Ministry of Education, Science and Technology
The Republic of Malawi

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR CONSTRUCTION OF A TEACHER TRAINING COLLEGE FOR SECONDARY SCHOOL TEACHERS IN LILONGWE
IN
THE REPUBLIC OF MALAWI

MAY 2013

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 and entrust the survey to Matsuda Consultants International Co., Ltd.

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.

May, 2013

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

Summary

1 Outline of the Country

The Republic of Malawi (hereinafter referred to as "Malawi") gained independence from the United Kingdom in 1964. It is a landlocked country with a north-south elongated shape located in the southeast of the African Continent. It has a total land area of 118,000 km^2, one-fifth of which is occupied by Lake Malawi. It has a population of 15,380,000 which is growing at a rate of 3.1 % per year. It is one of the most densely populated countries in Sub-Saharan Africa (the World Bank, 2011). The GDP of Malawi is US$ 5,700 million, *ca.* 30 % of which is accounted for by agriculture. Eighty per cent of its working population is engaged in agriculture and agriculture-related businesses. Major agricultural products of Malawi include tobacco, maize, tea, sugar, cotton, nuts and coffee beans. Agricultural products account for 80 % of the total exports. The primary, secondary and tertiary sectors of industry account for 35.5 %, 19.9 % and 44.6 %, respectively, of the GDP. Due to good agricultural production and high prices of agricultural products in the international market in recent years, the economy of Malawi grew at high annual rates of 8.6 %, 7.6 % and 6.7 % in 2008, 2009 and 2010, respectively, while the inflation rate remained below 10 % in the same period (8.7 %, 7.6 % and 7.4 % in 2008, 2009 and 2010, respectively). Despite these good numbers, the *per capita* GNI of Malawi is only US$ 340, which makes it one of the poorest countries in Sub-Saharan Africa. (All the above-mentioned economic indicators derived from the World Bank, 2011). The economic foundation of Malawi is fragile because of its heavy dependence on agriculture whose economic performance is affected greatly by climatic conditions and fluctuation in the prices of agricultural goods in the international market. Therefore, Malawi will have to not only improve agricultural productivity but also develop economic infrastructure and implement measures to promote small-scale businesses, in order to achieve sustainable economic growth which will lead to poverty reduction. Malawi will also have to explore and establish new sources of foreign currency such as mineral resources for the same purpose.

2 Background and Outline of the Requested Assistance

The Government of Malawi (GoM) mentions the importance of education as a part of the "social development" under the framework of the growth and development strategy for poverty reduction in "Vision 2020," the national development strategy, and "Malawi Growth and Development Strategy (MGDS) 2006 - 2011," the mid-term national development strategy. The "National Education Sector Plan (NESP) 2008 - 2017," the national policy on education, mentions extension of equitable access to education, improvement in the quality of education and improvement in governance and management in education as important issues in the entire sector and increase in the enrolment, improvement and extension of educational facilities and increase in the numbers of teachers and qualified teachers as some of the priority targets in the secondary education sub-sector. The "National Strategy for Teacher Education and Development (NSTED) 2008 – 2017" developed for the achievement of these priority targets mentions establishment of the Department of Teacher Education Development (DTED)

in the Ministry of Education, Science and Technology (MoEST), training of new fully qualified secondary teachers, promotion of continuous training programmes for existing teachers, and upgrading of existing under-qualified teachers as its objectives. Among these objectives, the establishment of DTED has been achieved. DTED established under the jurisdiction of the MoEST has been engaged in training of new teachers, research and development of curricula, provision of a distance education programme for under-qualified teachers to upgrade their qualifications and provision of opportunities for continuous professional development to existing teachers.

As a consequence of the introduction of the policy of free primary education in 1994, enrolment in secondary education increased from 50,000 in 2003 to 256,000 (a gross enrolment ratio of 21 %) in 2011 and the demand for school facilities and secondary school teachers increased rapidly (Education Statistics 2011, MoEST). In order to alleviate the severe shortage of secondary school teachers, GoM have employed former primary school teachers as secondary school teachers. As a consequence, 6,389 teachers among the total number of 11,300 working at secondary schools were under-qualified teachers without appropriate qualifications as of 2011 (*ibid.*). As NSTED estimates the number of secondary school teachers required for the provision of a secondary education at a satisfactory level in 2015 at 16,000, GoM will have to develop more than 11,000 newly qualified teachers by 2015 or to intensify the effort to upgrade qualifications of under-qualified teachers urgently.

The secondary school teacher education in Malawi has been undertaken by Domasi College of Education (DCE)and by teacher training institutions at the university level including national universities, the University of Malawi and Mzuzu University. The former is the only educational institution for secondary school teacher education in Malawi, which has offered a three-year diploma programme to *ca.* 400 students every year. The latter have produced nearly 500 graduates with a bachelor's degree in education/literature in education per year. However, *ca.* 30 % of those enrolled in these institutions are existing secondary school teachers seeking higher qualifications and there are students who do not intend to become teachers. Therefore, only *ca.* 50 % of those graduates become secondary school teachers. Meanwhile, 7.6 % of existing secondary school teachers retired or left their jobs in a year (Education Statistics 2011). Since this situation of the number of retiring/leaving teachers exceeding the number of newly qualified teachers has continued for years, it looks extremely difficult to achieve the target of NESP of having the required number of newly qualified teachers by 2017.

Against this background, GoM submitted a request for grant-aid assistance to the Project for Construction of a Teacher Training College for Secondary School Teachers in Lilongwe, in which a new secondary school teacher training college is to be constructed for the purpose of increasing the number of trained qualified secondary school teachers, to the Government of Japan (GoJ) in 2009.

3 Summary of the Study Results and Contents of the Project

JICA dispatched a preparatory study team to Malawi from February to March 2011. The Study Team

studied the background of the requested assistance, the current status of and demand for the secondary education and teacher education and policies and strategies in education of GoM and verified the necessity and relevance of the construction of a new secondary teacher training college. In the study period, the Study Team also studied the capacities of local contractors in the execution management in facility construction and procurement of equipment and the capacity of MoEST in the supervision of project implementation and concluded that it was possible to implement this Project under the Grant Aid for Community Empowerment. After returning to Japan, the Study Team analysed the data collected in Malawi and developed an outline design of the requested assistance.

As this Project is to be implemented with the funds provided under the Grant Aid for Community Empowerment, contractors of the recipient country will construct facilities in the Project in accordance with the existing design specifications for teacher training facilities of the recipient country. The adoption of the local specifications for the Project supported by the Grant Aid for Community Empowerment is for the reduction in the project cost and the improvement of efficiency of the project compared with the project implementation under the Grant Aid for General Projects. The outline of this Project developed by the team in consultation with the counterpart organisation is as follows:

1) Components of the Requested Japanese Assistance

The purpose of this Project is to construct and equip facilities for the establishment of a new teacher training college which is to provide a three-year diploma programme, Pre-Service Education and Training (PRESET) Diploma Course, (180 students/year x 3 years = 540 students) and a three-year distance education programme for existing under-qualified teachers, In-Service Education and Training (INSET) Diploma Course (200 students/year x 3 years = 600 students) and continuous professional training programmes including SMASSE. The components in the requested assistance consist of educational facilities (classrooms, laboratories, library/resource centre/computer centre, administration block, a multi-purpose hall and hostels for students), facilities of the affiliated secondary school, staff houses (42 for the staff of the college and 12 for the staff of the affiliated secondary school) and outdoor sport facilities. The Study Team decided to design this Project as the beginning stage of the construction of the new teacher training college and to construct the facilities required for the function of the college with the simplest components and at the smallest scale in this Project. The team decided to give the first priority order to the construction of the educational facilities among the components of the requested assistance and the second priority order to the construction of the affiliated secondary school and the staff houses, after consultation with the counterpart organisation. It was also decided that the final decision on the number of the staff houses to be constructed was to be made in accordance with the availability of the funds at the implementation stage. The team decided to exclude land preparation for and construction of the outdoor sport facilities from the Project because of the budgetary restrictions.

The team selected furniture for the educational facilities, equipment for scientific experiments and computers for educational uses as the equipment to be procured in the Project.

2) Outline of the Facility/Equipment Plan

The Study Team used the facility components and design specifications of DCE and teacher training colleges for primary school teacher education of the similar scale as the basis and studied the curricula provided, state of the use and maintenance of the facilities and the maintenance costs of the facilities in these institutions when designing the facility/equipment plan. The team used the information on the equipment for the experiments in physics, chemistry and biology used at DCE as the basis and studied the teacher training curricula, equipment actually used effectively in the scientific experiments at secondary schools, status of maintenance and local availability when selecting the laboratory equipment.

The tables below show the outline of the facility/equipment plan. As this Project is to be implemented under the Grant Aid for Community Empowerment, the final decision on the scope of the assistance will be made at the implementation stage.

Table: Facilities

Facility name	Components	Quantity	Total area (m^2)
First priority order: Educational facilities			**5,743.98**
Administration Block	Principal's Office, Vice Principal's Office, Dean's Office, Lecturers' office, INSET Office, Meeting Room, Reception and office rooms for administrative work	2	669.60
Library Building	Library, Resource Centre and Computer Centre	1	691.20
Classroom Block	12 standard classrooms for 40 students, 2 large classrooms 80 students and 12 Subjects Teachers'/Lecturers' Office	8	1,262.62
Laboratory Block	Physics Laboratory, Chemistry Laboratory, Biology Laboratory, Domestic Science Room, Preparation/Equipment Room and classroom	3	753.48
Multipurpose Hall/Kitchen	Hall (dining), stage, storage area, kitchen and staff room	1	1,110.97
Toilet buildings	Toilets for male and female students and toilets for teaching staff	3	173.28
Toilet attached to the Multipurpose Hall/Sick Bay	Toilets for male and female students, toilets for teaching staff and sick bay	1	102.24
External connecting corridor			967.63
Gate House	Gate house and rest room	1	12.96
First Priority Order: Hostel Block			**6,842.90**
Female Hostel Building	Accommodation capacity of 288 with toilet and shower facilities	12	2,872.80
Male Hostel Building	Accommodation capacity of 312 with toilet	13	3,112.20

	and shower facilities		
External connecting corridor			857.90
Second Priority Order: Affiliated Secondary School			**1,488.33**
Administration and Library Building	Head Teacher's Office, staff room, library and storeroom	1	211.68
Classroom Building (2 classrooms)	Two classrooms	1	131.04
Classroom Building (3 classrooms)	Three classrooms	2	393.12
Laboratory Building	Science laboratory, biology laboratory, preparation room, storage space	1	229.32
Toilet Buildings		2	115.52
External connecting corridor			407.65
Second Priority Order: Teachers' house	Three bedrooms, a living room, a bathroom and a kitchen/house	20	**1,620.00**
Total			**15,695.21**

Table: Furniture

Classification	Main equipment name	Use/place of use	Quantity
Furniture for the Administration Block	Senior staff desks and chairs, tables and filing cabinets	Bursar's offices, Dean's Office and administration offices	149
	Conference tables and chairs	Meeting Rooms 1 and 2	60
	Storage cabinets	Archive and storeroom	82
Furniture for the Library Building	Reading desks, tables and chairs	Reading room and reception counters	146
	Office desks and chairs, tables and filing cabinets	Librarian's Office, Resource Centre and Computer Centre	91
	Stack	Bookshelves for open-stack and closed stack libraries and book workshop	94
Furniture for the Classroom Block	Desks and chairs for students, desks, lecture tables and chairs for teaching staff	Standard classrooms (for 40 students) and large classrooms (for 80 students)	1,106
	Desks and chairs for teaching staff and filing cabinets	Staff Room/Lecturers' Room	143
Furniture for the Laboratory Block	Laboratory tables, demonstration tables, work tables and stools	Physics, Chemistry and Biology Laboratories and Domestic Science Rooms	236
	Equipment cabinet, work table and chairs	Preparation/Equipment Rooms	70
Furniture for the Multipurpose Hall/Kitchen	Dining tables and chairs	Multipurpose Hall	768
	Office desks and chairs, filing cabinets and beds	Kitchen Office, Sick Bay and (Gate House)	16
Furniture for the Hostel Block	Beds	For students living in the hostels	600
	Desks and chairs	ditto	1200
Furniture for the affiliated secondary school	Desks and chairs for students and desks and chairs for teachers	Classrooms	656
	Laboratory table, work tables, stools and equipment cabinet	Science and Biology Laboratories and Equipment Room	120
	Desks and chairs for teachers, tables and filing cabinets	Head Teacher's Office, Administration Office and Staff Room	85
	Reading desks and chairs, tables and stack	Library and Library Storeroom	68

Total			5,690

Table: Equipment

Classification	Equipment name	Use	Quantity
Equipment for the teacher training college			
Equipment of biology experiments	Microscopes, microscope slides and prepared slides, dissection kits test tubes, beakers, flasks, measuring cylinders spirit burner, Bunsen Burners, tripod stands clamps, pressure sterilizers, reagent bottles, human skeleton model Models of human eye/ear/teeth, analytical balance, pH meter photosynthesis apparatus, thermometers, etc.	Equipment for observation and practice Glassware and supplementary equipment for experiments, teaching models measuring equipment	67
Equipment of chemistry experiments	Test tubes, beakers, flasks, measuring cylinders, evaporation basins, reagent bottles, spirit burner, Bunsen Burners tripod stands, clamps, washing bottles, pressure sterilizers, analytical balances, triple beam balances, Roberval balances, calorimeters, spectrometers, voltmeters, ammeters, etc.	Glassware and supplementary equipment for experiments, measuring equipment	72
Equipment of physics experiments	Analytical balances, triple beam balances, calorimeters, voltmeters, ammeters, electric circuit kits, Rheostat, signal generators, oscilloscopes, generator motors pulley sets, pendulum bob, inclined plane, spring balance set, optical lens sets, ray boxes, stroboscopes, magnets, tuning forks, Bunsen Burners, tools for experiments, etc.	For basic experiments on electricity For experiments on force, light and sound Measuring equipment Supplementary equipment for experiments	59
Computers and accessory equipment	Desk-top computers	For practice of students	20
	Desk-top computers	For the Resource Centre for teaching staff	7
	Laser printers	For students and teaching staff	2
	Server, router and UPS	For shared-use	1
Equipment for the affiliated secondary school			
Classification	Equipment name	Use	Quantity
Common equipment for biology and scientific experiments	Test tubes, beakers, flasks, measuring cylinders, pipets, spirit burner, tripod stands, pressure sterilizers, reagent bottles, analytical balances, Roberval balances, stopwatches, rulers, tools for experiments, etc.	Glassware for experiments, supplementary equipment measuring equipment	62
Equipment for	Microscopes, microscope slides, prepared slide and	Equipment for	14

biology experiments	dissection sets Hand lens, human skeleton models and models of human eye/ear/teeth	observation and practice Teaching models	
Equipment for scientific experiments	Periodic tables, thermometers, thermo-hygrometer, magnets, etc. Voltmeters, ammeters, electric circuit sets, generator motors, pulley sets, inclined plane sets, spring scales, lenses, prisms, ray boxes, filters, etc.	for basic scientific experiments Equipment for the experiments on electric power, force and light	33

4 Implementation Structure and Project Period of the Project and Initial Cost Estimation

1) Implementation Structure

GoM and GoJ will sign an exchange of note (E/N) and GoM and JICA will conclude a grant agreement (G/A) on the implementation of this Project under Grant Aid for Community Empowerment. GoM will entrust implementation of the Project to a Japanese procurement agent by concluding an agent agreement (A/A) with the agent, in accordance with the agreed minutes (A/M) to be attached to the E/N and the G/A. The procurement agent will implement the Project on behalf of GoM as its agent. In practice, the agent will conclude various procurement agreements (with a supervision consultant, for construction work and for procurement of equipment and furniture), monitor progress of the Project and control the project budget. The construction works and procurement of equipment and furniture will be implemented by contractors, to be selected in open competitive tenders limited to Malawian companies. The Japanese consultant who has developed the outline design will supervise the project implementation using local engineers.

2) Project Period and Initial Cost Estimation

The period required for the implementation of this Project is expected at 31.5 months consisting of 6.5 months between the conclusion of the A/A and the commencement of the construction for the preparation of the tenders and conclusion of the construction agreement, 24 months for the construction works and a month for administrative processes after the handover of the completed facilities. The period expected to be required for the procurement of equipment and furniture consists of a five-month period from the preparation of tenders to the conclusion of the procurement contracts and a fifteen-month period from the conclusion of the agreement to the handover of the equipment and furniture. The procurement will be commenced and completed during the 24 month period of the construction works.

The part of the project costs to be borne by GoM is estimated at 16,700,000 yen.

5 Evaluation of the Relevance of the Project

1) Relevance

Because of the rapid increase in the enrolment in the secondary education, Malawi will have to

produce at least 11,000 new fully qualified teachers by training of new teachers and upgrading of existing under-qualified teachers. However, only *ca.* 400 newly qualified teachers are employed every year because of the limitation of the educational capacity of the existing institutions for secondary school teacher education. Therefore, an increase in the capacity of training institutions is urgently required.

GoM mentions education as a priority area both in the national development strategy, "Vision 2020," and in the mid-term development strategy, MGDS, and development of secondary school teachers/improvement in the capacity of secondary school teachers as one of the priority areas in NESP. NSTED 2007-2017 developed on the basis of NESP advocates measures for training of new fully qualified secondary school teachers, upgrading of existing under-qualified teachers and continuous professional development. Since this Project will directly assist achievement of the strategic objectives of GoM in the area of the secondary school teacher education and development by constructing and equipping a teacher training college for secondary education, it conforms to the comprehensive plans mentioned above.

Since the policy of GoJ is to assist Malawi in a) sustainable economic growth (development of agriculture and rural areas), b) social development (improvement in education, water resource development and health/medical services) and c) infrastructure development (development of transport infrastructure and promotion of rural electrification), this Project also conforms to the assistance policy and strategy of GoJ.

In this Project, facilities will be designed and constructed and equipment will be procured and installed in accordance with the standard design specifications corresponding to the grade of facilities in the existing DCE and similar primary school teacher training colleges constructed with assistance from the World Bank. Therefore, no special technology will be required for the operation and maintenance of these facilities and equipment. In addition, the scale of the new TTC is *ca.* half of that of the DCE. For these reasons, there will be no problem concerning the operation and maintenance of the facilities.

It will be necessary to appoint 42 teaching staff members including the principal, vice principal and deans, 19 administrative workers and 24 other workers for the operation of the new TTC. MoEST intends to prepare a personnel plan for the establishment of the operation and maintenance system in cooperation with educational institutions at the university level and other institutions concerned. The students enrolled in postgraduate courses in higher education institutions, including the University of Malawi and Mzuzu University, (511 in number in 2011) are considered as possible candidates for the new teaching staff to be employed for the new TTC. Large numbers of applicants have always applied for teaching posts at DCE. From these facts, the Study Team considers it possible to establish an educational system and operation system for the new TTC.

The annual running cost of the new TTC is estimated at 0.51 % of the operating budget of MoEST in fiscal 2010/11. The operating budget of the ministry grew at an average rate of 26 % per year in the

past three years. Therefore, the team concludes that the ministry can allot the budget required for the operation to the new TTC.

2) Effectiveness

[Quantitative effects]

The following quantitative effects are expected from the implementation of this Project:

- The PRESET programme (180 students/year x 3 years = 540 students) and the INSET programme (200 students/year x 3 years = 600 students) will be implemented at the new TTC and 380 qualified teachers (180 new teachers and 200 newly-qualified existing teachers) will graduate from the new TTC every year from its third year of operation.

[Qualitative effects]

The following qualitative effects are expected from the implementation of this Project:

- The increase in the number of qualified teachers is expected to improve the quality of the secondary education.

- The implementation of the existing teacher training programmes including SMASSE is expected to improve the quality of the secondary education throughout Malawi.

For the reasons mentioned above, the Study Team concludes that this Project is highly relevant and is expected to be highly effective.

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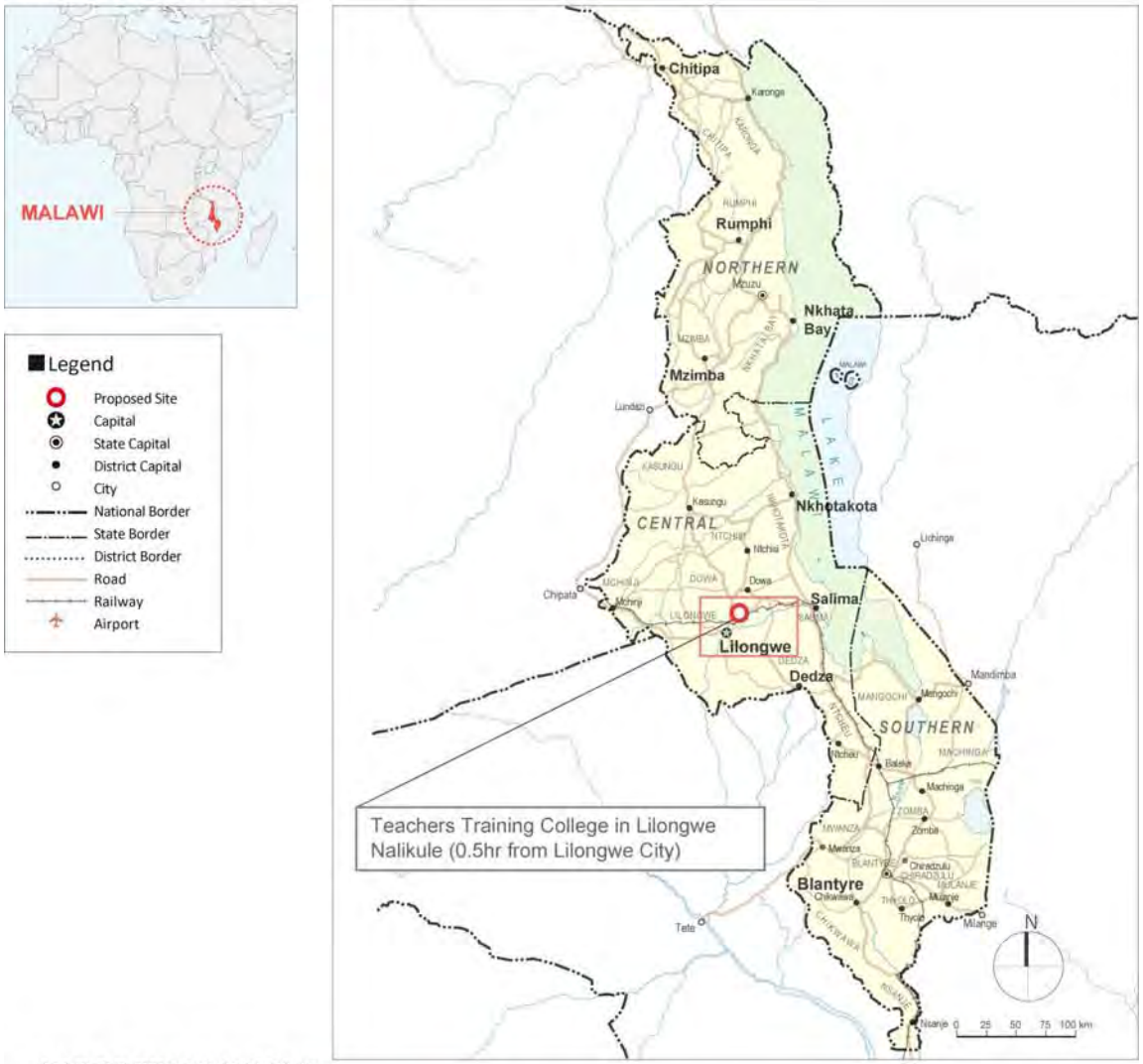
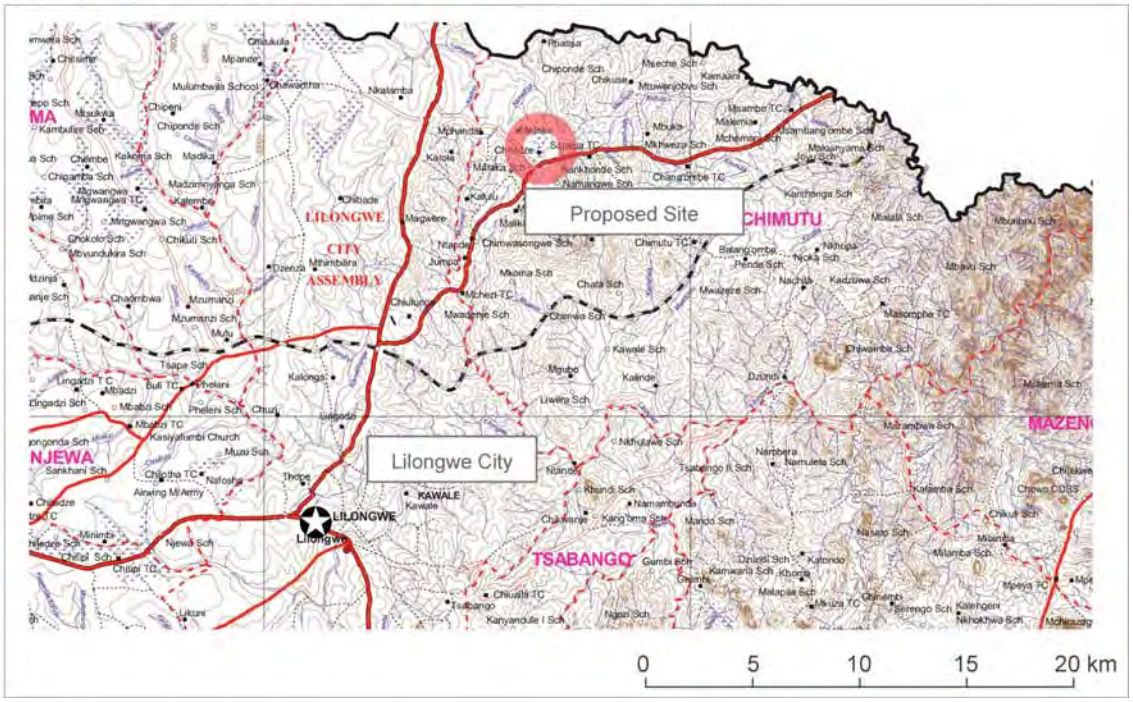
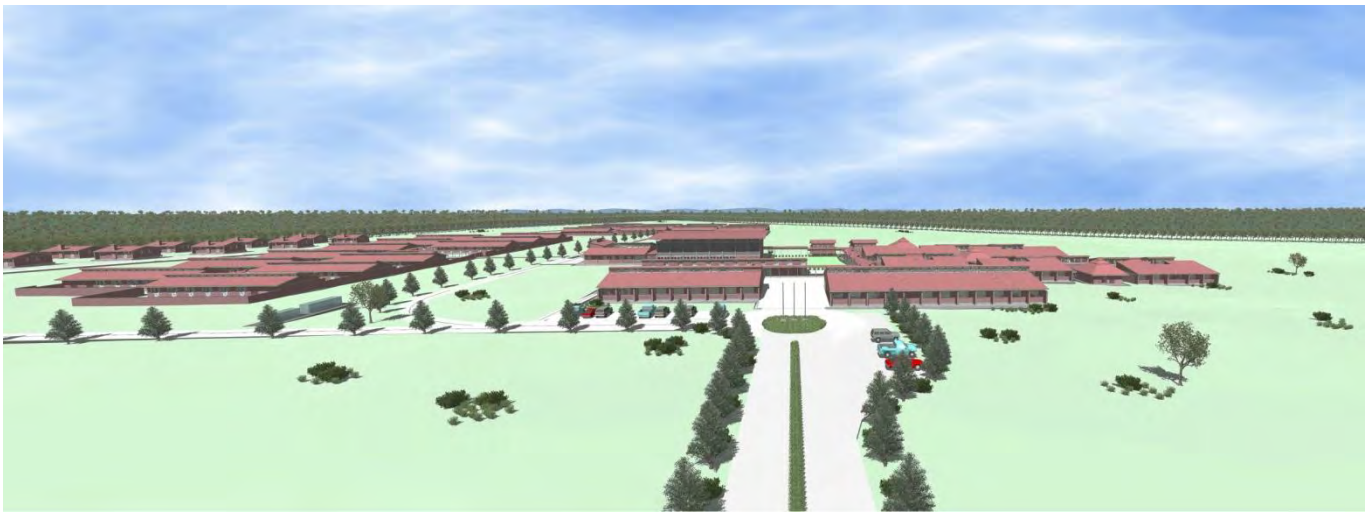
LOCATION MAP OF MALAWI



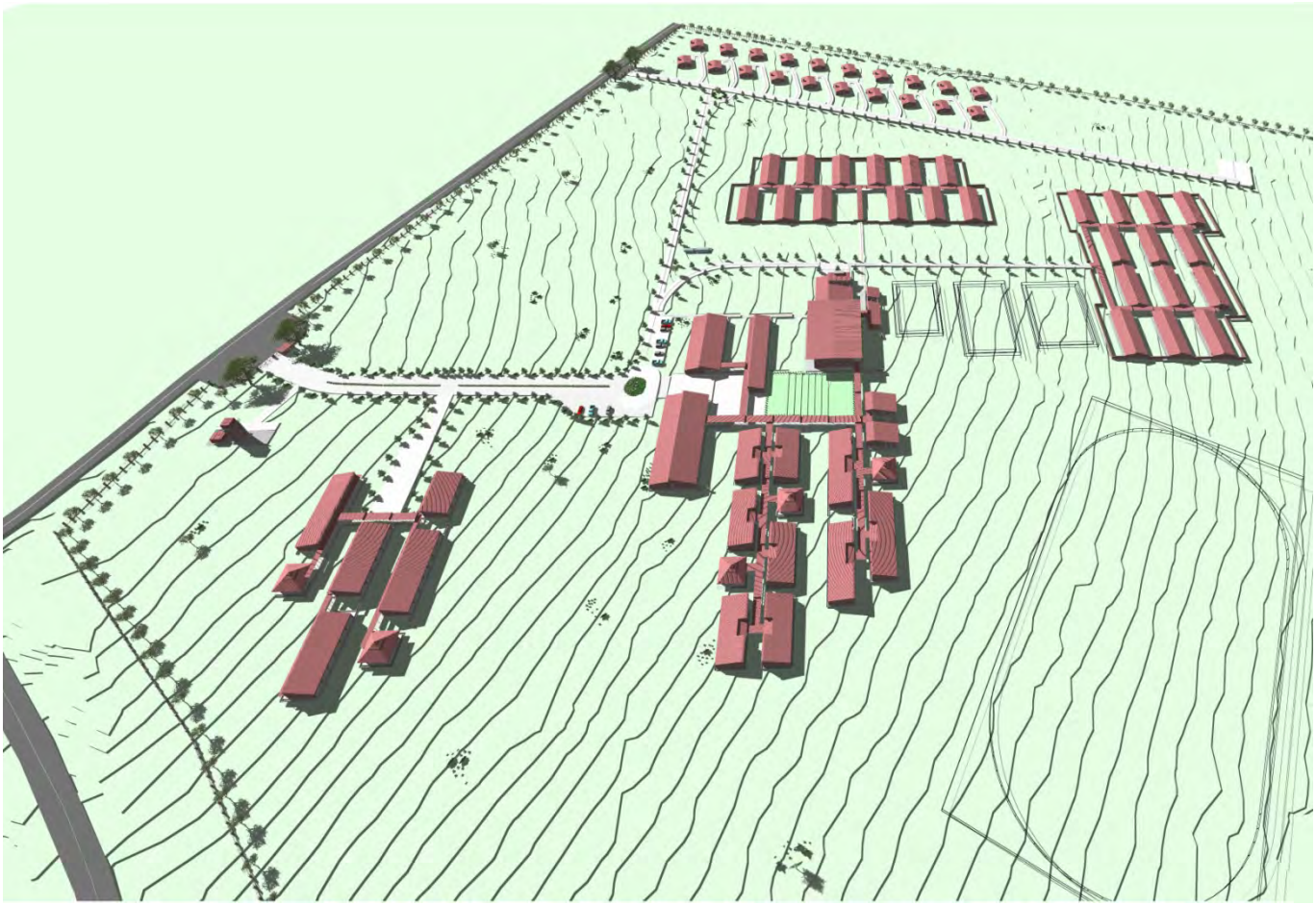
MAP OF PROPOSED SITE



BIRD’S-EYE VIEW



FRONT VIEW



WHOLE VIEW

List of Figures and Tables

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
CPD	Continuing Professional Development
CSS	Conventional Secondary School
DCE	Domasi College of Education
DEC	Distance Education Center
DTED	Department of Teacher Education and Development
EDMU	Education Development Management Unit
EFA	Education for All
EFA-FTI	Education for All-Fast Track Initiative
EIA	Environment Impact Assessment
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
MASAF	Malawi Social Action Fund
MBS	Malawi Bureau of Standard
M/D	Minutes of Discussion
MDGs	Millennium Development Goals
MGDS	Malawi Growth and Development Strategy
MWK	Kwacha
MoEST	Ministry of Education, Science and Technology
MRA	Malawi Revenue Authority
MSCE	Malawi School Certificate Examination
MTTC	Machinga Teacher Training College

NCIC	National Construction Industry Council
NESP	National Education Sector Plan
NSTED	National Strategy for Teacher Education and Development
OS	Open School
PIF	Policy and Implementation Framework
PRESET	Pre-Service Education and Training
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
SMASSE	Strengthening of Mathematics and Science in Secondary Education
SSB	Stabilized Soil Block
TRF	Textbook Revolving Fund
TTC	Teacher Training College
VAT	Value Added Tax
WB	World Bank

Chapter 1 Background of the Project

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1.1 Background and Summary of the Project

As a consequence of the introduction of the policy of free primary education in 1994, the level of enrolment in secondary education increased more than threefold from 50,000 in 2003 to 180,000 in 2004 and increased further to 256,000 (a gross enrolment ratio of 21 %) in 2011. This increase has led to rapid increase in the demand for secondary schools and their teachers. In order to alleviate the serious shortage of secondary school teachers, the government has employed former primary school teachers as secondary school teachers. As a consequence of this practice, only 4,911 teachers among the 11,300 teachers working at secondary schools in 2011 were qualified teachers and the remaining 6,389 teachers, or nearly 60 % of all the teachers at secondary schools, were under-qualified or non-qualified teachers with insufficient knowledge of the subjects in the secondary education curriculum and insufficient training on teaching methods.

Secondary school teacher education in Malawi has been undertaken by Domasi College of Education (DCE), Chancellor College of the University of Malawi, the Faculty of Education of Mzuzu University and private universities, including the Catholic University of Malawi, the University of Livingstonia and the Malawi Adventist University. DCE is the only institution for the secondary school teacher education in Malawi supervised by MoEST, which produces *ca.* 200 graduates every year. The universities have produced many graduates with university qualifications in their diploma and bachelor's degree courses in the education sector. Although the enrolment in these universities has been on the increase with the expansion of programmes in the education-related faculties, the number of newly employed qualified teachers has remained at *ca.* 400 per year because only about half of those who graduated from those universities with university qualifications want to become teachers. Thus, the existing teacher training system in Malawi has failed to meet the demands for secondary school teachers.

Although the government has been providing upgrading courses for under-qualified teachers, distance education and CPD programmes in addition to the training of new teachers, it is impossible to meet the demand of existing teachers for opportunities for education and training because of the limitation on the capacities of existing educational facilities and hostels in the teacher training institutions including DCE.

The decrease in the number of serving teachers because of departure from posts, retirement, deaths, etc. per year has exceeded the increase in the number of newly employed teachers for many years. Therefore, it seems extremely difficult to have the required number of qualified teachers by 2015 or by the target year of 2017, if the current status persists.

Against this background, GoM developed the "Project for Construction of a Teacher Training College for Secondary School Teachers in Lilongwe" for the construction of a new secondary school

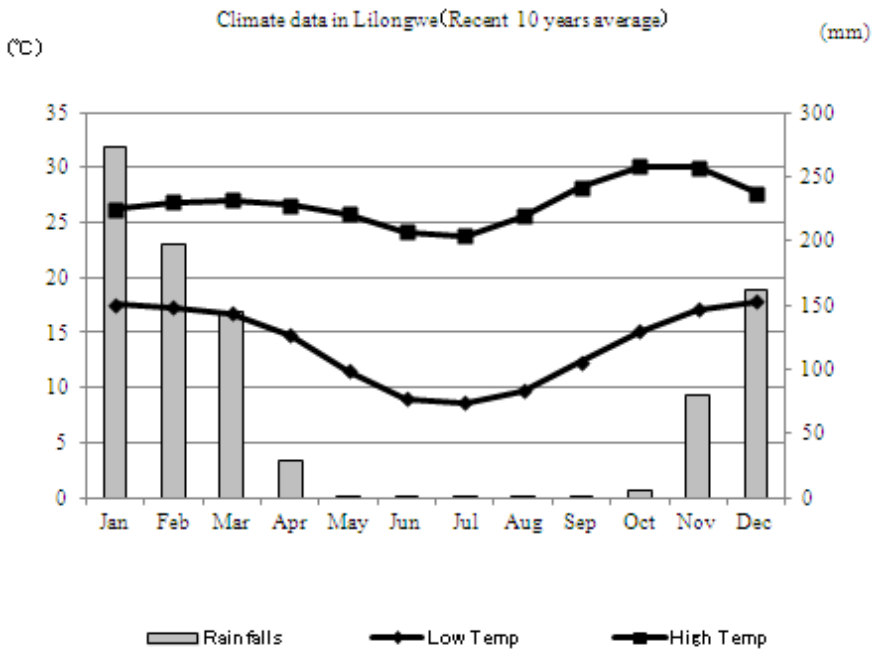
teacher training college near the capital, Lilongwe, in order to produce new fully qualified secondary teachers and upgrade existing under-qualified teachers, and submitted a request for grant aid assistance to the implementation of the plan to GoJ.

The Study Team implemented a preparatory study in February and March 2011 and confirmed the necessity and urgency of the construction of a secondary school teacher training college and the relevance of providing grant aid assistance of Japan to the Project. The purpose of this Project is to enhance the quality of the secondary education in Malawi by facilitating the increase in the number of qualified secondary school teachers (with the promotion of the training for new teachers, upgrading of existing under-qualified teachers, continuous training programmes for existing teachers). This is to be achieved by constructing a new three-year secondary teacher training college in the Lilongwe Capital Area and equipping it appropriately for the provision of diploma programmes, PRESET (Pre-Service Education and Training), with a quota of 540, for initial teacher training, and INSET (In-Service Education and Training) programme with a quota of 600, for upgrading the existing under-qualified teachers and training for professional development of existing secondary school teachers.

1.2 Natural Conditions

(1) Climate

Malawi is located in the tropical savanna climate zone. It has a dry season between May and October and a rainy season between November and April. The monthly average temperature in the dry season is between 16ºC and 21ºC (the highest temperature: 23 - 30ºC). The temperature rises to the average at 23 - 24ºC and the highest at 30 - 31ºC in October and November. Lilongwe, where the project site is located, is situated at 1,100 m above sea level and the average monthly lowest temperature sometimes drops below 10ºC in the dry season between June and August. The annual precipitation is around 900 mm and 80 to 90% of the precipitation is concentrated in the rainy season between November and March. Figure 1-1 shows the average temperature and precipitation over the past ten years at the meteorological observation station at Lilongwe International Airport, which is the meteorological observation station nearest to the project site.



Source: Malawi Meteorological Service (1999-2008)

Figure 1-1 Climate Data in Lilongwe

(2) Topography/Geology

Malawi is a landlocked country in the southeast of the African Continent located between 9º and 17º south and between 33º and 36º east. Its territory is long in the north-south direction with a length of 855 km and narrow in the east-west direction. The total land area of Malawi is 118,000 km^2, *ca.* one-fifth of which is occupied by Lake Malawi. The Great Rift Valley traverses a north-south direction in the east of the country and Lake Malawi is located in the depression at the bottom of the

valley. The territory of Malawi is classified into four areas in accordance with the topographic characteristics. They are Rift Valley lowland, Rift Valley escarpment, plateau and mountains. Most of the Western area between Lilongwe, where the project site is located, and the border with Zambia and the Southeastern area to the border with Mozambique is on the gently undulating flat plateau at an elevation of 1,100 - 1,400 m above sea level.

Most of Malawi is located on the Precambrian - early Paleozoic Mozambique Belt. Metamorphic rocks including a large proportion of gneiss and plutonic rocks including granite and gabbro are widely distributed in the country. Tectonic activities of the Great Rift Valley have created numerous crush zones around the Great Rift Valley. The project site is located on a plateau to the west of the Great Rift Valley. There is a thick layer of soil of weathered basement rocks and deposited alluvium below the ground surface at the site. The soil of weathered rocks is mostly composed of dark brown laterite or lateritic soils. This soil is often consolidated like a soft rock and exposed on the ground surface. The alluvium and deposit layers contain a wide variety of components. Among the components, sandy soil and clayey soil are widely distributed.

(3) Records of the Disasters Caused by Earthquakes and Floods

Earthquakes caused by tectonic activities of the Great Rift Valley have occurred frequently in Malawi. In the recent past, an earthquake of a magnitude of 6.0 on the Richter scale occurred on the shore of Lake Malawi in 1989. This is the only earthquake of a magnitude of 6.0 or above on the Richter scale on record in Malawi for the last 100 years. There is no record of damage caused by an earthquake in the central area where the project site is located. Therefore, the story shear coefficient of Ci = 0.08 will be used in the analysis and study of the effect of seismic lateral force on structures.

The project site is located on ground higher than the surrounding area on a gently undulating flat terrain. The site has a downward inclination from southwest to northeast. Although there is no record of damage caused by floods, creation of temporary water channels and temporarily inundated areas during the rainy season is expected in the lowland outside of the northeastern border of the site. The policy of constructing the planned facilities on the higher part of the site for better water drainage in the rainy season will be adopted for the site planning for this Project.

(4) Survey of the Natural Conditions of the Site

1) Site Survey

The site survey involving a plane survey and levelling was subcontracted to a local surveyors company. A 5 m grid and contour pitch of 0.5 m were employed for levelling and a survey map recording the latitude, longitude, bearing, existing structures, trees and infrastructure installations

was prepared. The site survey concluded that the project site is gently sloping, posing no obstructions to the construction of the planned facilities.

2) Ground Survey

The ground survey was subcontracted to a local engineering company and the necessary soil tests were conducted at the Polytechnic Laboratory of the University of Malawi. This survey involved a dynamic penetration test (161 pits with a drilling depth of 2 m), laboratory tests using samples (18 samples for triaxial testing as well as plasticity and grading test) and water penetration test (six sites). The results of these tests indicate that the soil at the project site is generally light red lateritic firm sandy clay with gravelling sand originating from decomposed light grey rock becoming more dominant at greater depths. Assuming the application of 690 mm wide continuous footings with a depth of 1 m, the ultimate bearing capacity based on Terzaghi's bearing capacity equation will be 307 kN/m^2. Meanwhile, the water penetration test results show an average penetration value of 0.8 mm/min, suggesting a low permeability of the local soil. These results indicate that the project site offers quite strong and stable ground conditions and is capable of accommodating the normal footing loads of buildings.

Based on the above findings, the long-term bearing capacity of the ground at the project site is set at 100 kN/m^3, one-third of the ultimate bearing capacity.

3) Groundwater Survey

The groundwater potential in the Nalikure area where the project site is located is considered to be average or low. To determine the feasibility of extracting groundwater at the site, electrical prospecting was subcontracted to a local engineering company specialising in water use and geological issues. This electrical prospecting involved vertical electrical sounding at six points which were selected through horizontal electrical profiling of the entire site. Based on the results of this vertical electrical sounding, three points showing relative resistance of the ground of 107 Ω–m, 125.9 Ω–m and 195.7 Ω–m respectively were selected for the test drilling of a borehole.

In September and October, 2011, test drilling, a pumping test and water quality test were conducted by a local driller based on the following specifications under the supervision of a Japanese engineer specialising in hydrology and geology.

- Borehole finishing diameter: ∅ 6 inches; average drilling depth of 60 m
- Screen and casing diameter: ∅ 6 inches (external diameter of 160 mm), PVC
- Screen installed in the aquifer and void between the drilling hole and screen filled with gravel
- Borehole development
- Pumping test (phased pumping test; constant flow pumping test; recovery test)
- Water quality analysis (based on the drinking water quality guidelines of Malawi and the WHO)

Of the four test drilling at the site, three boreholes produced groundwater suitable for drinking at a potential rate of 50 m^3/day in total, however this volume falls short of the anticipated water demand of 75 m^3/day. (see the Appendix for details of the test drilling results).

Table 1-1 Test Drilling Results

Test Boreholes	Drilled Depth（m）	Pump set Level（m）	Specific Capacity（m3/h/m）	Groundwater Potential（m3/h）	Available Discharge（m3/day）	Water Quality Test Result
No.1	53	-	-	-	-	-
No.2	54	47	0.022	0.44	10.56	Good
No.3	61	56	0.052	1.04	24.96	Good
No.4	70	65	0.030	0.60	14.40	Good

It is, therefore, essential to extend the local public water supply system to the site, and utilize both the groundwater from the boreholes and the public water for the Project. However, the additional two numbers of borehole will be prospected in the pre-construction stage due to instability of public water supply.

1.3 Environmental and Social Considerations

(1) Environmental and Social Impacts of the Project

The principal component of the Project is the construction of a new teacher training college on a 30 ha site which is part of the Nalikure Forest Reserve Land located along National Route 5 some 13 km northeast of Lilongwe, the capital. This Nalikure Forest Reserve Land used to be a eucalyptus plantation but is currently unused after the complete felling of the eucalyptus trees. The site is currently shrub land surrounding by farming land and no dwellings or settlements exist in the vicinity.

The implementation of the Project will necessitate the excavation of land for the building of the new facilities and the construction of drainage facilities as well as campus roads. The absence of any tall trees and the gently sloping but almost flat land mean that no major land preparation work will be required. Moreover, there are no special social aspects to be taken into consideration. Despite such favourable natural and social conditions for the construction work, however, the design for the Project must still carefully incorporate the following measures to minimise any impacts on the natural and social environments.

- The new facilities will be distributed to accommodate the existing topographical elements, especially the gently slope, to minimise the land preparation work for the buildings. In regard to

this land preparation work, the volume of cutting should match the volume of backfilling and banking so that no surplus soil requiring transporting from the site is generated.

- Roadside ditches and infiltration basins will be installed in an appropriate manner to prevent soil loss and ground erosion due to rainwater.

- As the sewage produced at the site will undergo on-site infiltration, it will not escape outside the site. Septic tanks and infiltration pits will be located at a necessary distance from the planned borehole location to avoid any contamination of the groundwater as well as well water.

- Careful planning will be required to ensure environmental conservation and protection of the local ecosystem on and around the site.

The implementation of the Project will not cause any resettlement of local residents or a major change of the living environment for local residents. No negative impacts on local life are, therefore, anticipated. As the Project involves the construction of educational facilities which will basically benefit local residents, it should lead to an improvement of the social environment of the area.

Based on the above assessment, the Project should be classified as "a project of which the adverse impacts on the natural and social environments are minimal or almost non-existent".

(2) Laws Concerning Environmental and Social Impact Assessment and Related Application Procedure, etc.

In Malawi, the Environmental Act and Guidelines for Environmental Impact Assessment determine the framework for environmental and social considerations and these matters fall under the jurisdiction of the Environmental Affairs Department of the Ministry of Forestry, Fisheries and Environmental Affairs.

Section 24/1 of the Environmental Act stipulates the types and sizes of projects amenable to an EIA. The present Project appears to fall under A4 Infrastructure Projects and A14 Major Policy Reforms.

When a project falls in a project category subject to an EIA, it is necessary to submit an "Outline of Project Brief" to the Environmental Affairs Department for judgement on whether or not an EIA is required. When an EIA is judged to be unnecessary, notes for project implementation are given in relation to the environmental and social considerations. In contrast, when an EIA is judged to be necessary, surveys related to the EIA must be conducted using a set procedure for review and approval of their findings. In the case of the present Project, the Ministry of Education, Science and Technology which is the executing agency for the Project must swiftly submit the Outline of Project

Brief to the Environmental Affairs Department with a view to completing all of the procedures related to the EIA prior to the commencement of the construction work for the Project.

1.4 Others (Global Issues, etc.)

Since the introduction of multi-party democracy in 1994, the Government of Malawi has been implementing a series of reform measures for poverty reduction along with decentralisation and has identified education as an important sector for poverty reduction. Malawi's national development strategy "Vision 2020" and its medium-term development strategy "Malawi Growth and Development Strategy 2006 – 2011" both call for special measures to encourage the school enrolment of girls and the promotion of gender equality.

At present, boys exceed girls for all educational indicators for secondary education. The reasons for the low enrolment ratio of girls are believed to include the unfavourable school environment and social environment for the education of girls and the low overall proportion of female teachers in secondary education of 21.6% (of which 12.3% are qualified)[1]. For the planned new teacher training college, the hostel spaces will be equally divided for male and female trainees. In addition, proactive measures will be employed to ensure the safety of as well as an improved learning environment for female trainees.

[1] Education Statistics 2011/MoEST

Chapter 2 Contents of the Project

Chapter 2 Contents of the Project

2.1 Basic Concept of the Project

(1) Higher Goals and Project Objective

In its National Education Sector Plan, the Government of Malawi identifies the development of a system to continually improve the vocational ability of existing secondary teachers as a priority along with the training of new secondary teachers. The Government of Malawi has also identified such roles of higher education institutions as ① training of secondary teachers, ② development of curricula for secondary teachers, ③ implementation of upgrading courses for under-qualified teachers using distance education and other means, ④ implementation of research in the education sector and ⑤ implementation of training for existing teachers as well as continuing professional development (CPD) programmes and has been making various efforts to realise these envisaged roles of higher education institutions.

The number of pupils enrolled in secondary education and the number of secondary schools rapidly increased in Malawi after the implementation of a policy to make primary education free in 1994. According to data provided by the Ministry of Education, Science and Technology (MoEST), the required number of secondary school teachers will increase to 16,000 by 2015 against the present number of 11,300 of which only some 43% or 4,911 teachers are actually qualified teachers. These figures mean that it will be urgently necessary to either train some 11,000 newly qualified teachers or to upgrade under-qualified teachers or to combine these two measures in the coming years to ensure a certain level of secondary education. Even though existing teacher training institutions, such as Domasi College of Education as well as the University of Malawi and Mzuzu University, have been actively conducting the relevant efforts, including the training of new teachers, upgrading of under-qualified teachers through upgrading courses and distance education and CPD programmes, the limited educational facilities on their campuses mean that the demand for a large number of fully qualified secondary teachers has not been sufficiently met.

Under these circumstances, the objective of the present Project is to expand the teacher training organizations to produce fully qualified new teachers, to qualify existing under-qualified teachers and to promote the CPD of existing teachers for the purpose of solving the problem of a substantial shortage of secondary teachers.

(2) Overview of the Project

To successfully achieve the above-stated objective, the Project intends to build a new three year secondary teacher training college to conduct a new teacher training course (PRESET 540 students) , upgrade course for existing under-qualified teachers (INSET 600 teachers) and other training

programmes for existing teachers. The Project also aims at providing a range of educational equipment, etc., primarily that are used for scientific experiments. With the implementation of the Project, it is expected to enhance the quality of secondary education in Malawi to increase capacity of the country to produce new fully qualified secondary teachers, to promote continuous training programmes for existing teachers and to upgrade existing under-qualified teachers.

For existing secondary teachers in Malawi, the majority of which are under-qualified, the SMASSE and other in-service (INSET) training programmes periodically provided by the Department of Teacher Education and Development (DTED) are the only opportunities to improve their teaching skills. The expansion and upgrading of such training for existing teachers has played a major role in improving the quality of teachers. The implementation of such training in the capital of Lilongwe where the DTED is located in addition to the existing training at the DCE some 300 km south of Lilongwe should prove to be an efficient move from the viewpoint of reducing administration and training cost, including the travelling expenses incurred by trainees who come from all corners of the country. As the implementation of INSET at a teacher training college makes it possible to retrain many more teachers with a limited budget, it is an efficient method of enhancing the capacity of the government to implement its educational policies.

2.2 Outline Design of the Requested Japanese Assistance

2.2.1 Design Policy

(1) Basic Design

The Project is designed to establish a new secondary teacher training college which runs PRESET diploma courses to produce secondary school teachers, INSET diploma courses for existing under-qualified secondary school teachers and CPD courses for existing qualified teachers. As in the case of other universities, teacher training collages are run as boarding schools for those selected for places nationwide. Although the Malawi side initially requested a college capacity of 1,020 students for the PRESET diploma courses, the capacity was reduced through a series of discussions to 540 students for the PRESET diploma courses to ensure a realistic scale of the new college for trouble-free operation and management. The capacity is expected to increase in the coming years to contribute to the elimination of the severe shortage of secondary school teachers. The originally requested facilities were classroom block, laboratories, library/resource centre/computer centre block, administration block, multi-purpose hall, hostel block, affiliated secondary school buildings, staff houses and outdoor sports facilities. The priority of these facilities was then discussed and finalised with the Malawi side. Priority ranking (A), i.e. first priority, was given to such educational facilities as classroom block, laboratories, library/resource centre/computer centre block, administration block, multi-purpose hall and hostel block while priority ranking (B), i.e. second

priority, was given to affiliated secondary school buildings and staff houses. In regard to staff houses, both sides agreed that the final number of houses would be adjusted based on the final budgetary allocation for this purpose.

Table 2-1 Planned Facilities Under the Project

Facility	Priority Ranking
Classroom block	A (first)
Laboratories	A
Administration rooms	A
Library/resource centre/computer centre block	A
Multi-purpose hall/kitchen	A
Hostel block	A
Affiliated secondary school buildings	B (second)
Staff houses	B
Outdoor sports facilities	B

For the basic design, the teacher training plan which is expected to be applied to the new college by the MoEST will be carefully analysed to determine a suitable facility plan based on the expected teacher training curricula, number of students, number of teachers and other relevant matters. For this purpose, references will be made to the Domasi College of Education (DCE), which was the only secondary teacher training college in Malawi and the Machinga Teacher Training College (MTTC) training primary teachers as similar institutions to examine the desirable types and scales of the facilities. In the case of the DCE, the total floor area of the facilities is approximately 28,000 m^2 (including 8,900 m^2 of direct educational facilities, hostel block accommodating 660 students, affiliated secondary school buildings and 57 staff houses). In contrast, the MTTC has a total floor area of approximately 15,000 m^2 (including 6,030 m^2 of direct educational facilities, hostel block accommodating 560 students, affiliated primary school buildings and 35 staff houses). For the Project, the target is to meet the minimum required facilities of a suitable scale for the training of secondary school teachers so that a new teacher training college with compact but functional facilities can be successfully launched as an initial stage of development. As the Project will be funded by the JICA's Grant Aid for Community Empowerment Scheme, it is assumed that the facilities will, in principle, be constructed by a construction company of the recipient country selected by open tender while the equipment will be procured by the successful bidder of an international public tender. Apart from these assumptions, the basic design will be based on the locally common standard design and specifications for the planned facilities where ever possible.

(2) Teacher Training Programmes Under the Project

1) PRESET Diploma Courses

The new college will offer PRESET diploma courses in three languages (English, Chichewa and French) in the Faculty of Language Studies for 170 students, five disciplines (history, geography, sociology, PE and religion/theology) in the Faculty of Humanities for 100 students and five disciplines (biology, chemistry, physics, mathematics and human ecology) in the

Faculty of Science for 270 students, totalling three faculties, 13 courses and 540 students. The Faculty of Education will offer additional inter-disciplinary courses, such as curriculum-based teaching, communication studies, educational sociology and education management, above the standard subjects, bringing the total number of faculties to four even though the Faculty of Education will not have its own students.

Each student will select two courses, i.e. course combination, from his/her faculty to obtain a teaching certification for two disciplines. Regardless of the course combination he/she opts for, he/she must study the predetermined compulsory subjects along with a variety of optional subjects. Actual examples of course combination at the DCE do not necessary combine two disciplines from the same faculty as course combinations across different faculties (such as a science course and humanities course or physical education course and mathematics course (or biology course) are permitted. It is planned that the new college will permit this practice of combining a main course and secondary course from different faculties.

Under the present plan, when the number of students of each faculty and course is equally distributed over three years, the number of students may be as small as 6 – 7 per year for some subjects. The Department of Teacher Education and Development (DTED) plans to produce a general lecture room size of some 20 students for each lesson through the efficient organization of students taking the same subject.

Table 2-2 Configuration of Faculties and Courses for PRESET Diplomas and Number of Students

Faculty	Course	First Year	Second Year	Third Year	Total Number of Students
Language Studies	English	20	20	20	60
	Chichewa	20	20	20	60
	French	17	17	16	50
	Sub-Total	57	57	56	170
Humanities	History	7	7	6	20
	Geography	7	7	6	20
	Sociology	7	7	6	20
	Physical Education	7	7	6	20
	Religion-Theology	7	7	6	20
	Sub-Total	35	35	30	100
Science	Biology	20	20	30	60
	Chemistry	20	20	20	60
	Physics	20	20	20	60
	Mathematics	24	23	23	70
	Human Ecology (Domestic Science)	7	7	6	20
	Sub-Total	91	90	89	270
3 Faculties	Total for 13 courses	183	182	175	540

2) Curricula for PRESET Diploma Courses

The curriculum for each diploma course to be offered by the new college will be basically the same curriculum adopted at the DCE.

Such curriculum consists of 45 lessons a week based on nine lessons a day between 07:30 and 17:30 (one lesson lasts for 60 minutes) for five days a week (Monday through Friday). First year students must study many compulsory subjects which are common to all faculties while second and third year students have more freedom to study optional subjects of their own choice. An academic year has two terms. The first term lasts for 12 weeks from January to March while the second term lasts for 12 weeks from late April to mid-July after the holidays. Although the second term is followed by a long holiday period, third year students are involved in practice teaching for six weeks between September and November.

In addition to diploma courses, the DCE offers degree courses (B.Ed in Primary Education and B.Ed in Secondary Education). The detailed number of lessons for diploma courses is shown in Table 2-3. Students take compulsory subjects as well as optional subjects based on their own combination of courses. In the case of such science courses as biology, chemistry and physics, students in each year basically receive three lecture room lessons and laboratory lessons (three continuous lessons) a week. Human ecology course students receive cooking practice (three continuous lessons) and dress-making practice (two continuous lessons). PE course students receive two lessons of practice a week in addition to lecture room lessons. All students regardless of course are engaged in an outdoor sport once a week in the ninth period.

Table 2-3 Course Curriculum at the DCE

Course	First Year		Second Year		Third Year		Weekly Total	
	Classroom Lessons	Laboratory/ Practical Lessons	Classroom Lessons	Laboratory/ Practical Lessons	Classroom Lessons	Laboratory/ Practical Lessons	Classroom Lessons	Laboratory/ Practical Lessons
Mathematics	5		8		12		25	
Basic Science	4		3		7		14	
Biology	2	6	4	5	7	6	13	18
Chemistry	3	6	3	3	3	3	9	12
Physics	3	6	3	3	7	3	13	12
Human Ecology	3	5	5	7	2	7	10	19
Physical Education	5	4	5	4	5	4	15	12
Geography	6		10		9		25	
History	6		9		9		24	
Religion/ Theology	7		9		9		25	
Sociology	6		5		7		18	
English	6		18		10		34	
French	6		18		10		34	
African Language	6		18		9		33	
English for Specific Purposes	6						6	
General Knowledge	2		2		2		6	
HIV/AIDS Education	3		3		3		9	
Education	24		16		17		57	

Curriculum-Based Teaching			4		13		17	
Total	76	27	143	23	141	23	387	73

Source: Prepared by the Study Team based on the DCE curricula for diploma courses

3) INSET Diploma Courses

INSET diploma courses are planned at the new college to train 600 existing teachers. These INSET courses are designed to upgrade under-qualified teachers at CDSSs and will use the same textbooks as the PRESET diploma courses. In addition to distance education for three years, teachers on an INSET course will be required to attend classroom lessons at the college for 13 weeks a year (seven weeks of intensive classroom lessons/practical lessons and three examination weeks in each term). The INSET course trainees will use the college facilities during the holiday periods for the PRESET courses as shown in Table 2-4.

Table 2-4 Use of College Facilities for INSET Courses

Term	Number of Trainees	Timing	Duration
First Term Examination	600	Early to late April	3 weeks
Second Term Examination	600	Mid-July to early August	3 weeks
Intensive lessons	600	Early August to late September	7 weeks
Total			13 weeks

4) Other Training Programmes for Existing Teachers

Apart from the PRESET and INSET diploma courses, a range of training programmes for existing teachers will be held using the facilities of the new college. These programmes will include SMASSE (Strengthening of Mathematics and Science in Secondary Education for existing teachers), training sessions for head teachers and school management training courses.

(a) SMASSE National INSET Programme

The SMASSE National INSET Programme has so far been held at the DCE located some 300 km away from the capital. Because of the growing number of degree course students, the DCE has found it increasingly difficult to accommodate SMASSE courses. The relocation of SMASSE courses to the new college located in the capital will make it possible for the DTED to manage these courses more efficiently while the travelling cost and other expenses for teachers attending these courses from all corners of the country will be reduced. The SMASSE National Inset Programme to be held at the new college is planned to serve six educational divisions of the country in turn as shown in Table 2-5. At present, the SMASSE Programme has seven full-time trainers and preparations are in progress to deploy three national trainers for each subject.

Table 2-5 SMASSE National INSET Programme (2011)

Educational District	Number of Participants (Females)	Breakdown of Teachers by Subject (Female Teachers)		Duration
North	57 (8)	Mathematics	20 (2)	2 weeks
		Physics/Science	19 (3)	
		Biology	18 (3)	
Central East	48 (6)	Mathematics	17 (4)	2 weeks
		Physics/Science	16 (1)	
		Biology	15 (1)	
Central West	67 (17)	Mathematics	23 (6)	2 weeks
		Physics/Science	22 (5)	
		Biology	22 (6)	
Southeast	50 (7)	Mathematics	14 (2)	3 weeks
		Physics/Science	14 (1)	
		Biology	16 (1)	
		Domestic Science	6 (3)	
Southwest	53 (9)	Mathematics	18 (4)	2 weeks
		Physics/Science	17 (1)	
		Biology	17 (4)	
Shire Highlands	32 (4)	Mathematics	12 (2)	2 weeks
		Physics/Science	10 (0)	
		Biology	10 (2)	
Total	307 (51)			13 weeks (3 months)

Source: DTED of the MoEST

The SMASSE Central Training Programme involves six morning lessons a day, totalling 30 lessons for each of four courses (mathematics, physics/science, biology and domestic science) a week or 120 hours for all four courses. Laboratory work or practical lessons are conducted in the afternoon on three days a week. In addition, there is joint training of four hours.

(b) Other Training Programmes Organized by the DTED

The DTED will organize the following programmes for existing teachers.

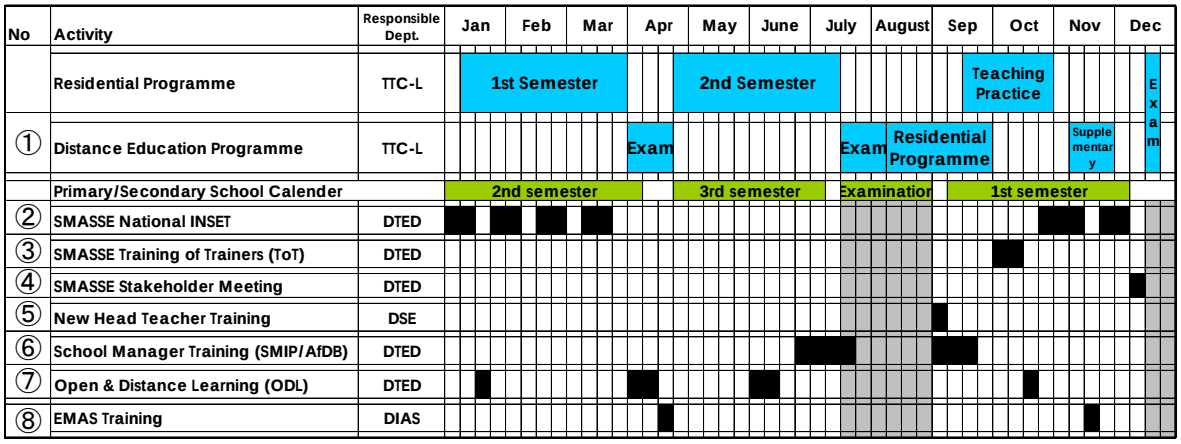
Table 2-6 Other Training Programmes of the DTED

Training Programme/Contents	Number of Participants	Timing	Duration
③ Capacity Development for SMASSE National INSET Programme Trainers			
- INSET Write-Up Development	15 – 20	September	1 week
- Preparation of National INSET	15	October	1 week
④ Training and Conference of SMASSE Stakeholders			
Follow-Up of National Steering Committee	20 – 25	September	3 days
Preparation of Divisional INSET	20 – 25	January	3 days
Review of Divisional INSET	20 – 25	June	3 days
⑤ Training for Newly Promoted Head Teachers			
Training for Newly Promoted Head Teachers	50	September	1 week
⑥ Training on School Management			
School Management Training I	60	June – July	3 weeks
School Management Training II	60	September	3 weeks
⑦ Open and Distance Learning (ODL)			

Preparation Exercise for Aptitude Tests	60	January	1 week
Making Exercise for IPET-ODL Aptitude Test	40	April	1 week
Data Entry Exercise	30	April	1 week
Workshop for Selection of Students	30	July	1 week
Exercise for Module Revision	50	October	1 week
⑦ School Inspector Training			
Annual Review Workshop	50	April	1 week
Workshop to Address Inspector Findings	50	November	1 week
Total	570		

Source: DTED of the MoEST

The annual schedule for all of these training programmes is compiled in Fig. 2-1.



Source: DTED of the MoEST

Fig. 2-1 Annual Training Programme Implementation Schedule

(3) Examination of Facilities

1) Examination of Key Facilities

The scale of the Japanese assistance will be determined to make it both appropriate and relevant by means of carefully selecting those facilities which are compatible with the secondary teacher training curricula, which are essential for the management of the training course and which cannot be substituted by other facilities. Because of the budgetary restrictions for the Project and the fact that it will be implemented under the JICA's grant aid scheme for community empowerment, the final scope of the project components for the Japanese assistance will only be determined based on the tender results and fund management at the project implementation stage. For this reason, the priority of each facility must be determined.

The examination results for such requested facilities as classroom block, laboratories, library/resource centre/computer centre block, administration block, multi-purpose hall and hostel block building are given below.

(a) Classroom Block

The DCE currently has 18 rooms to deliver lectures. These include 12 standard classrooms (40 seats), two large classrooms (80 seats), one special education room (training on the education of pupils with impaired vision), one geography room, one chemistry room and one language laboratory (LL). The MTTC (560 students) also has 18 rooms consists of eight standard classrooms (40 seats), two large classrooms (80 seats), one extra large classroom (160 seats), four small classrooms (20 seats), one lecture room for SNE (40 seats), one LL and one AV room. The minimum necessary number of classrooms will be adopted for the Project based on the training courses and curricula for a secondary school teacher training college.

It is assumed that the proposed college will adopt similar curricula to those for the PRESET diploma courses at the DCE. As already shown in Table 2-3, the weekly curricula have 387 lecture hours and 73 laboratory/practice hours. As 124 lecture hours for the SMASSE National INSET Programme take place at this college during the holiday time, the planned scale of the classrooms should be sufficient to cater for 511 lecture hours for PRESET and SMASSE courses a week. Given that it is essential to plan the minimum necessary scale of facilities for the Project, it is judged that the classrooms can be efficiently used for special education, geography and human ecology (dressmaking in the domestic science course) lessons. The current situation of these lessons at the DCE justifies this decision. In the case of a LL, it has been decided not to include it in the scope of the Project given the fact that the LL equipment at the DCE is no longer used because of maintenance problems. The INSET diploma courses will use the available facilities during the holiday periods between terms.

Table 2-7 Facility Utilization Rate

Facility	Programme	Number of Lectures	Total	Number of Rooms	Utilisation Rate	Remarks
Standard classroom (40 seats)	PRESET Diploma	330	450	12	83.3%	The scheduling of lessons is very tight with 12 classrooms.
	SMASSE National INSET	120		13	76.9%	14 hours of dressmaking practice in the classrooms makes the more efficient use of the classrooms.
	Human Ecology/Dressmaking Lectures and Practice	10	464	13	79.3%	
		4				
Large classroom (80 seats)	PRESET Diploma	57	61	1	135.6%	Two rooms are required as one room is not enough.
	SMASSE National INSET	4		2	67.8%	

The total number of lectures per week delivered in the standard classrooms (40 sears) are 450 (PRESET: 330, SMASSE: 120) and the utilisation rate is 83.3% with 12 classrooms.

However, once the need for lecturers to prepare for teaching, movement of students from one room to another and changes of the lessons hours are taken into consideration, it is very tight to achieve an adjustable timetable with 12 classrooms, making an additional classroom necessary. As part of this increase to 13 classrooms, 13 hours of dressmaking practice, etc. of the human ecology course will take place in a classroom to increase the overall utilisation rate of the standard classrooms to 79.3%. In the case of a large classroom (80 seats), one room alone is insufficient for 61 lectures in total (PRESET: 57, SMASSE: 4) per week because of the utilisation rate of 135.6%, making two large classrooms necessary. These large classrooms will be used for joint lectures for 600 INSET trainees, school management training, open and distance learning (ODL) and school inspector training (EMAS training) organized by the DTED to improve the utilisation rate.

(b) Laboratories

When identical curricula (see Table 2-3) to those at the DCE are adopted, the physics, chemistry and biology courses will have continuous laboratory lessons (three hours) twice a year for each student year. In addition, the human ecology course will have cooking practice (three continuous hours) once a week for each student year. Meanwhile, first year students of the dressmaking course will have weekly practice (two continuous hours) while the second and third year dressmaking students will have twice weekly practice. In the case of the SMASSE National INSET courses lasting for two or three years, morning lessons will be conducted in the classrooms. In the afternoon, laboratory lessons/practice which continues for three hours for each specialist subject will take place three times a week. For each laboratory experiment or practice, the preparation time and tidying up time must be taken into consideration. For this purpose, one hour each before and after the actual lesson/practice will be set aside, making the overall room occupancy duration of each laboratory experiment or practice five hours. In the case of dressmaking practice, half an hour each will be added before and after the practice for preparation and tidying up purposes to make an overall room occupancy duration of four hours per practice.

The original request included one physics, one chemistry and one biology laboratory in addition to one practice room for human ecology. As shown in Table 2-8, one physical laboratory, one chemistry laboratory and one cooking room should be sufficient to accommodate both the PRESET and SMASSE courses in view of the planned laboratory lessons of these courses. In the case of a chemistry laboratory, however, two laboratories will be required to reduce the utilisation rate of 111.1% for a single laboratory. In regard to the human ecology course, the DCE has one cooking room, one dressmaking room and one laundry room. For the new college, one multi-purpose room will be introduced to accommodate cooking practice. Dressmaking practice will use a standard classroom and a laundry room will not be included. The DCE also has separate chemistry and geography

classrooms. Given the actual use of these rooms at the DCE, these rooms will not be provided and standard classrooms should be sufficient to serve any relevant needs.

Table 2-8 Utilization Rate of Laboratories, etc.

Facility	Programme	Number of Hours	Total	Number of Times	Required Hours	Utilisation Rate	Required Number of Rooms
Physics Laboratory	PRESET Diploma	12	21	7	35	77.8%	1
	SMASSE National INSET	9					
Chemistry Laboratory	PRESET Diploma	12	21	7	35	77.8%	1
	SMASSE National INSET	9					
Biology Laboratory	PRESET Diploma	18	30	10	50	111.1%	2
	SMASSE National INSET	12					
Cooking Room	PRESET Diploma	9	15	5	25	55.6%	1
	SMASSE National INSET	6					
Dressmaking Room	PRESET Diploma	10	14	7	21	46.7%	Use of standard classroom
	SMASSE National INSET	4					

(c) Library/Resource Centre/Computer Centre

- Library

A library is an essential facility to assist the own learning of students through free access to various textbooks, teaching aids and reference materials and also to assist the preparation of teaching aids by teaching staff and their own research work. This library will have an open shelf area and reading space. In addition, it must have a stack room, book storage and repair workshop, reception counter and librarian's office as in the case of the library of the DCE and other similar institutions.

- Resource Centre

The resource centre will be used by teaching staff for access to the Internet to obtain useful information for the preparation of teaching aids and test papers. As the computers at a similar centre at the DCE are effectively used, this facility is included in the scope of the Project. At the DCE, computers at the resource centre cannot be used by students because of confidentiality. At the MTTC, computers for students are separately installed in the library. A similar arrangement will be adopted for the resource centre at the new college.

- Computer Centre

As the curriculum for secondary education incorporates computer lessons, every teaching training course must include practice training on computing. At the DCE, 20 computers are installed at the computer centre for use by the humanities and science course students. Teaching on computing includes the basic use of a computer, work processing to prepare documents using basic software, spread sheets and statistical processing. Students are also

engaged in more advanced work under the supervision of lecturers and use computers for information gathering and report preparation. An ante-room is sited next to the computer room for the storage of parts and consumables. A system engineer is assigned to the maintenance of computers and peripheral equipment. In view of the intensity of use of the computer centre at the DCE, the establishment of a computer centre at the new college is judged to be appropriate. It is reasonable to establish this facility in the library building so that a strategic flow line with the resource centre and library itself can be created.

(d) Administration Building

The administration building will accommodate such rooms as thePrincipal's office, Vice-Principal's office, accounting director's office, faculty heads' offices, INSET office and meeting rooms in addition to various rooms associated with college administration and teaching affairs. The INSET office will function as the distance learning centre with responsibility for communication with INSET diploma course students nationwide and for the management of the INSET diploma programme. It will also house the secretariat for the SMASSE National INSET courses during the on-campus training periods.

(e) Multi-Purpose Hall/Kitchen

Apart from its daily use as a college cafeteria, the multi-purpose hall will be used for such college-wide ceremonies as the enrolment ceremony and graduation ceremony. It will also be used for the orientation for the INSET and other courses as well as large meetings of students. The scale of this hall should be sufficient to accommodate 720 sating capacities for 600 students and college staff and the participant attending a college-wide ceremony. When it is used as a cafeteria, it should be able to accommodate 300 diners with tables to serve meals in two shifts. The kitchen facilities will be planned based on examples of similar existing facilities, taking a kitchen layout with local specifications into consideration.

(f) Hostel Buildings

In principle, teacher training courses in Malawi are residential courses. In the case of the DCE, some 200 students (depending on the availability of hostel spaces) are selected each year through examinations from some 8,000 applicants nationwide. The project site is located 13 km travelling east on National Route 5 from the branching point from National Route 1 at the 4 km point north of the centre of Lilongwe. Even though there is a fairly good bus service from the capital to the branching point, connecting bus services from this point on National Route 5 towards the project site are extremely poor. No settlements exist around the project site and the infrastructure for housing is non-existent. As the teacher

training courses last from 07:30 in the morning to 17:30 in the late afternoon, the construction of full-boarding hostels for students is essential. These hostel buildings can also be used for the INSET distance learning diploma courses with 600 trainees for their intensive on-campus training during the holidays of the PRESET courses. In the PRESET terms, the SMASSE National INSET programme will take place for 13 weeks (three months) a year as well as other INSET programmes at the new college and their participants will use these hostel buildings. The basic principle for the construction of the hostel buildings is to prepare an equal number of spaces for male and female students in consideration of gender equality as well as the actual need to increase the number of female teachers. For the hostel buildings to be constructed under the Project, however, the current situation of the SMASSE and other INSET programmes where the number of female participants is smaller than the number of male participants is taken into consideration. Accordingly, the number of hostel buildings for males is 13 compared to 12 for females to ensure the most efficient use of these facilities as explained further below.

The standard specification for a hostel building for higher education in Malawi is 20 occupants per building. This capacity will be increased to 24 for the planned hostel buildings under the Project to reduce the construction cost. 25 buildings (24 occupants each) will be required to accommodate 600 persons and will consist of 13 buildings for males (24 x 13 = 312 males) and 12 buildings for females (24 x 12 = 288 females). These hostel buildings are required to have perimeter fencing for security purposes and suitable fencing will be erected.

Table 2-9 shows the annual utilisation rate of the hostel buildings for their use by both PRESET and INSET programmes. Although the actual utilisation rate by the PRESET programme is 50.5%, 26.5% is added by INSET programmes during the holiday periods of the PRESET programme, totalling 82.1% which is a good utilisation rate.

Table 2-9 Utilization Rate of Hostel Buildings

Programme	Number of Participants	Weeks in Use ÷ 49 weeks*1	Number of Participants x weeks ÷ 600 spaces x 49 weeks
PRESET Diploma			
First Term	540	12	6,480
Second Term	540	12	6,480
September – November: 50%	270	7	1,890
PRESET Sub-Total Utilisation Rate *2		31 a) 63.3%	 b) 50.5%
① INSET Diploma			
First Term Test	600	3	1,800
Second Term Test	600	3	1,800
On-Campus Intensive Courses	600	7	4,200
① Sub-Total	1,800	13	7,800
Utilisation Rate		26.5%	26.5%
② SMASSE National INSET	307	13	664

North	57	2	114
Central East	48	2	96
Central West	67	2	134
Southeast	50	3	150
Southwest	53	2	106
Shire	32	2	64
③ SMASSE Training of Trainers	15	2	30
④ SMASSE Stakeholder Meeting	60 – 75	1.5	33.8
4-1 Follow-Up of National Steering Committee	20- 25	0.5	11.25
4-2 Preparation of Divisional INSET	20 – 25	0.5	11.25
4-3 Review of Division INSET	20 – 25	0.5	11.25
⑤ New Head Teacher Training	50	1	50
⑥ School Management Training (SMIP/AIDB)	120	6	360
6-1 School Management Training 1	60	3	180
6-2 School Management Training 2	60	3	180
⑦ Open and Distance Learning (ODL)	210	5	210
7-1 Preparation Practice for Aptitude Tests	60	1	60
7-2 Practice for IPET-ODL Aptitude Test	40	1	40
7-3 Data Entry Practice	30	1	30
7-4 Workshop for Selection of Students	30	1	30
7-5 Practice for Module Revision	50	1	50
⑧ EMAS Training	100	2	100
8-1 Annual Review Workshop	50	1	50
8-2 Workshop to Address Inspector Findings	50	1	50
②-⑧ Sub-Total	870	30.5	1,448
Utilisation Rate		62.2%	4.9%
①-⑧ Sub-Total	2,670	43.5	9,248
Utilisation Rate		a) 88.8%	b) 31.5%
PRESET + INSET Total			24,098
Utilisation Rate			b) 82.1%

*1 The annual usage of the hostel buildings is set at 49 weeks, excluding the Christmas holidays of three weeks.

*2 For calculation of the utilisation rate a), the denominator is set at 49. In the case of the aggregate occupants during the programme periods, the denominator is29,400 (600 persons (total capacity) x 49 weeks in use).

(g) Teachers' Houses

The existing TTCs have teachers' houses on their premises as part of the standard facilities. For example, the DCE has 57 houses against 72 teachers (56 at the DCE and 16 at the affiliated secondary school). The MTTC has 35 houses against 47 teachers. The Lilongwe Teachers College which trains primary school teachers has 38 houses against 59 teachers. This Lilongwe College is located at a site surrounded by residential and farming land located in the north of the city a 10 minute drive from the city centre but there are no bus services from the city centre to the area. In contrast, the site for the new college is located on a gently sloping hill which is a some 30 minute drive from Lilongwe but there are no houses nearby in which the teachers can lodge. Bus services from Lilongwe are very poor, making commuting from Lilongwe practically impossible. For this reason, the construction of teachers' houses is an essential part of the Project to successfully launch a TTC. The Malawi side has already requested the construction of 40 houses for the college teachers and 12 houses for the affiliated secondary school teachers. Because of the limitation of the

project budget, however, this component is ranked B in terms of priority and the final number of teachers' houses will be decided later based on the budget availability. Any houses to be constructed will be based on the standard design specifications and grades adopted for the existing teachers' houses.

(h) Affiliated Secondary School

The MoEST has a policy of establishing an affiliated primary or secondary school for every TTC. The DCE started as a TTC for the training of primary school teachers and its affiliated primary school required upgrading to a secondary school with Japanese grant aid in 2004. There are several objectives for the establishment of a secondary school affiliated to the new college.

① The existence of an affiliated school on the same site will allow students to learn how to effectively and efficiently proceed with lessons, how to manage classes and how to effectively communicate with people through constant teaching practice. ② The regular lectures and teaching practice will constantly complement each other to enhance the feed-back effects in the learning process of the students. ③ Using the opportunities provided by an affiliated school, the TTC can gather vital data and information to assist the development of suitable methods for the teaching of secondary school pupils, curriculum and methods to train teachers for each subject. As these activities are conducted every day, the teachers and students of the TTC will be able to easily share the accumulated information and knowledge.

Compared to an ordinary secondary school, a secondary school affiliated to a TTC has several advantages: ① the level and grades of the facilities and equipment are higher, ② the teachers tend to be highly qualified veteran teachers who have been specially selected through interviews, etc. and ③ the number of pupils per classroom is controlled to create a suitable environment for teaching practice.

As part of the planning process for the Project, a study was conducted to clarify the school enrolment situation in the local area and to check the feasibility of any nearby schools functioning as a substitute school. The nearest secondary school to the project site within a 20 km radius is Malikha CDSS located some 2.7 km away which was formerly built as a distance learning (adult education) centre with the self-help efforts of local people. The school has four classrooms with 484 pupils (F1: 132 pupils; F2: 119 pupils; F3: 103 pupils; F4: 128 pupils). Each class is over-crowded as the number of pupils is more than double the standard class size of 50 pupils. In the afternoon, 180 pupils attend the open school. The field survey found that this school cannot be used as a substitute school because of the

deterioration of the building and insufficient laboratories and equipment. Consequently, it will be necessary to set up an affiliated secondary school at the site of the new college.

< Local Demand for Secondary School Enrolment >

The local demand for secondary school enrolment was analysed as a condition for the construction of an affiliated secondary school at the project site. For this analysis, the size of the school zone was assumed to be the same as that of Malikha CDSS. In the case of Malikha CDSS, there are 11 primary schools in its school zone as shown in Table 2-10. In the school year of 2009/10, the total number of school leavers having completed the final year of primary education (G8) (those passing the PSLCE to become eligible to move on to secondary education) was 343. Of these, some 10% were admitted to a national or local government-run secondary school based on the PSLCE results while the remaining 90% went to Malikha CDSS. In the school year of 2010/11, some 120 pupils were enrolled in F1 apart from those who had to repeat the year. The number of pupils passing the PSLCE is expected to increase to some 429 by 2015, a 25% increase[1] on 2010. This means that 3 – 4 secondary schools will be required to receive the number of new pupils on a two class (100 pupils) per year basis. As such, there will be a sufficiently large enrolment demand for an affiliated secondary school in the school zone.

Table 2-10 Enrolment Situation at Primary Schools Within the School Zone of a New Secondary School

Name	Zone	Commuting Distance (km)	Number of Enrolled Pupils (2010/11)	Number of Those Passing the PSLCE in 2010	Estimated Number of Pupils Passing the PSLCE in 2015 (*1)
Katola	Malikha	7.0	804	28	35
Malikha	Malikha	2.7	1,096	66	83
Mataka	Malikha	2.5	1,022	27	34
Nankhonde	Malikha	2.0	925	28	35
Chiponde	Malikha	6.0	914	29	36
Chimwasongwe	Malikha	5.0	1,613	60	75
Namangwe	Malikha	7.0	438	5	6
Chimwa	Malikha	6.0	870	19	24
Mkoma	Malikha	7.0	2,292	48	60
Chata	Malikha	6.0	1,089	17	21
Liwera	Malikha	9.0	1,497	16	20
11 Schools Total	Malikha		12,560	343	429

Source: Office of the Central West Educational Division

*1 The number of pupils passing the PSLCE in 2015 is estimated based on an average annual increase rate of 4.6% for the period from 2002 to 2009.

There were 6,864 children in the area in the school age bracket for secondary education (2008 National Census) and the number is expected to increase to 8,513 by 2015 and 9,059

[1] Average annual increase rate of pupils passing the PSLCE in the period from 2002 to 2009: 4.61%

by 2017[2], indicating a strong potential local demand for secondary school enrolment. The National Security Education Programme (NESP) 2008 – 2017 has adopted a target GER (gross enrolment rate) of 30.5% for secondary education. To achieve this target, the number of enrolled pupils in secondary education in the area will have to increase to approximately 2,700 by 2017.

Table 2-11 Population of Local Communities

Community	Distance (km)	Population	Population: 14-17 year olds					
		2008	2008	2009	2010	2015	2016	2017
Chindala	3	1,325	795	820	845	986	1,017	1,049
Njande	2	770	330	340	351	409	422	436
Chitende	4	1,211	519	535	552	644	664	685
Chinokokawenga	4	2,100	900	928	957	1,116	1,151	1,188
Mtchoka	4	1,750	750	773	797	930	960	990
SadziwaKu Malikha	4	1,155	495	510	526	614	633	653
Mataka	2.5	1,463	627	646	667	778	802	828
Chiponde	6	2,205	945	974	1,005	1,172	1,209	1,247
Mwadenje	7	2,695	1,155	1,191	1,228	1,433	1,478	1,524
Liwera	9	812	348	359	370	432	445	459
Total		15,486	6,864	7,077	7,298	8,513	8,782	9,059

Source: Office of the Central West Education Division / 2008 National Census

The current school enrolment situation and local population dynamics suggest that there is a sufficient local demand for secondary education to justify the construction of a secondary school affiliated to the new college.

< Facilities of an Affiliated Secondary School >

The requested facilities for the affiliated secondary school are a classroom block, library/resource centre block, science laboratory block, administration block, multi-purpose hall and staff houses. In the overall planning of the Project, the construction of an affiliated secondary school is given priority ranking B and the inclusion/exclusion of certain components in the overall project has been planned to construct the minimum necessary facilities with a suitable scale.

① Classroom Block

Given the standard configuration of classrooms for an affiliated secondary school of two classrooms for each of four years, eight classrooms are required.

② Administration/Library/Resource Centre Block

[2] Based on the estimated population growth rate using the 2008 National Census results.

As a library is included in the standards for the establishment of secondary schools, the planned affiliated secondary school must be provided with a library. Based on the standard Phase I construction plan for a similar school (CDSS I), the library will be integral to the administration block. The resource centre will use space in the stack room attached to the library.

③ Science Laboratory Block

As the curriculum for science subjects lists science which combines physics and chemistry and biology as compulsory subjects, one science laboratory and once biology laboratory will be planned.

④ Multi-Purpose Hall

The affiliated secondary school should be able to use the multi-purpose hall to be constructed as part of the new college and, therefore, this facility is removed from the scope of the Japanese assistance for the affiliated secondary school.

⑤ Staff Houses

As the construction priority of the facilities of the affiliated secondary school is given to direct educational facilities, the number of staff houses to accommodate staff members of the affiliated secondary school will be subject to later adjustment along with the staff houses of the college based on the size of the available funding for this purpose.

Outdoor Sports Facility

Although an outdoor sports area will be set aside in the facility layout plan, the actual construction of an outdoor sports facility will not be included in the scope of the Japanese assistance. This facility should, therefore, be developed by the Malawi side.

(4) Policy Concerning Natural Conditions

1) Climate

The Lilongwe area in which the project side (EL 1,100 m) is located has two seasons, i.e. a dry season from May to November and a rainy season from December to April. During the hottest months of October and November, the average highest temperature is 30°C while the average lowest temperature is around 15°C. From June to August, the temperature often drops below 10°C. The annual precipitation is around 900 mm of which 80 – 90% falls during the rainy season. The savannah climate of the area means fairly pleasant weather conditions throughout the year. As the solar insolation is strong, the rooms will require a false ceiling to improve the heat insulation of the buildings. Another architectural feature to combat the strong sun and

rainfall during the rainy season is the introduction of deep eaves while ensuring good natural ventilation.

2) Geology and Topography

The soil survey up to a depth of 2 m from the ground surface conducted at the project site found that the local soil is lateritic firm sandy clay with the dominance of gravelly sand from weathered rocks increasing towards the deeper end. The ultimate bearing capacity of the ground is 307 kN/m^2 which is sufficiently strong to support the planned buildings. Based on these findings, a design bearing capacity (long-term bearing capacity) of 100 kN/m^2, i.e. one-third of the ultimate bearing capacity, is adopted for the Project.

The project site is gently sloping with an inclination of 1 in 20. The facilities are basically laid out along the contour lines to minimise the scale of the ground preparation work. To prevent any adverse impacts of storm water due to this gently sloping land, drainage channels will be provided around the buildings as part of an effective drainage system on the premises.

3) Earthquakes

Malawi experiences earthquakes caused by the Niassa Rift Valley which traverses East Africa. However, the central part where the project site is located has no previous records of earthquakes damaging local buildings. In view of the fact that the local structural design standards do not consider seismic stress, the value of the story shear force coefficient for the horizontal seismic force is reduced to conduct the necessary analysis.

(5) Policy Concerning Socioeconomic Conditions

Fencing around the hostels and perimeter fencing for the college premises are considered to be essential facilities to prevent burglaries and other security breaches. As part of the security measures, grilles will be installed at such openings as the doors and windows of rooms in which important equipment, etc. is stored. In view of the government policy of actively integrating disabled people into society so that all people live together harmoniously, the urban planning and development guidelines in Malawi stipulate the need to provide suitable measures for disabled people. The corresponding features in the Project will be the provision of toilets for disabled people and barrier-free buildings and passageways.

(6) Policy Concerning Construction and Procurement

1) Building Standards and Related Laws

Malawi does not have its own design standards and refers to BS or SABS for matters related to buildings and fire prevention. Either BS or SABS will be referred to for the Project and further reference will be made to Japanese standards when appropriate.

2) Utilisation of Locally Procurable Materials

Although all of the required construction materials can be procured in Malawi, domestic products are largely limited to cement, aggregates, some secondary concrete products (blocks and floor materials), timber and plywood. Other materials are imported mostly from South Africa. Most building service and electrical materials are also made in South Africa. The construction materials to be used for the Project will be selected from locally procurable materials based on robustness, economy and ease of maintenance.

3) Use of Local Construction Methods

The most common local structure for buildings of the sizes planned under the Project is masonry construction using stabilised soil blocks (SSBs). As the production of the type of brick traditionally used has stopped because of recent concern for environmental conservation, SSB masonry will be used as the main structural method for the Project. As mortar with a paint finish and corrugated steel sheet finish are the most common finishing methods for internal walls and the roof respectively, these methods or similar will be adopted for the Project.

(7) Policy Concerning the Use of Local Subcontractors (Construction Companies and Consultant)

1) Local Construction Companies

Construction companies, suppliers and consultants in Malawi must register their corporate status (registration with the Certificate of Incorporation) with the Ministry of Justice in accordance with the Companies Act, obtain a Tax Payer Identification Number (TPIN) from the Malawi Revenue Authority (MRA) and register with the National Construction Industry Council (NCIC) before legally commencing work.

Registration with the NCIC is based on the business category of each applicant which is determined by the size of the turnover, number of engineers, equipment in possession, past work performance and others. In the case of public work, the scope of eligible companies to be selected from the NCIC registration list and procurement method are set forth depending on the size of the procurement value.

The construction companies are classified into five ranks in the NCIC registration list according to their capacity which can receive an order of up to 75 million MWK, 100 million MWK, 200 million MWK, 500 million MWK and an Unlimited amount.

Because the Project will be implemented under the JICA's grant aid for community empowerment scheme, the contractor will be selected by means of tender for which bidders will be restricted to local companies. The study results on the past performance of likely local candidates suggest that most NCIC registered local construction companies of the higher rank, i.e. there is no ceiling on the amount of orders they can receive, have sufficient technical and financial strength to handle the construction work of the scale and contents of the Project.

2) Local Suppliers

The equipment and furniture to be procured under the Project will be a separate component of the Project from the construction work and orders will be placed with separate suppliers (not the construction company selected to construct the buildings). There are large furniture factories in Malawi and a few companies import ready-made furniture. The procurement under the Project will primarily consist of laboratory equipment and tools and there are local companies which specialise in such products. Given the fact that equipment for educational facilities has been smoothly procured for the projects of other donors, no specific problems are anticipated in regard to the procurement aspect of the Project.

3) Local Consultant

For the implementation of the Project, it is assumed that the Japanese consultant responsible for the outline design will continue to be responsible for the work supervision at the implementation stage. As part of such work supervision, the said consultant will use a local consultant and engineers as required. NCIC registered consultants include 10 architectural consultants, 26 engineering consultants and 11 quantity surveyors (QSs). Local qualified architects, engineers and QSs are controlled by the Malawi Institute of Architects, Malawi Institute of Engineers and Surveyors Institute of Malawi respectively.

(8) Policy Concerning Operation and Maintenance

The basic policy is to construct buildings which are easy to maintain, to install systems and equipment of which the operation and maintenance do not require special skills and not to use equipment which is difficult to maintain and for which supplies are difficult to obtain. To ensure a low operation and maintenance cost, natural lighting and ventilation will be used to the maximum so that the energy cost of the facilities and systems is kept at a low level.

(9) Policy Concerning Grades of Facilities and Equipment

1) Facilities

The grades and specifications of the buildings will be similar to those of existing TTCs in Malawi. The building specifications for the DCE and those for the MTTC which was constructed with the assistance of the World Bank will be referred to in order to determine suitable grades and specifications for the buildings of the new college while ensuring their functionality, economy and ease of maintenance.

2) Equipment

The grades of the equipment to be procured under the Project will be based on those of the DCE for their actual use for the biology, physics and chemistry curricula. The specifications must allow the procurement of equipment by local tender and equipment maintenance by a local company.

(10) Policy Concerning Construction Period

The field survey identified that the main causes of the delay of construction work in Malawi are the insufficient supply of locally procured materials, delayed payment by the contractor and adverse impacts of the rainy season. It must be noted that the construction of facilities of a similar size to those under the Project generally requires 24 months to complete instead of 20 months formerly required due to the recent situation of constant fuel shortage and difficulty of procurement. A sensible construction schedule will be determined for the Project considering the latest situation of the construction work in Malawi, and by means of adopting common local construction methods and avoiding the rainy season (December to March) as much as possible while ensuring rational procurement control as well as construction management with a view to shortening the overall construction period.

2.2.2 Basic Design (Facility Plan/Equipment Plan)

(1) Site and Facility Layout Plan

The project site runs some 460 m along National Route 5 linking Lilongwe, the capital, with Salima to the east and some 450 m north-south along a side road which branches out from National Route 5. This almost rectangular site has an area of 30 ha and gently slopes downwards from the southwest corner side where a side road branches out to the north at approximately 1 in 20. The front approach to the planned facilities will be from the side road to ensure safe entry to the site by avoiding the busy traffic on the trunk road. In view of the shape and surrounding environment of the site, the use of the site and layout of the facilities will follow the following principles.

- There should be a good distance from the boundary to ensure a quiet educational environment.

- The facilities should be located in harmony with the sloping ground or height difference so that the scale of the ground preparation work can be kept to a minimum.

- The axis of the buildings should run east-west as much as possible to avoid direct sun into the rooms in the morning and evening while taking the difference in ground height into consideration.

- The facilities should be laid out to develop organic links and efficient flow lines between the educational facility zone, administration zone, hostel and staff houses zone, outdoor sports zone and affiliated secondary school area. Sufficient space should be left around each facility to accommodate any future extension.

- The entire layout of the facilities should be compact while ensuring a sufficient distance between adjacent buildings for good natural draft and a good educational environment to allow activities involving adjacent facilities.

(2) Building Plan

1) Basic Policy for Building Configuration

The basic shape of the buildings will be single storey with a pent roof for easy workability, economy and maintenance. The central corridor style will not, in principle, be adopted to ensure maximum natural ventilation and lighting. In the case of the administration building and hostels in which a central corridor is introduced because of the need to accommodate many rooms, high transom windows will be installed along the corridor to obtain natural lighting and ventilation. No side corridors will be introduced and access to each room will instead be

directly made via an external connecting corridor to reduce the overall corridor construction area.

2) Plan

Uniform floor plan modules will be introduced to ensure the use of common building materials and efficient construction work. These modules will be based on the multiple number of the length of the SSB blocks (285 mm x 135 mm) which are fabricated on site as part of the local construction materials. The shorter span for the buildings will be either 3.6 m or 4.2 m while the longer span between the girders will be determined for individual buildings based on their primary functions. To be more precise, the floor plan modules will have a shorter span of 4.2 m and a longer span of 7.8 m in the case of the classroom building and laboratory building. Meanwhile, the administration building will have a shorter span of 3.6 m and a longer span of 5.6 m to allow for the introduction of partition walls in a flexible manner to rationally establish various room sizes. The library building and hall building will have the same shorter span but the longer span will be determined to ensure a large space required by their respective functions. A minimum floor plan module of 3.6 m x 3.6 m will be adopted for the hostel buildings based on the standard hostel building size.

The sizes of the other rooms will be determined with reference to the sizes of similar rooms at the DCE and MTTC. The layout of the furniture for these rooms will be determined based on their respective functions and activities which are expected to take place in each room and the tentative room sizes are shown in Table 2-12. The corresponding rooms of existing TTCs will be referred to while taking the differences in terms of the actual college size, staff strength and number of students between the DCE/MTTC and new college into consideration.

(a) Administration Block

The management of a TTC has two aspects: administrative management and course management. As all of the buildings to be constructed under the Project will be single story buildings to make them compact, two functionally different buildings will be constructed to handle administrative management and course management respectively.

- **Administration Building**

This building will house the principal's office, vice-principal's office, bursar's office, various administrative offices and meeting room.

Table 2-12 Sizes of Rooms in the Administration Building

Administration Building		DCE	MMTC	Project		
Room	Basis for Planned Size	Floor Area (m^2)	Floor Area (m^2)	Number of Rooms	Floor Area (m^2)	Total (m^2)
Principal's office	Enough space to accommodate a desk,	22.6	21.7	1	22.40	22.40

	chair, cabinet, table and visitor's chair; similar size to that at the DCE and MTTC					
Secretary's office	17.92 m^2 based on the size of existing similar rooms	22.6	16.0	1	17.92	17.92
Vice-principal's office	Similar size to that at the DCE	22.6	18.0	1	20.16	20.16
Bursar's office	Similar size to that at the DCE	22.6	13.9	1	20.16	20.16
Accounting office	Enough space to accommodate desks, chairs and cabinets for three staff members; similar size to that at the DCE and MTTC	22.6	18.0	1	20.16	20.16
Archive	Similar size to that at the DCE with the installation of cabinets to store administrative and academic records	22.6	26.5	1	20.16	20.16
Typing room	Enough space to accommodate desks and chairs for three typists; similar size to that at the DCE	22.6	30.8	1	20.16	20.16
Human development office	Functions to manage personnel affairs and teacher training programmes; similar size to that at the DCE	22.6	15.6	1	20.16	20.16
Administration office	Enough space to accommodate desks and chairs or an assumed six staff members and a reception counter	69.6	13.9	1	48.60	48.60
Meeting room	Enough space to accommodate tables and chairs for 32 persons	60.8	42.9	1	60.48	60.48
Storage room	Storage space for expendables and maintenance equipment	-	-	1	20.16	20.16
Toilets, corridors and other common spaces		239.6	176.5			137.16
Total		562.3	422.1			427.68

- **Course Management Building**

This building will house the offices of the deans of the faculty of science, faculty of humanities, faculty of language studies and faculty of education, office of the head of educational curricula, INSET office and staff room. The INSET office will manage the distance learning programme for 600 existing teachers nationwide. During the period of the on-campus SMASSE National INSET training, this office will be used as a lecturers' room along with a small meeting room. The staff rooms to be provided in the course management building will be those for teachers of the education course, physical education course and external lecturers. The staff rooms for other courses will be basically provided next to the respective classrooms as in the case of the room configuration at the DCE as well as the Faculty of Education of Mzuzu University.

Table 2-13 Sizes of Rooms in the Course Management Building

Course Management Building		DCE	MMTC	Project		
Room	Basis for Planned Size	Floor Area (m^2)	Floor Area (m^2)	Number of Rooms	Floor Area (m^2)	Total (m^2)
Deans' offices (faculties of science, humanities, language studies and education)	Enough space to accommodate a desk, chair, table and visitor's chair; similar size to that at the DCE	22.6	15.1	4	20.16	80.64
Office of head of	As above	22.6	-	1	20.16	20.16

educational curricula						
Staff room (education course, PE course and external lecturers)	Enough space to accommodate desks, chairs and cabinets for three teachers; staff rooms for other courses are located in the classroom block; similar size to that at the DCE	22.6	-	1	20.16	20.16
INSET office	Sufficient space to accommodate desks, chairs, cabinets, work tables, printer/computer table for the head of distance learning and three staff members; the office will function to prepare textbooks and INSET-related work, including the dispatch of textbooks	60.8	-	1	34.88	34.88
Small meeting room	Tables and chairs for 12 persons to serve faculty meetings; lecturers' room for SMASSE National INSET training and staff canteen	14.5 – 45.3	42.9	1	20.16	20.16
Toilets, corridors and other common spaces		239.6	176.5			25.60
Total		677.8	439.8			241.92

Note: The DCE and MTTC campuses have a test paper preparation room, teaching programming room and others in the corresponding building.

- **Library/Resources Centre/Computer Centre Building**

This building has the combined function of a library for self-learning by students and a resource centre as well as computer centre to gather information on the Internet or to prepare teaching materials. From the viewpoint of administrative efficiency, this building will be located near the administration building and will face the courtyard to allow the easy access of students. The access corridor will be used to display campus information. Because of security considerations, this building will not be used at night. During a visit to the DCE, those responsible for the library pointed out to the Study Team that there should be a space for book repair work, workshop space for the preparation of teaching materials and a stack room, all of which are absent at the DCE library. As the newer MTTC is provided with a 90.1 m^2 workshop/stack room, this space will be introduced under the Project.

Table 2-14 Sizes of Rooms in the Library Building

Library Building		DCE	MMTC	Project		
Room	Basis for Planned Size	Floor Area (m^2)	Floor Area (m^2)	Number of Rooms	Floor Area (m^2)	Total (m^2)
Library						
Open shelf area	84 shelves with a passageway width of 1.8 m; similar size to that at the DCE (approx. 20,000 books)	101.8	118.1	1	100.80	100.80
Reading room	Reading and own learning space with 86 seats (same as the DCE) with 0.67 m^2/seat	135.7	179.4	1	162.00	162.00
Librarian's office	Enough space to accommodate desks, chairs and cabinets for two librarians;	22.2	12.8	1	10.80	10.80

	similar size to that at the DCE					
Search and copying space	Enough space to accommodate a search desk, chair, table and copier	55.8	45.9	1	39.60	39.60
Reception counter/lending corner	Space with a functional counter providing lending and book information services and copier management	22.2	37.7	1	14.40	14.40
Book repair space/workshop	Enough space to accommodate a work table, chair and cabinet for book repair and teaching material binding work	-	90.1	1	82.8	82.8
Entrance hall	Necessary space to ensure the smooth flow of students, etc. with a security gate and lockers to leave personal items before entering the library property.	-	42.0	1	16.20	16.20
Resource Centre/Computer Centre		156.2	224.5			109.8
Resource centre	Enough space to accommodate 7PCs, one printer and one work table	48.0	82.3	1	32.40	32.40
Computer centre	20 PCs and one printer for students to learn computing; similar size to that at the DCE	54.0	58.5 x 2	1	54.00	54.00
Office equipment room	Enough space to accommodate one IT engineer and various pieces of PC equipment	54.2	25.2	1	23.40	23.40
Toilets, corridors and other common spaces		113.7	52.8	-	-	154.80
Total		607.6	803.3			691.20

(b) Classroom and Laboratory Building Blocks

There will be 13 general classrooms to meet the minimum requirement to implement the course curricula described earlier. The number of students per class is not uniform because of the student choices of course combination. Having taken the standard seating capacity for 40 students and the requested floor area of 64.8 m^2 into consideration, the floor area of a standard classroom is set at 65.52 m^2 (4.2 m/span x 2 spans x 7.8 m) based on the floor plan module dimensions. Two classrooms and two staff rooms will form one unit and the classroom building block will consist of six units (12 classrooms and 12 staff rooms). The one remaining classroom will be located in the laboratory building block because of the building design restrictions. The 12 staff rooms will correspond to the three language courses (English, Chichewa and French), four humanities courses (history, geography, sociology and religion/theology, excluding PE) and five science courses (mathematics, physics, chemistry, biology and human ecology).

The laboratory building block will consist of the physics, chemistry and biology laboratories, human ecology room and one classroom. Each laboratory or human ecology room will have five tables as students undergoing laboratory lessons will be divided into five groups. There will also be a work counter by a window. The size of these rooms will be the same as the size of existing rooms of 98.28 m^2 (4.2 m/span x 3 spans x 7.8 m). The common laboratory table

layout (for water, electricity and gas supply) will be adopted for the chemistry, physics and biology laboratories although the chemistry laboratory will have an additional gas chamber.

Each room except the classroom will be accompanied by a preparation/equipment room. As the laboratory assistants are expected to use the preparation/equipment room for relaxation, no special room will be introduced for laboratory assistants.

Neither the classroom units nor the laboratories will be accompanied by side corridors. Access to these rooms which will be located in two parallel rows will be made via an open walkway running down the middle. In this way, the total floor area of the corridors will be half of that of a side corridor configuration. At the same time, all of the rooms will receive sufficient natural lighting and ventilation from two sides, reducing the lighting system maintenance cost compared to an ordinary side corridor configuration where natural lighting and ventilation come from only one side.

Table 2-15 Sizes of Rooms in the Classroom Building Block

Classroom Building Block		DCE	MMTC	Project		
Room	Basis for Planned Size	Floor Area (m^2)	Floor Area (m^2)	Number of Rooms	Floor Area (m^2)	Total (m^2)
Standard classroom	Enough space to accommodate 40 standard student desks (60 cm x 40 cm x 72 cm), chairs and teacher's desk and chair	64.8	58.9 – 71.5	12	65.52	786.24
Large classroom	Enough space to accommodate fixed desks and chairs for 80 students; similar size to that at the DCE	97.8	105.1	2	97.79	195.57
Staff room	Enough space to accommodate desks, chairs and cabinets for three teachers (average) for each specialist course except those of the faculty of education	18.7	17.2 – 20.2	12	15.00	180.00
Corridors and other common spaces		1,027.3	249.1	6	16.80	100.80
Total		2,935.0	1,709.6			1,262.61

Table 2-16 Sizes of Laboratories, etc. in the Laboratory Building Block

Laboratory Building Block		DCE	MMTC	Project		
Room	Basis for Planned Size	Floor Area (m^2)	Floor Area (m^2)	Number of Rooms	Floor Area (m^2)	Total (m^2)
Chemistry laboratory	Enough space to accommodate five laboratory tables, teacher's table and side-wall counter; similar size to that at the DCE	98.3	97.2	1	98.28	98.28
Chemistry preparation/equipment room	With a work table and equipment shelves	23.4	19.0	1	21.00	21.00
Physics laboratory	Same as the chemistry laboratory	98.3	97.2	1	98.28	98.28
Physics	With a work table and equipment	15.2	19.0	1	21.00	21.00

preparation/equipment room	shelves					
Biology laboratory	Same as the chemistry laboratory	121.7	97.2	2	98.28	196.56
Biology preparation/equipment room	With a work table and equipment shelves	15.2	19.0	2	21.00	42.00
Domestic science room (cooking)	Enough space to accommodate five laboratory tables, teacher's table and side-wall counter; similar size to that at the DCE	99.1	96.4	1	98.28	98.28
Cooking preparation/equipment room	With a work table and equipment shelves	53.0	20.1	1	21.00	21.00
Domestic science room (dressmaking)	Not planned under the Project; use of a standard classroom)	67.8	131.5			
Dressmaking preparation/equipment room	Use of the cooking preparation/equipment room	53.8	15.5			
Classroom				1	65.52	65.52
Storage room	For the storage of common equipment and materials with equipment shelves	60.9		1	21.00	21.00
Corridors and other common spaces		558.7	237.5	3	23.52	70.56
Total		1,342.5	1,030.8			753.48

(c) Multi-Purpose Hall/Kitchen

The multipurpose hall will be used for such college-wide ceremonies as the enrolment ceremony and graduation ceremony. As it will be used on a daily basis as a student canteen, a kitchen will be added as in the case of a similar facility configuration at the DCE and MTTC. From the functional viewpoint, the hall itself will have sufficient space to accommodate 720 seating capacities for 600 students, the college staff and the participant. When used as a canteen, tables and chairs for 300 diners will be provided to serve 600 people in two shifts. As auxiliary facilities, toilets and a sick bay will be introduced at the side of the hall. The kitchen will be equipped with electrical cookers and grills and also local cooking methods, including the use of firewood for an occasional, and service system and will have the minimum but necessary functions in reference to similar existing facilities in addition to being a very hygienic facility. In principle, an air-conditioning system will not be installed and the building structure will be designed to encourage natural ventilation, breeze and lighting.

Table 2-17 Sizes of Rooms in the Multi-Purpose Hall/Kitchen Building

Laboratory Building Block		DCE	MMTC	Project		
Room	Basis for Planned Size	Floor Area (m^2)	Floor Area (m^2)	Number of Rooms	Floor Area (m^2)	Total (m^2)
Multi-purpose hall						
Hall	Enough space to accommodate 720 chairs	534.4	572.0	1	604.80	604.80
Stage	10.8 m x 7.8 m	91.8	108.6	1	78.00	78.00
Storage area	Located on both wings of the	180.2	162.0	2	31.20	62.40

	stage					
Sub-Total		806.0	842.6			754.20
Kitchen						
Service center	One counter serving 12 diners	60.6	46.8	1	42.12	42.12
Dish return and washing area	Similar size to that of existing facilities	33.9	29.8	1	20.28	20.28
Kitchen	As above	94.8	146.3		128.70	128.70
Pantry 1 (vegetables)	As above	17.0	15.0	1	12.00	12.00
Pantry 2 (dry food)	As above	17.0	14.0	1	12.00	12.00
Refrigerator	Installation of a refrigerator	17.0	13.5	1	15.00	15.00
Pantry (dishes)	Similar size to that of existing facilities	17.0	11.4	1	9.36	9.36
Kitchen office	Desk and chair for one person	17.0	15.6	1	10.14	10.14
Worker changing room (male)	With lockers, toilets and showers as in the case of similar existing facilities	17.0	18.5	1	19.50	19.50
Worker changing room (female)	As above	17.0	18.5	1	19.50	19.50
Firewood oven space	Enough space to accommodate necessary ovens	60.8	68.5	1	77.17	77.17
Sub-Total		369.1	397.9			365.77
Total for hall and kitchen		1,175.1	1,240.5			959.77
Auxiliary facilities						
Sick bay	Enough space to accommodate a treatment room and two beds	342.0	57.4	1	31.68	31.68
Hand washing area/toilets	Hand washing before and after eating and male and female toilets	72.0	104.4	1	70.65	70.65
Total for auxiliary facilities		414.0	161.8			102.24

(d) Hostel Block

The hostel block will consist of 12 hostel buildings for female occupants (24/building, totalling 288 beds) and 13 hostel buildings for male occupants (312 beds). As the hostel block is expected to expand in the future, toilets, showers and washing space will be added to each hostel building in accordance with the local specifications so that any future extension can be made on a hostel building by hostel building basis. The number of toilets and showers is based on a ratio of one booth per six occupants as in the case of similar existing facilities even though some congestion is expected due to their heavy use at certain hours.

A suitable distance will be maintained between neighbouring hostel buildings to allow natural draft as in the case of similar existing facilities and the hostel buildings will be linked by connecting corridors (2.5 m wide).

Table 2-18 Sizes of Rooms in the Hostel Block

Hostel Block		DCE	MMTC	Project		
Room	Basis for Planned Size	Floor Area (m^2)	Floor Area (m^2)	Number of Rooms	Floor Area (m^2)	Total (m^2)

Hostel buildings for female occupants (288 beds)		3,465.1	2,688.0	12	239.40	2,872.80
Bedrooms	2 persons/room; 6.4 m^2/person	12.96	24.0	12	12.78	153.36
Toilets/showers	1 booth/6 persons; 1.3 m^2/person	25.5	36.0	1	34.11	34.11
Washing/ironing space		19.4	21.6	1	15.12	15.12
Corridors		40.5	39.8			36.81
Hostel buildings for male occupants (312 beds)		4,885.2	2,688.0	13	239.40	3,112.20
Outdoor corridors and other common spaces		1,320.0	381.6			857.90
Total		9,670.3	5,815			6,842.90

(e) Affiliated Secondary School

The affiliated secondary school will consist of the administration buildings, classroom buildings, laboratory buildings and toilet building. The room sizes will be basically similar to those adopted for the CDSS Phase 1. As the school will be constructed on the TTC campus site, its architectural features, structural materials, structure and construction method will be the same as those employed for the new college, reducing the overall procurement cost and achieving efficient construction management. While the CDSS Phase 1 intends to add new independent classroom and laboratory buildings to meet the shortage of these facilities at existing secondary schools, the new secondary school under the Project will be constructed as an entirely new school with all of the necessary facilities. For this reason, the classroom buildings and science laboratory buildings will be connected by continual outdoor corridors as in the case of the secondary school affiliated to the DCE and those secondary schools constructed with the assistance of the World Bank.

Table 2-19 Sizes of Rooms of the Affiliated Secondary School

Affiliated Secondary School		DCE	MMTC	Project		
Room	Basis for Planned Size	Floor Area (m^2)	Floor Area (m^2)	Number of Rooms	Floor Area (m^2)	Total (m^2)
Administration Buildings						
Head teacher's office	Same as CDSS; structural modules are adjusted to match those of the college	19.8	18.3	1	18.27	18.27
Deputy head teacher's office	As above	16.3	12.0	1	11.97	11.97
Reception hall	As above		18.27	1	18.27	18.27
Administration office	As above	20.0	11.97	1	11.97	11.97
Staff room	As above (16 teachers)	71.3	60.5	1	60.48	60.48
Library	As above	190.0	60.5	1	60.48	60.48
Store room	As above	33.0	30.2	1	30.24	30.24
Sub-total	As above	350.4	211.8	1		211.68
Classroom Buildings (8 classrooms)						
Classroom (40 seats)	Same as CDSS; structural modules are adjusted to match those of the college	70.0	64.3	8	65.52	524.16

Sub-total		560.0	514.4			524.16
Laboratory Buildings						
Science laboratory	Same as CDSS; structural modules are adjusted to match those of the college	114.0	102.1	1	98.28	98.28
Biology laboratory	As above	114.0	102.1	1	98.28	98.28
Preparation room/storage space	As above	28.6	34.7	1	32.76	32.76
Sub-total		513.0	238.9			229.32
Toilet Building	The size is based on the number of classrooms.	92.0	95.76	2	57.76	115.52
Corridors and other common spaces		620.0	na			407.65
Total		2,253.4	1,316.6			1,488.33

Note: The CDSS Phase 1 anticipated that the number of classrooms will be 4 or 6. The relevant values are revised for eight classrooms except those for the corridors and other common spaces.

(f) Staff Houses

The existing staff houses are classified into four grades to reflect the different grades of teachers. In the case of the staff houses at the MTTC which were constructed with the assistance of the World Bank, the size is 147.7 m^2 for Grade A (one house), 116.2 m^2 for Grade B (12 houses), 97.7 m^2 for Grade C (16 houses) and 78.7 m^2 for Grade D (4 houses). In the DCE Facilities Improvement Project which was implemented with Japanese grant aid in FY 2003, a uniform floor area of 84 m^2 was adopted. All of these houses have three bedrooms to accommodate an average family size of 5 – 7 persons in Malawi. All of the existing staff houses are single storey detached houses to emphasise the privacy of the occupants. Under the Project, each house is planned to be a detached three bedroom house with a floor area of 81 m^2 to take advantage of the sufficiently large site to ensure privacy and a good living environment.

(g) Auxiliary Service Facility

A gate house is planned as a necessary auxiliary facility for the operation and management of the campus.

Facility	Basis for Planned Size	Floor Area (m^2)
Gate House	Enough space to accommodate two security guards, rest room and toilet; similar size to that at the MTTC	12.96

3) Cross-Section

All of the buildings to be constructed under the Project are planned as single storey buildings for a shorter overall construction period, good workability, economy and easy maintenance. The basic roof shape will be a pent roof. No central corridors or side corridors will be provided for the classroom and laboratory buildings and these buildings will be linked by connecting corridors. In this manner, the rooms in these buildings will receive natural lighting and

ventilation through openings on both sides. In contrast, the administration buildings and hostel buildings will have a central corridor with high transom windows for natural lighting. The multi-purpose hall building will have a steel truss roof so that the building has a sufficient air volume with a suitable eaves height. The side walls will be constructed using screen blocks which will allow natural lighting and ventilation while blocking direct sunlight and rain. The cross-section of the kitchen will show a high ceiling and high windows to facilitate sufficient ventilation without using a mechanical system.

(3) Structural Plan

1) Type of Structure

The principal structure for the buildings to be constructed under the Project will be a single storey masonry structure in consideration of the economy, local procurability of the building materials and workability. In Malawi, the burned bricks traditionally manufactured by brick factories and commonly used are being increasingly replaced by SSBs (stabilised soil blocks) due to environmental considerations. For this reason, the SSB masonry method will be used for the Project while reinforced concrete pillars will be used for the multi-purpose hall/kitchen and library buildings which will have a larger span than the other buildings.

< Footings >

As the standard footing specification for a masonry structure, continuous footings with a RC base will be adopted. The pillars of the multi-purpose hall/kitchen and library buildings will be supported by independent RC footings. The base level of the building footings will be 90 cm below the design ground surface for the buildings.

< Roof Construction >

In general, the roof of the buildings to be constructed under the Project will be a pent roof with a wooden structure (simple beams and wooden trusses) in view of maximising the natural lighting and ventilation of the buildings. Meanwhile, the multi-purpose hall/kitchen building will have a steel truss structure because of the large span employed for the building.

2) Structural Standards and Loading Conditions

British Standards (BSs) are commonly used in Malawi for structural design purposes while the South African Bureau of Standards (SABSs) are commonly referred to for building materials. There is a tendency for facilities constructed with the aid of other donors to use the standards of the donor in question. BSs and SABSs will be used in general for the Project while the Standards for Structural Calculation of Reinforced Concrete Structures and the Standards for

Structural Design of Timber Structures (both of the Architectural Institute of Japan) will be referred to as supplementary standards.

< Loading Conditions >

Bearing capacity : Based on the results of the ground survey subcontracted to a local company, a ground bearing capacity of 100 kN/m^2 will be used.

Wind load : Malawi is an inland country and past weather data for the project site does not indicate any adverse impacts of a cyclone or heavy storm. A reference wind velocity of 21 m/sec and wind pressure of 700 N/m^2 are adopted for the Project as recommended by the Malawi Institute of Architects.

Seismic force : Part of the Great Rift Valley runs along the shore of Lake Malawi and earthquakes do occur. However, no earthquake damage has been recorded in the Lilongwe area in which the project site is located. A coefficient of seismic story shear force (Ci) value of 0.08 is adopted for the structural analysis of the possible impacts of seismic horizontal force under the Project.

3) Structural Materials

- Concrete : The design strength is 18 N/mm^2 for footings and 21 N/mm^2 for underground beams, slab on grade, beams and pillars.

- Reinforcing bars : Commonly used general-purposed reinforcing bars in Malawi are based on the SABSs and these will be used for the Project. (The values in brackets are the tensile strength.)

  - Deformed bars Grade 45 (45 kN/cm^2)
  - Round bars Grade 25 (25 kN/cm^2)

- Steel : Widely used SABS-compatible steel will be used.

  - Shaped steel 300 WA (45 kN/cm^2)
  - Bolts Grade 88 (80 kN/cm^2)
  - Anchor bolts Grade 43 (43 kN/cm^2)

- SSBs : These will be manufactured on site using special machinery. Their quality will conform to the Malawi standard (MBS) and the mixing ratios of cement, sand and soil will be altered depending on the place of use.

  - General parts : Volume ratios of cement and soil: one part cement to 12 parts soil; compressive strength when dried $\geqq$ 2.5 N/mm^2
  - Parts exposed to rain, etc. : One part cement; three parts sand and six parts soil; compressive strength when dried $\geqq$ 3.5 N/mm^2

- Concrete blocks : These will be manufactured on site using special machinery. Their quality will conform to the Malawi standard (MBS) and the mean compressive strength and minimum compressive strength of the structural blocks shall be 5.0 N/mm^2 and 4.0 N/mm^2 respectively.

- Timber : Timber will be locally produced timber or bonded wood and the strength will conform to the MBSs.

  - Bearing stress along the fibre direction : 4.0 MPa
  - Tensile stress : 2.2 MPa
  - Compressive stress : 6.4 MPa
  - Elastic coefficient : 600 MPa

(4) Building Services Plan

1) Electrical Installations

(a) Power Supply System

At present, a high voltage distribution line (11 kV) is extended along the trunk national highway at the project site. Work is in progress to lay a high voltage distribution line (33 kV) along the project site.

According to regulations set by the ESCOM, a power supply company in Malawi, the type of service connection depends on the power demand of the facilities as shown in Table 2-20. The expected contract demand for the planned facilities under the Project is 360 KVA. As this is

less than 400 KVA, the contract will be classified as a low voltage power supply contract with a supply volume of 400 V. As far as the area of responsibility is concerned, the ESCOM commonly undertakes the work up to the service connection, including the installation of an on-site substation, and the user side pays part of the power supply extension work to the ESCOM as its own contribution. In the case of the Project, the service connection work included in the scope of the Project will involve (i) cabling from the second side low voltage distribution panel at a substation to be constructed by the ESCOM and (ii) the installation of an incoming panel. Among the planned facilities under the Project, the staff houses will individually receive 230 V low voltage power supply from the ESCOM via a watt hour meter installed in each house. Therefore, no electrical service work involving the staff houses will be included in the scope of the Project.

However, some cases involving other donors indicate that even though the power receiving and transforming facilities are supposed to be installed at a substation by the ESCOM, it is quite rare for such a station and/or other electrical systems to be properly in place within a project period. For this reason, it is recommended that a user or project implementation agency made advance payment to procure and install the power receiving and transforming facilities (substation) in addition to their statutory contribution so that the ESCOM can complete the necessary work to supply power without delay. As this advance payment will be subsequently returned by the ESCOM, the user or project implementation agency can expect a reduction of their contribution.

For the Project, it is essential that the power supply service be installed at a certain time during the project implementation period. Because of this priority, the contractor must make advance payment to install the power receiving and transforming facilities (substation) on the assumption that the cost of this work will be properly refunded by the project implementation agency. Therefore, MoEST, the project implementation agency, is requested to secure the budget for the cost of this work.

Although the ESCOM will have ownership and management responsibility for the substation, the site for the substation will be provided near the centre of the project site to minimise the length of the low voltage trunk line providing power supply to each block. However, if this substation is expected to supply power to not only the project site but also the neighbouring area, its installation at the road side may be demanded by the ESCOM.

The final details of the power contracts for the college and staff houses, location of the substation, amount of user contribution to the ESCOM and reduction of such contribution due to advance payment for the procurement and installation of a transformer, etc. may differ from those assumed above as a result of negotiations between the ESCOM and project

implementation agency which is the party to the power contracts. It is, therefore, essential that such final details are checked prior to the implementation of the Project.

Table 2-20 Outline of Power Service Connection Work (by the ESCOM)

Item	Description
Standards for Electrical Installations	BSs (British Standards), IEE (Institute of Electrical Engineers) Standards and CAWSs (Central Africa Wiring Standards) are used in Malawi.
Rated Power	High voltage side: 11 kVA, 22 kVA, 66 kVA, 132 kVA Low voltage side: three phase four wire 400 V/AC 230 V, 50 Ha
Dividing Point of Responsibility	The ESCOM is responsible for the work up to the watt hour meter.
	In the case of low voltage supply or a transformer capacity of less than 400 kVA: the ESCOM is responsible for the work up to the watt hour meter to be installed in the low voltage distribution panel.
	In the case of a transformer capacity of 400 kVA or higher: the ESCOM is responsible for the work up to the power receiving and transforming facilities (high voltage distribution panel, transformer and high voltage watt hour meter).

The electric load of the planned facilities under the Project is estimated in Table 2-21.

Table 2-21 Estimation of Electric Load

	Lighting Load (VA)	Power Outlet Load (VA)	Equipment Load (VA)	Sub-total (VA)	Safety Factor	Contract Demand (KVA)
College Facilities	51,740	134,300	321,300	507,340		
-Admin. Building	7,274	14,100	105,000	126,374		
-Library Building	7,153	22,800	33,000	62,953		
-Classroom Buildings	10,987	17,400	10,000	38,387		
-Laboratory Building	13,644	36,300	5,200	55,144		
-Multi-purpose Hall	6,678	16,700		23,378		
-Kitchen	3,259	25,200	168,100	196,559		
-Connecting Corridors	2,577			2,577		
-Gate House	168	1,800		1,968		
Hostel Buildings	63,625	210,000		273,625		
-Hostel Buildings for Female	29,587	100,800		130,387		
- Hostel Buildings for Male	32,053	109,200		141,253		
-Connecting Corridors	1,985			1,985		
Affiliated Secondary School	9,894	27,600	20,200	57,694		
-Administration Building	2,665	8,700	15,000	26,365		
-Classroom Buildings 6C	2,596	3,600		6,196		
-Laboratory Buildings 2CR	3,940	15,300	5,200	24,440		
-Connecting Corridors	693			693		
Water Supply System			9250	9250		
Sub-total	125,259	371,900	350,750	847,909		
Simultaneous Use Factor	0.7	0.1	0.5	(0.35)		
Simultaneously Used Power (VA)	87,681	37,190	175,375	300,246	1.2	360
Each Staff House	800	1,200	6,000	8,000		
20 Staff Houses	14,000	24,000	120,000	160,000		
Simultaneous Use Factor	0.8	0.4	0.4			
Simultaneously Used Power (VA)	12,800	9,600	48,000	70,400		

(b) Generator

In view of the local power supply situation, an emergency power source (125 kVA) will be installed to meet the power demand of the gate house, computers, kitchen, lighting for the multi-purpose hall, minimum lighting in the hostel block and other key areas.

(c) Trunk On-Site Distribution Lines

Power will be distributed from the transformer/switchgear to be installed by the ESCOM to the distribution panel at each planned building via underground cable. Branch circuits from the said panel will supply power in three phase, four wire and 400/230 V.

(d) Lighting System

Given the fact that the daytime lessons will end at 17:30, the standard illuminance for the planned facilities is 200 lx for educational facilities and offices, 300 lx for the library and approximately 100 lx for the toilets, taking daytime rain into consideration. No set illuminance is introduced for the corridors although the minimum necessary number of lamps will be installed to ensure safety of movement. The bedrooms in the hostel block will have an illuminance of 150 lx. Meanwhile, no set illuminance is introduced for the staff houses as it is assumed that the occupants will bring their own light fittings to use the wall brackets provided. The basic policy for light fittings is the use of widely marketed fluorescent lamps to reduce the maintenance cost (power charge and lamp replacement cost). In the case of the multi-purpose hall, mercury lamps will be installed as in the case of similar existing facilities because of its large space.

(e) Power Outlets

The standard number of power outlets per room is two for classrooms and offices. Exclusive power outlets will be installed to serve PCs, air-conditioners, laboratory equipment and kitchen equipment.

(f) Communication System

A PABX (private automatic branch exchange) will be installed in the administration building and telephone lines in conduits will be laid to the administration office, offices of senior personnel, kitchen office and gate house. The installation of telephone sets is not included in the scope of the Project.

(g) College LAN System

A college LAN system is not included in the scope of the Project because of (i) the necessity to develop an appropriate system after the firm establishment of the campus operation and management system and (ii) the need to install the latest information communication equipment and systems against the background of the steady advancement of technologies, including the wireless communication technology.

The computers to be procured and installed with the Japanese assistance will be those to be installed at the computer centre and resource centre. Computers to be installed in offices and those used for course management are not included in the scope of the Japanese assistance.

2) Air-Conditioning and Ventilation Systems

An air-conditioning system will be installed under the Project at the computer centre, resource centre and main offices (i.e. administration office and course management office) in the administration block. Power outlets to enable the use of an air-cooling system will be installed in staff rooms and the librarian's office. Air-conditioning units are not included in the scope of the Project for these rooms.

To provide mechanical ventilation, a ventilation fan will be installed in the laboratories and cooking room. Ventilation in other rooms will be provided by means of a suitable architectural design which ensures sufficient natural ventilation.

3) Plumbing Installations

(a) Water Supply System

The test drilling and pumping test conducted for the Project found that the possible groundwater supply volume will fall short of the water demand of the new college. It is, therefore, planned that the Malawi side will extend the local public water supply system to the site. However, the additional boreholes (2 numbers) will be prospected in the pre-construction stage due to instability of public water supply. The public water and the groundwater from the boreholes will firstly be received by a water tank on the site and will then be pumped to an elevated water tank for subsequent distribution throughout the site using the gravity system. The elevated water tank will be constructed at the highest place on the site and its height will be sufficient to produce a water supply pressure of 30 kPa at the taps located in the hostel block and staff house area, both of which will be located furthest from the elevated water tank.

(b) Estimation of Water Consumption

Table 2-22 Estimation of Water Consumption

Number of Occupants	Breakdown of Occupants	Total Number of Occupants	Daily Water Consumption (litres/person)	Total Daily Water Consumption
Hostel Block	300 males; 300 females	600	80	48,000 litres (48 m^3)
Staff Houses	4 persons/house x 20	80	80	6,400 litres (6.4 m^3)
Sub-Total		680	80	54,400 litres (54.4 m^3)
< Non-Residents >				
College Staff	40 teachers; 40 general staff	80	40	3,200 litres (3.2 m^3)
Affiliated Secondary School Staff	16 teachers; 8 general staff	24	40	960 litres (1 m^3)
Pupils	40 pupils/class x 8 classes	320	40	12,800 litres (12.8 m^3)
Non-Resident Sub-Total		424	40	16,960 litres (17 m^3)
Total				71,360 litres (71 .4 m^3)

The daily water consumption at the college and affiliated secondary school is estimated to be 71.4 m^3 based on the number of expected water users. In view of the water use in the kitchen, the total daily water consumption is set at 75 m^3. In accordance with the characteristics of the daily water usage fluctuations of the college facilities, affiliated secondary school, hostel block and staff houses, the effective capacity of the water receiving tank and elevated water tank is designed to be 40 m^3 and 10 m^3 respectively.

(c) Sanitary Installations

The planned sanitary fittings for the college and affiliated secondary school are those commonly used at educational institutions in Malawi. Closets will be the Western type with a cistern while urinals will be stainless steel trough style urinals with a high tank. Wash basins (ceramic) will be installed on a counter to prevent any damage. The sanitary installations in the hostel block will be the same. Wash basins and dish washing sinks in the canteen and kitchen area (i.e. multi-purpose hall building) will be wide types made of concrete. The laboratories and domestic science room will be provided with water taps and stainless steel sinks. The actual number of sanitary fittings for the educational facilities will be decided based on the number of expected users of each area using the relevant calculation formula recommended by the Society of Heating, Air-Conditioning and Sanitary Engineers of Japan. For this purpose, the number of users in each area is set at 600 (300 males and 300 females) for the classroom block and laboratory area, 100 (50 males and 50 females) for the library block and 300 (150 males and 150 females) for the multi-purpose hall. Teachers' toilets will be placed next to the students' toilets to be constructed in each area and the number will be one closet and one urinal. The number of pupils' toilets in the affiliated secondary school will be based on 160 boys and 160 girls.

Table 2-23 Planned Numbers of Sanitary Fittings

Area		Male			Female	
		Closet	Urinal	Wash Basin	Closet	Wash Basin
Classroom and Laboratory Area	Required	5	10	4	10	8
	Planned	6	9	6	9	9
Multi-Purpose Hall/Kitchen	Required	3	5	4	5	5
	Planned	2	4	4	4	4
Library	Required	2	2	2	3	3
	Planned	2	2	2	3	3
Affiliated Secondary School	Required	3	6	3	7	5
	Planned	4	6	4	6	6

(d) Wastewater Treatment Plant

Wastewater should be treated within the premises. Sewage disposal facilities will be located at the lowest point in the premises, and the treated water shall be soaked through sub-drainage piping into the ground.

4) Fire Extinguishing Equipment

Although the installation of fire extinguishing equipment in certain types of buildings is a compulsory requirement in Malawi, there are no local standards for the installation location and quantity of such equipment. The fire extinguishing equipment shown in Table 2-24 is planned based on the results of consultations with a local fire station and past examples of similar projects. Because of the small scale of each building, an indoor hydrant will be directly connected to a water supply pipe and no fire extinguishing pumps will be installed.

Table 2-24 Fire Extinguishing Equipment by Building

Block Name	Fire Extinguishing Equipment
Classroom Block	No obligation
Administration/Library Block	Indoor Hydrant (30 m) ×1, Dry Chemical Fire Extinguisher (9kg) ×1, CO_2 Fire Extinguisher (5 kg) ×1
Laboratory Block	Indoor Hydrant (30 m) ×1, Dry Chemical Fire Extinguisher (9kg) ×1, CO_2 Fire Extinguisher (5 kg) ×1, Foam Fire Extinguisher (9 kg) ×2
Toilet Block	No obligation
Kitchen	Indoor Hydrant (30 m) ×1, CO_2 Fire Extinguisher (5 kg) ×1, Fire Fighting Cloth×1
Hall	Indoor Hydrant (30 m) ×1, Dry Chemical Fire Extinguisher (9 kg) ×1, CO_2 Fire Extinguisher (5 kg) ×1, Fire Alarm
Hostel	Indoor Hydrant (30 m) ×1, Fire Alarm
Staff House	No obligation

(5) Building Materials Plan

The following basic principles are adopted for the selection of the building materials.

- Materials which are suitable for the local climate and which are economical and easy to procure locally

- Materials which can use a common local construction method and which are easy to maintain

- Materials which are equivalent to those used for the existing DCE buildings and other similar buildings constructed by other donors.

Table 2-25 Local Construction Methods and Selected Materials and Methods

Section		Local Construction Method		Selected for the Project	Reason for Selection
< Exterior >		DCE	MTTC		
Roof		Roof tiles and steel roof	Coloured steel sheets (angular trapezoidal – fluted) T = 0.6 mm	As left	Good weatherability and easy local procurement
External walls		Brick masonry	SSB block masonry with weather-resistant coating	As left	Economical and easy local procurement; commonly used locally
Windows		Steel framed outswinging glass windows	Steel framed outswinging glass windows	Steel framed outswinging glass windows; aluminium frame jalousie glass windows	Economical and easy local procurement; widely used at other national universities
Openings of multi-purpose hall		Steel framed outswinging glass windows	Steel framed outswinging glass windows	Screen blocks with a paint finish	Good ventilation and natural lighting and economical
Doors		Steel frame with wooden door	As left	As left	Durable; commonly used locally
Connecting corridors		Concrete slab blocks	As left	As left	Economical
< Interior >					
Floor	Administration offices and corridors	Mortar with a trowel finish	Carpet (personal offices); ceramic tiles	Ceramic tiles	
	Classrooms	Mortar with a trowel finish	As left	As left	Economical
	Laboratories/ Domestic science room	Mortar with a trowel finish	As left	As left	Economical
	Resource centre	Mortar with a trowel finish	Ceramic tiles	As left	Better maintenance of PCs with less dust
	Computer centre	Mortar with a trowel finish	Ceramic tiles	As left	Better maintenance of PCs with less dust
	Library	Mortar with a trowel finish	Ceramic tiles	As left	Economical
	Multi-purpose hall	Mortar with a trowel finish	Ceramic tiles	Mortar with a trowel finish and	Economical and durable

				mortar hardener coating	
	Kitchen	Ceramic tiles	Ceramic tiles	As left	Easy to clean to ensure an hygienic environment
	Toilets	Mortar with a trowel finish	Mortar with a trowel finish	Ceramic tiles	Easy to clean to ensure an hygienic environment
	Hostel/ Bedrooms	Mortar with a trowel finish	Mortar with a trowel finish	As left	Economical
	Hostel/toilets and shower rooms	Mortar with a trowel finish	Mortar with a trowel finish	Ceramic tiles	Easy to clean to ensure an hygienic environment
	Staff houses	Mortar with a trowel finish	Mortar with a trowel finish; ceramic tiles	Mortar with a trowel finish	Economical
Walls	Offices/rooms/ Corridors	Mortar with a paint finish	Mortar with a paint finish	As left	Economical
	Kitchen	Tiles; upper parts are mortar with a paint finish	Tiles; upper parts are mortar with a paint finish	As left	To ensure an hygienic environment
	Toilets	Tiles; upper parts are mortar with a paint finish	Tiles; upper parts are mortar with a paint finish	As left	To ensure an hygienic environment
	Hostel/ Bedrooms	Mortar with a paint finish	Mortar with a paint finish	As left	Economical
	Staff houses	Mortar with a pain finish	Mortar with a paint finish	As left	Economical
Ceiling	Offices/rooms	Exposed roof backings	Plywood with a paint finish	Plywood with a paint finish	Good insulation and economical
	Multi-purpose hall	Exposed roof backings	As left	As left	Economical; common method
	Kitchen	Exposed roof backings	Plywood with a paint finish	As left	To ensure an hygienic environment
	Toilets	Exposed roof backings	Plywood with a paint finish	As left	Good insulation and economical
	Hostel/ Bedrooms	Plywood with a paint finish	Plywood with a paint finish	As left	Economical; common method
	Staff houses	Plywood with a paint finish	Plywood with a paint finish	As left	Economical; common method

(6) Furniture Plan

A range of furniture which is essential for the operation of the new college and affiliated secondary school is planned for the educational facilities and administration rooms of these two educational institutions. Their specifications follow the standard specifications for educational facilities in Malawi. Furniture for the staff houses is not included in the scope of the Project as such furniture will be procured by the Malawi side. As blackboards and noticeboards are included in the scope of the building work, they are not included in the furniture list below.

< Classroom and Laboratory Block >

- Classroom : Desks and chairs for 40 students; desk and chair for the teacher
- Large meeting room : Five seater fixed desk and chair x 18 units (to seat at least 80 persons); desk and chair for the teacher
- Laboratory/domestic science room : Five laboratory tables to serve five groups; 40 stools; demonstration table; chair for the teacher
- Preparation room : 12 equipment shelves; preparation work table (with a sink); two stools
- Staff room; lecturers' room : Three sets of teacher's desk, chair and cabinet as it is assumed that the room will be shared by three teachers/lecturers

< Library Block >

- Reading room : Reading desk (six seater) x 14; 102 chairs, including window-side carrel desks
- Search and browsing : Centre table (four seater) x 2; eight armchairs; five low book shelves
- Open stacks : 24 stacks (1,800 mm wide, double-sided D500 type x 18; single-sided D260 type x 2; 900 mm wide double-sided D500 type x 3; single-sided D260 type x 1)
- Librarian's office : One set of staff desk and chair; two cabinets; two guest chairs
- Reception counter : Two general staff chairs; two cabinets (low height type)
- Library workshop : Work table (4 seater) x 2; eight chairs; six bookshelves (1,800 mm wide single-sided D260 types); four equipment shelves
- Stack room : 16 book shelves for a closed stack system storing textbooks and books

- Resource centre : PC desk x 7; work table (6 seater) x 1; eight chairs; large cabinet x three

- Computer centre : PC desk and chair x 20 sets

- IT office : General staff table, chair and cabinet for an IT engineer, one equipment shelf; one guest chair

< Administration Block >

- Chancellor's office : Senior staff desk and chair; centre table and soft; cabinet x 3

- Vice-chancellor's office : Senior staff desk and chair; centre table (small) with three guest chairs; cabinet x 2

- Bursar's office : Senior staff desk and chair; cabinet x 2, three guest chairs

- Administration office : Required number of general staff desks, chairs and cabinets as determined by the number of staff members working in this office

- Meeting room (large) : Conference table (three seater) x 8 and conference table (2 seater) x 2, totalling 12 tables; 32 chairs

< Course Management Block >

- Dean's office : Senior staff desk and chair; cabinet x 3; three guest chairs

- Curriculum head's office : General staff desk and chair x 3 sets; cabinet x 3; three guest chairs

- External lecturers' room : General staff desk and chair x 10 sets

- INSET office : Senior staff desk and chair; general staff desk and chair x 3 sets; cabinet x 6; one work table with four chairs

- Small meeting room : Three seater table x 4 and 12 chairs

< Multi-Purpose Hall/Kitchen >

- Hall : Pipe chair x 720; six seater dining table x 48; some 300 pipe chairs will be stored in the stage-side storage space when the hall is used as a canteen

- Kitchen office : General staff desk, chair and cabinet; two guest chairs

- Sick bay : General staff desk, chair and cabinet; one examination bed and one stool; two patient beds

< Hostel Block >

- Female hostels : Bed, small desk and chair x 288 sets

- Male hostels : Bed, small desk and chair x 312 sets

< Affiliated Secondary School >

- Head teacher's office : Senior staff desk and chair; cabinet x 2, centre table with three sofas

- Deputy head teacher's office: Senior staff desk and chair; cabinet x 2; two guest chairs

- Administration office : General staff desk and chair; cabinet x 2

- Staff room : teacher's desk and chair x 16 sets; cabinet x 8, centre table x 3; armchair x 6

- Library : Open shelf x 12; 2 seater reading table x 12; 24 chairs

- Library/equipment room : Open shelf x 14; work table x 2; stool x 4

- Classroom : Pupil's desk and chair x 40 sets; teacher's desk and chair

- Science laboratory : Eight seater laboratory table x 5; teacher's demonstration table; stool x 41

- Biology laboratory : Eight seater laboratory table x 5; teacher's demonstration table; stool x 41

- Preparation room : Equipment cabinet x 20; teacher's work table with two chairs

(7) Equipment Plan

The range of equipment to be provided with the Japanese assistance under the Project will be that for scientific experiments, computers and peripheral equipment.

For the planning of the list of equipment to be provided, a study was conducted on the range of necessary equipment and tools actually in use for exercises and laboratory experiments in accordance with the physics, chemistry and biology curricula for laboratory experiments based on the list of equipment owned by the DCE. The study also included the available equipment, etc. and its use and maintenance at other educational institutions (University of Malawi and Mzuzu University).

In the process of selecting the equipment, consultations were held with the DTED and SMASSE team to confirm that the range of equipment to be provided under the Project would be that which will be essential for the implementation of the curricula for laboratory experiments and which will be frequently used for various experiments. Meanwhile, it was agreed to exclude (i) those which would be essential for the implementation of the said curricula but which could be replaced by others and (ii) those of which the maintenance would require special skills from the scope of equipment selection. Agents and other consumables were excluded from the scope of assistance in line with the rules of Japan's grant aid scheme. The necessary quantities of glassware are included as these are essential for experiments. In the case of scientific experiment equipment for the affiliated secondary school, that selected under the CDSS Phase 2 is also selected for the Project.

Table 2-26 shows the current laboratory experiment curricula for biology, chemistry and physics at the DCE and equipment, etc. in use.

Table 2-26 Scientific Experiment Curricula at the DCE

	Field of Experiment	Equipment, etc. Used	Purpose of Experiment
Biology	01 Cell and Plant Biology	Microscope; dissecting microscope; microscope slide; cover slide; dissecting lens; petri dish; others	Understanding of microscopy, diversity of cell types and plant varieties
	02 Invertebrates and Vertebrates	Microscope; dissecting microscope; microscope slide; cover slide; dissecting set; petri dish; dropper; stirring rod; others	Understanding of protists, molluscs, anthropods, fish, amphibians, reptiles, birds and skeletons of vertebrates
	03 Plant Form and Function	Analytical digital balance; Pasteur pipette; prepared slide; dissection set; dissecting lens; others	Learning of plant growth and alimentary canal, gaseous exchange and heart function of animals
	04 Human Social Biology	Microscope; prepared slide; microscope slide; cover slide; burner; test tube; test tube holder; measuring cylinder; petri dish; conical flash; beaker; others	Learning of nutrition, energy content of food, sexually transmitted diseases and their impacts and development of the fertilised egg
	05 Microbiology and Pathology	Microscope; petri dish; conical flask; test tube; test tube holder; dissecting set; others	Learning of aseptic techniques, bacterial growth and microbiological examination of water for portability

	06 Genetics	Microscope; microscope slide; cover slide; beaker; watch glass; spirit lamp; others	Understanding of genes, heredity, probability, meiosis and gametogenesis
	07 Cell Biochemistry	Dissecting set; test tube; stirring rod; measuring cylinder; burner; water bath; thermometer; others	Characterisation of carbohydrates, proteins and lipids; understanding of enzyme properties and effects of enzyme and substrate concentrations
	08 Ecology	Microscope; test tube; stopper for large test tube; conical flask; measuring cylinder; test tube brush; pH test kit; spatula; Pasteur pipette; others	Understanding of natural ecology; soil pH and determination of the moisture content of soil samples; observation of the population growth multiplication of yeast cells
	09 Environmental Biology	Conical flask; beaker; stand and clamp; analytical digital balance; measuring cylinder; burner; others	Observation and understanding of water quality, dissolved solids and suspended solids
Chemistry	01 Basics and Techniques for Experiments	Beaker; volumetric flask; measuring cylinder; stand clamp; funnel; pipette; analytical digital balance; others	Learning of how to select and use measuring instruments
	02 Chemical Reactions	Beaker; measuring cylinder; flask; test tube; funnel; watch glass; analytical digital balance; power supply; spectrometer; rheostat; milli-ammeter; stop watch; water bath; thermometer; voltmeter; burner; others	Understanding of electrolysis, heating of solution, dilution and neutralisation, electrochemical cells, rate of reaction, hydrolysis and synthesis/production of components
	03 Properties and Measuring of Substances	Test tube; beaker; flask; volumetric flask; measuring cylinder; stirring rod; watch glass; burette; burner; power supply, milli-ammeter; stop watch; water bath; analytical digital balance; spectrometer; others	Learning of the identification of ions in a compound, moles and molarity, molecular mass of liquid, chloride ion measurement, chemical structure, bonding, properties, construction of solubility curves, pH and buffers
	04 Change of Substances	Beaker; measuring cylinder; test tube; thermometer; water bath; calorimeter; goggles; others	Learning of heating and cooling curves; determination of enthalpy change, etc.
	05 Determination of Molecules, Compounds and Mixtures	Beaker; flash; pipette; pipette filler; burette; stirring rod; stand and clamp; water bath; thermometer; others	Determination of NaOH concentration, iodine solution concentration, H_2SO_4 concentration, mass percentage of sodium hypochlorite and solubility of a substance
Physics	01 Basics and Techniques for Experiments	Triple beam balance; ticker tape timer; power supply; stand and clamp; micrometer; others	Understanding of how to use measuring instruments and error analysis
	02 Force, Motion and Energy	Mass; triple beam balance; ticker tape timer; stop watch; tilt table; pendulum bob; micrometer; power supply; others	Understanding of vector addition and forces in equilibrium, velocity and acceleration, projectile motion and moment of inertia; determination of acceleration
	03 Electricity	Power supply; voltmeter; ammeter; resistor; circuit board; resistance box; oscilloscope; switch; galvanometer; top water; others	Measurement of current and voltage in DC circuits and understanding of electromotive force, electric resistance, measurement of the force between electric current and conductor, characteristics of semiconductor diodes, temperature dependence of resistance, etc.
	04 Waves, Sound and Light	Power supply; signal generator; oscilloscope; stroboscope; microscope; optical lens set; stand and clamp; tuning fork; stop watch	Understanding of the properties of waves, reflection and refraction properties of waves; velocity of sound and resonance and Newton's

			rings; observation of focal length of converging lens
	05 Heat	Triple beam balance; beaker; stirring rod; calorimeter; thermometer; burner; tripod; gauze wire; power supply; stop watch; others	Learning of specific heat, specific latent heat of fusion and vaporisation and other matters

The quantity of each item is determined based on the required quantity for the current use and purpose of use. In principle, five sets of laboratory equipment, etc. will be provided to support those experiments to be conducted by five groups with eight members each while 10 sets will be provided for those experiments to be conducted by 10 groups with four members of each. For those to be used for demonstration by the teacher, one each is planned. In the case of biology experiments, as two laboratories will be used simultaneously for the PRESET course and INSET/SMASSE course, the planned quantities of the basic equipment are sufficient to support two laboratories at the same time.

Laboratory Equipment

Based on the above analysis, the items and quantities to be provided with the Japanese assistance for the various laboratories are listed in Table 2-27 through Table 2-31.

Table 2-27 Biology Laboratory Equipment List

Item No.	Item/Biology Lab	Quantity		
		Q'ty/ group	Groups	Total
BIO-1	Microscope	1	20	20
BIO-2	Dissect microscope	1	20	20
BIO-3	Microscope cover slips	1	10	10
BIO-4	Microscope slides	1	10	10
BIO-5	Specimen prepared (Cells)	1	5	5
BIO-6	Specimen prepared (Bloods)	1	5	5
BIO-7	Dissecting set	1	20	20
BIO-8	Dissecting dish	1	20	20
BIO-9	Dissecting board	1	20	20
BIO-10	Test tube	10	20	2
BIO-11	Test tube stand	2	20	40
BIO-12	Test tube holders	1	20	20
BIO-13	Beaker 100ml	2	20	40
BIO-14	Beaker 250ml	1	20	20
BIO-15	Beaker 500ml	1	10	10
BIO-16	Flask conical 100ml	1	20	20
BIO-17	Flask conical 250ml	1	20	20
BIO-18	Flask conical 500ml	1	10	10
BIO-19	Flask round Bottom 250ml	1	20	20
BIO-20	Flask round Bottom 500ml	1	10	10
BIO-21	Measuring cylinders 25ml	1	20	20
BIO-22	Measuring cylinders 100ml	1	20	20
BIO-23	Measuring cylinders 250ml	1	20	20
BIO-24	Volumetric pipette 10ml	1	10	10

BIO-25	Volumetric pipette 20ml	1	10	10
BIO-26	Dropping pipette	2	20	40
BIO-27	Pipette filler	1	20	20
BIO-28	Funnel	1	20	20
BIO-29	Stirring rod	1	20	20
BIO-30	Forceps	2	20	40
BIO-31	Spatula	1	20	20
BIO-32	Petri dish	2	20	40
BIO-33	Watch glass	2	20	40
BIO-34	Evaporating Basin	1	20	20
BIO-35	Glass tube	1	10	10
BIO-36	Reagent bottle 250mls	5	2	10
BIO-37	Reagent bottle 250mls	5	2	10
BIO-38	Wash bottle	1	20	20
BIO-39	Washing brush (beaker)	1	20	20
BIO-40	Washing brush (flask)	1	20	20
BIO-41	Washing brush (tubes)	1	20	20
BIO-42	Water bath	1	2	2
BIO-43	Hand lens	1	20	20
BIO-44	Mirror	1	20	20
BIO-45	Thermometer	1	20	20
BIO-46	Bunsen Burner	1	20	20
BIO-47	Spirit burner	1	20	20
BIO-48	Tripod stand	1	20	20
BIO-49	Tripod stand	1	20	20
BIO-50	Retort stand base	1	20	20
BIO-51	Retort stand rod	1	20	20
BIO-52	Burette clamp	1	20	20
BIO-53	Boss head	1	20	20
BIO-54	Retort clamp	1	20	20
BIO-55	G clamp	1	20	20
BIO-56	Wire gauze	1	20	20
BIO-58	Hemocytometer	1	2	2
BIO-58	Model of eye	1	1	1
BIO-59	Model of ear	1	1	1
BIO-60	Human skeleton	1	1	1
BIO-61	Model of teeth	1	1	1
BIO-62	PH meter	1	20	20
BIO-63	Photosynthesis apparatus	1	2	2
BIO-64	Pressure sterilizer	1	1	1
BIO-65	Rubber stoppers	5	1	5
BIO-66	Rubber tube	10	1	10
BIO-67	Analytical balance (open)	1	2	2

Table 2-28 Chemistry Laboratory Equipment List

Item No.	Item/Chemistry Lab	Quantity		
		Q'ty/ group	Groups	Total
CH-1	Analytical balance (covered)	1	1	1
CH-2	Triple beam balance	1	5	5
CH-3	Roberval balance	1	5	5
CH-4	Test tube	10	10	100
CH-5	Test tube stand	1	10	10
CH-6	Beakers 50ml	4	10	40
CH-7	Beakers 100ml	4	10	40
CH-8	Beakers 250ml	2	10	20
CH-9	Beakers 500ml	2	10	20
CH-10	Flask conical 100ml	2	10	20
CH-11	Flask conical 250ml	2	10	20
CH-12	Flask conical 500ml	1	5	5
CH-13	Flask round bottom 100ml	1	10	10
CH-14	Flask round bottom 250ml	1	10	10
CH-15	Flask round bottom 500ml	1	10	10
CH-16	Flask volumetric 50ml	1	10	10
CH-17	Flask volumetric 100ml	1	10	10
CH-18	Flask volumetric 250ml	1	10	10
CH-19	Flask Buchner 250ml	1	5	5
CH-20	Measuring cylinder 25ml	1	10	10
CH-21	Measuring cylinders 100ml	1	10	10
CH-22	Measuring cylinders 250ml	1	10	10
CH-23	Measuring Pipette 2ml	1	5	5
CH-24	Measuring Pipette 5ml	1	5	5
CH-25	Measuring Pipette 10ml	1	5	5
CH-26	Pipette 25ml	1	5	5
CH-27	Dropping pipette	5	10	50
CH-28	Pipette filler	1	10	10
CH-29	Funnel	1	10	10
CH-30	Buchner funnel	1	10	10
CH-31	Burets 50ml	1	10	10
CH-32	Petri Dish	2	10	20
CH-33	Evaporating basin	1	10	10
CH-34	Watch glass	1	10	10
CH-35	Glass tube	1	10	10
CH-36	Reagent bottle 250mls (clear glass)	5	10	50
CH-37	Reagent bottle 250mls (amber)	5	10	50
CH-38	Spatula	1	10	10
CH-39	Stirring rod	1	10	10
CH-40	Thermometer	1	10	10
CH-41	Thermo-hygrometer	1	10	10
CH-42	Calorimeter	1	5	5
CH-43	Water Bath	1	5	5
CH-44	Water condenser	1	5	5
CH-45	Bunsen burner	1	10	10
CH-46	Spirit burner	1	10	10
CH-47	Retort stand base	1	10	10
CH-48	Retort stand rod	1	10	10
CH-49	Burette clamp	1	10	10
CH-50	Boss head	2	10	20

CH-51	Retort clamp	2	10	20
CH-52	G clamp	1	10	10
CH-53	Test tube holders	2	10	20
CH-54	Wire Gauze	1	10	10
CH-55	Tripod stand	1	10	10
CH-56	Tripod stand	1	10	10
CH-57	PH meter	1	5	5
CH-58	Spectrometer	1	5	5
CH-59	Power Supply (12 V)	1	5	5
CH-60	Rheostat	1	5	5
CH-61	Voltmeter	1	10	10
CH-62	Ammeter	1	10	10
CH-63	Leads and crocodile clip	2	5	10
CH-64	Stop watch	1	10	10
CH-65	Rubber stoppers	1	5	5
CH-66	Rubber tube	1	5	5
CH-67	Eye protector	2	10	20
CH-68	Wash bottle	1	10	10
CH-69	Washing brush (beaker)	1	10	10
CH-70	Washing brush (flask)	1	10	10
CH-71	Washing brush (tubes)	1	10	10
CH-72	Periodic table	1	1	1

Table 2-29 Physics Laboratory Equipment List

Item. No.	Item/Physics Lab	Quantity		
		Q'ty/ group	Groups	Total
PH-1	Beaker (100ml)	2	10	20
PH-2	Beaker (250ml)	2	10	20
PH-3	Glass tube	1	5	5
PH-4	Stirring rod	1	10	10
PH-5	Bunsen burner	1	10	10
PH-6	Spirit burner	1	10	10
PH-7	Tripod Stand	1	10	10
PH-8	Tripod Stand	1	10	10
PH-9	Retort stand base	1	10	10
PH-10	Retort rod	1	10	10
PH-11	Boss head	1	10	10
PH-12	Retort clamp	1	10	10
PH-13	G. clamp (boss, large, small)	1	10	10
PH-14	Wire Gauze	1	10	10
PH-15	Pulley set	1	5	5
PH-16	Pendulum bob (50g)	1	5	5
PH-17	Inclined plane set	1	5	5
PH-18	Ticker tape timer and roll	1	5	5
PH-19	Spring Balance 10N	1	10	10
PH-20	Spring Balance 1N	1	10	10
PH-21	Mass hangers + mass slots	1	5	5
PH-22	Mass set (1kg, 5kg)	1	5	5
PH-23	Hand lens	1	10	10
PH-24	Microscope	1	10	10
PH-25	Ray optics box	1	5	5
PH-26	Optical filter set	1	5	5

PH-27	Prism	1	5	5
PH-28	Prism	1	5	5
PH-29	Optical lens set (biconvex)	1	5	5
PH-30	Optical lens set (binoconcave)	1	5	5
PH-31	Optical lens set (plano-convex)	1	5	5
PH-32	Lens holder	6	5	30
PH-33	Stroboscope	1	5	5
PH-34	Voltmeter	1	5	5
PH-35	Ammeter	1	10	10
PH-36	Micro ammeter	1	5	5
PH-37	Power supply (12 V)	1	5	5
PH-38	Rheostat	1	5	5
PH-39	Resistor set	1	5	5
PH-40	Electric circuit	1	5	5
PH-41	Capacitor set	1	5	5
PH-42	Transistor	1	5	5
PH-43	Signal generator	1	5	5
PH-44	Dual trace Oscilloscope	1	5	5
PH-45	Galvanometer	1	5	5
PH-46	Motor	1	10	10
PH-47	Knife switch	1	10	10
PH-48	Leads and crocodile clip	1	5	5
PH-49	Bar Magnet	1	10	10
PH-50	Compass-12	10	5	50
PH-51	Stop watch	1	5	5
PH-52	Micrometer	1	5	5
PH-53	Calorimeter	1	5	5
PH-54	Thermometer	1	10	10
PH-55	Triple beam balance	1	5	5
PH-56	Analytical balance (open)	1	1	1
PH-57	Tuning forks 1 set of 7 (250-512Hz)	1	1	1
PH-58	Laboratory tool kit	1	1	1
PH-59	Rubber stoppers	1	5	5

Computing Equipment

The minimum required range and quantity of computing equipment are planned here on the basis of the field survey findings on the actual use of such equipment at the DCE and their subsequence analysis results in Japan.

Table 2-30 Computing Equipment

Category	Equipment	Q'ty	Purpose of Use and Basis of the Planned Quantity
Computer	Desk top computer; network card; wireless software	20 sets	Practical learning of computing by 20 students a time
	UPS for individual computers		
	Desk top computer; network card; wireless software	7 sets	Gathering and editing of information to prepare teaching aids by 7 teachers at a time
	UPS for individual computers		
	Laser printer (Black & white)	2	One in the Computer Centre; one in the Resource Centre
	Server	1 set	Shared use by the Computer Centre and the Resource Centre
	UPS for server		

	Wireless router	1	Shared use by the Computer Centre and the Resource Centre
	Extension code	27	Total number of PC sets

Laboratory Equipment for Affiliated Secondary School

The range and quantity of laboratory equipment for the affiliated secondary school below are planned based on the Secondary School Improvement Plan Phase 2.

Table 2-31 Laboratory Equipment List for the Affiliated Secondary School

ITEM NO.	ITEM	Quantity		
		Laboratory		Total
		Phy.Sc	BIO	
L-1	Test tube	2	1	3
L-2	Beaker 100ml	24	24	48
L-3	Beaker 250ml	12	12	24
L-4	Beaker 500ml	3	3	6
L-5	Flask 100ml	6	6	12
L-6	Flask 250ml	6	6	12
L-7	Flask 500ml	1	1	2
L-8	Flask 250ml	1	1	2
L-9	Flask,distillation	1	1	2
L-10	Measuring flask 250ml	6		6
L-11	Funnel 100mm	6	6	12
L-12	Dropping Funnel	6		6
L-13	Measuring cylinder 25ml	6	6	12
L-14	Measuring cylinder 100ml	6	6	12
L-15	Measuring cylinder 250ml	6	6	12
L-16	Petri dish		12	12
L-17	Evaporating basin	6	6	12
L-18	Trough	1	1	2
L-19	Pipette	6	6	12
L-20	Dropping pipette with teat	6		6
L-21	Pipette filler	6		6
L-22	Burette 50ml	6	6	12
L-23	Liebig condenser	1	1	2
L-24	Stirring rod	12	6	18
L-25	Tubing	6	6	12
L-26	Tubing	6	6	12
L-27	Tubing	6	6	12
L-28	Burner/spirit	6	6	12
L-29	Bunsen burner	6	6	12
L-30	Gauze	6	6	12
L-31	Tripod stand	6	6	12
L-32	Spatula,spoon	12		12
L-33	Retort stand base	6	6	12
L-34	Retort stand rod	6	6	12
L-35	Burette clamp	6		6
L-36	Bosshead	6	6	12
L-37	Retort clamp	6	6	12
L-38	G clamp	6	6	12
L-39	Test tube holders	12	12	24
L-40	Stoppers (rubber)	6	6	12

L-41	Tubing (6mm dia.)	1		1
L-42	Tubing (10mm dia.)		1	1
L-43	Cork borer	1		1
L-44	Cork stoppers	1		1
L-45	Glass cutter	1		1
L-46	Laboratory tool kit	1		1
L-47	Test tube stand	12	12	24
L-48	Wash bottle	6	6	12
L-49	Reagent bottle clear glass	6		6
L-50	Reagent bottle amber glass	6		6
L-51	Brush for beaker	6	6	12
L-52	Brush for bottle	6	6	12
L-53	Brush for test tube	6	6	12
L-54	Autoclave		1	1
L-55	Thermometer	6	6	12
L-56	Thermometer	6	6	12
L-57	Mason's thermometer hygrometer	1		1
L-58	Periodic table chart	1		1
L-59	Magnet	6		6
L-60	Plotting compass	12		12
L-61	Electrodes	6		6
L-62	Bi-metallic strip	1		1
L-63	Dissecting dishes		6	6
L-64	Dissecting boards		6	6
L-65	Dissecting set		6	6
L-66	Forceps	6	6	12
L-67	Hand Lens		12	12
L-68	Microscope		6	6
L-69	Microscope slides		1	1
L-70	Cover slips		1	1
L-71	Set of prepared slides of animal cells		3	3
L-72	Blood slides		6	6
L-73	Model of the human eye on stand		1	1
L-74	Model of the human ear		1	1
L-75	Human teeth set model		1	1
L-76	Human skeleton		1	1
L-77	Stop watch	6	12	18
L-78	Triple beam balance	6		6
L-79	Metre rule	12		12
L-80	Measuring tape (30m)		1	1
L-81	Roberval balance	6		6
L-82	Analytical balance (open)	1	1	2
L-83	Ammeter	6		6
L-84	Voltmeter	6		6
L-85	Electric bell	1		1
L-86	Diode	12		12
L-87	Small motor/generator unit	1		1
L-88	Resistor	12		12
L-89	Rheostat	6		6
L-90	Knife switch	12		12
L-91	Electric circuit board kit	6		6
L-92	Balance (10x0.1N)	6		6
L-93	Balance (1x0.01N)	6		6

L-94	Pulley block	6		6
L-95	Brass hanger	6		6
L-96	Slotted brass weight	12		12
L-97	Slotted iron weight, 100g	12		12
L-98	Hexagonal iron mass, 500g	2		2
L-99	Inclined slope set	6		6
L-100	Lens, biconvex	6		6
L-101	Lens, biconcave	6		6
L-102	Lens	6		6
L-103	Lens holder	12		12
L-104	Plane mirror	6		6
L-105	Plane mirror	6	6	12
L-106	Prism	6		6
L-107	Prism	6		6
L-108	Ray optics box	6		6
L-109	Optical filter set	6		6

2.2.3 Outline Design Drawings

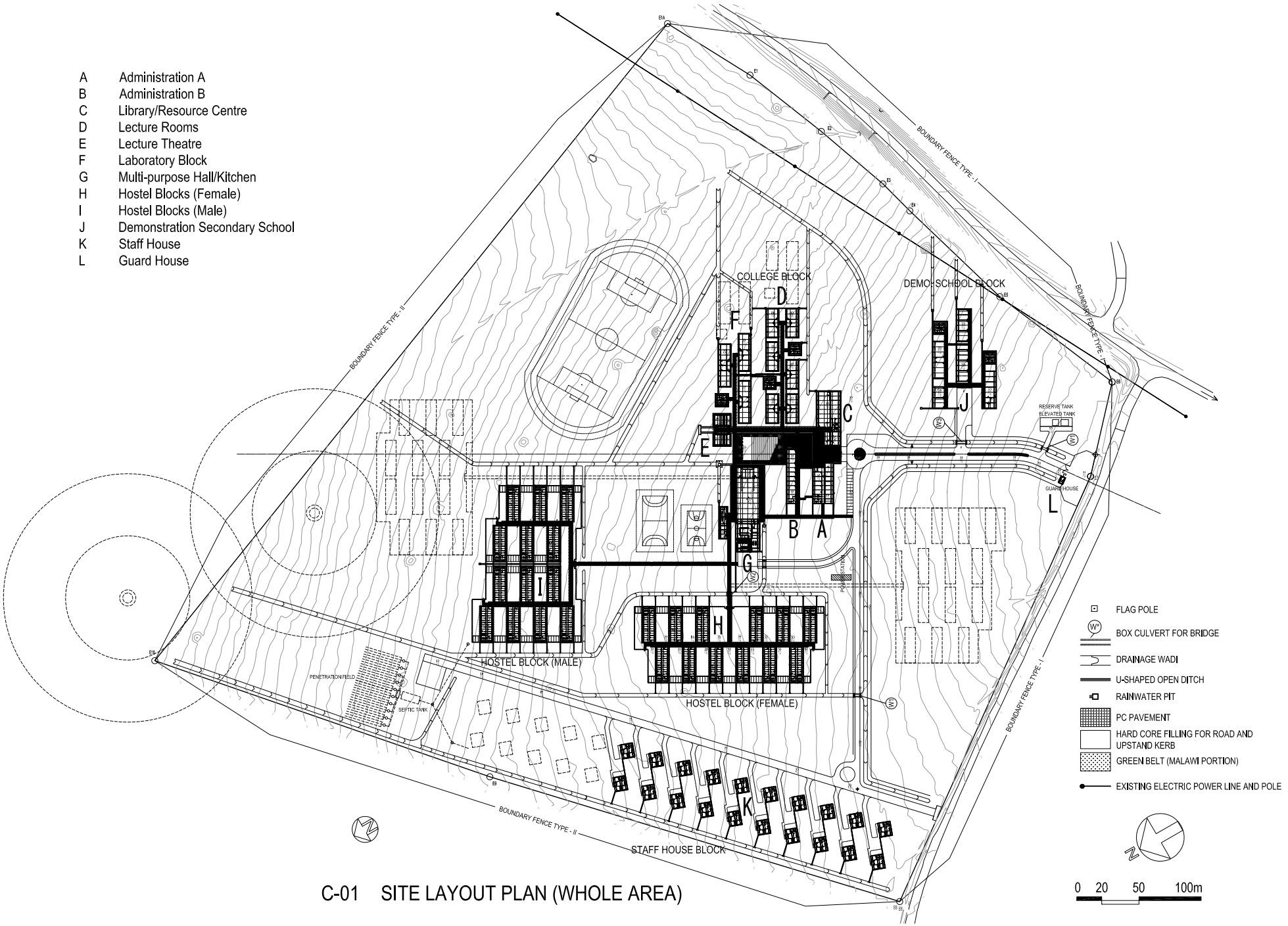
LIST OF FLOOR AREAS OF THE PLANNED FACILITIES
DRAWING LIST

C-01	SITE LAYOUT (WHOLE AREA)
C-02	LAYOUT PLAN (COLLEGE BLOCK)
C-03	LAYOUT PLAN (HOSTEL BLOCK)
C-04	LAYOUT PLAN (DEMONSTRATION SECONDARY SCHOOL)
A-01	ADMINISTRATION BUIDING A & B
A-02	RESOURCE CENTER & LIBRARY
A-03	LECTURE ROOM UNIT
A-04	LECTURE THEATER
A-05	LABORATORY (PHYSICS/CHEMISTRY)
A-06	LABORATORY (BIOLOGY)
A-07	HOME ECONOMICS LABORATORY
A-08	MULTIPURPOSE HALL & KITCHEN
A-09	SICK BAY AND TOILET, TOILET, GUARD HOUSE
A-10	HOSTEL BLOCK (MALE/FEMALE)
A-11	DEMO. S. SCHOOL: ADMINISTRATION & LIBRARY, LABORATORY
A-12	DEMO. S. SCHOOL: CLASSROOMS (2CR/3CR)
A-13	STAFF HOUSE

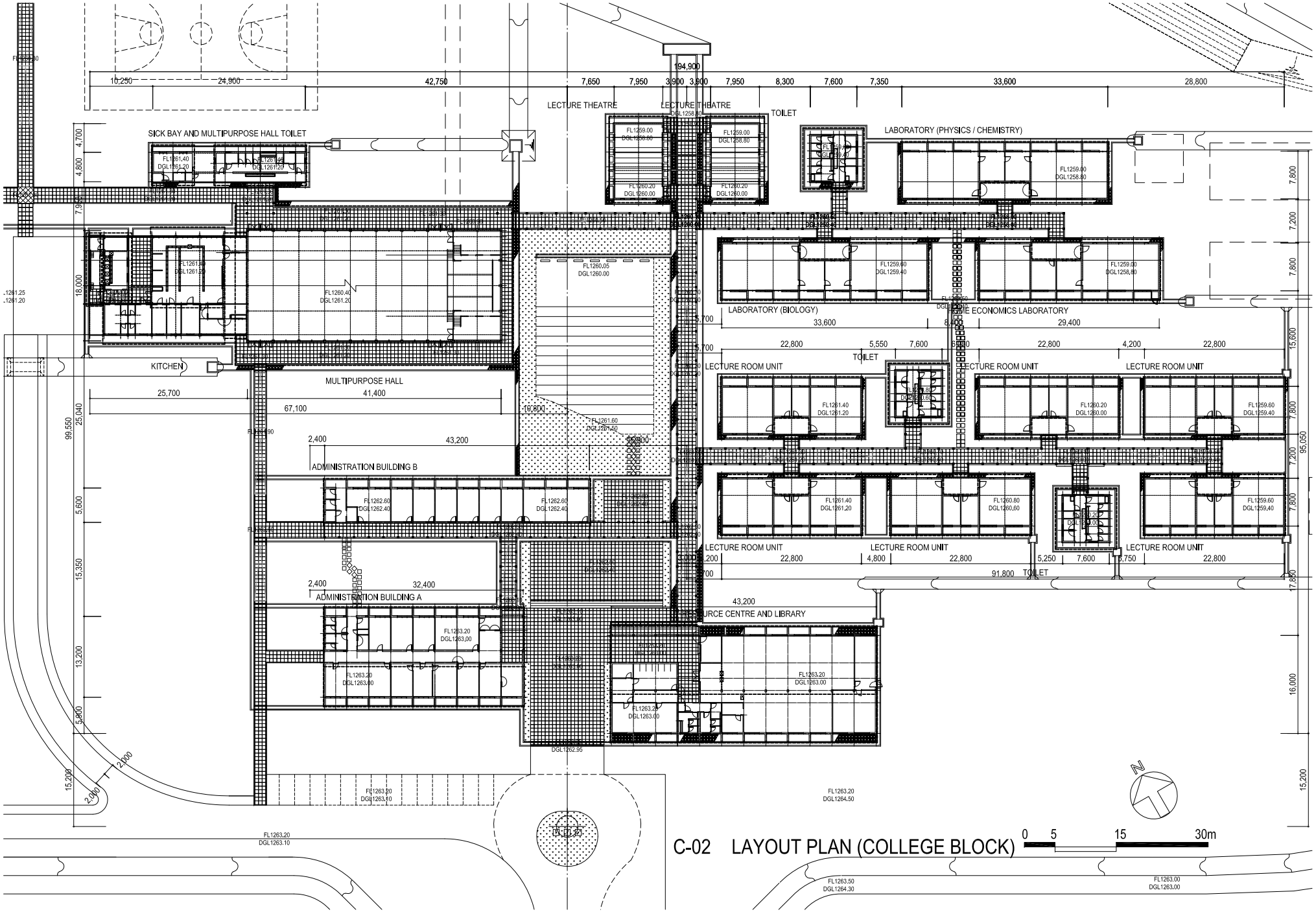
Table 2-32 List of Floor Areas of the Planned Facilities

Name of Facilities	Unit Floor Area (㎡)	Number of Buildings	Total Floor Area (㎡)
Educational Facilities			**5,743.98**
Administration Block			**669.60**
Administration Building	427.68	1	427.68
Course Management Building	241.92	1	241.92
Library Building	691.20	1	**691.20**
Classroom Block			**1,262.62**
Classroom Building (40 seats)	177.84	6	1,067.04
Classroom Building (80 seats)	97.79	2	195.58
Laboratory Block			**753.48**
Physics and Chemistry Lab. Building	262.08	1	262.08
Biology Laboratory Building	262.08	1	262.08
Home Economics Practice Building	229.32	1	229.32
Multi-purpose Hall/Kitchen			**1,110.97**
Toilet Building for Classroom Block	57.76	2	115.52
Toilet Building for Laboratory Block	57.76	1	57.76
Toilet Building for Multi-purpose Hall	102.24	1	102.24
External Connecting Corridors			**967.63**
Gate House	12.96	1	**12.96**
Student Hostel Block			**6,842.90**
Female Hostel Buildings	239.40	12	2,872.80
Male Hostel Buildings	239.40	13	3,112.20
External Connecting Corridors			857.90
Affiliated Demonstration Secondary School			**1,488.33**
Administration and Library building	211.68	1	211.68
Classroom Building (2 classrooms)	131.04	1	131.04
Classroom Building (3 classrooms)	196.56	2	393.12
Laboratory Building	229.32	1	229.32
Toilet Building	57.76	2	115.52
External Connecting Corridors			**407.65**
Staff Houses	81.00	20	**1,620.00**
Total			**15,695.21**

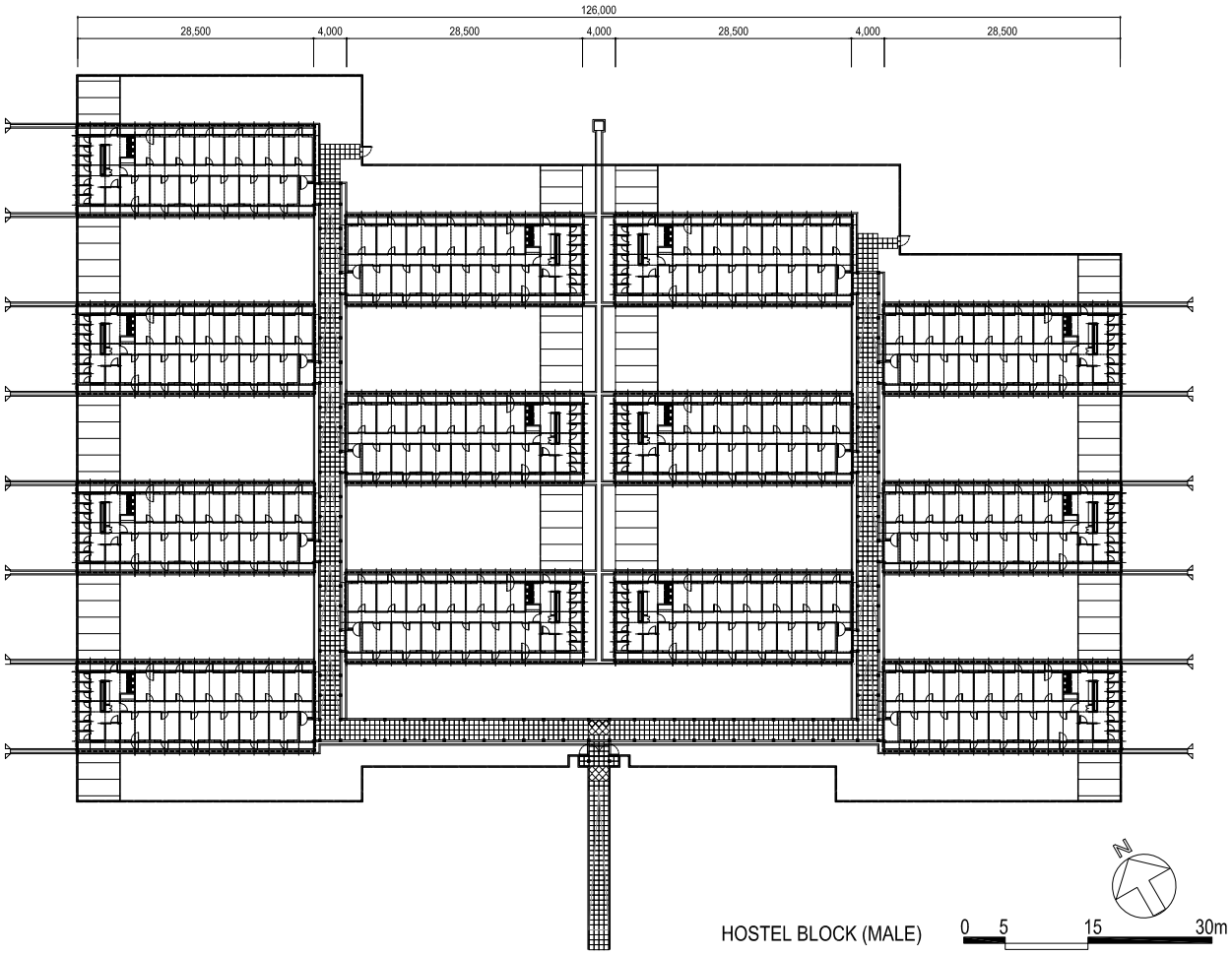
A Administration A
B Administration B
C Library/Resource Centre
D Lecture Rooms
E Lecture Theatre
F Laboratory Block
G Multi-purpose Hall/Kitchen
H Hostel Blocks (Female)
I Hostel Blocks (Male)
J Demonstration Secondary School
K Staff House
L Guard House

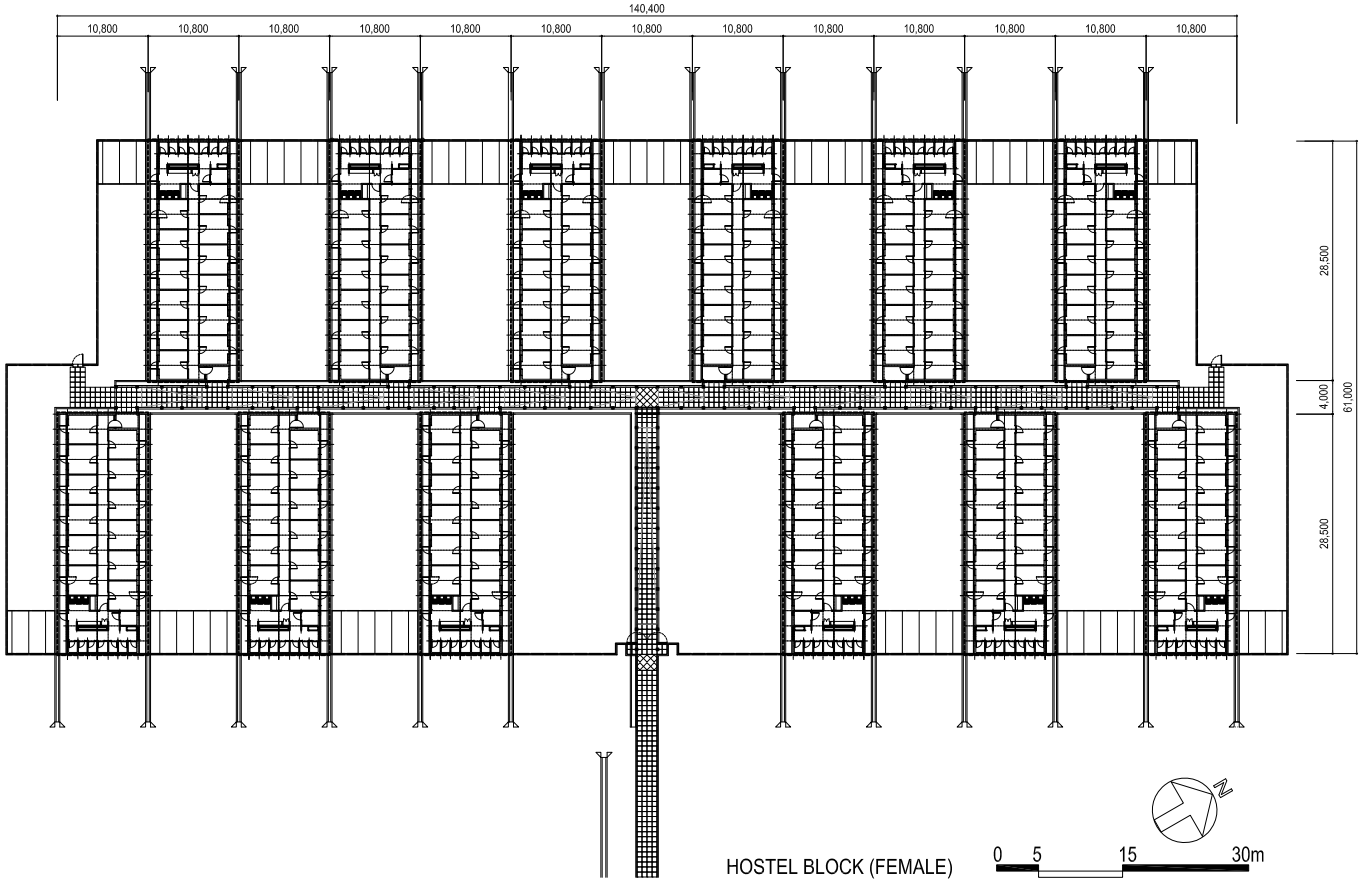


C-01 SITE LAYOUT PLAN (WHOLE AREA)

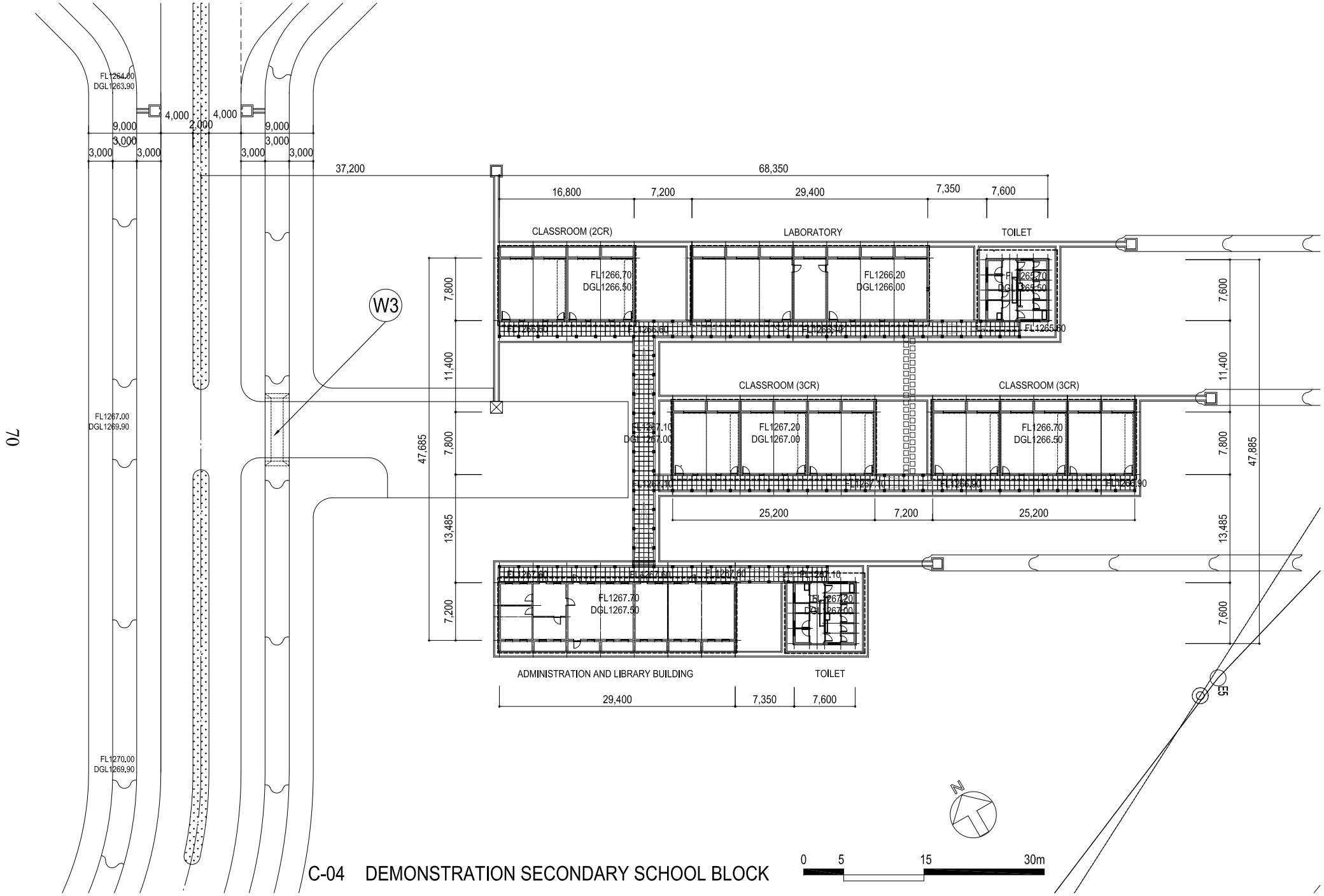


C-02 LAYOUT PLAN (COLLEGE BLOCK)





C-03 LAYOUT PLAN (HOSTEL BLOCK)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DGL1263.90
4,000
4,000
9,000
2,000
9,000
3,000
3,000
3,000
3,000
3,000
3,000
37,200
68,350
16,800
7,200
29,400
7,350
7,600
CLASSROOM (2CR)
LABORATORY
TOILET
FL1266.70
DGL1266.50
FL1266.20
DGL1266.00
FL1265.50
W3
7,800
11,400
7,800
13,485
7,200
47,685
CLASSROOM (3CR)
CLASSROOM (3CR)
FL1267.20
DGL1267.00
FL1266.70
DGL1266.50
25,200
7,200
25,200
7,600
11,400
7,800
13,485
7,600
47,885
FL1267.00
DGL1269.90
FL1267.70
DGL1267.50
ADMINISTRATION AND LIBRARY BUILDING
TOILET
29,400
7,350
7,600
FL1270.00
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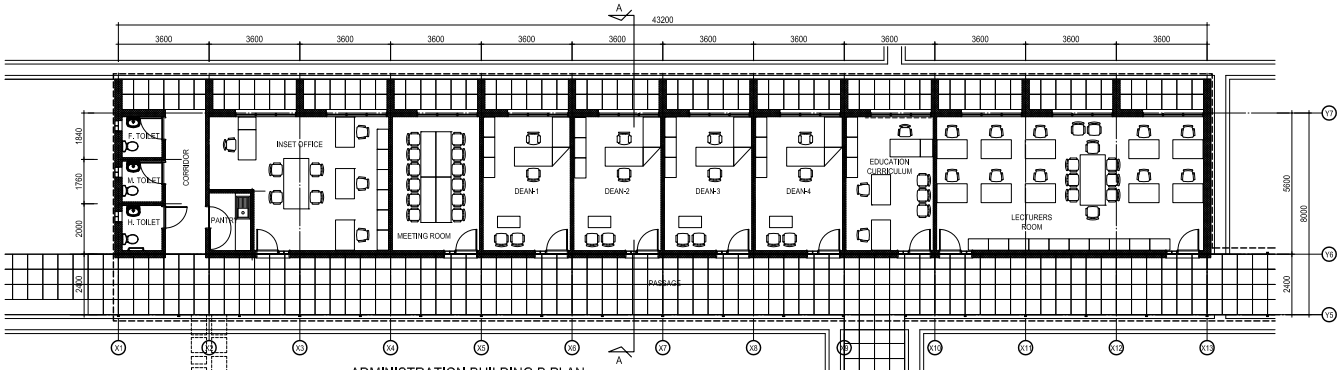
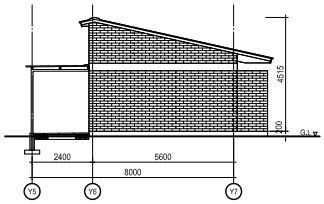
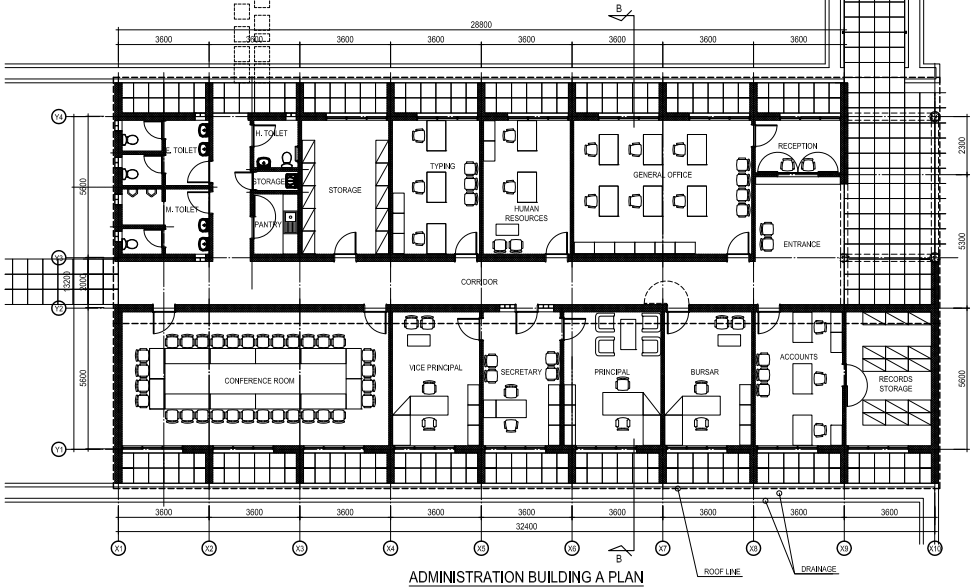
70
55
N
0
5
15
30m
C-04 DEMONSTRATION SECONDARY SCHOOL BLOCK



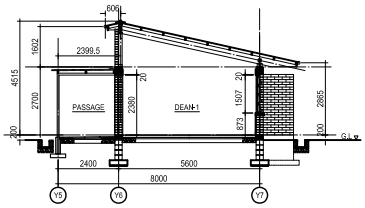
ADMINISTRATION BUILDING B PLAN



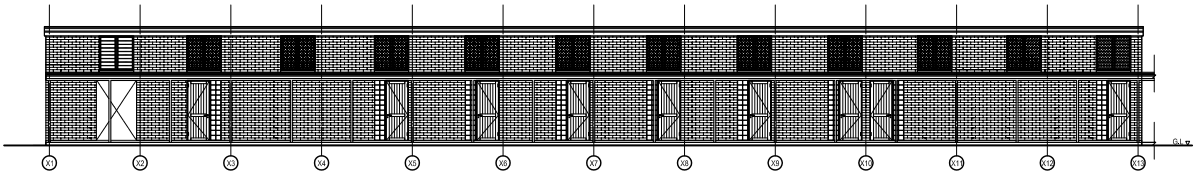
EAST ELEVATION
ADMINISTRATION BUILDING A



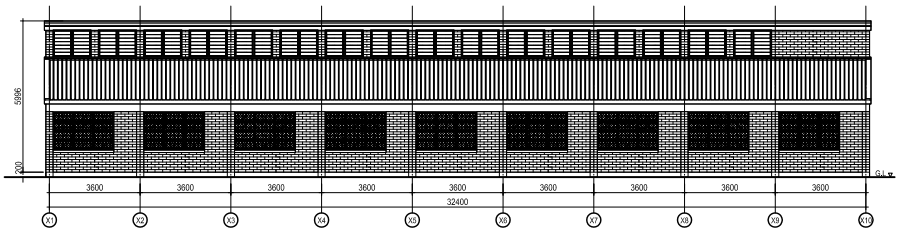
ADMINISTRATION BUILDING A PLAN



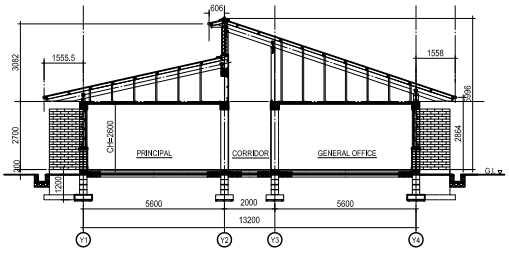
SECTION A-A
ADMINISTRATION BUILDING A



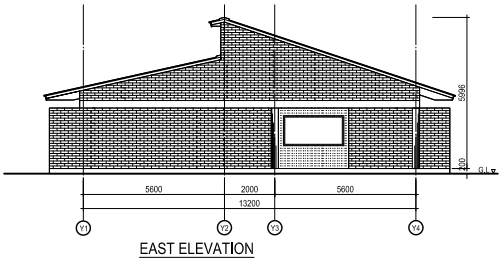
SOUTH ELEVATION
ADMINISTRATION BUILDING A



SOUTH ELEVATION
ADMINISTRATION BUILDING B

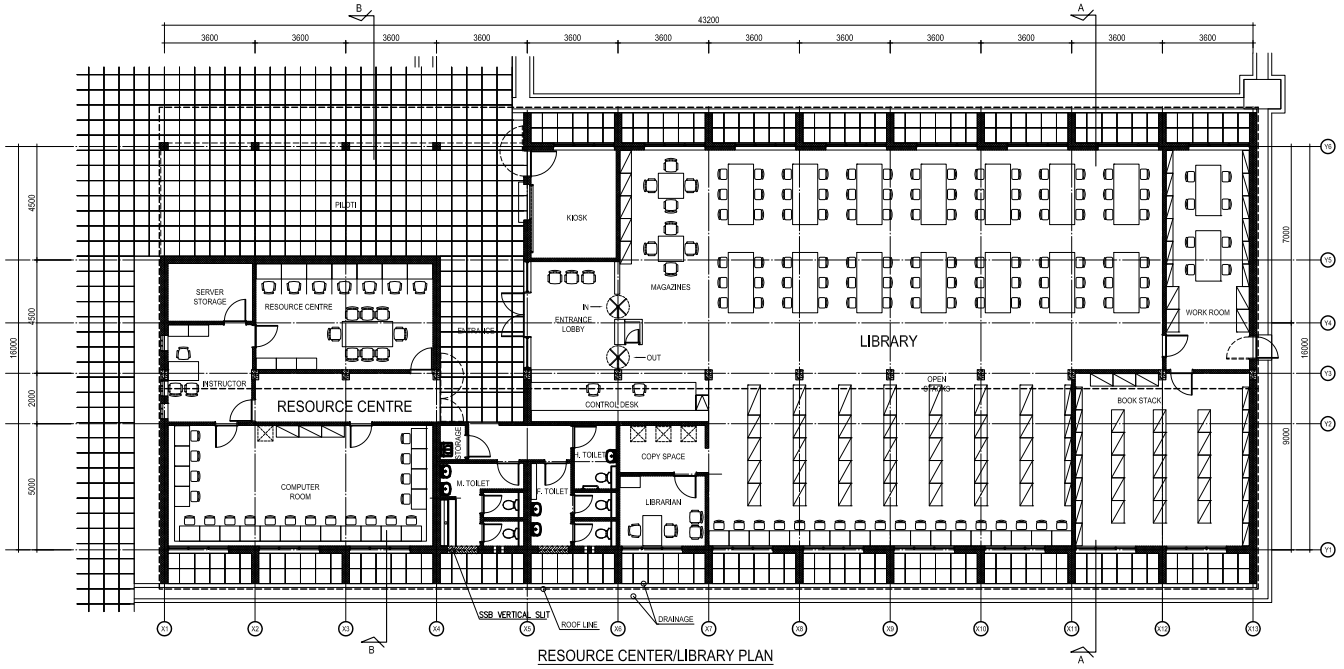


SECTION B-B
ADMINISTRATION BUILDING B

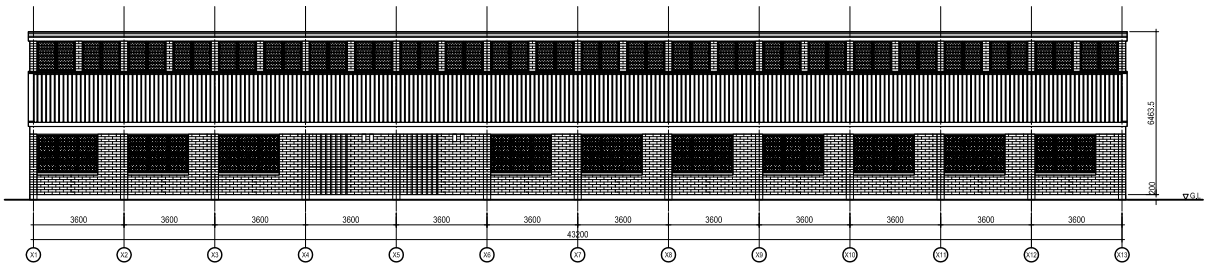


EAST ELEVATION
ADMINISTRATION BUILDING B

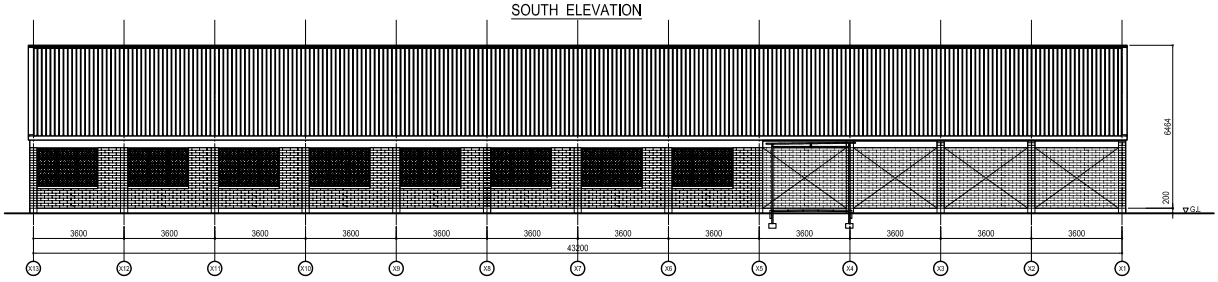
A-01 ADMINISTRATION BUILDING A & B (PLAN, ELEVATION, SECTION) S:1/300



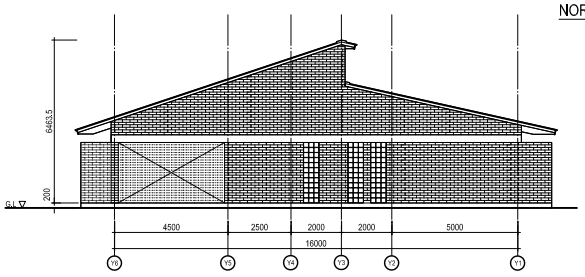
RESOURCE CENTER/LIBRARY PLAN



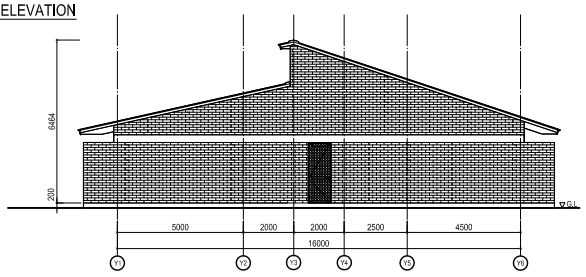
SOUTH ELEVATION



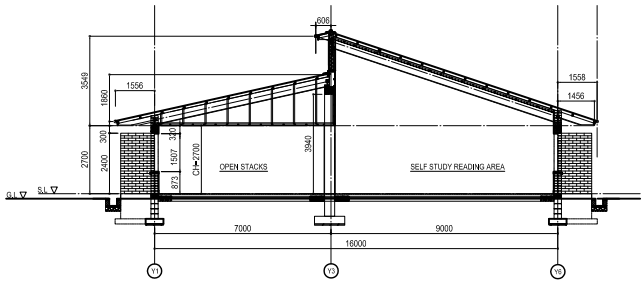
NORTH ELEVATION



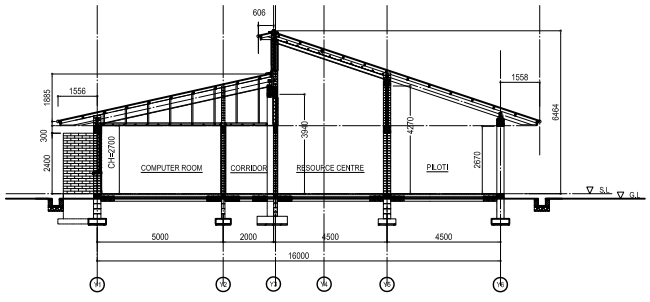
WEST ELEVATION



EAST ELEVATION



SECTION A-A



SECTION B-B

A-02 RESOURCE CENTRE AND LIBRARY (PLAN, ELEVATION, SECTION) S:1/300