes rather a spacious room. In the Project, the classroom size will be reduced to 64.26m^2 (8.40m×7.65m) for efficient floor planning while ensuring appropriate space. Although F1 and F2 classrooms are likely to have more than 40 students because of the high repetition rate, the classrooms to be constructed are for F3 and F4 because the plan is an expansion of existing schools. By arranging two desks together as a unit, each classroom can accommodate up to 56 students. This will enable 25% reduction of each classroom block.

Table 2-10 Comparison of Classroom Area

	AfDB CDSS	Japan's Grant Aid Domashi College of Education	This Project
Classroom Floor Area	89.10m2 (10.80m×8.25m)	75.00m2 (10.00m×7.50m)	64.26m2 (8.40m×7.65m)
Prescribed Number	40 persons	40 persons	40 persons
Floor Area/person	2.23m^2/person	1.88m^2/person	1.61m^2/person



Furniture layout plan for 40 students of AFD Education IV

Furniture layout plan for 40 students of the Project

Furniture layout plan for 56 students of the Project

Figure 2-2 Classroom Furniture Layout

b. Administration Block / Library

The administration block and library are in separate buildings in the standard design. However, floor area of the library will be reduced in accordance with the actual use and the two blocks will be integrated into one building in order to improve efficiency and reduce the cost. Shelves needed in the administration block and library will be built.

Administration Block

Basic components of an administration building of AfDB projects include a headmaster's office, deputy headmaster's office, accountant's office, staff room and storage. Schools where city water can be supplied are also equipped with toilets and kitchen. When the layout of the necessary furniture is taken into consideration, the area size of each room is appropriate. Thus, the AfDB plan will be adopted for the administration block. However, toilets and kitchen will

not be built regardless of the city water availability.

Library

The library surface area excluding the corridor is 138.60m^2 (16.80m×8.25m) in the AfDB standard design, which is twice as spacious as a regular classroom. It consists of (1) librarian reception desk/work station, (2) library and (3) reading area. The number of library books of existing schools differs by school and the majority is textbooks. Thus, the library's role will be limited to storage and loaning of textbooks and reference materials, leaving minimum space for library and reading area. As a result, the library surface area will be designed to be 60.48m^2 (8.40m×7.20m) and the area including the corridor will be 56% reduction of the AfDB plan. Because it will be integrated with the administration block, the span will be in accordance with that of the administration block for efficiency improvement.

c. Laboratory

The laboratory building will house one natural science laboratory and one biology laboratory based on the standard design. The laboratories will be equipped with island lab benches that are commonly used in Malawi for students and each bench will have water supply, drainage and gas stove for experiments. Each laboratory will be equipped with a preparation room, storage and gas cylinder storage, as well as work tables and shelves.

d. Toilet Block

Three types of toilets; one for students, one for teaching staff and one for persons with disabilities, are built in one building in the standard design, which constitute rather a big building. However, because the ventilation system does not work even with the odor chimney, the inside is filled with the odor. The maintenance condition is bad probably partly because such a condition influences users' attitude. The toilet building of schools built by local communities as in the Project is designed to accommodate two to four toilet booths and the ventilation is functioning and thus there is no odor problem.

The toilets of the community style will be adopted to build several small toilet buildings with four booths as one unit with a good ventilation system in the Project. Because the Project includes some sites with a significant height difference, land development work can be reduced by making the building size small.

One booth will be allocated for each class including the existing classrooms. Two buildings (8 booths) for girls and two buildings (4 booths and urinals) for boys and two buildings (1 booth each for men and women and 2 booths for persons with disabilities) for teaching staff are planned to be built.

e. Students' Hostels

Students' hostels are included as a component only in the WB plan. Four students occupy one room or unit and the capacity of one building is 56. Several buildings are built in accordance with the school capacity. The hostels are equipped with such attached facilities as toilets, shower rooms, laundry area and drying lines and storage for each students. Rooms are arranged on both sides of a corridor and daylighting and ventilation are not good. In the Project,

each room will be large enough to accommodate eight students. The feeling of pressure will be reduced by expanding the room area. The building will be shaped in a square without one side around a patio. As a result, by opening the door facing the corridor, light can enter the room from both sides and ventilation condition will improve.

Storages and lounges will be also built in the hostels. Although the lounge will be a simple design similar to the exterior, it will be roofed to be used as students' communication space and as a drying area in the rainy season.

f. Kitchen/Hall

Because the hall functions not only for gatherings but also as a dining room for students, it will be integrated with the kitchen with a piloti in between for efficient flow.

Kitchen

A WB design consists of a matron's office, five storages, a changing room, servery, students' wash-up and students' shop in addition to the kitchen space. The kitchen consists of space for cleaning meat and vegetables and spacious washing sinks. However, in the Project, only basic functions will be installed in line with the actual use to reduce the surface area. The kitchen in the Project will consist of kitchen space, two storages, servery, students' wash-up and students' shop. The one-story kitchen is planned to be rational and efficient. As a result, the actual kitchen floor area excluding the corridor will be 178.92m^2 (10.65m×16.80m), which is smaller by 55% than WB's standard design of 399.96m^2 (23.85m×16.77m).

Hall

The hall is expected to play the role to host gatherings, recreational activities and examinations and as a daily dining room for students as well as gathering space for the community. It will consist of the hall space, stage, changing rooms, toilets and shower rooms. The Project will adopt the WB design except for the facility that uses water and minimum space to arrange chairs for 320 people for all students to be seated at gatherings will be secured. The floor area is similar to that of WB design.

g. Staff House

Each house of the AfDB plan consists of three bedrooms, a living room, dining room, toilets, a shower room, storage, outdoor kitchen and laundry space. Staff houses built by the local community also have three bedrooms. Each house in the Project also will consist of three bedrooms equivalent to those in the AfDB plan. However, because the floor space per house including the outdoor kitchen and the entrance hall is big at 120.51m^2 in the AfDB plan, the area will be reduced by 13% by revising the span in the Project.

Although each building is dependent in the AfDB plan, one building will consist of two houses to improve economic and construction efficiency in the Project. As for the toilet block, the design of staff housing built by the community will be adopted--each house is equipped with one outdoor toilet with direct permeation system to enable easy maintenance. Flush toilets in the standard design of other donors will not be adopted in the Project.

h. Guard House

The guard house in the AfDB plan is designed to be a concrete block building whose outer wall is also used as part of the exterior wall fence. Because the guard house is allocated near the entrance to play its role, the AfDB plan is very efficient and thus the Project will adopt the plan.

The table below shows the facility and room area of each block based on the plan above.

Table 2-11 Facility Composition and Area (m^2) by Site

Building Name	Site Name / Floor Area	Chikhwaza CDSS	Dziwe CDSS	Mseche CDSS	Namalomba CDSS	Nanjiriri CDSS	Nankumba CDSS
a Classroom Block	164.43m2	2 bldg	2 bldg	2 bldg	2 bldg	3 bldg	2 bldg
b Adm. / Library Block	269.01m2	1 bldg	1 bldg	1 bldg	1 bldg	1 bldg	1 bldg
c Laboratory Block	291.06m2	1 bldg	1 bldg	1 bldg	1 bldg	1 bldg	1 bldg
d-1 Toilet Block (Boy)	18.00m2	2 bldg	2 bldg	2 bldg	2 bldg	3 bldg	2 bldg
d-2 Toilet Block (Girl)	18.00m2	2 bldg	2 bldg	2 bldg	2 bldg	3 bldg	2 bldg
d-3 Toilet Block (Staff)	23.76m2	1 bldg	1 bldg	1 bldg	1 bldg	2 bldg	1 bldg
e Hostel	354.42m2	2 bldg	2 bldg	2 bldg	2 bldg		
f Kitchen / Hall	617.40m2	1 bldg	1 bldg	1 bldg	1 bldg		
g-1 Staff House	209.45m2	4 bldg	4 bldg	4 bldg	4 bldg		
g-2 Toilet for Staff House	5.76m2	8 bldg	8 bldg	8 bldg	8 bldg		
h Guard House	7.09m2	1 bldg	1 bldg	1 bldg	1 bldg	1 bldg	1 bldg
Sub Total		3,201.90m2	3,201.90m2	3,201.90m2	3,201.90m2	1,215.97m2	991.78m2
Grand Total							15,015.35m2

(3) Structural Plan

The structural plan will be formulated based on the standard design with some revisions for cost reduction while ensuring the structural strength and quality.

a. Structure

Main Structure

The standard design is the masonry construction with bricks or SSBs. It is a common construction method in Malawi. The same construction method will be adopted using easily available SSBs in the Project. As for the outer wall, half-brick wall and full-brick wall with different thickness will be efficiently arranged in accordance with the standard design and a stabilizing wall will be built depending on the wall length in order to prevent the collapse by the lateral pressure.

The wall of kitchen and hall has a large surface. In order to enhance the strength against the lateral pressure, reinforced concrete columns, beams and reinforced concrete beams at the top of the SSB wall will be efficiently arranged at the top of SSB wall to solidify it.

Substructure

The standard design is continued footing slab with no underground beam. The load of the block wall is received by plain concrete continued baseplate (60cm in width). Although the Project will adopt the similar substructure, reinforced concrete continuous footing will be used

because the soil bearing capacity of the foundation will be relatively low. The building foundation level will be DGL-90cm in accordance with the standard design.

Roof Structure

Based on the comparison of meteorological data of the target sites and wind pressure that is commonly used locally, the section size of wooden truss members will be reduced. The wooden truss is fixed to the reinforced concrete beams with SSB blocks in the standard design. In the Project, the opening height will be increased to fix the wooden truss to the reinforced beams directly to increase rigidity.

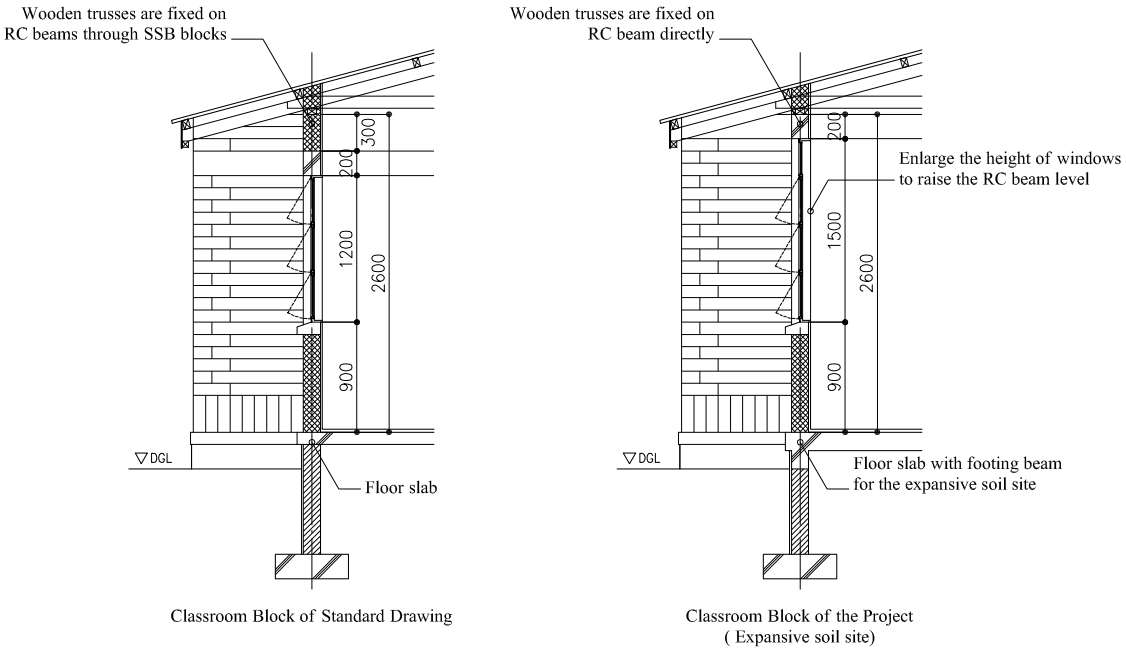


Figure 2-3 Comparison of Structural Sectional Plan

The large-span roof structure of the kitchen and hall is the combination trusses with laminated timber and stressed steel lode in the standard design. However, because it is not a common structure in Malawi, steel truss that can be made in the country will be used in the Project.

Expansive Soil

The surface of the sites of Dziwe in Balaka and Namalomba is covered with expansive soil. When it contains water, it expands and affects the building structure seriously. Thus, reinforced concrete underground beams will be built, the earth slab (10cm in thickness) will be used as the structural slab (15cm in thickness) and the underground beams will be appropriately added in the span center depending on the surface area of the slab. By doing so, the strength against the outer pressure caused by soil expansion will increase. The expansive soil within 1 meter around the foundation will be replaced with gravels.

b. Structural Standard/ Load Conditions

The load conditions will be determined as follows based on the result of natural condition survey:

Ground bearing capacity: Based on the result of the ground survey that was subcontracted locally, the capacity is planned to be 50kN/m^2.

Wind load: Malawi is an inland country and there is no impact of such storm as cyclone according to the past meteorological data of the target sites. The standard wind velocity of 21m/sec and wind pressure of 700N/m^2 will be used based on the recommended figures by the Malawi architects' association.

Seismic load: The Great Rift Valley runs somewhere along Lake Malawi and earthquakes have been recorded. However, the seismic energy was not big and no trace of damage was discovered even on old school buildings in the site survey. However, the shear force coefficient (Ci) at 0.08 was used to calculate the horizontal force in earthquakes to compare it with the wind load horizontal force. The result revealed that the wind load horizontal force exceeded the horizontal force in earthquakes at all buildings and thus no structural analysis with the horizontal force in earthquakes shall be conducted.

c. Structural Materials

The structural materials listed below will be used in accordance with the specifications of local standard design.

Concrete: The design strength is 14N/mm^2 for the foundation and 21N/mm^2 for the underground beam, earth slab, floor slab, beam and column in accordance with the standard design.

Reinforcement: Although the British Standard (BS) is designated in standard specifications, reinforcing bar of South African Bureau of Standards (SABS) are commonly distributed and thus it will be used in the Project. * Values in parenthesis indicate tension strength.

- Deformed bar Grade45 (45kN/cm^2)
- Round bar Grade25 (25kN/cm^2)

Steel: Steel of SABS is commonly used and thus it will also be used in the Project.

- Shaped steel 300WA (45kN/cm^2)
- Bolt Grade88 (80kN/cm^2)
- Anchor bolt Grade43 (43kN/cm^2)

SSB: It will be manufactured on site with a special machine. The quality complies with the Malawi Bureau of Standards (MBS) and the ratio of cement, sand and soil is changed by area.

- General site Volume ratio of cement to soil: 1 to 12, compressive strength in dry phase: more than 2.5N/mm^2
- Stabilized soil block Volume ratio of cement to sand to soil: 1 to 3 to 6, compressive strength in dry phase: more than 3.5N/mm^2

Concrete block: It will be manufactured on site with a special machine. The quality

complies with the Malawi Bureau of Standards and the average compressive strength and minimum compressive strength of the structural concrete block will be 5.0N/mm^2 and 4.0N/mm^2, respectively.

Wooden truss: Truss will be made of domestically produced pine wood that meets the Malawi standards and truss beam will be manufactured on site with metals for fixation.

(4) Facility Plan

The facility shall be planned as follows in accordance with the standard design of the MoEST:

a. Electric Installation

Although all the target schools are existing schools, only Nankumba has electric installations. Of the other five sites, Chikhwaza, Dziwe and Nanjiriri sites are able to have power supply via the power grid. The other two sites of Mseche and Namalomba are too far from existing power grid to be electrified and thus solar panels are planned to be installed there.

Power Receiving and Transforming and Main Installations

High-pressure power will be received via special transformation installation at the sites where power can be supplied via the power grid. Power from existing 11kV high-pressure power grid will be transformed into three-phase four-wire 380 voltage via the pole transformer and it will be pulled into the feeder pillar to be installed independently on the premises. The Recipient shall be responsible for the work to pull in power from the high-pressure power grid to the pole transformer and the work after the transformer will be included in the Project. Because power meters will be installed independently for staff houses, the Recipient shall be responsible for the work from the pole transformer to the power meter to be installed on outer wall of each house.

Solar Panel Generator

Solar panels will be installed independently on the roof of each building at schools where power is supplied by solar energy generation. The power will be stored in the battery to supply minimum necessary power. The system will have the scale shown in the table below depending on the each building scale.

Table 2-12 Solar Power Generation System

		Solar Panel	Battery	Note
Classroom Block, Administration/Library Block, Laboratory Block, Kitchen	Lighting Fixtures	120W x 2	105Ah x 2	
	Outlets	120W x 3	105Ah x 8	
Staff House (per unit house)	Lighting Fixtures	120W x 1	105Ah x 1	
	Outlets	120W x 2	105Ah x 2	
Hall	Lighting fixtures	120W x 4	105Ah x 4	
	Outlets	120W x 3	105Ah x 8	
Hostel	Lighting Fixture	120W x 4	105Ah x 4	
	Outlets	120W x 6	105Ah x 16	

The system in the table above enables continuous use of four days of lighting when the

classroom lighting is on for two hours a day and a crime prevention light is on for 10 hours a day in a classroom block. It also enables continuous use of three days when four computers are used for three hours daily and no other electric appliance is used in the administration and library building if it is equipped with computers in the future.

Lighting Fixtures

Lighting fixtures will be installed in classrooms and other rooms as necessary in accordance with the standard design. Crime prevention lights will also be installed on the exterior wall of each building. Basic indoor lighting fixtures will be 60-watt fluorescent lights, although locally available 100-watt halogen lights will be installed as stage lighting in the hall. As for the sites where solar power is used as power source, small 9-watt fluorescent lights will be used to control power consumption.

Outlet Fixtures

Outlet fixtures will be installed in each room as necessary in accordance with the standard design. Outlets for the number of computers and printers will be provided in the library. Sites where solar power is used as power source will have DC and AC outlets.

Telecommunications Installation

Although the standard design includes phone conduit and line system in the administration block, the Project will not include the system.

b. Air-conditioning and Ventilation

Ventilation fans will be installed for the draft chamber of the laboratories in accordance with the standard design.

c. Water Supply, Drainage and Sanitary Installations

Water Supply System

All target schools are equipped with a city or well water supply system. Nanjiriri and Nankumba situated in the city zone already have or are able to have city water. Although Nanjiriri is accessible to city water, city water installations will be newly constructed because water use is expected to increase after the Project completion. The height difference is large on these sites where city water is supplied. Because city water is connected at a high location, no elevated water tank will be installed and water will be directly supplied to each building. The Recipient will be responsible for pulling in water to the water meter and work from the water meter will be included in the Project.

All sites using wells have hand pumps. Although conditions differ from one site to another, the wells are shallow wells and thus water shortage can occur in the dry season. Deep wells will be newly built for stable supply of necessary water and water will be stored in the water tank and then the elevated water tank (water tower) with a lifting pump. Then water will be supplied to each point with gravity. Either electric or solar pump will be installed in line with site conditions. Well-digging work will be included in the Project.

Water supply is needed in the laboratories, toilet blocks (for hand wash only), students' hostels, kitchen and staff houses.

Sanitary Installations

The laboratories, toilet blocks, students' hostels, kitchen and staff houses need water supply. Water supply in the toilet blocks where students use on a regular basis will be only for washing hands. No flash toilets will be installed as it is now in order to reduce maintenance work. Toilets in staff houses will adopt the same system. Because the toilets are built in a separate toilet building, they have little sanitary impact on the living room and thus the direct permeation style toilet will be built and solid matters will be dipped out regularly.

However, entry into students' hostels needs to be restricted for management and crime prevention and the hostels are in the same building as the living room, thus flush toilets will be built for sanitary reasons.

Wastewater Treatment Facility

Wastewater will be treated on the premises. Rainwater and domestic effluent will go into the seepage pit via the drain ditch built around each building. Wastewater from flush toilets in students' hostels will be permeated into the ground through the perforated pipes via the septic tank. The direct permeation method that is used at the target schools will be applied for treating wastewater from toilets in buildings other than students' hostels. Solid matters need to be dipped out regularly for the direct permeation-style toilets. However, no problem has occurred even such work has been performed for six years since the construction at existing schools.

d. Disaster Prevention Installations

Fire hydrants, extinguishers, emergency bells and other disaster prevention devices are installed in each building in the standard design. The following is planned in the Project based on consultations with local fire departments and similar project achievements.

Table 2-13 Disaster Prevention Devices by Building

Block Name	Fire Extinguishing Equipment
Classroom Block	No obligation
Administration/Library Block	Indoor Hydrant (30m) ×1, Fire Extinguisher (9kg) ×1, CO2 Fire Extinguisher (5kg) ×1
Laboratory Block	Indoor Hydrant (30m) ×1, Fire Extinguisher (9kg) ×1, CO2 Fire Extinguisher (5kg) ×1, Bubble Fire Extinguisher (9kg) ×2, Indication of no smoking
Toilet Block	No obligation
Kitchen	Indoor Hydrant (30m) ×1, Fire Extinguisher (9kg) ×1, CO2 Fire Extinguisher (5kg) ×1, Fire Fighting Cloth×1
Hall	Indoor Hydrant (30m) ×1, Fire Extinguisher (9kg) ×1, CO2 Fire Extinguisher (5kg) ×1, Fire Alarm
Hostel	Indoor Hydrant (30m) ×1, Fire Alarm
Staff House	No obligation

(5) Building Material Plan

Construction specifications will be planned based on the standard design in consideration of the coordination with concerned organizations, visits to past similar projects by other donors and previous facilities built by grant aid, as well as basic grade, robustness, durability and

construction efficiency as school facilities.

Table 2-14 Comparison of Specifications of Main Parts

Element		Standard Design	Specification/Construction Method for the Project	Rational for Selection
Exterior Part				
Roof		IBR color steel sheet, t=0.6mm	Same on the left	It is a proper material for construction and maintenance and disseminated as a standard design in Malawi.
Wall		SSB fair face masonry work + brick sealer	Same on the left	It is a general and standard design in Malawi.
Windows		Steel frame + top-hinged out-swinging, burglar bar shall be installed at necessary rooms such as equipment storages.	Same on the left	It is a standard design in Malawi and adopted since no operational troubles were founded during the site survey.
Doors		Steel frame + wooden framed, burglar bar door shall be installed at necessary rooms such as equipment storages.	Same on the left	Same as the above
Perimeter		Pre-cast concrete paving slabs	Gravel spread only	The gravel spread method is adopted in consideration of the fundamental function and lower cost because it is not used for pedestrians.
Interior Part				
Floors	General part	Mortar steel trowel (25mm)	Same on the left	There is no general method for concrete monolithic surface finish and local contractors' abilities are not clear, thus the standard method shall be adopted.
	Open corridor	Pre-cast concrete paving slabs	Same on the left	Considering no shrinkage crack, easy maintenance and economic efficiency, the standard design shall be adopted.
Walls	General part	Mortar + Paint	Same on the left	It is a general and standard design in Malawi.
	Hall	SSB fair face masonry works	Same on the left	Considering lower cost and no troubles with quality, the standard design shall be adopted.

Ceilings	General part	Exposed IBR sheets on wooden trusses	Same on the left	It is a general and standard design in Malawi.
	Rooms of staff house	Exposed IBR sheets on wooden trusses	Plywood + Paint suspended ceilings with wooden furring	Considering the improvement of interior space and cutting off the quantities for upper separation wall, suspended ceiling shall be adopted.
Wooden Trusses	Whole	Termite treatment + Paint	Termite treatment only	The need for painting of the interior which is not exposed to wind and rain is not substantial.

2-2-2-3 School Furniture Plan

Basic school furniture necessary for school operation will be provided in accordance with the local standard design. Specifications will comply with the standard of the MoEST and the furniture will be provided as follows:

a. Classroom Block

Classroom: Capacity of each classroom will be 40 and each room will be equipped with 40 pairs of desks and chairs for students as well as one pair for the teacher.

Storage: Because it will also function as a preparation room for the teacher, it will be equipped with one stool.

b. Administration Block and Library

Headmaster's office: One pair of desk and chair, two chairs for visitors, three sofas and one large low table will be provided.

Deputy headmaster's office: One pair of management desk and chair, one chair for visitors, one file cabinet, two sofas and one small low table will be provided.

Accountant's office: One pair of management desk and chair, one chair for visitors and one file cabinet will be provided.

Reception: It will be equipped with six chairs for teachers and two tables as a waiting room for visitors and as a meeting room. There is no personnel allocated for reception and thus no other furniture will provided.

Storage: Two tables for computers and four steel framed chairs will be provided in the center for work.

Staff room: The work space will be equipped with 14 pairs of desks and chairs for teachers and four file cabinets. For the rest area, six sofas, three large low tables and four small low tables that is half the amount of local standard will be provided.

Library: Eight desks for reading, four tables for computers, and 20 steel framed chairs for reading will be provided. One pair of teachers' desk and chair as well as two file cabinets will also be provided for librarians.

c. Laboratories

Laboratories: Each laboratory will equipped with 43 stools--42 for students and one for the

teacher.

Preparation room: One stool will be provided.

d. Students' Hostel

Residential room: Because each residential room is planned to accommodate eight students, four sets of bunk bed and eight students' lockers will be provided.

Lounge: Four low tables and 16 steel framed chairs will be provided for students to get together.

e. Kitchen and Hall

Hall: It is designed to accommodate 320 students and thus will be equipped with 320 steel framed chairs as well as 32 tables for dining.

Students' shop: One stool will be provided.

f. Others

Litter bin: Five litter bins will be provided at each school and placed on campus as necessary.

Table 2-15 Quantity of School furniture

Item	Chikhwaza	Dziwe	Mseche	Namalomba	Nanjiriri	Nankumba	Total
Student's Desk	160	160	160	160	240	160	1,040
Head Teacher's Desk	1	1	1	1	1	1	6
Officer's Desk	2	2	2	2	2	2	12
Teacher's Desk	19	19	19	19	21	19	116
Reading Table	48	48	48	48	10	10	212
Low Table (large)	12	12	12	12	4	4	56
Low Table (small)	5	5	5	5	5	5	30
Computer Table	6	6	6	6	6	6	36
Student's Chair	160	160	160	160	240	160	1,040
Teacher's Chair	29	29	29	29	31	29	176
Head Teacher's Chair	1	1	1	1	1	1	6
Officer's Chair	2	2	2	2	2	2	12
Sofa	11	11	11	11	11	11	66
Steel Framed Chair	376	376	376	376	24	24	1,552
Laboratory Stool	93	93	93	93	94	92	558
Steel Cabinet	8	8	8	8	8	8	48
Bunk Bed	56	56	56	56			224
Steel Locker	112	112	112	112			448
Litter bin	5	5	5	5			20

2-2-2-4 Laboratory Material Plan

The laboratory materials are planned in consideration of current physical science and biology curriculum and syllabus. Their specifications will be based on those of the similar projects by WB and AfDB and the science laboratory equipment provided in the Project for Secondary School Teacher Training Facility Improvement at Domashi College of Education, one of Japan's grant aid projects.

a. Laboratory Experiments in Curriculum

Physical science: Students have four classes per week for the junior secondary and five classes in the senior secondary. The syllabus mainly contains the 18 laboratory experiments in the table below and materials, apparatus and their purposes of the use are defined as teaching guidelines.

Contents of Exercise	Teaching & Learning Materials	Intended Use
01.Water and Solution	Beaker, Flask, Test tube, Test tube stand, Wash bottle, Balance etc.	Separation of mixture by distillation
02.Scientific Experiment	Thermometer, Stop watch, Hand lens etc.	Learning of basic laboratory technique for experiments
03.Mechanics of Force	Spring balance, Bar magnet etc.	Basic experiments of mechanics
04.Works/Energy	Thermometer etc.	Experiments of heat capacity
05.Energy/Machine	Pulley, Weight, Inclined plane etc.	Learning of mechanical enlargement
06.Concept of Electricity	Ammeter, Voltmeter, Electric circuit, Transistor etc.	Basic experiments of electrical circuit
07.Light and Reflection	Mirror etc.	Relation between focal length and image
08.Chemical Bonding	Flask, Test tube etc.	Experiments of chemical reaction
09.Scientific Investigation	Glass wears like a Test tube, Glass tube and Flask, Thermometer etc.	Learning of safety usage of laboratory equipment
10.Exercise of Force	Spring balance etc.	Measurement of force and effects on objects
11.Exercise of Electricity	Ammeter, Voltmeter, Slide resister, Knife switch etc.	Learning of series and parallel circuits
12.Magnetism	Bar magnet, Iron power, Magnetic compass etc.	Learning of magnetic force and field
13.Molecule, Compound,	Bunsen burner, Evaporating basin, Beaker, Filter paper, Stirring rod etc.	Learning of difference and property between compound and mixture
14.Chemical reaction	Test tube, Glass wears, Deflagrating spoon etc.	Learning of difference between physical changes and chemical reaction
15.Force and Motion	Inclined plane table, Pulley, Weight etc.	Leaning of advantages of machinery
16.Gravity of material	Measuring cylinder etc.	Learning of measuring gravities
17.Energy Conduction	Thermometer, Spirit burner etc.	Basic experiments of heat energy
18.Oscillations and waves	Mirror, Lens, Prism etc.	Basic experiments of light

Biology: Students take four classes per week for junior secondary and five classes in the senior secondary. The syllabus mainly contains the eight laboratory experiments in the table below and materials, apparatus and their purposes of the use are defined as teaching guidelines.

Contents of Exercise	Teaching & Learning Materials	Intended Use
01.Investigative Skills and Techniques	Glass wears like a beaker, Spirit burner, Microscope etc.	Learning of safety usage of laboratory equipment
02.Livings around us	Microscope, Specimen prepared etc.	Learning of characteristics of living things and observation
03.Digestion in mammals	Test tube etc.	Learning of chemical digestion
04.Interaction between organisms and the physical world	Thermometer etc.	Learning components of substances in nature
05.Photosynthesis	Microscope, Glass wears like a test tube etc.	Learning of photosynthesis and observation of stoma.
06.Human Nutrition	Glass wears like a test tube	Learning of nutritious elements in food
07.Respiratory system	Glass wears like a flask, Human skeleton etc.	Measurement of water vapor and carbon dioxide in air
08.Function of Eyes and ears	Eye and Ear structural models etc.	Learning mechanism of an eye and ear.

b. List of Selected Experiment Apparatus

Chemical agents and other consumables are excluded in the Project in accordance with the grant aid scheme of Japan. Test tubes, beakers and other glass product necessary in experiments are included in the Project. The quantity is based on the layout of the lab bench (sink and gas cock). For experiments conducted in 12 groups, 12 sets of experiment apparatus will be provided. For experiments in six groups by combining one small lab table on the window side and one in the center into one group, six sets of apparatus will be provided. Apparatus whose quantity is indicated as one or two are for teachers' demonstration.

Table 2-16 List of Selected Experiment Apparatus (as per each school)

Biology

No.	ITEM	DESCRIPTION	Quantity (No. of unit)
BI-1	Microscope	Student range, student inclined type	12
BI-2	Microscope slides	1.0-1.2 mm thick. Size 75 x 26mm. Boxes of 72 pcs.	6
BI-3	Cover slips	Number 1.5. Thickness 0.160/0.190mm, 40 x 22mm, Box of 100 pcs.	6
BI-4	Specimen prepared	Blood sample, chromosome, etc.	6
BI-5	Dissecting set	Comprising dish, scissors, pin, scalpel, tweezers, etc.	6
BI-6	Hand lens	Approx.75mm, focal length approx. 250mm	12
BI-7	Evaporating Basin	Porcelain, round bottom, capacity 50ml or more	6
BI-8	Test tube stand	Single row of holes with pegs, hole 20mm, 12 holes	12
BI-9	Test tube	Glass 125mm x 16 mm without rim and printing、Box of 100pcs.	1
BI-10	Beaker	Glass with gradations, capacity 100ml, 300ml	12
BI-11	Flask, conical	Glass, with gradations, capacity 100ml, 300ml	12
BI-12	Flask, round bottom	Glass, capacity, 200ml, 500ml	6
BI-13	Measuring cylinder	Graduated, Glass, 100 x 1ml, 25 x 0.5ml capacity	12
BI-14	Glass tube	Approx. 6mm x 120cm length or more, pack of 10	12
BI-15	Mirror	Square with frame, 200 x 140mm or more	12
BI-16	Spirit burner	Glass type, capacity 70ml or more	12
BI-17	Human skeleton	Plastic, full size replica fully articulated	1
BI-18	Teeth model	Human teeth set model	1
BI-19	Eye and ear models	Human eye and ear models	1
BI-20	Petri dish	Polysyrene, sterile, single vent.90mm diameter	12
BI-21	Pressure sterilizer	Small pressure vessel for sterilizing, max. 125℃, capacity Approx. 10L	1
BI-22	Pipettes	Whole pipettes, capa. 20ml, 10ml	6
BI-23	Burner	For LPG or Buthane with gas cock and base, accessories: socket, plug and rubber tube	12
BI-24	Photosynthesis appara.	Photosynthesis apparatus	1
Physical Science			
PH-1	Test tube stand	Wood, with steel spring for closing jaw, 180mm long	12
PH-2	Test tube	Glass 16 x 125mm without rim and printing , Box of 100pcs.	1
PH-3	Wash bottle	Polyethylene, narrow neck, column, 250ml capacity	12
PH-4	Reagent bottle	Clear/brown glass, narrow neck, glass stopper, capa. 250ml	6
PH-5	Evaporating basin	Porcelain, round bottom, capa. 50ml or more	12
PH-6	Pippete	Class B, 25ml capacity, soda glass	6
PH-7	Dropping pippete	With teat	6
PH-8	Pippette filler	Pi-pump, 25ml capacity	6
PH-9	Spatula	Spoon, stainless steel	12
PH-10	Beaker	Glass with gradations, capa. 100ml, 300ml	12
PH-11	Flask , conical	Glass with gradations, capa. 100ml, 300ml	12
PH-12	Flask, round bottom	Glass, capa. 200ml, 500ml	6
PH-13	Flask, volumetric	Glass, whole gradations, with stopper	6
PH-14	Stirring rod	Dia. 6mm x 200mm or more, glass, pack of 10	12
PH-15	Washing brush	For beakers, flasks, and test tubes	12
PH-16	Funnel	120mm diameter, soda glass, short stem	6
PH-17	Measuring cylinder	Graduated, glass, 100 x 1ml, 25 x 0.5ml capacity	12
PH-18	Thermometer	General purpose, -20 to 105℃, 0 to 360℃, 1 each, mercury	12
PH-19	Thermo-hygrometer	Analog type, temp. -10 to 50℃, humidity 0 to 100%	12
PH-20	Stop watch	LCD digital, upto 9h59min.59.99seconds	6
PH-21	Spring balance	10 x 0.2N, 1x 0.02N, Newton scale	6
PH-22	Optical lens set	Spherical, bi-concave, bi-convex, etc. total 6 kinds	6
PH-23	Prism	Right angle prism, (L)40mm x (T)20mm or more, pair	6
PH-24	Glass tube	Appox. 6mm x 120cm length or more, pack of 10	12
PH-25	Spirit burner	Glass type, capa. 70ml or more	12
PH-26	Rubber stoppers	No 1, 3, 5, 7, 9 10pcs each	6
PH-27	Bunsen burner	For butane/propane gas with 13mm outside diameter, tube, air regulator	12
PH-28	Gauze	Iron wire, square, stainless steel, approx. 150 x 150mm	12
PH-29	Laboratory tool kit	Hammer, Plier, etc. 16 tools or more with case	1
PH-30	Tripod stand	For spirit lamp, gas burner	12
PH-31	Pulley set	Single, double pulley, string and weights, etc.	6
PH-32	Bar magnet	Approx. 150 x 18 x 6mm, in pairs with keepers	6
PH-33	Voltmeter	Analog DC voltmeter, -1～＋3V, -5～+15V, -100～+300V	6
PH-34	Ammeter	Analog DC -10～+50mA, -100 ～+500mA, -1～+5A	6
PH-35	Slide resister	Single tube, 2A, 30ohms	6
PH-36	Resister	Carbon film, 1/3 Watts, 2.2ohms, 4.7 ohms, 5.6 ohms	6
PH-37	Electric circuit	Electric circuit board kit (Worcester Circuit board Kit)	2
PH-38	Motor	Small motor/ generator unit	2
PH-39	Inclined plane set	Inclined plane, cart, stirup, weight, etc.	6
PH-40	knife switch	With plastic base, knife-shaped switch, with clips	6
PH-41	Transistor	p-n-p, n-p-n, 1 pc each	6
PH-42	Table balance	Capacity 200g, readability 200mg, with weights	6
PH-43	Periodic table	Chart	1

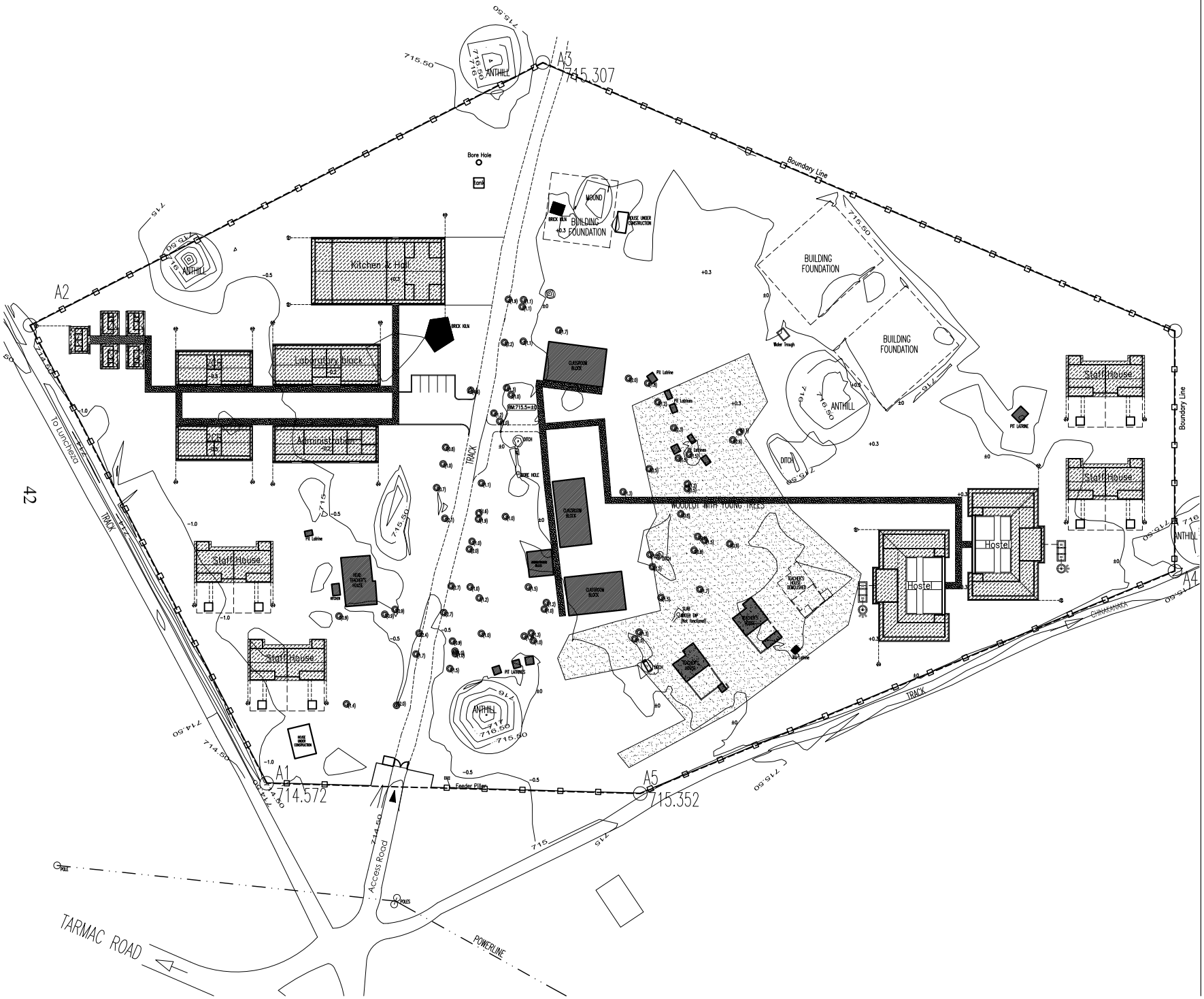
2-2-3 Outline Design Drawing

Layout

A-01	Chikhwaza CDSS
A-02	Dziwe CDSS
A-03	Mseche CDSS
A-04	Namalomba CDSS
A-05	Nanjiriri CDSS
A-06	Nankumba CDSS

Floor plan, Elevation plan, Sectional Plan

A-07	Classroom block
A-08	Administration/library block
A-09	Laboratory
A-10	Toilet block
A-11	Hostels
A-12	Kitchen/Hall 1
A-13	Kitchen/Hall 2
A-14	Kitchen/Hall 3
A-15	Staff house/toilet



SITE NAME : CHIKHWAZA CDSS

EDUCATION DIVISION /DISTRICT	Shire Highlands/Mulange
SITE AREA	41,730 sqm. (measuring by CAD)
FEATURE	flat
ACCESS	dirt road
EXISTING BLDG.	classroom, administration, latrine, staff house
INFRASTRUCTURE	in site : borehole (hand) near : city water, electricity
NEIGHBORHOOD	farmland, vacancy

COMPONENT

• CLASSROOM BLOCK	×2
• ADMINISTRATION / LIBRARY BLOCK	×1
• LABORATORY BLOCK	×1
• TOILET BLOCK	×5
• HOSTEL	×2
• KITCHEN / ASSEMBLY HALL	×1
• STAFF HOUSE	×4
• STAFF HOUSE	×8
• WATCHMAN'S SHELTER	×1

LEGEND

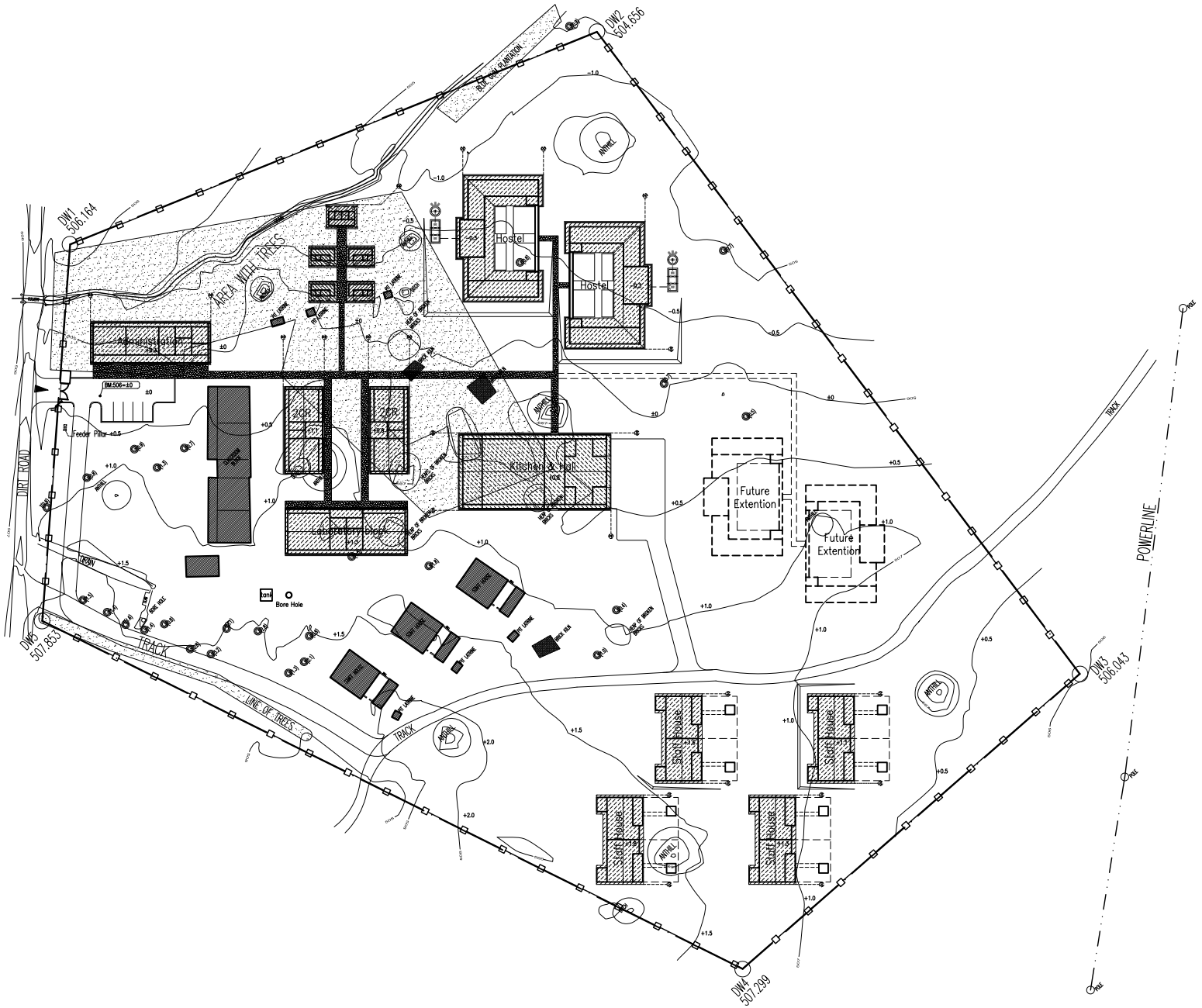
- Boundary line
- Tree
- Area covered by trees
- Boundary fence
- Planned Building
- Existing Building
- Power line
- Interlocking pavement for walking
- Manhole (MH)
- Soakaway
- Storm water passage

N

CONTOUR INTERVAL : 0.5m

0 10 25 50m

SITE PLAN A-01



SITE NAME : DZIWE CDSS

EDUCATION DIVISION /DISTRICT	Southern East/Balaka
SITE AREA	37,893 sqm. (measuring by CAD)
FEATURE	gentle slope
ACCESS	dirt road
EXISTING BLDG.	classroom, administrarion, toilet, staff house
INFRASTRUCTURE	in site : borehole (hand) near : electricity
NEIGHBORHOOD	farmland, vacancy

COMPONENT	
• CLASSROOM BLOCK	×2
• ADMINISTRATION / LIBRARY BLOCK	×1
• LABORATORY BLOCK	×1
• TOILET BLOCK	×5
• HOSTEL	×2
• KITCHEN / ASSEMBLY HALL	×1
• STAFF HOUSE	×4
• STAFF HOUSE	×8
• WATCHMAN'S SHELTER	×1

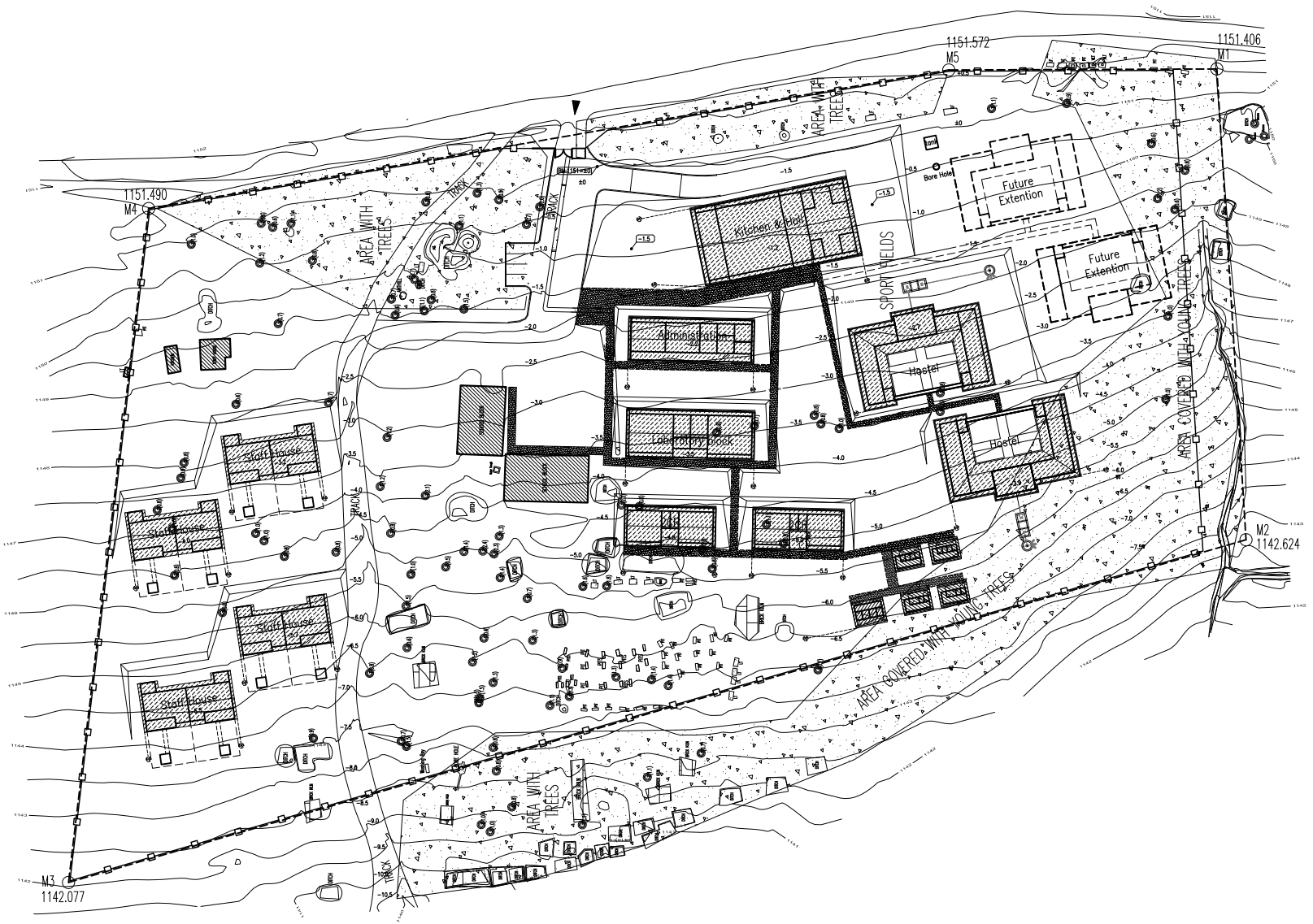
LEGEND

- Boundary line
- Tree
- Area covered by trees
- Boundary fence
- Planned Building
- Existing Building
- Power line
- Interlocking pavement for walking
- Manhole (MH)
- Soakaway
- Storm water passage

N

0 10 25 50m

SITE PLAN A-02



SITE NAME : MSECHE CDSS

EDUCATION DIVISION /DISTRICT	Central West/Lilongwe Rural East
SITE AREA	38,988 sqm. (measuring by CAD)
FEATURE	slope
ACCESS	dirt road
EXISTING BLDG.	classroom, administrarion, toilet, staff house
INFRASTRUCTURE	in site : borehole (hand)
NEIGHBORHOOD COMPONENT	vacancy

• CLASSROOM BLOCK	×2
• ADMINISTRATION / LIBRARY BLOCK	×1
• LABORATORY BLOCK	×1
• TOILET BLOCK	×5
• HOSTEL	×2
• KITCHEN / ASSEMBLY HALL	×1
• STAFF HOUSE	×4
• STAFF HOUSE TOILET	×8
• WATCHMAN'S SHELTER	×1

LEGEND

- Boundary line
- Tree
- Area covered by trees
- Boundary fence
- Planned Building
- Existing Building
- Power line
- Interlocking pavement for walking
- Manhole (MH)
- Soakaway
- Storm water passage

N

0 10 25 50m

SITE PLAN A-03

SITE NAME : NAMALOMBA CDSS

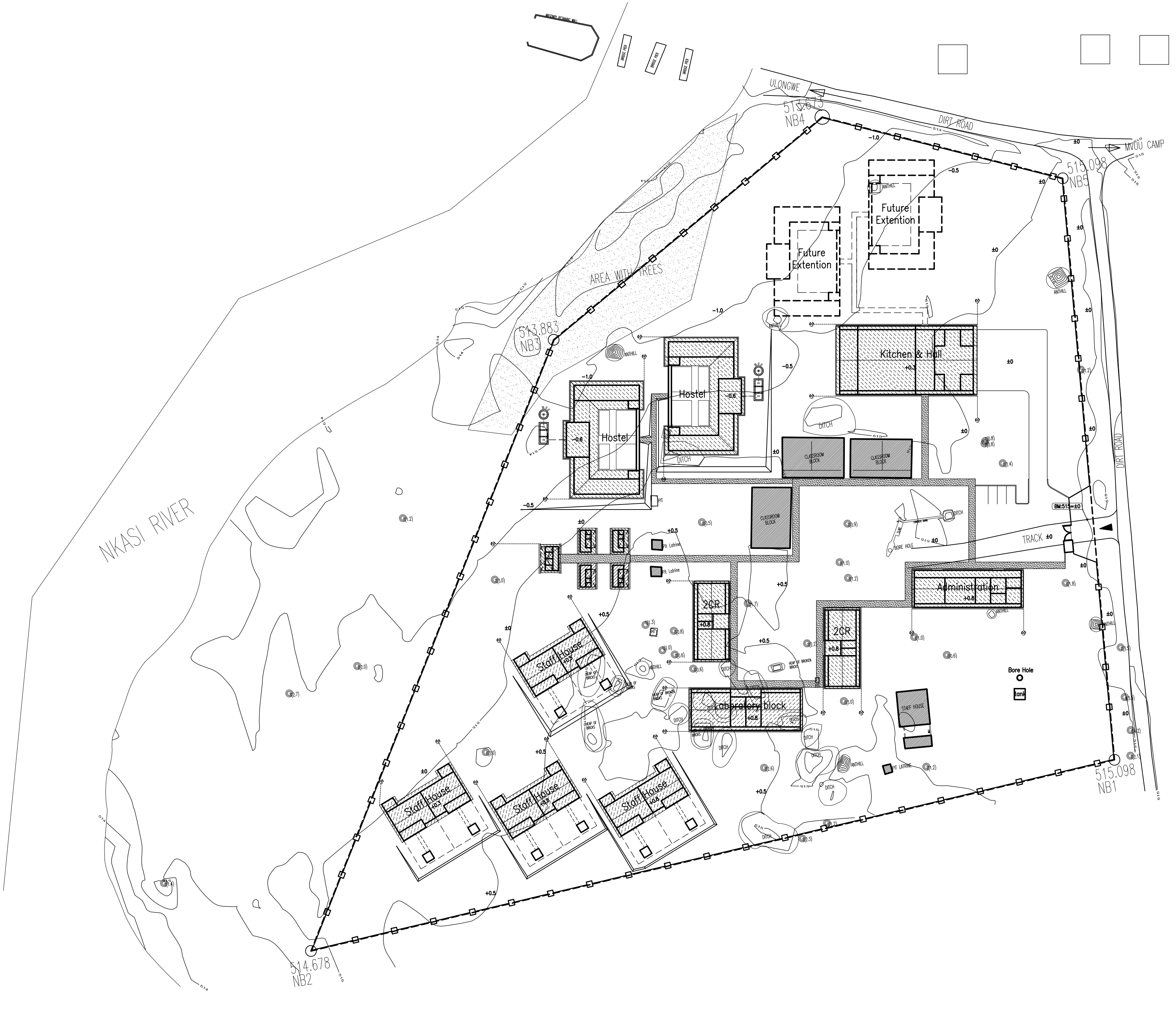
EDUCATION DIVISION /DISTRICT	Southern East/Balaka
SITE AREA	31,036 sqm. (measuring by CAD)
FEATURE	gentle slope
ACCESS	dirt road
EXISTING BLDG.	classroom, administration, toilet, staff house
INFRASTRUCTURE	in site : borehole (hand)
NEIGHBORHOOD	residence area, farmland, river

COMPONENT

• CLASSROOM BLOCK	×2
• ADMINISTRATION / LIBRARY BLOCK	×1
• LABORATORY BLOCK	×1
• TOILET BLOCK	×5
• HOSTEL	×2
• KITCHEN / ASSEMBLY HALL	×1
• STAFF HOUSE	×4
• STAFF HOUSE便所	×8
• WATCHMAN'S SHELTER	×1

LEGEND

- Boundary line
- Tree
- Area covered by trees
- Boundary fence
- Planned Building
- Existing Building
- Power line
- Interlocking pavement for walking
- Manhole (MH)
- Soakaway
- Storm water passage



CONTOUR INTERVAL : 0.5m

0 10 25 50m

SITE PLAN A-04